NUREG-0662
Vol. II

Final Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere

Final NRC Staff Report

TMI Support Staff
Office of Nuclear Reactor Regulation

Prepared for
U.S. Nuclear Regulatory
Commission

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

June 18, 1980

Docket No. 50-320

The "Final Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmospehre" (NUREG-0662, Volumes 1 and 2) was prepared under the direction of Dr. Bernard J. Snyder by the following staff members:

Karl Abraham, Region I, Public Affairs Office

Lawrence G. Bell, TMI Program Office

Ronald R. Bellamy, Effluent Treatment Systems Branch

Donald S. Brinkman, TMI Program Office

Robert T. Carlson, Region I, Inspection and Enforcement

T. Jerrell Carter, Jr., Technical Support Branch

Lawrence J. Chandler, Office of Executive Legal Director

Donald P. Cleary, Siting Analysis Branch

John T. Collins, TMI Program Office

Frank Congel, Radiological Assessment Branch

Marilee Duncan, TMI Program Office

Anthony N. Fasano, Region I, Inspection and Enforcement

Reginald L. Gotchy, Radiological Assessment Branch

Charles S. Hinson, Radiological Assessment Branch

Algis J. Ignatonis, TMI Program Office

George Kalman, Region I, Inspection and Enforcement

Jay Y. Lee, TMI Program Office

Paul H. Leech, TMI Program Office

Joseph Levine, Accident Evaluation Branch

Ronnie Lo, TMI Program Office

Oliver D. T. Lynch, Jr., TMI Program Office

Scott Newberry, TMI Program Office

Walter E. Oliu, Technical Information and Document Control

Walter J. Pasciak, Radiological Assessment Branch

William D. Travers, TMI Program Office

Lowell E. Tripp, Region I, Inspection and Enforcement

Richard Weller, TMI Program Office

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Manuscript Completed: May 1980
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**Prepared for TMI Support Staff
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555**

PREFACE

In March 1980 the NRC staff published the draft version of this Final Environmental Assessment (NUREG-0662) and two subsequent Addenda for public comment. The staff received approximately 800 comments on the draft Environmental Assessment. Of these, approximately 195 responses generally supported purging krypton from the reactor building, approxmiately 500 opposed it, and the remaining responses were either recommended alternatives for removing the krypton or comments that took no position on the staff's recommendation.

This volume of the Final Environmental Assessment contains copies of letters and reports that suggested either decontamination alternatives or that in some way commented on one or more alternatives proposed in the draft Environmental Assessment. Also included in this volume are representative letters either opposed to or in favor of purging krypton from the reactor building. These letters come from private citizens and groups, from the business and professional community, and from local, State, and Federal officials and organizations.

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Table of Contents

The NRC staff has received comments claimed to be proprietary by Science Applications, Inc., and Mitre. Because of the proprietary claim, those letters are not being included.

Department of Energy
Washington, D.C. 20585

FEB 5 1980

Mr. William J. Dircks
Acting Executive Director for Operations
U.S. Nuclear Regulatory Commission (MNBD)
Washington, D. C. 20555

Dear Mr. Dircks:

At the request of the Chairman of the Nuclear Regulatory Commission (NRC), the Department of Energy (DOE) is conducting a program in cooperation with NRC and the Electric Power Research Institute (EPRI), aimed at learning as much as possible from an examination of Three Mile Island Unit 2 (TMI-2) plant and equipment. This program was endorsed by the President in his December 7, 1979 message responding to the Kemeny Commission report. In connection with DOE efforts to plan and conduct this program, I have become aware of the need to gain prompt access to the reactor system and core in order to replace monitoring instrumentation and to begin the process of defueling at the earliest possible time. The increased knowledge and control of reactor conditions that would be gained by such prompt access is an important element in NRC's and the General Public Utility's (GPU) mutual objectives of assuring the continued safety of workers and the surrounding public. Such access is today precluded by the existence of radioactive gas in the containment, the removal of which is currently under evaluation by the NRC.

I understand that the owner, GPU Company, has evaluated alternative methods of removing the gas, and has concluded that a controlled purging which meets all Federal regulations is the most acceptable alternative from a public health standpoint. GPU has requested NRC approval of that course of action in a letter dated November 13, 1979, and ~~that~~ NRC has the GPU recommendation under active consideration. My staff has performed an independent review of the matter, and has concluded that a controlled purging is indeed the preferred method. It would result in less public radiation exposure than accrues from many other power plants, both nuclear and fossil. The purpose of this letter is to urge the Commission to act promptly on the matter, and in the event of NRC approval, to offer the resources of the Department of Energy to assist in monitoring off-site conditions during the purging process to help guarantee that conditions remain within acceptable limits. The basis for the DOE conclusion on purging is explained in the enclosure.

Sincerely,

G. W. Cunningham
Assistant Secretary
for Nuclear Energy

Enclosure

DOE REVIEW OF GPU RECOMMENDATION OF TMI-2 CONTAINMENT PURGING

There are at present about 44,000 curies of Krypton-85 gas in the TMI-2 containment at a concentration of about three-fourths microcurie per cubic centimeter. The GPU Company has requested approval to purge this to the atmosphere from the plant stack at rates which are permissable within current Federal regulations and which would be monitored to assure exposure to personnel is well within acceptable limits. The purging would be done over a period of 30 days or more and would be done only when favorable weather conditions are present. The alternatives to controlled purging are:

1) Maintain containment isolation while designing, constructing, and installing new systems to separate and isolate the Krypton gas from the containment atmosphere. Complete functional systems to accomplish this separation at TMI are not presently available. DOE laboratories have estimated it would take at least two years to build one such system. We believe that the actual time including licensing would be longer, even with a crash program. Furthermore, subsequent storage and transportation of the separated Krypton would pose significant radiological risk to workers and the public.

2) Maintain containment isolation while gas storage tanks are constructed, and then, using compressors, pump the entire containment atmosphere into these tanks. This storage option would require more than twenty-five miles of thirty-six inch dimension pipe (filled to a pressure 340 psig), would take at least two years to procure, test and install, and would have to be housed in large buildings designed to provide adequate environmental protection to the storage tanks.

3) Maintain containment isolation until the Krypton gas decays to lower radiation levels. The half life is 10.5 years. Thus, several decades of storage would be required.

Each of these alternatives creates two principal difficulties which, we believe, make them impractical and unsafe.

First, they involve a lengthy delay in gaining access to the inside of the TMI-2 containment to begin assessment, cleanup and defueling operations on the reactor plant. Such operations cannot be safely conducted with the Krypton gas present. Access for work is urgently needed to assure that the reactor system continues to be maintained in a safe condition. The instruments which monitor the nuclear and thermodynamic condition of the reactor core have been unattended, in a high humidity atmosphere, for over 10 months. It is prudent and important for safety to replace these instruments with new and reliable instrumentation and controls as soon as possible. It is also prudent to gain access to the reactor plant and core in order to determine its configuration and to plan and implement the defueling operation at the earliest possible time. Delay in achieving the control that would result from these actions increases the risk to worker and public safety.

Second, the delay associated with each of these alternatives increases the likelihood of uncontrolled release of Krypton gas to the environment. Such releases, because they could occur at or near ground level (rather than from a 160 foot high stack) and because they may occur under favorable weather conditions, could cause higher radiation exposures than would the controlled purging. Such release could occur if, for example, the containment building atmospheric cooling equipment, which has been operating for 10 months unattended, should develop a failure. This could happen at any time, considering the extreme humidity conditions inside containment. Failure of this cooling equipment would permit internal containment pressure to increase slightly thus leading to small leakage which, although within containment leakage specification limits, has thus far been prevented by keeping the containment below atmospheric pressure.

The proposed purging process is within all operable rules and regulations and is practiced by other operating utilities with no adverse effect on public health and the environment. A review of available NRC records reveals over 70 cases during the period 1971 through 1977 in which the annual discharge from a single nuclear power plant exceeded 44,000 curies per year of noble gas. Furthermore, studies conducted by the Oak Ridge National Laboratory indicates that the total integrated population exposure from discharge of radioactivity from a modern, high efficiency coal plant would be on the order of 1.2 to 11 person-rem/year. This compares to the estimated total integrated population exposure within 50 miles of TMI of about 1 person-rem as a result of purging. For comparison, naturally occurring radiation exposes the same population to over 200,000 person-rem every year.

In the interest of safety, we conclude that the "prudent man" decision would be to approve the controlled purging of Krypton gas from the TMI-2 containment.

March 12, 1980

Commissioner Jos. M. Hendrie
Nuclear Regulatory Commission
Washington D. C.

Commissioner Hendrie:

Before the Manhatten project, the only radioactivity harnessed by man was radium. "At this time the total world supply was 1000 curies." (WE ALMOST LOST DETROIT, Fuller, page 27.) Depending on the source of information, estimates of "normal" radioactive emission from a "normally" operating atomic energy plant vary from 35 to 70-80 curies daily. Think about this. If a plant emits 35 curies daily, in 28.5 days this would be 1000 curies. If emissions are 70 curies daily, the emissions of only 28.5 days would equal twice the world supply of the early Fourties.

It was printed that you "bitterly derided...the time consuming safety precaution...during cleanup of TMI...even if the entire amount of Krypton 85 were inadvertantly released, the resulting exposure would be less than 1/10 of natural background." Isn't "natural background" level an arbitrary figure? Are you saying that TMI has already released so much that our area has a "natural background" which would be abnormally high at any other location? What geographical area would you need to get this 10% increase in "natural background"? Would this include all life in a 50 mile radius? 100 mile radius? 200 mile radius? Do you also ignore the higher "normal" levels near TMI to get your low statistical projection?

How heavy is Krypton? How far would it travel? What force winds would be required to get the 10% increase you predicted?

To exhaust the estimated 50,000 curies as desired by Met-Ed in 60 days, 833 curies would have to be exhausted daily - 24 times the 35 curies "normal"; 555 curies would have to be emitted daily for 90 days (only 16 times the 35 curies "normal") to get rid of this garbage. This is the cheapest, fastest, easiest method of disposal. Is it the safest?

Mr. Hendrie, the people within the 5 mile area would welcome you and your family as neighbors. This is an invitation to share our fear and also the insignificant fall-out from TMI.

We want this cleaned-up. We want this done in a safe, humane manner.

Sincerely,

Charles W. Emerick, Sr.
Genevieve B. Emerick

Mr. & Mrs. Charles W. Emerick, Sr.
489 Willow St.
Highspire, PA 17034

HERCO

ONE CHOCOLATE AVENUE
HERSHEY, PENNSYLVANIA 17033

Edward R. Book
President and Chairman
717 / 534 - 3099

March 10, 1980

MAR 12 1980

The Honorable William W. Scranton III
Lieutenant Governor
Commonwealth of Pennsylvania
Room 200
Main Capitol Building
Harrisburg, Pennsylvania 17120

Dear Bill:

In my responsibility to the stockholders, employees and their families of Hershey Entertainment & Resort Company (HERCO) as well as to the countless others in this area who derive a living or benefit directly or indirectly from tourism, I would be negligent if I did not bring up the anticipated venting at TMI.

Clearly, safety is the number one objective. Beyond that, however, we would respectfully request that the approximate 51-day vent mentioned in the media be scheduled either far enough in advance of the peak June-August tourism season or just after it as is

(a) consistent with safety, and
(b) least likely to impact negatively on the tourism industry.

There is no need for me to belabor the point. There are many industries, interest groups and others who will suffer from the inevitable media blitz of the venting no matter when it is scheduled. We will support your decision with full knowledge that this tiger's tail puts you, and all of us here in Pennsylvania, essentially in a "no win" position. The tourism industry of Adams, Cumberland, Dauphin, Lancaster, Lebanon and York counties, however, will be hard pressed to survive a second consecutive disastrous year if the venting occurs during the three month peak season.

Wishing you every success.

Warmest regards,

Edward R. Book
Chairman & Chief Executive Officer

ERB:nsh

ENVIRONMENTAL COALITION ON NUCLEAR POWER

Co-Directors: Mr. George Boomsma—R.D. #1, Peach Bottom, Pa. 17563 717-548-2836
Dr. Judith Johnsrud—433 Orlando Avenue, State College, Pa. 16801 814-237-3900

March 14, 1980

Dear Sir or Madam:

Below are my comments on NUREG-0662, the Environmental Assessment for the Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere," which I abbreviate as EA.

With the release of this EA and the unnecessarily short 15 day public comment period, the NRC Staff continues its policy of mismanagement by crisis which has become so typical throughout the continuing TMI-2 accident. The Staff continues to invent crises so as to force the implementation of the "action" or "fix" that is ready to be implemented or in place and which has already been decided upon by the NRC Staff and the suspended licensee. This policy of action by crisis was used to force the use of Epicor II in late 1979, and is used again in this EA. The result of this is that because of the invented crisis, public debate and comment is severely limited.

This failure of the Staff to deal in an honest and forthright method with the public began much earlier in the course of the TMI-2 accident. One unfortunate example is the silly and meaningless method used by the NRC public relations office in King of Prussia, Pa. This office, throughout the month of April was unable (or refused) to offer useable or interpretable data concerning the ongoing releases of radioactive gases (mainly, iodine-131). What the office did report was vent exhaust gas concentrations, with no mention whatsoever of the vent exhaust rate or total quantities of radioactive gases on an hourly or daily basis. This policy was also carried out through the issuance by the NRC of the various PNO bulletins throughout the early course of the accident.[1]

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[1] See, for instance, PNO-79-67X, page 2. Here are listed a number of iodine-131 concentrations in the ventilation stack. With no further information, these numbers are meaningless and useless, since there is no specification of the volume of gas released during the specified time periods.

In an attempt to get accurate, timely, and useable information among other things concerning the TMI-2 accident, I filed an emergency petition in accordance with the Commission's rules (10 CFR 2.202(a)(1) and 2.206(a)) on April 27, 1979, and supplemented on May 16, 1979. These requests asked for a public hearing before any change in plant status or plant technical specifications, or before the "modifications of equipment, processes or structures at TMI-2." (May 16, 1979, Supplement, p. 9). Not only was this request ignored in its entirety, the meager flow of accident-related information that had been coming to the lawful intervenors in the incomplete TMI-2 licensing process soon dried up. Despite involvement in the TMI-2 proceeding since 1974, and despite the specific requests (above) for information and public hearings, the initial receipt of the Epicor II EA arrived only after Epicor II had been designed, purchases, and constructed, and after public comment had been received, on October 20, 1979. Of course, at that time, an offer of hearings was made by the NRC, but only after the fact, and only after all other alternatives had been precluded, and all public comments were rendered useless.

Now, a year after the accident began, there is a new emergency. Suddenly, the krypton-85 remaining in the containment building must be vented, and the only way just turns out to be exactly what the suspended licensee and the NRC Staff have already agreed upon. Here again, a crisis has been created so as to preclude meaningful public comment and a thorough evaluation of alternatives. There does not appear to be any reason whatsoever why this subject of krypton disposal could not have been approached on a rational, deliberate timetable. Instead, the Staff stalled and seemed to ignore the problem of equipment failure inside the TMI-2 containment structure until the spectre of imminent failure could be used to create a crisis to force an otherwise unacceptable krypton dispoal option.

So here we are again. A new crisis has been found, and a new, forced option has been chosen quietly by the Staff and the suspended licensee to again preclude meaningful public involvement and meaningful discussions of alternatives.

The options suggested in the EA are sufficiently rigid and poorly thought out that little choice is offered among them. For instance, the reactor building purge option (to take place slowly, over the period of two months) obviously releases the krypton to the atmosphere, but at the site of the accident. It is inconceivable that this option would not add

greatly to the mental stress and anguish already suffered by the residents of central Pennsylvania. Yet the other systems of krypton removal (charcoal absorbtion, gas compression, cryogenic processing, and selective absorbtion) all assume that the krypton is to be contained somewhere until it all decays (the half-life is about 10 years). This rigid assumption allows the Staff to raise the spectre of accidents in the storage of the gas. The Staff does not seem to view as a workable alternative the collection of the gas, the removal from the site to some <u>unpopulated</u> place, like the Atlantic Ocean, the Pacific Ocean, the Antarctic, or the Arctic, and the release of the krypton there under specified conditions. Such an option would go a long way toward restoring public confidence in the NRC.

There are at least two other alternatives which have not been evaluated by the NRC Staff. I can only speculate as to the reasons for these omissions.

First, if imminent failure of equipment in TMI-2 is indeed a real problem, the gas could simply be transferred to the containment structure of TMI-1, which will not be operable for months or years if ever, anyway. Then, the needed maintenance could take place at TMI-2 without the need to subject the already traumatized residents of central Pennsylvania to further mental torture and involuntary radiation exposure. Of course, once in the TMI-1 containment, one of the other dispoal options could be implemented at an orderly pace.

Secondly, the containment structure could be vented rapidly, as in a "puff" release. This should take place in an orderly fashion, on a day with predetermined meteorological conditions (as steady winds and full sunlight to enhance upward mixing). Such a plan could be announced well in advance, with the actual release to take place, for instance, on the first Saturday or Sunday which meets the meteorological criteria. The advantages of this plan are listed below:

1) It is quick, and the public can be reassured that the gaseous release problem is over with.

2) Those members of the public who choose not to be exposed to radiation for which they get no benefit and those who simply want no further involuntary radiation exposure for themselves and their children (and the unborn) can simply leave the area to be affected for the day. Costs would be minimal, as would be the total population exposure.

3) The NRC and the suspended licensee could break with their past practices and demonstrate a modicum of concern for the feelings of the public.

4) People all over the world would for the very first time learn how many members of the affected public would take

> protective actions appropriate to reduce or avoid exposure to radiation or to radioactive materials. (10 CFR 140.85(b)(4)).

The only disadvantage that I can conceive of to the "puff" option would be that the nuclear industry and its unquestioning promoters in government, including the NRC itself, would also find out how many people don't want to be exposed to any more radiation from TMI-2. Such knowledge would undermine the myth of public acceptance of unnecessary radiation exposure and would look bad on the record of future reactor licensing proceedings.

For each of the "less preferred" options in the EA, the Staff discusses the time required to implement the option. In none of these discussions does the Staff acknowledge that many months have already been wasted by the inaction (or inattention)of the Staff and the suspended licensee to the krypton problem. The public must not be held hostage and again used as guinea pigs in the continuing TMI-2 accident as a result of the incompetence of the NRC Staff and the suspended licensee.

The "preferred option," that of slow venting into the atmosphere requires the public to continue to trust and rely on both the NRC Staff and the suspended licensee. The TMI-2 accident has amply demonstrated that neither is worthy of trust.

Chauncey Kepford

Chauncey Kepford

March 17-1980 X

Mrs Rosalyn Carter
Pennsylvania Ave.
Washington. DC. 20515

Dear Mrs Carter:

As Concerned as you seem to be about public health & welfare ~~especially~~ - Small children, and the physically & Mentally handicapped, I am urging you to use any influence you have with your husband, the "President".. Try to convince him to not approve the venting of the Krypton gas from the Crippled nuclear Reactor at - Three Mile Island - Middletown - Pa..

As a near by resident of a nearby town, Lebanon, I do not wish to see the effect these gasses could have on people in the future.

I have younger sisters & brothers, as well as neice's & nephews and am concerned for their future welfare, as I am sure you would be - Considering you also have a young daughter, as well as grand-children.

The N.R.C. should urge the Met. Ed. officials to use the Cryogenic - Means of riding the reactor building of these gases. More Costly - but - a heck - of - a lot safer.

I hope this letter is not simply looked upon as a Crank; as all the people in this area share the same concern, but many of them are just not writing - They feel it will not do any good. I hope they are wrong.

Thank you for reading this.

A Concerned resident of Central Pennsylvania.

Mrs Millie Hoke
968 Jay St.
Lebanon, Pa - 17042

March 17, 1980

Mr. Denton,
Nuclear Regulatory Commission
Middletown, Pa.

Dear Sir,

I am strongly opposed to venting Krypton 85, gas into the atmosphere for the following reasons.

Krypton 85, has a half life of 10.8 years, and to date the long term effects are not known. Studies of Krypton 85, were not begun until 1973, of the small amount of information collected research shows the trend is upward.

If normally operating nuclear plants routinely release twenty thousand times more Krypton into the atmosphere each month than than what has already been released, this is more reason why you should not release this gas into the atmosphere, but use the safest method available, regardless of cost to the Utility Co. Where radiation is concerned, cost should not be considered.

People in the Delaware Valley have had considerable radiation exposure in the past four years. "e had fairly high levels of fallout from the Chinese Nuclear explosion, people were subjected to more than was necessary due to the delay in informing people the fallout was passing over this area. Many people had clothes drying on the line, remained outdoors longer than they would have had they been informed, windows were open and summer furniture was left outside. Then the Three Mile Island accident that released unknown amounts of radiation in the first hours after the accident that was not monitored. There were continuous releases of radiation from March 28th, thru May 23rd. Now the Krypton 85, from the airlock and you want to release more.

If this gas is released into the atmosphere when other safe methods are available it shows lack of concern for human life.

Spring is almost here and cattle will be grazing and it will be planting season, all this ground could be contaminated and the more of these products we use the greater the risk to our health. The milk from all of this area is pasturized together.

I feel that people working with radioactive material are becoming very lax in the handling of it, I don't know if it is because the dangers are kept at a low key and they are not impressed with the responsibility they have, not only in protecting themself but the earth.

Human suffering, the lives that can be lost, and the earth cannot be replaced, other methods of producing safe electricity can be used.

Sincerely

Ruth Wilkinson

Mrs. R. Wilkinson
48 Oregon Ave.
Cherry Hill, N.J. 08002

3/20/80

Nuclear Regulatory Commission
Middletown, Pa. 17057

Attention: Mr. John Collins:

Dear Mr. Collins:

I am writing once again to protest the venting of radio-active gases from Three Mile Island. Your agency seems intent on purging this poison despite the protests of most area residents. We will not tolerate your lack of concern for us and our children. And we are not stupid - it does not matter how many times you state that such venting is harmless, we know differently.

I am currently pregnant with my first child. I live in constant terror of what may have already been done to my unborn baby, and what lies ahead for this child. My nights are sleepless, and often interrupted by nightmares about the results of venting this poison. Those gases must not be vented.

If Met-Ed had no other choice, the matter might be different. But they have already had one year to start clean-up with alternative methods. Granted, these other methods might be more expensive, but it's time this incompetent company stops worshipping the almighty dollar and starts facing their responsibility.

I repeat, the gas must not be vented - I hold your agency as responsible as Met-Ed for what lies ahead.

Sincerely yours,
Barbara J. Ulrich

8

received 3/24/80

March 20, 1980

File
CC: S. Polon
Original: R.C. Arnold

WE Riethle

Chairman
"Clean-Up Team"
Nuclear Regulatory Agency
Three Mile Island
Middletown, Pa

Dear Sir,

I just listened to a radio report of your problem (one of many) in hurry to clean up the radioactive gases in order to repair the damaged core of the reactor. I'd appreciate your consideration of a possible plan.

Rather than venting the gases directly into the atmosphere and evoking the anguish of the residents of the nearby communities, why not use a little space technology - the guys at Cape Canaveral are available. I propose that the gases be vented into a large - partially helium filled balloon - lead lined and fitted with radio controlled vents. The balloon could be lifted to an altitude deemed safe enough or steered out over the ocean and the radioactive gases could be vented gradually to be dissipated in the upper Troposphere or the Stratosphere.

Just an idea! Nobody gets hurt - materials are available.

(over)

Manpower is available – technology is there.

Thank you for your attention.

Marvin H. Skudin

MARVIN H. SKUDIN
3105 DENTON DR.
MERRICK, NY 11566

ENVIRONMENTAL POLICY CENTER
317 Pennsylvania Ave., S.E., Washington, D.C. 20003
(202) 547-6500

March 20, 1980

50-320

Statement of Eleanor Walters, Washington Representative
Presented at the Environmental Impact Statement Scoping Meeting, Baltimore, MD

The Environmental Policy Center opposes the Nuclear Regulatory Commission's proposal to release radioactive gases and water from the Three Mile Island reactor into the atmosphere and Susquehanna River. It is our belief that entombing the radioactive wastes within the containment is an option which has not been throughly explored by the NRC. By keeping the radioactivity on-site, it will not pose a threat to the health and safety of persons living down wind or down stream.

The reasoning behind the proposal to slowly vent the krypton is that the gases must be removed before clean-up operations can begin and that this will keep health hazards to a minimum. It does not matter, however, what the rate of venting is because the total radioactivity vented is the same. There is an increasing amount of scientific data which suggest the amount of genetic damage in the exposed population will be maximized by slow releases over an extended period of time.

More specifically, spreading out a given total dose minimizes the short-term biological effects but actually maximizes the much more serious long-term effects which include genetic damage. This is because the immediate cause of radiation-induced disease is damage to the DNA. Reproduction of misinformation eventually results in a visible effect such as cancer. At low levels of exposure it is extremely unlikely that a cell will be so damaged that it cannot reproduce itself. At higher levels of exposure, however, cell killing is more likely. A dead cell cannot produce a cancer or future genetic defect.

The release of the contaminated water from the reactor poses the same type of long-term risk to public health. In fact, it is more of a threat to public health because the Susquehanna River provides the drinking water for southeast Pennsylvania and northeast Maryland residents. It is a major tributary to the Chesapeake Bay -- one of the U.S.'s most fragile and productive ecosystems -- thus, further radiation contamination can result by the incorporation of long-lived radionuclides in the food chain. Should the Chesapeake be contaminated by the TMI radioactive wastes the economic and environmental reprecussions would be devestating.

The federal government has consistently maintained that TMI radiation releases are not harmful to the public. It has not been able to determine, however, what it causing the increased incidence of spontaneous abortions, stillbirths, and illnesses among TMI residents. Radiation may not be the only reason for this increase but it is unlikely that it has not at least contributed to it.

Because releasing the wastes will create the potential for additional health problems among a larger population and contaminate the environment, the Environmental Policy Center proposes that (1) the NRC adopt an alternative to releasing the radiation into the environment, such as entombment; (2) the Environmental Protection Agency increase its on-site and off-site monitoring capability; (3) the Pennsylvania and Maryland Health Departments monitor vegetables, fruit, and dairy products grown down stream from TMI for strontium; (4) independent monitoring systems be implemented; (5) the NRC, EPA, state, and independent monitoring data be analyzed by independent reseachers; and (6) the cost/benefit analyses include the long-term health costs created by TMI.

Remarks to be presented to
Nuclear Regulatory Commission
Department of Environmental Resources
Metropolitan Edison Company
at Elizabethtown High School, 7:30 p.m.
on Thursday March 20, 1980

My name is Harry L. Flick, Jr. and I serve as the executive director of the Pennsylvania Dutch Visitors Bureau (PDVB). The PDVB is a non-profit trade organization composed of approximately 425 members dedicated to promotion of Lancaster County as a vacation and business meeting area.

As a result of its efforts, the PDVB has helped to establish the Lancaster County visitor industry as the fifth largest in the state, generating sales in 1978 of $233.5 million and creating jobs for 10,200 Lancaster County residents. In addition, Lancaster County's tourism industry provided tax receipts to the state and county in the amounts of $14.8 million and $493,000, respectively, as reported by the United States Travel Data Center.

The PDVB is grateful for this opportunity to present its remarks in regard to a serious problem. The problem point in reference is the clean up operation at Three Mile Island nuclear facility.

After nearly one year since the accident at Three Mile Island, it should be evident that the accident had a significant impact both psychologically and economically on the area. For example, in 1977 the PDVB logged 495,000 visitors at its Route 30 location, in 1978 it logged 516,000 visitors, but in 1979 the bureau logged only 214,000 visitors. Obviously, the Amish polio scare and spot shortages of gasoline exacerbated this condition, but the potential danger as presented by the news media was the most significant contributing factor in the decline of visitors to Lancaster County.

Unfortunately, for the well-being of the area economy, the objectiveness of the media reporting has not improved. It seems that the news media has chosen to give a high priority to the reporting of news on this event which has already been inscribed in our history books and to report on subsequent events at TMI in a most economically detrimental way.

A perfect example of this style of sensationalism is the March 10 venting of a minute amount of Krypton 85 gas. National and local television, radio and print media proclaimed radioactive gas being released during the cleanup procedures at TMI. The travesty of the reportage was the failure to note the amount and to relate it to the known danger. Perhaps if that were done the public may ask why in fact was it ever mentioned in the first place.

Acting in response to a deluge of calls at the NRC field office in Middletown, Clifford L. Jones, Secretary for the Department of Environmental Resources called the amount of radiation "miniscule and insignificant in terms of any environmental or health impact. No precautions of any kind are necessary." A DER radiation specialist reported that less than 50 millicuries of Krypton 85 were to be released, compared to approximately 50,000,000 millicries in the main containment building.

It is important to note that the release of 50 millicuries compares to the routine vexting with government approval of approximatley 1,000 curies each month at operating nuclear power plants. A DER spokesperson said: "If a person stood at the site boundary for the entire three day period, total calculated exposure would be less than one-tenth of a micro-rem. During that same time, the person would be receiving somewhere between 500 and 720 micro-rems of exposure from natural background."

The point to be made is that despite scientific knowledge of the insignificant impact to be made by this gas release for some reason it never became the predominant feature of the news releases. The Visitors Bureau urges that all news releases in the future contain an explanation (in layman's terms) of the physiological and enviromental impact. It is the opinion of the Visitors Bureau that such information might then be conveyed to the public in establishing the appropriate perspective to this situation.

The visitors industry plays an important role in the economy of Lancaster County and more attention must be shown to those factors which would adversely impact upon its performance. According to statistics reported by the Pennsylvania Travel Industry Advisory Council, 100 tourists per day cause an increase of 459 in the population, create a demand for 140 new households, raise enough in tax receipts to support 156 school children, increase bank deposits by $144,000, increase retail sales by $1.1 million, provide financial support for seven retail establishments and 111 new industry related jobs.

From these figures it should be abundantly evident that the visitors industry interfaces with the local economy in a very dependent fashion. Furthermore, it should be quite clear that very careful attention must be given to the preparation of news releases and the conduction of news conferences. The Pennsylvania Dutch Visitors Bureau urges the Nuclear Regulatory Commission, the Department of Environment Resources and Metropolitan Edison Company to coordinate their media releases taking into consideration the following points and to serve as a leader for others in the industry in reporting the facts in the perspective in which they happen.

On behalf of the Pennsylvania Dutch Visitors Bureau, I appreciate having this opportunity to present these facts to you. If these suggestions are followed in the manner in which they are intended, Lancaster County's economy can be assured of a steady recovery from this unfortunate incident. Failure to do so will manifest itself in economic despair that will affect all aspects of the region's economy.

51

March 21, 1980

Dear President Carter,

The continuing problems of the clean up of Three Mile Island Nuclear Plant are causing confusion, mis-trust and fear in the residents of our area.

We need your immediate help to locate and send to us the best men available to try and solve these problems.

Some include:

1. 57,000 curies of Krypton 85 gas to be disposed of safely - without exposing us to more radiation.
2. 500,000 gal. of contaminated water also must be disposed of safely-without contaminating our drinking water.

3. Removing the damaged core.
4. Continuing leaks of gas and water - why?
5. There are no evacuation plans!

This has been a traumatic experience for us - a year has gone by - Time is running out and the problems continue to mount.

Please Help Us!

Sincerely,
Molly Reinhart
4403 Ann Dr.
Hbg. Pa 17112

Mrs. Patricia A. Rodde
202 E. Maywood Ave.
Peoria, Illinois 6]603
March 22, 1980

Dear Mrs. Prelesnik,

After hearing the discussion of the problems at the Three Mile Island Nuclear Plant, and the NCR's plan to vent the Krypton gas, my husband mentioned a safe alternative to the NRC's plan.

Since my husband is a registered professional Mechanical Engineering Consultant, licensed in two states, who specializes in Heating, Ventilating, and Air Conditioning of structures, I thought that I would pass his idea on to you.

" One or more large capacity air compressors could be used to evacuate the containment building. The discharge of these compressors would be piped into pressure radioactive shielded storage containers or tanks. In this manner all of the Krypton gas could be removed from the containment building and taken to a place more suitable for disposal."

According to my husband, this method of extraction is so simple that he can not believe that it wasn't brought up before. The expense will be greater, of course, than just venting the Krypton gas to the atmosphere, but then, the safety of the citizens of Middletown will also be insured. This method will also be more time consuming but if it can relieve the citizens of fear of danger from accidental contamination would not this be worth the added time and expense? Who knows this might also increase the confidense in the credibility of the NRC to handle such problems in the years to come.

Most Sincerely,

Mrs. Richard J. Rodde

Mrs. Richard J. Rodde

cc

Mr. Jack Anderson ABC News

Nuclear Regulatory Commission Washington, D.C.

Miss Claudia Ritter
336 S. President Ave.
Lancaster, PA 17603
March 23, 1980

Nuclear Regulatory Commission
Post Office Box 311
Middletown, PA 17057

Dear Sirs:

I am strongly opposed to the proposed plan to vent radioactive krypton gas from the damaged Three Mile Island Nuclear Facility. I have seen estimates that the venting will expose the surrounding public to 2 millirems of radiation. Against the 100-150 mrm that the citizenry of this area receives each year, 2 mrm sounds like a small amount. However, my fear stems from the fact that 75 to 80% of all cancers in the United States are caused by environmental factors. Thus, the 100-150 mrm figure is not something to be sneezed at since it contributes so greatly to the American cancer rate.

By adding the seemingly inconsequential amount of 2 mrm to the environment this spring, the NRC will just be adding to the already lethal amounts of radiation received each year by the public. Furthermore, with new leaks from TMI being reported a couple of times each month, the yearly amount of radiation received by the public continues to grow. This is one type of growth that we cannot afford. I am therefore against the NRC's deliberate release of radiation in the form of krypton gas, which would just again add to the public's radiation intake.

Sincerely, Claudia Ritter

X

Janet B. Allen
109 Garfield Ave.
Cherry Hill, N.J. - 08002

Nuclear Regulatory Commission
Post Office Box 311
Middletown, Pa. - 17057

March 24, 1980

Dear Sirs:

I wish to add my protest to the venting of the radioactive gasses at TMI into the atmosphere. I urge you to insist on the more expensive alternative of liquifying the gas by "freezing" it - and insist on working immediately toward that end.

I also urge the conversion of all existing plants, and those under construction, away from nuclear power. The claim that nuclear power is cheaper rings hollow when an accident requires expensive clean-up. It also fails to take into account the cost of lives and health. I feel it is entirely irresponsible to proceed with nuclear power. Not only are the plants themselves subject to accident, but the safe containment of the nuclear "garbage" and its long-term storage is impossible.

No matter what stringent measures are required for the transportation and storage of this radioactive material, it is ridiculous to even imagine a 99.2% of containment (the Safe level, according to Dr. John Gofman) at every stage, hour after hour, day in and day out,month after month for many years, When Dr. John Gofman, one of the pioneers in nuclear power, is now preaching against it because of his years of studying the effects of radiation and consequent conclusion that no level of radiation is safe, we must heed his words.

Even if the impossible percent of containment could be guaranteed, the danger of sabotage or of a conventional bomb being dropped on a nuclear power plant, which would have a worse effect than an atomic bomb, the risk is too great.

Dr. Gofman claims that if we stopped wasting energy, largely through inefficient heating, we wouldn't "need" nuclear power.

Until nuclear fusion, which has no harmful by-products and no problem of storing radioactive waste, becomes economically worthwhile, HALT ALL NUCLEAR PLANTS!

Meanwhile, expense in dollars must not be chosen above expense in health and lives! Insist on the more costly clean-up at TMI - and add that to the cost of nuclear power, proving that nuclear plants are not as economical as their advocates claim.

Sincerely,

Janet B. Allen

502 Meadowpark Lane,

Media, Pa. 19063

March 24, 1980

Nuclear Regulatory Commission

P.O. Box 311

Middletown, Pa. 17057

Dear Sir:

Our college students are the parents of our next generation. Many will be parents in the next few years.

I understand you are making a decision about venting Krypton 85 into the atmosphere by April.18.

My suggestion, briefly, is that if this venting could be delayed about a month, until around May 25, most colleges in the area will be closed for vacation. These students will be spread all over the country. I don't know exact figures, but, I think at least 15,000 critical age young people would be out of the area. This would include students at Millersville State College, Penn State Capitol Campus, Franklin and Marshall, Elizabethtown, York and many other colleges.

I hope you will give this idea some thought. Thank you for reading my letter.

Sincerely,

Doris K. Pagesy

SUITE 17, MEDICAL ARTS BUILDING
2328 AUBURN AVENUE
CINCINNATI 45219

LEE J. VESPER, M. D.

March 24, 1980

Nuclear Regulatory Commission
1717 H Street Northwest
Washington, D.C. 20006

Dear Sir:

Recent testimony before the NRC has suggested that residents in the immediate area of the Three Mile Island nuclear power plant would be severely disturbed by the release of radioactive krypton into the atmosphere at the Three Mile Island. On the other hand, the staff members of the Nuclear Regulatory Commission believe that only by removal of this radioactive gas can decontamination of this damaged unit be continued. If the radioactive gas is not removed, a multimillion dollar facility would be unusable.

I recommend venting the radioactive material into an enclosed balloon and attach this to a helium balloon, pull it over the Atlantic Ocean and release it. A remote explosive device could be attached to the krypton-containing balloon so that it could be destroyed when it reached an appropriate height over the eastern Atlantic.

If your technicians feel that the release of this small amount of krypton in the region of Three Mile Island would be safe (but is prevented by the understandable emotional sentiments of the local residents), surely the release of this same radioactive material at great height over an unpopulated area would even be safer.

I would like very much some acknowledgement that this letter has been read by at least some one on your staff and if this idea is defective, I would appreciate the err in my reasoning pointed out.

Thank you very much for your consideration.

Sincerely yours,

Lee J. Vesper

Lee J. Vesper, M.D.

LJ /mb

March 24, 1980

Mr.John Ahearn
Chairman
Nuclear Regulatory Commission
1717 H. Street NW
Washington, D.C. 20555

Dear Mr. Ahearn,

We the undersigned would like to officially protest the hearings concerning Three Mile Island which are presently being held in Pennsylvania. As citizens of Connecticut we feel that hearings should be held in Connecticut as the venting of Three Mile Island affects us as well as the residents of Pennsylvania. We are especially concerned with the venting process, causing the release of not only krypton gas into the atmosphere but other more hazardous radioactive gases. As mothers we are especially concerned with the alpha and beta particles which are making their way into the food chain.

Sincerely,

Mrs. Hilary Heijmen
134 East Avenue
New Canaan, Connecticut 06840

Rosanne Maroufkhani

Ms. Rosanne Maroufkhani
15 Old Stamford Road
New Canaan, Connecticut 06840

Allison Brown

Mrs. Allison Brown
75 East Avenue
New Canaan, Connecticut 06840

The Brothers of the Christian Schools

Stevenson Hall
635 Ocean Road
Narragansett, Rhode Island 02882

Mar. 24, 1980

Gentlemen:

A suggestion which, I hope, may be of help.

The krypton gas at 3 mile island can be liquefied, can't it.

Why not employ the help of a company engaged in the manufacture of air components - krypton is one.

With the gas liquefied, store it in suitable containers and dispose of it at a nuclear dump.

Sincerely,
Brother Philip Beirne

P.S. With a density 3 times that of air, upper air venting only delays descent of the concentrated radioactive to ground level.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAR 24 1980

Docket No. 50-320

MEMORANDUM FOR: Richard H. Vollmer, Director
TMI-2 Support

FROM: Jan A. Norris, Sr. Environmental Project Manager
Environmental Projects Branch 2, DSE

SUBJECT: COMMENT ON THE ENVIRONMENTAL ASSESSMENT FOR TMI-2 DECONTAMINATION (NUREG-0662)

After having read the Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere, NUREG-0662, I would like to point out that for the gas compression method the volume of contaminated air to be stored could be drastically reduced by introducing the replacement volume of gas in containers in order to prevent mixing and dillution of the contaminated air. The replacement gas (such as helium) could be contained in flexible (or rigid) baloons. Varying the sizes of baloons would minimize the interstitial volume.

Theoretically, only one reactor building volume would have to be compressed and disposed. Practically, only the bulk of the gas could thus be purged, however, the remaining volume to be drawn off by feed and bleed operation would be significantly reduced. After purging, the baloons could be collapsed and after decontamination disposed as low level waste.

Jan A. Norris, Sr. Environmental
Project Manager
Environmental Projects Branch 2
Division of Site Safety and
Environmental Analysis

March 25, 1980

John Collins
Deputy Director
TMI Support Group
US Nuclear Regulatory Commission

Dear Mr. Collins,

This letter is in response to the NRC request for public comment on the proposed venting of Krypton gas from the TMI Unit II containment building. As residents of Londonderry Township living within a mile of TMI, we are very concerned with the progress of the Unit II Recovery Effort. We believe that the radiation clean-up operation and eventual de-fueling are essential to the public safety of this area.

Therefore, we most definitely concur with the Met Ed/NRC proposal to vent the Krypton gas within the Unit II containment building into the atmosphere. It is the only logical and safe way to proceed considering the status of the Unit II reactor and associated equipment.

We are the parents of five children all under eight years of age. We do not feel this radiation release will harm them or ourselves. However, we do feel that further delays in the Recovery Effort will jepordize their health and safety because of the increased risk of uncontrolled releases, equipment failures, and remote but possible further core damage.

In closing, we would like to take this opportunity to thank you and your Staff for your work and efforts in a sometimes unfriendly and inconsiderate environment. There are many people of the area who appreciate what you are doing.

Very truly yours,

George Kunder
Barbara Kunder

George and Barbara Kunder

TMI Support Staff
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

3/25/80

SUBJECT: Draft Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere, March 1980

Dear Sirs:

I have personally reviewed your Environmental Assessment for Decontamination of the TMI Unit 2 Reactor Building Atmosphere and offer the following comments as constructive criticism of your report. Although I agree with your conclusion, that being that purging the reactor building is the most intelligent option available in consideration of the need to maintain the instrumentation and equipment inside, I do have some general criticisms which are identified below, as well as some specific comments, attached.

The EA lacks the perspective required by the public to understand the significance of the proposed action. A comparison of the dose consequences of each alternative, including the "no action" alternative which you have not specifically addressed, should be made to natural background exposures for each critical organ (skin and total body). It might be helpful to compare Kr-85 exposure to the maximum individual to exposures which result from radon gas exposures in homes made of brick or stone in that both Kr-85 and Rn-220 are radioactive gases.

The most important issue, indeed, the subject of the EA, is removal of the Kr-85 from the reactor building to allow maintenance of instrumentation and equipment inside. All other reasons such as decommissioning, recovery of the unit, removal of damaged fuel etc. are secondary at this point in time. It is the public health and safety risks associated with not maintaining/refurbishing the safety-related instrumentation and equipment inside the building which should be of primary concern. This is not consistently clear in the current EA.

The presentation of two different reactor building Kr-85 concentrations (1.0 µCi/cc and 0.78 µCi/cc) is confusing as is simply defining the quantity contained as curies of Kr-85. This says nothing about the relative hazard of krypton gas, and because it is a big number (57,000 Ci) is somewhat intimidating. A thorough explanation of what Kr-85 is, how it reacts or doesn't react with human body, what limits apply to operating reactors, etc. would be helpful to the public.

In summary, I find your Environmental Assessment, although technically sound, to be of little value to a lay person who must derive some understanding of the hazards involved. It is with this concern that these criticisms are offered. Also attached are specific comments to the report. If you should have any questions on these comments, please do not hesitate to contact me.

Sincerely,

Craig Fredrickson

Craig Fredrickson
2742 Veranda Rd. N.W.
Albuquerque, NM 87107
(505) 344-1048

Specific Comments

1. Section 1.0, page 1-3 (line 5) - The dose consequences of planned releases are not suspect. They can be well defined within limits according to the rate of purging and coinciding meteorological conditions.

2. Section 1.0, page 1-3 (line 13) - Although the releases associated with accidents during a 1½ to 4 year waiting period may be smaller than the controlled release of Kr-85 contemplated, the actual dose consequences of an accidental release at some time in the future could be greater if unfavorable meteorlogical conditions exist. This should be stated.

3. Section 1.0, page 1-4 (lines 1 & 3) - Same as Comment 1.

4. Table 1.1, page 1-5 - The comparison of dose consequences should include a comparison to the range of natural background exposures for each critical organ. Also, the occupational exposures should be defined as whole body exposures.

5. Table 1.2, page 1-6 - An advantage to reactor building purge is low occupational exposure. Since this segment of the population (radiation workers) is the highest exposed, minimizing their exposure is desirable and consistent with ALARA considerations. Similarly, a disadvantage of the cryogenic processing system is high occupational exposure.

6. Section 4.1, page 4-1 (line 12) - Purging of the reactor containment does not per se represent a way to dispose of the Kr-85 gas. This alternative would be better termed "controlled dispersal" rather than disposal.

7. Section 6.1.2, page 6-2 (line 13) - Administrative limits for the controlled release of Kr-85 should be defined.

8. Section 6.1.4, page 6-4 (line 9) - This section states that a particulate removal efficiency of 90% is assumed for the two-stage HEPA filter system. Although the HEPA filters would not remove Kr-85, the credited particulate removal efficiency is unrealistically low. A two-stage HEPA system would be expected to provide a reduction in the source term, due to particulates, by a factor of 10^6.

9. Section 6.1.4, page 6-4 (line 20) - The X/Q values assumed should be accompanied by their corresponding stability class. It is likely that dose consequences could be reduced by more than the factor of 2 or 3 stated by venting only when dispersion conditions exceed certain limits.

10. Section 6.1.5, page 6-6 (line 13) - The calculated dose consequences of the worst-case accident are not defined in terms of the dose receiver; i.e., is it the maximum individual offsite, average individual offsite, maximally exposed worker? Also, it is not clear that the accident limits of 10 CFR 100 are appropriate in that they apply to major accidents at operating nuclear power plants and are used primarily for siting. It might be more correct to compare the dose consequences to 10 CFR 20 limits or perhaps both parts 20 and 100.

11. Section 6.1.5, page 6-7 (line 1) - Guaranteeing continued reactor building isolation is not possible for any of the alternatives including purging. It would be true, however, to state that the likelihood of an accidental release is increased with the delay associated with implementing the alternatives to purging. Also, in the last paragraph of this page "interpretation" should be "misinterpretation."

12. Section 7.3, page 7-2 - The Commonwealth of Pennsylvania radiological monitoring capability consists of fixed filter cams which would be of little use in monitoring for Kr-85. Therefore, credit should not be taken for this monitoring capability as part of the program.

13. Section 7.6, page 7-4 - The discussion of the DOE radiological monitoring program includes objectives which are not relevant to the task of monitoring the purge operation and which do not belong in this Environmental Assessment.

West Shore School District

1000 HUMMEL AVENUE • LEMOYNE, PENNSYLVANIA 17043
(717) 763-7101

March 26, 1980

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Sirs:

The West Shore School District lies on the west bank of the Susquehanna River opposite the Three Mile Island nuclear facility. The district's Newberry Elementary School lies within the five-mile radius of the plant and the Fishing Creek Elementary School and Red Land High School lie within the six-mile radius. During the crisis a year ago we evacuated the populations of these schools to a neighboring district some 15 miles to the west.

Presently we are receiving a considerable number of parent inquiries about our plans if radioactive gases are vented directly to the atmosphere. Some of these parents, concerned about their children's education but even more concerned about their health, are requesting that we close our schools. They indicate that they will leave the area during any venting and they are asking for some accommodation to eliminate the necessity of placing their children's educational progress in jeopardy. We don't know how large this parent group is but our experiences with parents this last year would indicate that the number could be sizable.

Most of the school districts in the vicinity of the Three Mile Island plant will close for the summer the week of June 9. The West Shore School District will complete its school year on Tuesday, June 10. If you do decide to approve venting of radioactive materials to the atmosphere, would you please consider postponing this action until the schools in the area have closed for the summer. I recognize that the Commission must weigh many factors in its decision and that postponement may not be in anyone's best interests for other reasons. However, I want the Commission to be aware of the effects of its decisions on the school children who reside in the Three Mile Island area.

Sincerely yours,

Jacob N. Wentzel

Jacob N. Wentzel
Superintendent

bf
cc: W. Reed Ernst, Superintendent,
Middletown Area School District

Dr. Henry R. Hoerner, Superintendent,
Lower Dauphin School District

IYC 1979

1818 Northbrook Drive
Lancaster, Pa. 17601
March 26, 1980

The Nuclear Regula tory Commission
1717 H Street, N. W.
Washington, D. C. 20585

Dear Sirs:

I am writing to express my violent opposition to the venting of the radioactive krypton-85 gas from the containment building at Three Mile Island. I am aware that this gas presents an obstacle to the maintainence necessary to prevent a worsening of the already dangerous water problems at the plant and that it is essential that it be removed. Nevertheless, the Met Ed Corp. was certainly aware that this problem would have to be dealt with shortly after the accident, almost a year ago. It would seem that the NRC must have been aware of it also, or obviously should have been. This problem has now been presented to the public as a sudden emergency requiring immediate action. This is the same technique that was used when Met Ed attempted to dump radioactive water into our drinking water supply.

The krypton problem should have been dealt with many months ago. Shortly after the accident met Ed received an offer from another nuclear plant of equipment for containing the gas in containers. Met Ed refused the offer, because it was more expensive to dispose of the gas in this way than to simply vent it. Met Ed has once again diplayed its total indifference and insensitivity to the health and saftey of the poeple who live in this area. Through what sort of negligence or incompetence is it that the NRC manages to remain ignorant of the necessary operations to clean up that plant safely, even at this stage. Surely the NRC ought to have determined that the safe containment of this gas was necessary long ago and to have required that Met Ed take the necessary actions to do this. It is imperative that it do so now, and require Med Ed to act on it soon.

The effects of the TMI accident on the residents of this area can never be adequately measured or quantified. The stress and anguish suffered by my family and myself when we fled this area was indescribable. My husband's sister and her family have moved away from this area specifically because of the accident. The thought of being exposed to further radiation, however small the amount is said to be, is intolerable to the poeple who live here, after what we have already been forced to endure . The clean-up procedures of Met Ed have shown that they are no more fit to operate a nuclear facility than they were when the allowed the accident to occur a year ago. The only way to deal fairly with the residents here is to decommission that facility and allow them to regain the peace of mind they have lost since the accident. It will never return until that plant is closed forever. The people who confronted the NRC at the Middletown and Elizabethtown meetings recently were not the minority, they were an expression of the feelings of the majority of the peeple who live here. I know because I live here; and those who do not live here, like yourselves, gentlemen, cannot really know what it was to live through that accident and the anxiety that still remains in its aftermath, the clean-up. We were exposed to radiation because Met Ed lied to us. We were assured repeatedly at the time of the accident that all was perfectly safe and we remained here when we should have left because of that deception. It should not be hard to understand that people here do not trust the assurances of Met Ed that the exposure to radiation this time will be minimal. It was Met Ed's desperate attempt to conceal the real facts of the accident that caused us to be exposed to radiation at the time of the accident. Met Ed is now desperate again, because they are close to bankruptcy. It is not inconceivable, in light of their past actions, that they would try to release a larger amount of radioactive gas than they announce publicly. And in view of the NRC's past preformance, it is not inconceivable that they would be oblivious to this act. Perhaps we might never know. In any case, the credibility of both the NRC and Met Ed around here is about at zero. In God's name, we have been through enough. Let's get this plant cleaned up and closed down without any further harm to the people around here. You are supposed to be serving the public, not Met Ed.

Sincerely,
Lynn Goldfarb

3/26/80

Nuclear Regulatory Commission..
Dear Sirs:

Let the PUC, Met-Ed etc forget about Cost for a moment and Concider Our lives.

They have spent thousands of dollars to come to the Conclusion "to vent" the KRYPTON GAS and to save the stock holders dividend So, why not save us + spent more dollars to buy the equipment from Phila Elec. Co and get rid of the gas properly. They offered the equipment a year ago. So — what is stopping NRC etc.

As Hendrie so angrily + sarcastically said "Lets get with it". I agree but save us not dollars.

Sincerely
Queen E. Riegel
1400 Brandt Ave
New Cumberland, Pa 17070

Etters, Pa.
March 26, 1980

The Nuclear Regulatory Comm:

Dear Sir,

I am writing you in regard to Venting The Krypton-85 Gas at TMI. I live 1/2 mile from the Building containing The gas and recommend you people vote to Freeze The gas rather then vent it and contaminate the area more than it has been already.

It would be better for me to pay an additional $160.00 Income tax, or double my electric bill for years to come in order to get rid of The gas by the Freeze method. Also it will be cheaper for me in the long run, as I will be leaving The area when they start their circus and wont be back until its over.

Sincerely,

Frank R. Bost

Box 121
Etters, Pa. 17319

PS: I also recommend it be closed forever as a Nuclear facility. We were here before they sold us the unmetered cheap electricity gimmick in the 50s. FB

R.D. NO. 5, BOX 258
Lebanon, Pa. 17042

Nuclear Regulatory Commission
Middletown, Pennsylvania 17057

March 26, 180

Gentlemen:

Re: Comment - Proposed Krypton Gas Venting

We believe that it is important for the Commission (NRC) to understand our position and that of our neighbors in central Pennsylvania, toward the proposed venting of Krypton gas by Met Ed at TMI.

In following this situation in the media, it becomes more and more apparent that the NRC is hardening its position in favor of this procedure. Testimony by NRC Commissioners and staff at public meetings and to various bodies, stresses the need to "do something" soon, before the fans quit, etc. Discussion of the opposition of the local populance to venting is in the light of 'how can we change their minds and make them believe us'?

As an Environmental Review Officer for local government, I know how easily an environmental assesment can be affected by the attitudes of ones superiors and co-workers. I will be very much suprrised if the NRC Assesment does not make a strong case for venting.

The point the NRC and Met Ed seem to be missing, is that this is not a viable alternative. We the residents of central Pennsylvania will never allow the venting to take place. Please understand that this is not a threat on our part, but rather a statement of fact. Public attitudes are such that no number of studies will change the minds of the people directly affected.

The NRC has had this alternative removed from their decision making process by the people. You are only kidding yourself by continued discussion of this procedure. Further consideration should be discontinued.

We support recent editorials by the Philadelphia Inquirer (3/23/80) and the Harrisburg Patriot News, which we believe reflect the opinions of most people in this area.

The more time that is wasted on review and discussion of venting, the more clean-up is delayed.

The NRC should aprroach this decision from the question, 'Will Unit 2 ever be restarted?', the answer should be no. Based on that starting point, cleanup takes on an entirely different approach.

We personally favor freezing the gas, but do not preclude other alternatives asside from venting.

In summary, no governmental agency or Commission will pay for mistakes with TMI cleanup. We the residents of central Pennsylvania will pay via our health, our lives and our electric bills.

NRC
Page 2

Please wake up and listen to the people most likely to be affected. We are counting on you.

Thank you,

Raymond J. Bender
Beverly A. Bender

Raymond J. and Beverly A. Bender

cc: President Carter
Senator Heinz
Senator Schweiker
Congressman Walker

Mar. 26, 1980 X

Dear Sir:

In regards to the N.R.C.'s recommendation to allow G.P.U. to release the radioactive krypton-85 gas from T.M.I. into our atmosphere. My suggestion is to allow the release only when the conditions are favorable.

The conditions being:

1. a north-westerly breeze, to carry the radioactive contamination away from our area, and into the Washington DC area.

Thank you
William [illegible]

R.D. #4 Box 215
Allentown, PA 18103
March 26, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

Gentlemen:

As a citizen of Pennsylvania, the United States and the earth, I am strongly opposed to any venting of krypton-85 gas into the atmosphere. As shown by TMI, we can no longer trust information given by the utility companies. I therefore refuse to be a test animal for another one of the utility's experiments. They state the wind will disperse the radiation. How can they be assured that the wind will evenly disperse radiation and not have it caught in an air current and then dropped in larger concentrations than estimated on some of our citizens? Even if it is evenly dispersed, the short-term and long-term effects of low-level radiation are still not known. I again refuse to be a test animal.

Has GPU considered producing a filter to remove the krypton-85 and all other radiation from the gas so it can be released safely into the atmosphere? No matter what the cost, this type of technology must be developed before any gas is released. The expense of such a procedure must not be accepted as an opposing reason since human life and the quality of that life is far more important than "dollars." Our lives have already been greatly affected because the utility companies have ranked "dollars" more important than safety. Please do not allow them to do this again.

I am still strongly opposed to venting of krypton-85 gas into the atmosphere.

Thank you for your time.

Sincerely,
Diane R. Schappell

March 26, 1980

Dear Commission:

I'm concerned about the venting of krypton-85 gas into the atmosphere at Three Mile Island.
I'm also concerned about the discharge of water into the river.
So much so that all my life (I'm 54) I fished the immediate area, spent a lot of time days at a time in the area. I haven't been closer then I am now, 20 miles away. I'm I suppose you would say afraid to go near or to eat any fish from the river.
I feel there has to be other means of disposeing of the cleanup materials, other then the two previously mentioned.
I'm retired, after working 31 years in the steel industry with a lot of time to use that area now I'm afraid to, In fact I don't feel to safe here at home. I wish the place was converted to coal. I'd feel safer breathing that.
Please try an have the place cleaned up safely an with a way that you will know what the out come in the future will be. Once it is cleaned up let it stay shut up, there is other an safe means of producing Electricity.

Sincerely
Lester c. Crabbs
Lester c. Crabbs
604 Hammond Ave.
Hanover, Pa. 17331

516 Panmuré Road
Haverford, Pa.
March 26, 1980

The Nuclear Regulatory Commission
1717 H Street, NW
Washington, D.C.

Gentlemen:

Is there a possibility that the krypton-85 gas could be released into drums instead of into the air? I don't live in the area, but I sympathize with the feelings of the people there. On the other hand, I try a little bit to enter into your problem although, personally I have no use for the nuclear option. Releasing into drums would be expensive, I realize, (and only defer the problem), but I think that the nuclear source is going to be expensive if it is to be used rightly and safely. Maybe the costs will help turn us to a more intense crash program to develop solar, wind, and other forms of energy.

I did force myself to read through David E. Lilienthal's "A new nuclear day is dawning," as a matter of open-mindedness and I was mildly impressed. Maybe you could get a member of The Union of Concerned Scientists who was not too absolute in opposition to nuclear energy to study and report on the danger or non-danger of the release. The credentials of such a member might reassure the people who no longer believe in the government nor (naturally, who would?) believe in the self-interested corporation.

Actually, we all may have to develop a simpler life style. Does our complex life style really give us that much happiness? While reading the account of Indian life by Lame Deer, Seeker of Visions I feel tempted to go "primitive(?)" and join an Indian tribe. Of course, I know that, at age 72, I'm too long corrupted by "civilization" for such an adaptation, even though my life is simpler than that of many Americans--no car, few modern gadgets. I find my life happy enough without them.

Sincerely and respectfully yours,

Constance Hyslop
Constance Hyslop

Address (in case interested)
Union of Concerned Scientists
1208 Massachusetts Avenue
Cambridge, Mass. 02238

Francine Maultz
916 Hummingbird Lane
West Chester, Pa. 19380
3/26/80

w/Encl.

President James Carter.
%White House
Washington, D.C.

Dear President Carter.

On behalf of many members of "Displaced Homemakers" and many other women in my area, I am writing to you to ask you to consider this proposal.

In reference to the clean up program at "3 Mile Island" Penna; we are being told that the intention is to release radio active krypton gas into the atmosphere.

I have no doubt that there is a cleaner and more efficient manner for Met. Ed to disburse of this kripton gas. I would immagine it simply cost more! - I am asking you to please consider making Met-Ed be forced to wait until the children are out of school and many parents will have vacation time from their jobs to be able to take

3.

their families away until it is over. - If we have no choice as to the method; just give us a chance to save our childrens lives.

I voted for you in the last election; think of the many voters in the Pennsylvania area who will be influenced by your decision. There are also many people in the United States who are sympathetic to our cause.

Yours truly,

Francine Maultz

P.S.
OVER

P.S.

This letter will take but a minute to read; please see that the president does read it.

It just might make a difference in a decision.

There is also a article from "The Daily Local" which Mrs. Carter should truly read. * I would appreciate a answer, not from the N.R.C., but from my President.

*Enc.

From the desk of

DR. PETERS

03-27-80

Mr John Collins, NRC

Dear Sir:

I think it is about time some one spoke up in behalf of TMI and the Nuclear Industry. All that is heard is the loud noise of a relatively few -- the same kind of noise that swayed the lawmakers into removing the reading of the Bible and the Pledge of Allegiance from the Public Schools. The vast majority of people didn't say anything and let mostly one woman take these things away from our children.

Three to four hundred noisy radical people, acting like mad animals -- if you looked at the T.V. reports of the meeting at the Liberty Fire Hall -- you could see nothing more than an exact duplicate of the uncontrolable mobs in Iran -- and if left go, violence will erupt. Can you blame the sane, level-headed members of the community for not saying anything. It was tried once, and altho the anti-nuclear faction were given a respectful chance to air their views to which they are entitled, <u>no</u> pro-nuclear could say anything -- they were booed and shouted down at the Borough Council Meeting. Members of the Police had to be brought in so it was safe for the wives and their council husbands to leave and go home.

From the desk of

DR. PETERS

There were, by newspaper estimate, around four hundred people at the Liberty Fire Hall last week -- probably half of those from outside our community -- more people than that go to Three Mile Island every day to work. The GPU system provides electricity to 4 million people living in almost half of the states of Pennsylvania and New Jersey -- the customers alone number 1.5 million. Shouldn't they be listened to?

And about polls -- on two occasions after the accident of last year, poll takers interviewed me -- once at my office and once at my home. On both occasions, when they heard my views, they left without making any notations. I expect they wanted certain statistics to develope.

I am quite certain that the vast majority of the anti-nuclear people do not know much about what they are afraid of-- radiation, krypton, contamination, the hydrogen bubble -- and all other ramifacations of that incident. Both the Press and the news make a big cry of each incident which flood into the minds of the un-informed -- but in fine print, with little enthusiasm, is mentioned facts that show there will be little or no basis for that particular fear -- and this is not remembered or soaked in by those ones who haveleft themselves get out of con-

From the desk of

DR. PETERS

trol of their sane thinking. Everbody picked up the report of the five cases of babies having thyroid trouble (which happens all the time in all communities), just because a State worker discovered the fact and jumped to get press coverage. No body noticed a later report several investigations made which stated there was no basis for a connection between this and the accident.

It is about time for some one with a backbone, one who is not afraid of not being elected again to a soft position, to make a stand and say we are going to clean up this mess. It has gone on entirely too long as it is -- the longer it lies as it is the more chance of trouble. You can not have Boron and other chemicals lying around in pipes and machinery without sooner or later producing trouble. Anyone with half a brain knows it has to be cleaned up and the State, Government, the utility, and all the committees and commissions to date have had more than enough time to come up with answers. If the best way to get rid of the gas is by venting -- ther it should be started to-morrow. If the best and safest way to get rid of the treated contaminated water is by putting it in the Susquehanna -- then put it in.

From the desk of

DR. PETERS

I do not like to see any form of polution in the air, or in the water either-- any more than anyone else. -- but we can't have everything going for us in this world -- we have to take the rainy days with the sunny ones.

Our Mayor and our Governor should try to quiet the fears of their people --- it seems they are trying hard to do the opposite. Our Mayor, and I think he is a good mayor and I respect him very much, but I think he forgets at times that TMI made this town when the Air Base folded up. When all the safeguards are incorporated, with Government controlers on the site -- and perhaps with government officials in charge, TMI will be the safest nuclear plant in the country, for with all the world watching every little move, no one would allow even a tiny mistake to occur.

Nuclear power <u>is</u> safe -- nothing is 100% safe. Air-planes, ships, trains and the space programs have all taken their toll in human lives and are continually doing so every day. Just pick up the paper or view the T.V. -- look at the road toll just in our own community each week -- it is much safer living across the Route 441 from TMI than it is to go out in your car.

From the desk of

DR. PETERS

Sure, a mistake was made -- but as far as operator mistake -- it was something the men were not trained for -- it was something that couldn't possible happen, as shown by the gauge that might have prevented the serious ending of a little malfunction. The builders put the guage back out of sight in a corner, behind the banks of controls which the operators monitor.

If nuclear energy is such an ogre -- why is it that all other countries are rushing into it -- now more than ever. China had men visit TMI and they went home with the recommendation that Nuclear Energy can be safe and China has recently stated that three nuclear plants would be built. France in 1995 expects to get 65% of its energy from Nuclear plants and is also going into Fast-breeders. Germany Russia, England are all fast expanding their nuclear systems, because they know they are at the mercy of the oil barons, and it would be disastrous to all but possibly Russia, if war came or some mad fanatic decided to stop the flow of oil to these countries -- they know they have to get away from dependance on oil -- and Nuclear is the only way --before the year 2000 at least, that alternative energy can be found in any appreciatable amount.

In the War that I know about, our boys were trained to defend the ships against

From the desk of

DR. PETERS

flying airplanes — but no one had any experience or were taught to defend themselves against dive bombers or kamakawazi fanatics who drank rice wine for the courage to dive into a target. We lost a lot of ships and boys -- but the boys grew into men fast and came back -- to win. We need some of this old-fashioned American Spirit that has almost disappeared - we need to roll up our sleeves and clean up this mess, put on all safe-guards and Start-up TMI-I. and get cheaper electricity. My bill this month went up by an additional $6.95, and there will be more raises. I don't see why the local people aren't concern'ed about this side effect. Where do people think the millions of dollars that is spent just in care-taking of the Island come from -- don't they know they are paying for it. We all have to work till the middle of May each year for taxes before we can do things for ourselves -- and each month it is getting worse, soon the whole first half of each year will be a dead loss financially for every family.

The main trouble is that there are too many self centered people around. These things happen at home to us -- if this accident had happened in Kentucky or Texas it would have been forgotten in a

From the desk of

DR. PETERS

day or so. If we got our nuclear energy from Erie and they had the accident we wouldn't be very much concerned -- we would want them to get back on the road soon so we could get lower energy costs. We worry about polution in the river -- yet I heard no one say any thing of the massive green and yellow stream coming from the mine seepage up state several months ago, in the Susquehanna River.

We should all calm down and get educated just not listen to everything that is said -- most don't know much about the facts any way. I was in the hospital eight years ago and had 14 x-rays taken; my wife had more than 20 taken last year in her hospital visits -- we both had more radiation than any-one in this community received. We both expect to fly to the West Coast next Month and visit on a stop over in Denver. Denver has several times as much natural radiation as the Harrisburg area, and has always been considered an ideal place to live.

We should be proud -- that thru this trouble, we have made all nuclear plants and their communities much safer, not just in this country, but all over the world. I have often wondered how these weak people that ran and are still running could ever go thru things I saw like the bombing of London, the invasion

From the desk of

DR. PETERS

European countries -- children were killed right in front of parents -- husbands were killed in front of their wives -- whole families disapeared in one flash -- but the women went right to work with their men to re-build. We are all too soft, too used to all conveniences, and day-to-day soft living -- we can't take set-backs.

If our elected lawmakers in Washington would have done what they were sent there to do, we wouldn't need Nuclear Emergy so much as we do now. In 1973 when the Mid-East cut off the oil supply -- they should have known theycould do it again at any time -- and if any trouble starts, and with us on the side of Isreal, we will get no oil at all -- and besides we have a commitment to supply Isreal with oil in case of trouble. If this happens the tires of your cars will rot in the garage for you won't have gas to drive -- you will wear sweaters or overcoats for there will be no oil to heat your homes -- and it will be too expensive to use.

I, for one, would rather live in the TMI community than be a slave to the oil-cartel, both in this country and elsewhere. I hate to be taken -- and we all are being taken. Starting up TMI-I would save 10 million barrels of oil in one year

From the desk of

DR. PETERS

Since 1973 the Government should have made a crash progrem to get away from oil-- Even Pennsylvania with all the talk of coal where is all our energy coming from -- even now energy from our coal is still just talk We should now have big plants producing gasahol -- we should have big plants for de-gassification of coal. Lets get our nuclear plants running -- we can't get along without them for at least 25 years -- then we can think of phasing them out.

As for waste products -- no one can tell me that a country that can do the space work that we did, put a man on the moon, and take pictures of the distant solar system and bring them back -- no one can tell me that a crash program would not solve a lot of that problem. There must be a way to break down the end products and make them useful and/or harmless.

Lets get back to normal and devote our energy to safer streets and communities, robbing of homes, raping, molesting, mugging, youth drinking and drugs -- if we don't lick these our children will not grow up -- and it won't be 1.5 millirems of radiation that will keep them from becoming an adult. Some of the biggest anti-nuclear acquaintences I have are heavy smokers -- they and their children sit in

From the desk of

DR. PETERS

a small TV room filled with smoke -- they ride in a car and smoke all the way, and the children breeth it -- they are all going down the cancer road much faster than this TMI is taking them.

So Lets get TMI-I going immediately as soon as all safe-guards are placed, lets save 15 million barrels of oil a year just here in Middletown -- the same elsewhere, lets quit sending all our taxes to the mid east and other oil countries, lets bet the $ back into respect, lets get our nation back into respect -- we don't have a real friend in the world -- England add Canada are probably the best ones -- all the rest would cut our throats the first chance they get. I've been around quite a bit -- no peoples care for us any more, they put up with us for what they can get and our hand-outs. And if the people in Washington can't get us these things, lets throw the whole bunch out and get ones in that will work for us and our country.

Dr John R. Peters

(You may use this comment for what ever purpose you want)

March 27, 1980
R.D. #3 Cleveland Street
Irwin, Pennsylvania 15642

Dear Mr. President,

With the problems of the "Three Mile Island" Nuclear Power Plant and the Nuclear Regulatory Agency deciding if Krypton gas should be vented into the atmosphere...I wonder if ~~it would be~~ possible to vent the radioactive material into some light, flexible pipe; through a compressor and into (gas compressor) tanks--which can then be disposed of in traditional methods.

Sincerely yours,

Martin R. Prytherch

Martin R. Prytherch

MRP

March 27, 1980
RR 3 Box 355
Monterey, TN.
38574.

The Commissioners
Nuclear Regulator Commission
Department of Energy
Washington, D.C. 20555

Dear Sirs:

I strongly suggest that an environmental impact study, in accordance with Federal guidelines, be made prior to the further "venting" of radioactive material at the damaged Three Mile Is. reactor. Any circumvention of such guidelines is an obvious betrayal of your obligations as appointed commissions.

I would appreciate a response.

Sincerely,

E. G. Masland

The Nuclear Regulatory Commission
1717 H Street, NW
Washington, D.C. 20585

March 27, 1980

Commissioners:

Given the information I've read in our newspapers concerning Metropolitan Edison's proposal to vent Krypton 85 at Three Mile Island, I oppose the venting.

Correct me if I'm wrong, but wouldn't it be possible to transfer the gas from Unit 2 to Unit 1 without exposure to the outside world? That would result in safe storage of the Krypton 85 and permit access to Unit 2 for further clean-up.

I realize that this would cause contamination of Unit 1, but my opinion is that the NRC and Met Ed owe the people of this area the safest possible method of clean-up. I am completely unconcerned with the "health" of Unit 1's equipment or the financial well-being of Met Ed and GPU. Further, I think those who hope to re-open either unit at Three Mile Island are not facing reality. I don't believe the people of this area ever will allow TMI to operate again. Certainly, then, the eventual clean-up of Unit 1 could not be more difficult than the eventual decommissioning of the plant as a whole.

Finally, I regret that your recent public hearing in Middletown, which I could not attend, was disrupted to the point that you couldn't present your options as planned. But you certainly should have known what to expect -- both then and in the future.

Sincerely,

Timothy Potts
31 W. Simpson Street
Mechanicsburg, PA 17055

Nuclear Regulatory Commission
Middletown Pa

3/27/80

Dear Sirs:

I want to express my grave concern on your impending decision to vent radiation from the Three Mile Island nuclear facility. I want you to know I am totally opposed to this decision and feel that it is extremely foolhardy. There are too many alternative answers at your disposal, including cyrogenic processes or even the use of charcoal to trap the radiation making it easier to dispose of, than to take the chance of exposing hundreds of thousands to unnecessary amounts of low level radiation. Of course, these alternatives are expensive and require time and in fact should have been started months ago. This doesn't help us now.

These alternatives must be explored now and put to use now. Waiting only gives Met. Ed Co. the chance to utilize the cheapest and easiest means of correcting this situation. Sooner or later the air conditioning units that are keeping the reactor chamber cool will breakdown and large levels of radiation could be released. Met Ed. wants us to believe its an either/or situation, either we get contaminated with low levels of radiation for a long period of time or a large dose over a short period. These are more of Met. Eds Tactics.

I implore that you decide not to vent this radiation and to explore the alternatives. You're dealing with peoples lives and the lives of their children. Responsible decisions must be made now!

Thank you
Allan Guber
359 Concorde Ave.
Ewing, N.J. 08618

Joseph R. Heckman
613 N. Broad St.
Lansdale, Pa. 19446

March 27, 1980

Nuclear Regulatory Commission
Post office Box 311
Middletown, Pa. 17057

Dear Sir:

I am absolutely opposed to the venting into the atmosphere the radioactive krypton gas trapped inside the TMI facility. Although more costly, the most practical alternative would be to employ the Cyrogenic process. Venting the gas would be irresponsible and unnecessarywith this alternative available.

The venting of the gas would subject the people of Pennsylvania to unsafe doses of radiation inaddition to that which they have already been exposed since the beginning of the accident. It is my belief that decisions on safety should be made without any examination of dollors involved, but only from the standpoint of human life.

Sincerely,

Joseph R. Heckman

Joseph R. Heckman

JOSEPH W INSLE
DOWLINS FORGE
DOWNINGTOWN PA 19335

western union Mailgram

4-0828338087 03/27/80 ICS IPMMTZZ CSP WSHB
2152692412 MGM TDMT DOWNINGTOWN PA 47 03-27 1049P EST

DIRECTOR EARL DENTON
DIRECTOR NUCLEAR REACTOR REGULATIONS
WASHINGTON DC 20555

DEAR DIRECTOR DENTON
PLEASE DEMAND THAT METROPOLITAN EDISON CO IMMEDIATELY FREEZE KRYPTON GAS NOT VENT IT, THERE IS NO PRECEDENT CONCERNING EFFECT OF WIDESPREAD VENTING OF KRYPTON ON DNA OF PENNSYLVANIA RESIDENTS, MOST CONCERNEDLY
MARY W INSLE

22:49 EST

MGMCOMP MGM

TO REPLY BY MAILGRAM, SEE REVERSE SIDE FOR WESTERN UNION'S TOLL - FREE PHONE NUMBERS

March 27, 1980

SAMUEL E. CASSELBERRY
1501 CARLTON DRIVE
LANCASTER, PA. 17601

Nuclear Regulatory Commission
1717 H. Street, N.W.
Washington, D.C.

Dear Commissioners,

We would like to express our concern as residents of Lancaster on the venting of krypton 85 gas into the atmosphere - we are opposed to such venting. It's been over a year since the disaster at T.M.I with nothing having been done on clean-up of a still dangerous situation. There are alternative methods to cleaning up the gas and one of these must be utilized. Cost should not matter when the health and safety of thousands of residents is concerned. It is simply not known what long range health problems will result from the release of the krypton gas. We do not want any chances taken on the lives of our children and future generations. Please consider what we have already lived through with this nuclear nightmare. Would you want to live near T.M.I?

Sincerely yours,
Mr. & Mrs. S. Casselberry

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WORLD-WIDE FLAG COMPANY

Division of World-Wide Heralds

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612 ADAMS AVENUE
SCRANTON, PA. 18510
PHONE: (717) 344-0089

March 27, 1980

Nuclear Regulatory Commission
1717 H Street, N. W.
Washington, D. C. 20036

SUBJECT: THREE MILE ISLAND FACILITY

introduction
Extraneous

Gentlemen:

I think that any charged particles or weed containments can easily be neutralized through the employment of high-intensity radar and air, all confined within the reactors; and resultant acids, et al, like sulphuric acid, can be made ineffective by means of electrolytic and alkali means.

All can be introduced into the cells from without the containers easily.

Yours truly,

Dan W. Salamone

Dan W. Salamone, Herald

DWS:hem

TRADEMARKS REGISTERED

Box 118 Saylor's Mill Rd.
Spring City, PA.
March 27, 1980

Dear Sirs:

I am writing to urge you not to release krypton from TMI. It is not fair to the people who live in the area immediately surrounding the plant or those who live as far as the Philadelphia. It is known that the wastes can be frozen + stored more safely + with less harm to people, but that this process is more costly + takes longer. I fear that you may take the quickest + easiest way out + the people be damned. Surely it is time for the NRC to look out for the public welfare + the health + safety of future generations rather than the financial interests of the utilities.

It would also be irresponsible to release wastes into the river, especially the hydrogen isotope. People are aware + are educating themselves + their friends + neighbors to the facts + not to the platitudes that utility companies + government agencies put out. Nuclear power is unconscionable + we can not + will not tolerate it.

Sincerely,
Anne Conn

3/27/80 ①

Dear Sirs,

We the undersigned are very concerned, indeed outraged at your plans to vent 57,000 Curies of Krypton^{85} into the atmosphere. We are aware that within the containment Building at the three mile island nuclear plant, There is enough radiation to surpass the amount released at the bombing of Hiroshima by a factor of 2,000.

We do not believe G.P.U.'s lies. They are saying that the amount of radiation that would be absorbed by the general public is equivalent to 1/5 of 1 millirem. G.P.U.'s computations are based on "target radiation" as it applies to "X rays".

If that Krypton^{85} is released we will receive "Total body radiation". The health effects of "Total body radiation" are at least 10x's greater than the effects of "target radiation".

Anyway, can G.P.U. predict which way the wind will blow. The Krypton^{85} could come out in clouds + float over to Pottstown. It could rain that day + we could receive a large dose.

(2)

Whether they release the gases all at once or in increments doesn't really matter. The health effects of radiation are cumulative.

Krypton 85 is a radioactive isotope and when inhaled through the lungs is metabolized and concentrates in the gonads. It causes cancer for those unfortunate enough to inhale it, or it causes mutative diseases for future generations. Krypton 85 is radioactive for more than 560 years.

We know that through cryogenics, the Krypton 85 could be frozen and encased in concrete, then buried in the ground.

We do not believe the stories about the seals going bad in the containment building. Since it will take several years for the clean up; why not start on a cryogenics program now.

We also want to protest G.P.U.'s plan to dump 3,500 curies of tritium into the Susquehanna river. This Tritium is radioactive & is a powerful mutagene. It will pollute the aquatic life of the river, and eventually work it's way down to the oyster & clam beds of the Chesapeake Bay.

RAUL + MARIA KOVERA
RD#1 BOX 133
DOUGLASSVILLE, PA. 19518-

Mr + Mrs Robert Kellar
Douglassville RD#1 Box 156

+ Mrs. Thomas Morrow
RD1, Box 127
Douglassville, Pa. 19518

Mr + Mrs Gordon A. Nairn
Box 128
Douglassville, Pa
RD#1 - 19518

Steve + Kathy Kraasley
Red Corner RD. Box 186
Douglassville, PA 19518

Mary Catherine Hughes
Box 33 RD1
Douglassville, Pa 19518

Ed McDade
RD#1, BOX 185
Douglassville Pa.

Rose D Semplen
RD1. Box-187,
Douglassville
19518. Pa.

Curtis J. Brown Jr.
RD#1 Box 184
Douglassville, Pa. 19518

Curtis J Brown Sr.
R.D. # 1 Box 184
Douglassville Pa. 19518

Linda Donovan
R.D.#1 Box 188
Douglassville, Pa. 19518

Kathryn Kruco
R.D.#1, Box 183
Douglassville, Pa. 19518.

Louis E. Waldo
RD#1, Box 191A
Douglassville PA. 19518

Ruth V. Waldo
RD#1, Box 191A
Douglassville, Pa. 19518

L P Bernard
R1 Box 192
Douglassville Pa

Dorothy J Faust
RD1 Box 181
Douglassville, Pa

Kathryn Layman
RD#1,
Douglassville, Pa

Carl J. Layman
RD#1,
Douglassville, Pa.

Paula Layman
Ernest W. Young Jr.
R.D. #1
Douglassville, Pa.

Pauline Care
RD1 Douglassville

Carol Petro
RD1 Douglassville

111 Orchard Square
Pittsburgh, PA 15229
March 28, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

re your proposal to vent Kr-85 from TMI-II:

The recommended practice of the radiological health community is to assume zero health effects only at zero dose ~~for a given exposure to ionizing radiation~~, i.e., the "linear hypothesis." Since the available evidence is insufficient to establish conclusively the existence of a "threshold" dose, this would appear to be a prudent assumption with respect to public health & safety. Those health effects which are assumed beyond zero dose are "acceptable" to the public because either there is no choice in the matter (as, for example, with background radiation which is a normal and unavoidable part of our environment), or the benefits which accrue from processes giving rise to the exposure outweigh the health effects ~~a~~ (as, for example, with the production of ~~n~~

nuclear electricity). There is – at this time and, perhaps, for all time to come — no tangible benefit from TMI-II. One would expect, therefore, that the public should be exposed to no additional radioactivity as a result of TMI-II. If there is no benefit, why should the public expect any risk? What is more, the technology exists to isolate the Kr-85 within the containment. For example, the Ford Foundation / MITRE Corporation report "Nuclear Power: Issues and Choices" clearly states, in relation to the reprocessing of spent fuel, "The exception appears to be krypton-85, which would be released in relatively large amounts in reprocessing plants presently contemplated but which could be <u>captured</u> <u>using</u> <u>available</u> <u>technology</u>, at some cost." (my emphasis).

To allow Met Ed to vent will set a very bad precedent and cause much anguish among the public. Removing and containing the gas, on the other hand, would have beneficial effects far beyond the costs involved:

1) the credibility of the NRC would be enhanced.

2) a decision by the NRC to sequester & contain gaseous fission products would serve notice on the rest of the nuclear industry to get their act together as they never have before.

3) the stress experienced by the general public would be greatly relieved.

I, for one, do not understand why the industry (or the NRC) does not have in place and ~~availble~~ available systems appropriate to managing the release of fission products from mild LOCA's such as TMI. The H-recombiner, Epicore II, and other systems (greatly improved, I hope) should be made available by the industry for just such eventualities.

Sincerely, Richard A. Hayden

RA Hayden
111 Orchard Square
Pgh, PA 15229

cc: Senators Heinz & Schweiker, ECNP

March 28, 1980

Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

Dear Sirs,

I am writing this letter at the suggestion of Senator John Heinz of Pennsylvania (March 20, 1980) and a copy has been mailed to him. This letter pertains to the venting of krypton-85 from the Three Mile Island plant Unit 2. I recommend that you vent it as soon and as rapidly as possible.

A simple physical calculation shows that the entire core of Three Mile Island reactor contains about 500,000 Curies of krypton-85. If all the fuel rods in that core failed their claddings, then about 5000 Curies might appear in the containment. From the amount actually present today, an ordinary high school graduate might estimate the extent and scope of damage to that reactor core.

Regardless of that, it is well established that krypton-85 decays with a half-life of eleven years giving off an electron. Only 0.4% of decays produce a gamma ray; so that there are less than 20 Curies of gamma activity to be released. The krypton-85 is a non-poisonous, inert gas. When the 5000 Curies of krypton-85 are mixed with the 5,000,000 Curies of carbon-14 naturally present all the time in the earth's atmosphere, no one will be able to detect its presence. Since no one is dying of fear nor from exposure to those five million Curies of carbon-14, only the irrational are likely to die of fear when you release the krypton-85. Let's not procrastinate further.

Sincerely, Walton Chubb
3450 MacArthur Drive
Murrysville, Pa. 15668

9 Woodland Ave, Apt 2C
Bloomfield, Ct. 06002
March 28, 1980

Nuclear Regulatory Agency
Washington, D.C.

Gentlemen,

May I suggest a possible method of removing Krypton gas from the Three Mile Island nuclear facility.

Animal charcoal is an excellent media for absorbing gases. By passing small amounts of the Krypton gas through charcoal it is possible that it could be adsorbed by the charcoal which subsequently could be disposed of as the usual solid nuclear waste has been.

This may sound as an unorthodox method, but I believe this possibility merits investigation.

Sincerely yours,

Leonard Slutsky

105 Names Dr.
Grass Valley, Calif.
95945
March 28, 1980

President of the United States of America
1600 Pennsylvania Ave.
Washington D. C.

Dear President Carter,

I have a suggestion, based on recent technological advances, to reduce the danger of Krypton contamination during the venting process at Three Mile Island. Several modes of transportation are available for natural gas, which could be employed in this operation. The gas could be pumped into air tight vehicles, compressed, and be transported to a remote area and released there. If, as the N.R.C. said, there is little danger in a populated area, how much less danger if this gas were released in a remote area ?

I am personally convinced that monetary factors rather than public safety is the dominant thought behind current anticipated methods.

While it would be more expensive, my solution would be safer and more acceptable to the public at large.

Respectfully Yours

Mary Jo Ramsgate

Mary Jo Ramsgate

PO Box 155
Kimberton, Pa. 19442
March 28, 1980

To the members of the Nuclear Regulatory Commission:

I understand that you are meeting on April 2nd to decide whether or not to release large amounts of Krypton gas from Three Mile Island power plant.

I and my family do not live in Middletown, Pa., but 60 miles away. Yet I am under no illusion that this gas, however much you may call it "low level radiation" is safe. It will poison the atmosphere and environment for the human beings, animals, crops and soil for a vast area. The only moral way of dealing with Three Mile Island - although I realize its expense - is to seal it up with the Cryogenic Process.

The only motive for releasing this gas and avoiding the Cryogenic Process is an economic one, to benefit a relatively small number of people in the short run. But greed and short-sightedness have been shown in their true colors when compared with self-sacrifice and social conscience before now.

I hope you will have the strength to fulfill the responsibility of your position.

Sincerely,

Sherry Schwartz

3/28/80

To Whom It May Concern,

This letter is to implore Met Ed not to release Krypton into our environment.

It has come to my attention that there is a safer way, through the cryogenic process, in which to dispose of the waste products of nuclear power.

Our health is at stake! Please don't pollute our air, water, soil, food sources and consequently, our lives!

Very Sincerely,

Lisa Marks

(teacher and extremely concerned citizen)

520 Sutton Apartments
Collingswood, N.J. 08108
March 28, 1980

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa. 17057

Dear Commissioners:

I am writing to register my opposition to the proposed venting into the atmosphere of radioactive gases now contained at the Three Mile Island nuclear facility.

As a resident of a community located very near Philadelphia (and, therefore, approximately 100 miles from the reactor site) I have experienced much the same anxiety about events of the past year as those who are more immediately threatened by the TMI power plant: because they may lead to exposure to gases whose harmful effects can be felt far and wide, your deliberations are of great concern to residents of Philadelphia and surrounding areas.

It is my understanding that a decision to sustain the venting plan would have to be made in the face of known alternatives to this procedure, such as liquification of the gas by use of a cryogenic process or compression of the gas and pumping over charcoal beds. The argument against these alternatives seems to be that they are too expensive and too time-consuming. But words like "too" are comparative: "too" expensive compared to what is the question that must be posed and answered. To my way of thinking no added financial burden (which, in all likelihood, will be passed along to the utility's customers) can be too great when considered in light of the potential for long-term psychological, physical and genetic damage which venting presents.

As one familiar with the legal system in this country, I was struck by the similarity between the decision which you will be called upon to make, and the determination which a judge must make when confronted with the question of whether a party to a lawsuit can, as a matter of law,

be found negligent by a jury. I hope that you will indulge me this brief and rudimentary lesson in the law, and take from it what you will.

In deciding whether a party may, as a legal matter, be found negligent, a trial judge must first find that that party owed a duty of care to the injured person. Whether a duty of care is to be imposed depends, in turn, upon a careful balancing of the potential for harm presented by the activity engaged in against the burden of taking precautions against such harm. Where the cost of prevention far exceeds the potential for harm, a party ordinarily will not be legally accountable for injuries caused by his activity. Conversely, where the potential for harm is great, compared to the cost of taking precautions, a party may be held accountable for the resultant injuries.

By this recitation I simply wish to point out that, as is the case with negligence, where the cost of prevention is minimal compared to the potential for harm (as I believe it clearly is in the case of alternatives to venting) the utility should be required to pay such costs. The only material difference between the judge's task and your own is that he must wait to rule until after the damage is done, whereas you are much more fortunate, because you are empowered to prevent the damage before its occurrence.

I wish you the courage and wisdom to do what needs to be done. Please do not permit TMI to be the precedent upon which other utilities rely.

Very truly yours,

Joseph M. Jacobs

Joseph M. Jacobs

3 Delmont Avenue
Harrisburg, Pennsylvania 17111
March 28, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

Subject: Venting of Krypton-85 gas at Three Mile Island

Our family consisting of my husband, four young children and myself and living within the 10 mile radius of TMI, are greatly concerned about the proposed venting of Krypton into the atmosphere, so that clean-up of the containment building can take place.

It is our feeling that this issue be looked at long and hard, so that the safety of HUMAN LIVES takes priority over the fastest and least expansive way of clean-up as seen by Met-Ed.

This past year for those of us in the TMI area has been nothing short of a living nightmare. The psychological stress which we have dealt with and continue to deal with each day is unbelievable. There is not only the fear of how safely this clean-up operation will be carried out, but that constant fear that someday they might even place the Plant back in operation.

Just what damage to humans the radiation leaks of the past have caused might take years to find out. And now we face the possibility of more radiation exposure in the clean-up. This is not right, do you know what it's like to wonder if your own children were damaged either physically or psychologically by this accident? It is hard enough being a parent in this world today without this added burden of TMI. We have been used as "human guinea pigs" last year because of this, PLEASE don't permit this to happen to us again.

The people of the TMI area have suffered enough. For a Country as great as ours, who help and give aid to others in this World, how can it put its own people through this type of "living nightmare". Please we ask of you in making your decision about venting the Krypton-85 to think of humans FIRST and the financial well-being of Met-Ed as LAST.

Hopefully, the Nuclear Power Industry has learned valuable

lessons from this accident, but the people of this area don't want our nightmare to continue, we want it to END without any further damage to our physical and mental health. Thank you for taking time to hear our feelings on this most serious issue.

Sincerely,
Rebecca Bittinger
Rebecca Bittinger
(Mrs. L.R. Bittinger)

Donald P.Lookingbill
1359 Bradley Avenue
Hummelstown, Penna.
17036
March 28, 1980

Mr. John Ahearne, Chairman
U.S. Nuclear Regulatory Commission
Washington D.C., 20555

Dear Mr. Ahearne:

The current public outrage over the suggested release of the Krypton-85 from TMI-2 should be telling us something: the people in this area have absolutely no confidence that public health and safety represent the major concerns in the cleanup operation. In my view, the reasons for this distrust are:

1. MET-ED - A company on the verge of bankruptcy, (particularly this one) cannot be expected to ignore economic considerations in their decision making processes. As we're constantly being reminded, the company simply has too much at stake economically.For this unpredented clean-up, we need decision makers who are not distracted by the profit motive.
2. THE CONTAMINATED CONTAINMENT - The mess in the TMI-2 containment building presents a radioactive clean-up problem without precedent. The March 23, 1980 edition of the Harrisburg Patriot News quoted G.P.U. Chairman William G. Kuhns as characterizing the clean-up as a "laboratory experience". What concerns me is that my family have become unwilling participants in this "laboratory experience" - currently via the psychologicaal stress of knowing that we may yet, at any time, be exposed to more radioactive releases (indeed we're told that a meltdown is even still not completely out of the question), and, potentially, via any physical damage which could result if unexpected large release occur. My major concern is not over the reportedly relatively modest amount of Krypton 85 gas (although I don't relish its release), but over the much more substantial amounts of radioactive material in the damaged core, water and walls in the containment building. This contains, as you know, much more dangerous, biologically active, long-lived isotopes. It's difficult to be reassured that the clean-up of this mess can proceed without a hitch when such an undertaking has never been done before, when the equipment is not yet available to do it, and when It's described as a "laboratory experience". Given all this, I think it's not unreasonable for us to feel a bit anxious about the future.
3. THE FUTURE OF TMI - I will never forget the terror of the days following the accident of March 28, 1979. March 30 was especially memorable. When it became evident on that day that the situation at TMI was one of total confusion, we evacuated our children to Philadelphia. The emotional impact of evecuating ones family because of a threatened ~~nuclear~~ nuclear disaster has to be experienced to be appreciated.

I, for one, hope never to have to experience it again. For the past year we have continued to live with the uncertainties involved with the cleanup. It appears that this situation will persist until the clean-up is complete. After that, I think we should be entitled to say, "enough is enough!" Having been sufficiently sensitized to the haards of nuclear energy, we should not have to live again with the threat of another nuclear accident - as would be the case if TMI 1 or 2 were to be reopened by anyone - most particularly by Met-Ed.

4. THE NRC - Some view the NRC as yet another group with a vested interest in the nuclear industry, and therefore, one not to be trusted. I would like to think that this judgement is unfair. It seems to me that the NRC is the only hope we have for resolving this problem in the best interests of the public.

But much more needs to be done if there is to be any possibility of restoring public faith for the difficult clean-up proceedures ahead. I think the following steps are essential:

(1) Remove Met-Ed from the TMI scene - forever!
(2) Entrust the clean-up procedure to a federally appointed and financed team of experts - utilizing the best people in the country and ensuring that the primary concern is public health and safety - not profit and loss. If it is to be a "laboratory experience", let's be sure we have the best possible people in the lab.
(3) Guarantee that TMI will never again operate as a nuclear facility. This point is crucial and provides "the light at the end of the tunnel" that we so badly need. We need hope that we may sometime in the future, again be able to feel safe in our own homes.

I hope you'll give these suggestions your most serious consideration. Our future is in your hands.

Sincerely,

Donald P Lookingbill, M.D.

Donald P. Lookingbill

c.c. - Mr. Victor Gilinsky
Mr. Peter Bradford
Mr. Richard Kennedy
Mr. Joseph Hendrie

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa, 17057

March 28, 1980

Dear N. R. C.,

If you people ever expect to regain and credibility with the public, you had better handle Three Mile Island clean up with the public's safety in mind!

Allowing Krypton gas to escape from the containment building into the air is hardly a safe or sane method!! Freeze the gas and place it in properly constructed containers. And then, if you still think its safe, take it home and bury it in your backyard!!

Fearfully yours,

Santo F [illegible]
1176 S. 11th st
Phila Pa 19147

March 28, 1980

General Public Utilities
100 Interpace Parkway
Passippany, NJ 07054

Attention: Mr. Herman Dieckamp

Dear Mr. Dieckamp:

I offer my humble solution to the removal of the so called 40,000 curies of krypton gas from the Three Mile Island vessel. I feel certain this can be removed inexpensively with the least amount of objections by citizens or environmentalists and above all the most safe yet suggested.

1) The use of large balloons capable of travel to the stratosphere and large enough to transport a containment vessel capable of carrying an appreciable amount of the gas under pressure.

2) After the balloon reaches a high enough altitude, relief valves on the containment vessel can be released by radio control, and later the balloon can be destroyed by explosives.

This can further solve the apparent transportation problem if an effort is made to transport the gas by land. Ie. (citizens objecting to or accidental discharge).

I needn't explain the further repercussions or costs connected with release of the gas in the atmosphere directly above the Three Mile Island plant.

Perhaps this could be the only safe solution and certainly should be considered.

Sincerely,

Albert B. Snizik

ABS/ds
cc: N. R. C. - Attn: Harold Denton
Governor Richard Thornburgh
Robert Arnold - Executive Vice President, N. R. C.

J. R. FRANKLIN, INC.
INDUSTRIAL CASTING REPAIR
MAIN STREET · THREE BRIDGES, NEW JERSEY 08887
(201) 782-6482

28 MAR 1980

Dear Sirs

After Reading About venting the deadly Radioactive gasses, I will again give you my Idea on how I would vent the gasses. to vent the gas out the stack it will contaminate the surrounding aera & Possibly give the Residents in that aera some form of cancer 10 or 15 years from now, is Not the way to go.

I propose the gas be pumped into Large Bagloons & then Let Rise to a high Altitude & then Released somewhere over the Atlantic ocean.

Reasons

1-cheap
2-effective
3-a Baloon can hold many square foot of gas
4-Safe
5-No cleanup

Charcoal makes more Radioactive waste_

J. R. FRANKLIN, INC.
INDUSTRIAL CASTING REPAIR
MAIN STREET · THREE BRIDGES, NEW JERSEY 08887
(201) 782-6482

Where the main problem is, what do you do with the waste materials? the Goverment & Power companies Ran head Long into Building Nuclear power plants with no solution on geting Rid of the waste By products. But you keep Building & you are going to keep getting into trouble. thier are workable solutions & Nuclear power is the way to go if you do things Right. the more you fight the public, again the more trouble you are going to get in. I have Ideas on how to get Rid of waste from these nuclear plants But it takes dollars & time to figure the Best way. But again no one wants to listen & doesn't care. When we All cannot swim in the ocean, or drink the water, or grow food Because everything is poisoned who will step foward & take the Blame. But then it is to Late.

I hope my Idea can Be of help to you.

I Remain,
F. Whittlesey

APR 29 1980

National Audubon Society

950 THIRD AVENUE, NEW YORK, N.Y. 10022 (212) 832-3200 CABLE: NATAUDUBON

March 28, 1980

Statement of Dr. Jan Beyea, Consultant
to the National Audubon Society

(Dr. Beyea, a nuclear physicist at Princeton University's Center for Energy and Environmental Studies, has studied the safety of nuclear facilities for governments around the world. Most recently he has carried out a study of hypothetical releases of radioactivity from Three Mile Island for the Council on Environmental Quality.)

I have been asked by the National Audubon Society to look into the question of Krypton venting at Three Mile Island. I have concluded that the official reports which deal with venting[1,2] fail to justify the need for Krypton release on safety grounds. It has not been demonstrated that Krypton release at this time will significantly reduce the doses to workers entering the containment building, nor has it been demonstrated that Krypton release at this time is necessary to allow access to the containment building to attend to the safety of the reactor core.

Krypton release will save money and, by making it easier to work inside the reactor, may possibly shorten the time by which the reactor will be cleaned up.

According to current scientific understanding, the direct physical consequences, immediate and delayed, of controlled release of 50,000 curies of Krypton 85 into the atmosphere at

Three Mile Island appears to be insignificant. However, the psychological effects and stress among a sizeable segment of the population which may result from the release appear to me to be so significant that a release should only proceed at this time if ample justification has been made that the release is needed on safety grounds.

Thus, if I were in charge, I would only approve venting of the containment building if I were sure that the health and safety of my workers were at stake or if I felt venting were necessary to allow entrance to the containment to prevent the core from overheating.

I can find no hard evidence that these conditions are met. Therefore I conclude that venting of the Unit #2 containment is premature.

However, I must warn you that the situation could change. For instance, should certain equipment fail--equipment which is now maintaining or monitoring the integrity of the core--it might be necessary to obtain prolonged access to the containment building. Under such a situation, I too might recommend venting to forestall the possibility of a more serious release.

In any case, should complete venting of the containment building be decided upon, regardless of the reason, every effort should be made to reduce the anxiety of that fraction of the public which appears to be extremely frightened of the release.

If the executives of Metropolitan Edison, the N.R.C. Commissioners, those persons in charge at the site, their children and their grandchildren are all willing to stand downwind at the site boundary while being exposed to the released radiation, then I think it will be clear to the public that those in charge honestly believe the release to be insignificant.

If, on the other hand, any of these people refuse to meet this test, I don't see how the public can be expected to believe statements that the release is insignificant.

In addition I suggest, that any controlled venting be done in bursts occurring at times when the wind is blowing in one, agreed upon direction.

Residents residing in the downwind sector would then have the option to move outside the sector for the duration of the release. The public could then vote with its feet as to its confidence in official pronouncements. To make such moves easier for the public the releases could be scheduled on Saturdays.

Those persons residing in the downwind path who would not be concerned enough to move, but still interested in taking additional precautions, could reduce their dose significantly by sheltering themselves in basements according to pre-arranged instructions.

LACK OF JUSTIFICATION FOR IMMEDIATE RELEASE OF KRYPTON

I shall now outline for you the reasons I have concluded that Krypton release cannot be justified on safety grounds at this time.

Nuclear Regulatory Commissioner Hendrie has argued that venting is necessary to allow access to the reactor sooner than other methods of Krypton removed would allow.

However, it has not been demonstrated that Krypton is the major problem preventing access.

The residual radiocesium on the walls may be more important in determining worker access time than the krypton gas in the air. Given the state of public alarm it is premature to vent the Krypton before equipment is placed in the containment capable of predicting the radiation levels which will remain in the building after the Krypton is gone.

It has been implied in the "Haller Report"[2] that "gamma" radiation levels in the containment will drop by 75% after Krypton release, but no documentation has been given of this number, suggesting that it is a very "soft" estimate, -- one that should not be relied on to justify a policy decision of the magnitude that the proposed release of Krypton represents.

Furthermore, even should subsequent measurements show the 75% reduction figure to be a valid prediction, there appear to exist shielding alternatives which could reduce the worker dose by the same amount as could venting. It appears to be possible to build a walkway with a roof of lead bricks which would significantly reduce the long-range radiation (Gamma Radiation) from radioactivity on the walls and from the Krypton in the air above.

This approach would not be as convenient as complete removal of the Krypton would be, because workers would still have to wear protective clothing to reduce the short-range radiation (Beta radiation) from Krypton next to their skin. But the trauma of releasing all of the Krypton to the atmosphere would be avoided. The Krypton could then be removed by slow liquification techniques without interference with the checking and maintenance of equipment which I agree are sorely needed to insure the long-range safety of the core.

I must caution the public, however, that this alternative I have mentioned would not prevent all releases of Krypton. Some Krypton would be released each time the containment was entered. But the total of such releases would be much less than that resulting from complete venting.

ADDITIONAL COMMENTS ON HEALTH EFFECTS RESULTING FROM THE PROPOSED KRYPTON RELEASE.

According to current scientific understanding, venting of unit # two's atmosphere will probably not lead to any deaths or injuries either in the short-or long-run. I make this statement based on my own analysis, since the N.R.C. has not apparently published any prediction of what is called the "total population dose". Every few thousand person-rem may lead to a cancer death. For policy purposes, in the absence of precise knowledge of low-level radiation effects, many scientists assume that the same number of deaths will result if 10,000 person-rem is accumulated through 1000 persons receiving 10 rem or 10 million persons receiving one milli rem.

Consequently, the total population dose is the crucial number which is needed for policy purposes when deciding upon the impact of low-level releases. (I hope that in the future, reporters will become aware of the right questions to ask of public officials about low-level releases.)

Publication of the projected person-rem dose along with the population dose would allow radiation scientists everywhere to comment meaningfully on the radiation significance of the proposed release without having to do detailed calculations.[3]

Notes

1. Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere, Nuclear Regulatory Commission, Washington, D.C., NUREG-0662, 1980

2. Report of the Special Task Force on Three Mile Island Clean-up

3. The N.R.C. should compute total population dose from a) cloud passage in the vicinity of the plant, b) The long-term Krypton dose to the world's population, and c) The long-term dose from any escaping radiocesium which would deposit on the ground.

28 March

Dear Sir

I have just been made aware of the planned venting of substantial amounts of radioactive krypton gases from Three Mile Island in April 2. I want to register my adamant protest of this or any other subsequent venting of these gases, on behalf of myself, family (2 children under three and I am expecting another early in September) friends and all the people of the area surrounding TMI. Also on behalf of all people who are potential consumers of all the agricultural products food and milk produced in this area. Also on behalf of the whole life cycle within nature affected by such a venting.

I understand that there is another possible solution in the cryogenic process of liquification of these gases and that this is not being pursued because of money and time. I abhor whatever principles that hold profit more valuable than the health of millions of people, animals and plants and therefore the future of America.

Sincerely

Susan Beedy
RD 3 Box 282A
Phoenixville, Pa
19460

March 28, 1980

Nuclear Regulatory Commission
P. O. Box 311
Middletown, Pa. 17057

Dear N.R.C.

Your actions astound me. You do not know what you are doing, but you do it anyway. Releasing toxins into the atmosphere is totaly unacceptable.

If the TMI cleanup is going to cost $400 million anyway another $10 million for a safer cleanup is negligable. Compare this cost to what it will cost the U.S. in health, wildlife and emotional trauma.

Another alternative to venting must be used, such as cryogenics. It seems your decisions are based on what is best for Met Ed and not the people (which, as you remember, is suppose to be the government.) Let us have the governmental bureaucracy do the right thing for America.

Aurelio Pontarelli
417 N. Rolling Rd.
Springfield, Pa. 19064

THEODORE LEE GAILLARD, JR.
9805 PARK LANE PLACE
DALLAS, TEXAS 75220

March 28, 1980

Chief Engineer,
Three Mile Island Nuclear Power Station,
Three Mile Island,

Pennsylvania

Dear Sirs:

<u>Problem:</u>
How to get slightly radioactive gas out of the powerplant's containment building, without venting directly into the atmosphere and causing undue concern by a worried populace.

<u>Possible solution worth consideration:</u>
Have you considered obtaining a high-altitude weather/atmospheric sounding balloon? The gas vent opening for the balloon could be sealed around the power plant's vent opening and the gas force-vented into the deflated balloon. When the gas has been exhausted from the building and/or the balloon filled, the balloon can be tied off or sealed at the throat, and the balloon containing the gas can then be transported by a variety of means to a desert or ocean area where the gas can be released (or buried). Such a balloon offers several advantages:

1) availability
2) designed to contain gas without leaking—and usually at some pressure since these balloons carry payloads of some weight to extremely high altitudes
3) immense volume—far more than would be needed, I suspect, to empty the building.

Perhaps this has already been suggested. If not, I hope it may be of some help.

Sincerely,

Theodore L. Gaillard, Jr.

Theodore L. Gaillard, Jr.
(214) 350-9152 (home)
(214) 363-6311 (work)

✓cc: Director, Nuclear Regulatory Commission

217 West McKinley Avenue
Myerstown, Pennsylvania 17067
March 29, 1980

Nuclear Regulatory Commission
Middletown
Pennsylvania
17057

Gentlemen:

After due consideration of the alternatives available, I strongly urge the Nuclear Regulatory Commission to approve venting to the atmosphere the krypton gas in the containment building at Three Mile Island. The procedure as proposed by Metropolitan Edison appears to have an inconsequential effect on the residents around Three Mile Island, of which I consider myself to be a part.

I would hope that this issue is decided on the technical merits of scientific evidence, rather than as a result of the theatrics of a very vocal, but highly misinformed, minority.

In addition, I suggest that the customers in the service area of Metropolitan Edison would be greatly benefited by re-opening of Three Mile Island Unit 1. I urge that this be accomplished as soon as technically possible.

Very truly yours,

Donald King

Donald J. King

cc: Congressman Robert Walker
Governor Richard Thornburgh
Lt. Gov. William Scranton

704 North Wales Rd.
North Wales, PA 19454
March 29, 1980

Nuclear Regulatory Commission
P.O. Box 311
Middletown, PA 17057

Dear Sirs:

There is some confusion in my mind at this time as to the exact prupose of the NRC. In 1946 the Atomic Energy Act established the AEC with the intent of "improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace." Based on this criteria, I would hardly deem your efforts to this date successful. History speaks for itself. In spite of the reputed satety of nuclear power, accidents have been a major part of its history world wide, including:

-a partial meltdown at Chalk River reactor in 1952, followed by another accident in 1958
-a partial meltdown and near critical mass explosion in 1955 at the EBR-1 breeder in Idaho Falls
-fire at the Windscale reactor in Great Britain in 1957 resulting in massive releases of redioactive iodine
-the death of three men at the SL-1 test reactor in 1961 at Idaho Falls
-a partial meltdown of the Fermi Fast Breeder outside Detroit in 1966
-release of radioactive iodine from the Dresden II plant in Morris, Illinois in 1970
-release of radioactive waste into the Mississippi River at Monticello, Minnesota, in 1971
-the fire at Bronws Ferry in 1975, resulting in loss of safety systems for the reactor

And the list goes on. Is this your idea of improving the public welfare?

In 1974, the AEC found a total of 3,333 safety violations, yet imposed punishments for only eight violations. Does this fall under the catagory of improving the public welfare?

There are presently hundreds of millions of tons of radioactive mine tailings lying throughout the western U.S. In Grand Junction, Colorado, these tailings were actually used in the construction of 5,000 homes. Is this an improvement in the standard of living-to be irradiated with the equivilent of 550 chest x-rays per year?

The list of abuses is endless. From mining to transportation to manufacturing to processing to storage, the NRC has failed miserably in its appointed duty to the people of this state, not to mention the country and the entire planet. As usual the reason is profit. Damn the people as long as Babcox and Wilcox makes a buck, subsidezed by our tax dollars.

Your commission must soon make important decisions regarding Three Mile Island. It is time to quit laying in bed with Met-Ed and show some responsibility for the purpose your were created. The venting of radioactive Krypton gases is an irresponsible move.

A study conducted by your own agengy, the Mancuso study, showed that low levels of ionizing radiation causes a significant increase in the cancer mortality rate. Other studys (British Medical Journal 1:1495, 1958; Journal of National Cancer Institute 28:1173, 1962; Lancet 1:1185, 1970) confirm the results - low level radiation has adverse results on the population involved. The release of redioactive gases from TMI is unquestionably wrong.

Your commission is ignoring viable alternatives, including compressing the gas, freezing the gas and/or filtering the gas. Met-Ed was even offered cyrogenic equipment, yet refused! Is there any rationality to the management at this facility?

The NRC must assume full responsibility for the safety of the people, not corporate headquarters of Met-Ed. It is within your power to prevent the loss of any further radiation to our environment. You must exercies that authority. Then you can truly say...

there is no cause for alarm...

Peace, R. Allen Fazenbaker

R. Allen Fazenbaker

RAF/raf

STEPHEN R. REED, MEMBER
THE CAPITOL
HARRISBURG, PENNSYLVANIA 17120

HOUSE OF REPRESENTATIVES
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

March 29, 1980

Honorable John Ahearne, Chairman
U.S. Nuclear Regulatory Commission
Washington, District of Columbia 20555

Dear Chairman Ahearne,

As you already know, there is considerable opposition to the present NRC-Metropolitan Edison Company plan to vent radioactive Krypton 85 into the atmosphere around Three Mile Island.

The full effects of low level radiation are not known as yet and the NRC nor Met Ed cannot guarantee the public's health from the exposure you now plan. Moreover, the last thirty years indicates a series of instances wherein "low level radiation expsoures" brought about serious health impact, such as what happened in Utah.

The standards used by the NRC and Met Ed to measure radiation and exposures to it have been, in part, discredited by recently released review entitled the Heidelburg Study, and there is therefore doubt as to the accuracy or validity of the Hrypton venting plan's estimates regarding exposure.

There are options to your plan to vent Krypton which have not been explored by independent assessment. I strongly favor having a citizen group dominated independent assessment capability, but to put that fully in place takes additional time.

In view of your plans to vent Krypton beginning in April, I am writing to request that you immediately suspend those plans to allow time for an already in-place independent assessment to take place by such a noted group as the Union of Concerned Scientists.

I have not ascertained the availability of the Union for this purpose, although a number of their members were in Harrisburg this weekend for the TMI rally at the Capitol Complex.

It would not take a great deal of time to "crank up" the Union of Concerned Scientists to get busy on reviewing the Krypton 85 venting plan, I would imagine, but there is no point in contacting them about it if the NRC is not willing to suspend its plan now. That is why I am writing.

I do believe that independent assessment is important to the other phases of decontamination of Three MIle Island's Unit 2 and the citizen dominated effort, utilizing non-NRC and non-Met Ed personnel and expertise for that purpose, remains an agenda item for me, but for now suspension of the venting for Union review purposes is a more immediate need.

I appreciate your consideration of this suggestion.

The question is not whether Unit 2's Containment Building should be decontaminated, but rather how it will be done. It is on that point that local opinion runs strong and independent assessment would lend credibility to whatever finnally results.

Yours sincerely,

STEPHEN R. REED
State Representative

cc: John Collins

3-29-80

Dear Sirs,

My husband and I have been too long a part of the so-called 'Silent Majority'.

We do not want radioactive gases expelled into our air. We have been lied to for years about the safety of nuclear power and now that the truths are becoming known, feel we must speak.

The atomic blast in Nevada are now - 30 years later - producing abnormally high rates of cancer in area residents. We have only been fooling around with splitting atoms for a relatively short time - ~~the~~ when are you people going to learn that tomorrow must be taken into account when we do something today? The people still being treated at a special hospital in Hiroshima, Japan - with new cancer patients every year - should tell you - 35 years later that radioactivity may not show serious problems for years and years - when we can't recognize our children or your grandchildren as even being human because of birth defects, or worse, when the human gene structure becomes so altered that we become sterile, when we have not only altered the face of this great nation with steaming pockets of uninhabitable radioactive waste-lands, but when we have altered our people - physically and mentally - then will you listen?

You don't live near TMI so you don't care; I don't live near TMI and I do care!

Listen to the warnings - take the time to liquify the gases - don't do it the easy cheap way - do it the best way - Remember someday your children or grandchildren may live in the shadow of a nuclear plant that melts down!

Respectfully,
Pat & Doug Hackridge
213 Overlook Ave
Croydon Pa, 19020

1537 Garfield Ave.
Wyomissing, PA 19610
March 29, 1980

Nuclear Regulatory Commission
P.O. Box 311
Middletown, PA 17057

Gentlemen:

As a concerned citizen- concerned for the future safety and good health of all the world's people, and now especially those who live in and close to Middletown, I plead, urge, beg you to use the alternate method for venting the krypton gas - i. e. the crystallization process. cryogenic

Please put lives ahead of dollars!!

Very tr uly yours,

Joe T. Penderant

120 N. Union St
Middletown, PA 17057
March 29, 1980

Mr. John Ahearne, Chair
Nuclear Regulatory Commission
Washington, DC

Dear Mr. Ahearne:

One year after the accident at Three Mile Island, I am writing to you to tell you my views on the clean up at TMI. Since last year I have spent many hours attending meetings and reading documents and talking with my family and neighbors about the accident and its aftermath. I have tried to learn as much as I could about nuclear power and tried to keep an open mind on the matter. It has been difficult. I would rather have enjoyed spending hours with my family than reading the Kemeny Commission Report or Rogovin Report. I would have rather enjoyed a quiet evening at home playing with my son and daughter than to attend one of the many public hearings held by the NRC. I am generally an easy going person and do not seek to make "noise" publicly. But, the events of this past year at TMI have changed me. And that is why I am making these several requests of you.

I ask you not to vent the Krypton on my family. Use the most feasible alternative, as indicated in your Environmnetal Assessment Study.

I ask that we residents of Middletown be better informed of radiation monitoring. Allow citizens to become involved. Make the information public.

I ask that some independent, knowledgeable and objective group be formed as consultants on the cleanup. Despite the good intentions of the utility, there must be an independent assessment of the entire clean up operation.

I realize that you are a busy person. I do not wish my requests to overburden you. I want to act in a responsible and informed manner and hope that my requests have helped you to understand how one citizen views the accident at TMI and its aftermath. Thank you for your attention.

Sincerely,

Jacob L. Susskind
Jacob L. Susskind

March 30, 1980

TO THE NRC COMMISSIONERS:

As a resident within 25 miles of TMI and the mother of two small children, I am opposed to the venting of radioactive Krypton 85 into the air we breathe. I feel the cryogenic processing system is the way to go! The risks you claim in the cryogenic process are no excuse to dump *all* the Krypton into our air.

You say venting would take about six weeks. Met-Ed says venting will occur on windy days for proper dispersal of the Krypton. In other words venting will take six weeks of windy days or longer than six weeks since in a six week period of time not every day will present the proper weather conditions!

Another point — Met-Ed plans entry into the containment building with or without venting permission; so obviously venting is not all that necessary! Let them go into the containment now do what they must while a cryogenic system is constructed to take care of the Krypton-85 and public health will be no more jeopardized then it has been in the past 12 months.

In case you've missed my point — I HAVE HAD

ENOUGH RADIATION FROM TMI !!!
My family and the people of Pennsylvania are not guinea pigs for Met ED, The NRC or THE NUCLEAR DEVELOPEMENT FOR THE U.S.!
NO MORE RADIATION! NO KRYPTON VENTING! NO RADIOACTIVE WATER FOR DRINKING! NO MORE OF TMI'S GARBAGE! I HAVE HAD ENOUGH!

Sincerely,
Margaret A. Hummel
1397 Meadowbrook Ln.
Lebanon Pa. 17042

HARRY SILVER
1351 MAGEE AVE.
PHILA, PA. 19111

March 30, 1986

Mr. Denton
N. R. C.
Washington, D.C.

Sir:

Why can't the Krypton gas at TMI be vented into a rubber balloon partially filled with Helium - sealed and floated off into space?

This should solve the problem at TMI.

Respectfully,
Harry Silver

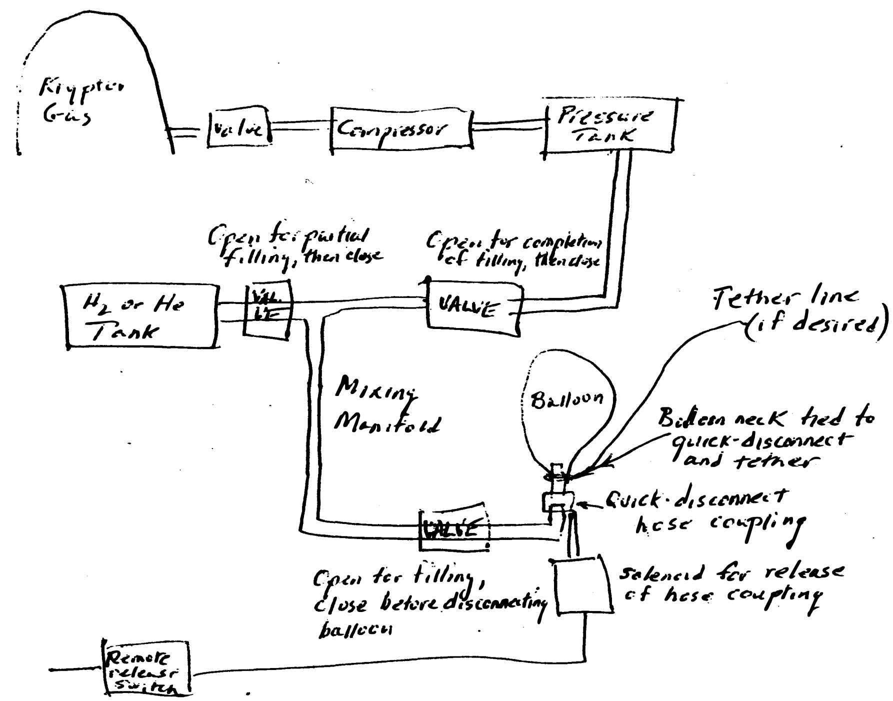
MR Puglee
863 Golf View Rd.
Moorestown N.J.
3-30-80

Administrator
NRC
Middletown, Pa.

Dear Sir

I wish to offer an idea which may be preferable to local venting of the radioactive Krypton gas, not because venting is a problem, but because of the emotions involved. My idea is to use meteorological balloons to carry the gas to high altitudes, where they would burst, preferably over the Atlantic Ocean if they are launched under proper wind conditions.

The attached diagram shows how the balloons could be filled with a mixture of Krypton and Hydrogen or Helium. The filling should be done atop a building so that if a balloon should burst while being filled, only a small amount of gas would be released, and it would disperse without danger to personnel on the ground. Several hundred balloons might be required.



Approach to filling balloons and releasing them from a remote location

If there is danger of radioactive contamination for the balloon material or the hose coupling used in filling the balloon, the balloons could be tethered until a sizeable group has been assembled. They could then be attached to a towing vehicle such as a blimp and transported out over the Atlantic. The burst balloons would be sunk by the weight of the hose couplings. If the balloons were filled with a mixture of Hydrogen instead of Helium, they could be totally destroyed by a radio-activated firing mechanism controlled from the towing vehicle; this might be preferable to uncontrolled bursts at high altitude because the possibility of the balloons drifting back over land would be avoided.

A helicopter could be used as the towing vehicle only if the balloons had negative bouyancy, and if such were the case, they would be difficult to control while being assembled prior to towing.

Sincerely yours

[signature]

3/30/80
5:35 p.m.

Dear Staff,

I am writing this brief note to tell you that I oppose absolutely the venting of any krypton gas into the atmosphere. It is an evil, immoral and unnecessary risk to take with the health and well-being of central Penna. residents. Why is no one considering the cryogenic/crystallization process which does exist? - Phila Electric has the equipment! Why doesn't Met-Ed rent it?! Met-Ed is still looking for the cheapest way out of this crisis! If you - the NRC - will not protect our interests, we will be forced to take action which should also

(over)

be unnecessary. Our lives are at stake!!! Is that so difficult for you to understand!? Don't allow the gas to be vented!!!

Yours for survival,
Paul Eugene Clark
Jr

March 31, 1980

Nuclear Regulatory Commission;

Dear Sirs,

I would like to state two very important reasons why I wish to be on record as opposing the venting of krypton gas from the cooling towers in Middletown.

First - last summer our daughter-in-law was hospitalized with an infection which began as a strep. throat and travelled to the valves of the heart. She had sores on her body - from head to feet - which were like small boils. From experience, I know that any such infection of the heart valves can result in rheumatic fever or worse. The sores cleared up with medication, only to be repeated periodically until the present time. Her doctor says he can only attribute this persistent infection to possible absorption of foreign matter, which could very likely have come from the "accident" last March. We have also noted that doctors in the Middletown area are saying many more strep. throats are reported this year than previously. This daughter-in-law lives in Wrightsville, down river a few miles, in a direct line from TMI.

Secondly, another daughter-in-law, who lives in Columbia, is pregnant and is expecting her baby in July. This has naturally been a big concern that she will be able to deliver a strong, healthy child. She tells us she lives in fear of hearing the sirens which just continue for 5 minutes and tell everyone (in affect) don't go outside, there's danger! This makes people nervous wrecks - to say the least.

It is common knowledge that there is an alternative method — Cyrogenics. Can the dollars Met. Ed saves be more important than the health & welfare of our children?

My husband and I are consumers and therefore contributors to Met. Ed. in Reading. Must we feel our dollars are contributing to fear, demoralization and possibly much worse for our very own children?

Please take the customers' plea to heart.

A concerned parent,

[illegible]

R D 4, Box 863
Duncannon, PA 17020
March 31, 1980

The Nuclear Regulatory Commission
1717 H Street, NW
Washington, DC 20585

Re: TMI

Gentlemen:

I am not convinced that the best way to dispose of the radioactive krypton-85 gas at TMI is to vent it into the atmosphere. However, if the management of General Public Utilities Corporation feels that this is the best way to handle this, it should be done only with the following stipulations:

1. GPU should announce publicly no less than two weeks prior to the first venting the exact date and duration of the planned venting.

2. Area residents within 20 miles of the plant should be reimbursed by GPU for all evacuation costs including travel expense, motel expense and lost wages for the duration of the venting.

3. No GPU employee who wishes to flee the area during the venting should be penalized in any way.

4. None of the above should even be considered until studies of alternative methods have been completed and the reports released to the public in detail through local newspapers. These studies should be done by scientists including physicians and zoologists who are not on the permanent payroll of either GPU or the NRC.

Sincerely,

Bon Dea

Bonnie Deaven

3/31/80

Dear Sirs

I urge you to oppose the venting of the deadly krypton gas at TMI. The people of the area have suffered and are suffering enough due to this accident. Instead I urge you to have Met Ed use the cyrogenic method which PECO has in its possession. It's about time the value of human lives be put above that of monetary gain or loss to a utility.

Lucille C Riegel
609 N. 10th St
Reading, PA 19604

March 31, 1980

The Nuclear Regulatory Commission
1717 H Street, N. W.
Washington, D. C. 20585

Gentlemen:

A recent letter from Senator John Heinz (PA) suggests his constituents write to the Nuclear Regulatory Commission in comment upon the plan to vent the radioactive krypton-85 trapped in the containment building at Three Mile Island.

May this letter serve to heartily endorse the plan to slowly vent the gas. After a year of every imaginable delay, legal readblocks, environmental studies and any basis for more delay that can be conjured up - - I say let's address ourselves promptly to the task of cleaning up the problem at Three Mile Island and get the job finished.

I recognize there are many hysterical and irrational people who think otherwise and I'm just as sure that a goodly number of them support that position just for the sake of joining an opposition even though they have not the foggiest idea of the issues involved or the scientific facts impinging on the problem.

Moreover, I earnestly hope that when safeguards are completed at 3MI Unit #1, it will be reactivated and as promptly as possible....and without all the bureaucratic delays and legal roadblocks that a wilful few can throw into the path of progress.

We chaff at the slowness and lack of action onthe part of the Congress. The innumerable delays at Three Mile Island seem every bit as futile.

Are Americans, who can place a man safely on the moon too stupid to run a nuclear plant? Did not the Federal Government itself institute the push into the nuclear age? If Europeans, the Russians and the Japanese can operate nuclear plants in apparent safety to their citizens (and citizens of the world) are Americans too dumb and stupid to do likewise?

There always have been and always will be risks in every undertaking, be it a trip to the corner store, the voyage of Christopher Columbus, or a cross-country trip on a jet plane. Have Americans lost their zeal to pioneer, accept a calculated risk? Since the occurrence of the 3MI accident (in which nobody was killed or apparently even hurt) how many have died in aiprlane accidents and in highway crashes. Three Mile Island opponents might well address themselves to these problems too! The accident rate in many other facets of our daily lives has been far more alarming. Why all this hysteria?

The news media, for lack of something better to "work over" has reviewed and re-hashed 3MI so many times that I'm sure most people are sick and tired about hearing about it further. Let's get on with the task - and do it promptly!

Sincerely,

Harold R. Diffenderffer
Harold R. Diffenderffer

1017 HELEN AVE.
LANCASTER, PENNA. 17601

COMMISSIONERS
JOHN E. MINNICH, CHAIRMAN
NORMAN P. HETRICK
STEPHEN R. REED
CHIEF CLERK
SIDNEY A. REESE
MAILING ADDRESS
P.O. BOX 1295
HARRISBURG, PA 17108
PHONE: 255-2741

OFFICE OF
COUNTY COMMISSIONERS
DAUPHIN COUNTY
HARRISBURG, PENNSYLVANIA

SOLICITOR
HERBERT A. SCHAFFNER
ASSISTANT SOLICITOR
ROBERT L. KNUPP
SPECIAL COUNSEL
LEONARD TINTNER
MEETING DAY
MONDAY
10:00 A.M.

March 31, 1980

Honorable John Ahearne, Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Chairman Ahearne,

The attached represents the Resolution formally adopted by a unanimous decision of the three-member Dauphin County Board of Commissioners this date relative to plans to vent Krypton 85 into the air at Three Mile Island.

Three Mile Island is physically located within Dauphin County.

With warmest regards, I am

Yours sincerely,

STEPHEN R. REED
Commissioner

cc: John Collins
Robert Arnold, Met Ed VP

COMMISSIONERS
JOHN E. MINNICH, CHAIRMAN
NORMAN P. HETRICK
STEPHEN R. REED
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SIDNEY A. REESE
MAILING ADDRESS
P. O. BOX 1295
HARRISBURG, PA. 17108
PHONE: 255-2741

OFFICE OF
COUNTY COMMISSIONERS
DAUPHIN COUNTY
HARRISBURG, PENNSYLVANIA

SOLICITOR
HERBERT A. SCHAFFNER
ASSISTANT SOLICITOR
ROBERT L. KNUPP
SPECIAL COUNSEL
LEONARD TINTNER

March 31, 1980

Whereas,

The March 28, 1979 accident and subsequent events at Three Mile Island have left the Containment Building of Unit 2 with dangerously high levels of radiation and contamination that need to be decontaminated, and

Whereas,

The U.S. Nuclear Regulatory Commission has determined in concert with the Metropolitan Edison Company, owners of Three Mile Island, that the venting of over 50,000 curies of radioactive Krypton 85 into the atmosphere is the best method available for the removal of such Krypton from Unit 2; such plans have met with opposition from members of the public concerned with the possible health implications from such a release of radiation and gas. Be it therefore

Resolved,

That the Dauphin County Board of Commissioners hereby opposes the release of radioactive Krypton in the manner presently planned by the NRC and Metropolitan Edison Company because (a) the health of humans, animals and plants nearby cannot be fully guaranteed, (b) the full health implications of low level radiation exposure are not known, (c) health studies on human thyroids and various ailments afflicting animal life have not been completed to determine what effect, if any, previously released low level radiation has already had on humans and animals in the TMI area, (d) other options remain for the removal of the Krypton 85 which have not been assessed independently by experts outside the NRC or Metropolitan Edison Company, (e) experience of the last thirty years from radiation exposure to indigenous populations near nuclear sites indicates clear health risk and resultant increased health problems from varying exposure levels to radioactive particles, (f) radiation and exposure measurement standards currently being used by the NRC and Metropolitan Edison Company are based on experiments and standards discredited by recently completed Heidelburg Studies and serious question as to their accuracy and validity therefore exists in the scientific community; and be it further

RESOLVED,

That a copy of this Resolution be sent the Chairman of the U.S. Nuclear Regulatory Commission, the NRC TMI Cleanup Director, the Metropolitan Edison Company, the Metropolitan Edison Company Cleanup Operations Director, as evidence of the Board's opinion on present plans regarding Krypton 85 disposal.

Offered by Commissioner Stephen R. Reed

March 31, 1980

Dear Sir:

I would like to take a position on the proposed venting of radioactive Krypton gas from the crippled Three Mile Nuclear power plant.

The Metropolitan Edison Co. would like to vent this gas as part of a speedy decontamination plan. But they are not letting Citizens take a position. This speedy venting plan is the most economic option, but not the safest option. Cryogenic process will cost more money but is clearly the way to go.

Please Take Public Emotion and Attitudes into Heart & mind

[illegible]

[illegible]

JAMES B. COULTER
SECRETARY

LOUIS N. PHIPPS, JR
DEPUTY SECRETARY

STATE OF MARYLAND

DEPARTMENT OF NATURAL RESOURCES
ENERGY ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401
(301) 269-2261

March 31, 1980

Mr. Richard H. Vollmer
Director of Three Mile Island Support
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Draft Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere (NUREG-0662)

Dear Mr. Vollmer:

These comments and recommendations are submitted on behalf of the State of Maryland. They represent a consensus of Maryland's Department of Health and Mental Hygiene and its Department of Natural Resources. The Maryland Governor's Committee on Three Mile Island concurs in these recommendations and has submitted to the Governor its own report, which is appended.

Having reviewed and checked the quantity of Kr-85 potentially available for release, the likely dispersion during transit to the Maryland border, and the resultant dose to Maryland citizens, we conclude that the radiological impact in Maryland would be negligible from venting the containment building over a period of approximately 60 days as described. Our predictions of doses to the most exposed Maryland citizens are less than 0.1 mrem to the skin and 0.001 mrem to the whole body. Our own radiation monitoring data shows that variations in dose due to natural radioactivity frequently exceeds one millirem from time to time and place to place within Maryland over a similar 60 day period. Consequently, Maryland has no reason to oppose the venting option.

Of course, in determining the proper choice for handling the containment gases, it is necessary to consider the impacts on Pennsylvania's citizens, particularly those residing in close proximity to Three Mile Island. We note that projected radiation doses for all options presented are within the limits imposed by the plant's Operating License and the values established in 10CFR50, Appendix I for keeping radiation doses from operating reactors to the public as low as reasonably achievable.* On that basis, we believe all the options presented should be considered to have acceptable levels of radiological impact. However, as in the case of an operating reactor, every reasonable opportunity should be taken to minimize the discharge of radioactivity to the environment during the cleanup of Three Mile Island. It is in this context that the alternatives for handling the containment gases should be evaluated.

Although Maryland supports the concept of a programmatic Environmental Impact Statement to address the overall decontamination operation, we believe it is proper to make a decision regarding the containment building atmosphere at this time. It appears that a decision based upon the programmatic EIS could not be forthcoming for at least another year. At that time, the additional two or more year wait to implement any one of the options utilizing krypton capture devices would weigh even more heavily in favor of the purge option than it does now. A decision to purge the containment building at this time would not preclude, but rather facilitate other options for the remainder of the decontamination process. On the other hand, if the decision is to utilize one of the krypton capture devices, making that decision now would preclude fewer options than would making the identical decision one year from now. Therefore, because there is no benefit but there is substantial loss in delaying the decision, Maryland supports the separation of this decision from the programmatic EIS schedule.

*We believe the goals established for a single unit in 10CFR50, Appendix I are the appropriate values to be considered (ie., maximum off-site dose rates from gaseous effluents should not exceed 10 mrad/year from gamma radiation and 20 mrad/year from beta radiation, and doses to the maximally exposed individual should not exceed 5 mrem/year to the whole body nor 15 mrem/year to the skin).

Maryland continues to be extremely concerned over the presence of approximately one million curies of bioaccumulatable radionuclides in aqueous solution within the power plant. Should error or malfunction cause discharge of even a very modest fraction of this material, public water supplies and fishery resources in Maryland are in peril of serious contamination. Even chronic leakage at a level sufficient to produce a detectable increment of radioactivity in Maryland seafood would jeopardize the marketability of our harvest and the livelihood of our watermen, due to public aversion in the marketplace. We believe that it is in Maryland's best interest to decontaminate the plant's water inventory as expeditiously as is consistent with careful planning, review and control.

Due to the long lead times involved in implementing any of the alternatives to containment purge, it would be at least three, perhaps five years after the accident before there would be reasonably free access to the building. We do not feel it is prudent to wait this long to replace and repair instrumentation nor to maintain vital equipment in the containment building, and Maryland is opposed to any decision which would effectively prohibit containment entry for such protracted periods. Consequently, the evaluations of the various options should be rewritten to include the unavoidable releases and occupational doses inherent in performing the necessary containment entries over the respective periods prior to completion of the krypton removal.

Although it has sufficiently demonstrated that containment purge can be accomplished within established dose limitations, the Environmental Assessment is deficient in that it has neglected to properly evaluate the dose reduction which can be accomplished by limiting krypton releases to periods of rapid dispersion, as indicated by real-time meteorological data. We believe this option is a practical opportunity for reducing radiological dose to the local population. The Environmental Assessment should specifically delineate the actual scheme for this control, and, based on an historical set of sequential meteorological data, estimate the dose reduction probably achieved and additional time probably required should purging be conducted with these limitations.

Other deficiencies noted in the Environmental Assessment relate to the monitoring activities described in Section 7. Only those air grab samples to be collected by Metropolitan Edison at the estimated plume touch down point seem intended for feedback capability to the Unit 2 control room. It is not clear from the description if adequate real time dose rate or beta-emitting gas detectors will be used by the sampling crews to ensure that they are actually at the point of maximum ground level concentration when each sample is taken. Reliance solely upon atmospheric transport modeling seems inadvisable for assurance that such samples are taken at the point of maximum impact, even at relatively modest distances.

In addition to the radiological impact of each alternative, there is a non-trivial psychological impact to be considered. We note that the local public sentiment mentioned in the Environmental Assessment expresses the unattainable goal of no further planned or accidental release of radioactive materials. Clearly, this cannot be used as an acceptance criterion, since both planned and unplanned releases will occur for any of the options considered. We note that even a process which is 99.9999% effective in capture of the krypton would result in a release somewhat greater than the 47 mCi of Kr-85 which caused much public consternation when the airlock was recently entered. It is not clearly stated in the Environmental Assessment how much Kr-85 would remain in the containment building after the operation of each of the alternative krypton capture devices. Apparently, each would be operated to reduce the containment building atmosphere to the MPC level of 1×10^{-5} µCi/cc. At this point, 0.6 Ci of Kr-85 would still remain in the containment building. The Environmental Assessment should clearly state whether this would be intentionally purged or eventually leaked during repeated building entry. All descriptions of krypton capture devices except that of the Cryogenic Processing System give the impression that krypton release would be zero.

In weighing the psychological impacts inherent in each of the options, we make the observation that public reaction has not been directly proportional to the number of curies in a release, and it should not be presumed to be so in choosing among the options in this case. A sense that every practical opportunity will be taken to reduce public radiation exposure would certainly aid in achieving public acceptance of any proposal. In that regard, the Environmental Assessment is particularly unsatisfying due to its cursory treatment of meteorological restrictions which could be imposed in the venting process, as mentioned above. Other factors which we believe would be useful in reducing public stress are provision of more certainty as to the scheduling of any releases and the maximum dose associated with the releases. Real-time off-site dose rate monitoring provides direct confirmation and an opportunity to catch errors in prediction. The publicly accessible monitoring programs to be conducted by the Department of Energy appear to be useful for enhancing and maintaining public confidence that sufficient control is being maintained over the sixty day purge duration. The Commission should ensure that these DOE programs are in readiness prior to commencement of the purge and that the resultant data is made available to and reviewed by Metropolitan Edison personnel as quickly as possible. If properly analyzed for such factors as wind persistence and ranges of short term dose rates, the predictions mentioned earlier based on sequential hourly historical data could be very useful in interpreting the significance of individual measurements from the DOE monitoring program.

In summation, Maryland agrees with the Commission's staff recommendation that a decision be made at this time, and supports the choice of purging the containment building as the best available option. However, we recommend that, prior to granting final approval of a plan to accomplish the purge, more detailed specification of the meteorological limitations and real-time environmental monitoring be required and be evaluated by the Commission to be sure that resultant public radiation exposure be kept as low as practicable.

Sincerely,

Steven M. Long, Ph.D.
Director, Power Plant Siting Program

SML:ps

THE JOHNS HOPKINS MEDICAL INSTITUTIONS

DIVISIONS OF NUCLEAR MEDICINE AND RADIATION HEALTH SCIENCES

NORTH WOLFE STREET
LTIMORE, MARYLAND 21205
Telephone 301; 955-3350

March 28, 1980

The Honorable Harry R. Hughes
Governor, State of Maryland
Executive Department
Annapolis, Maryland 21404

Dear Governor Hughes:

As members of the Maryland Governor's Committee on Three Mile Island, we have studied the Draft NRC Staff Report NUREG-0662 which assesses the problem of radioactive krypton gas in the reactor building, considers several options for removing it, and makes a recommendation. In essence, the NRC officials propose to vent the gas out of a 160-foot stack over a 60-day period when the meteorological conditions are suitable.

We agree that the radioactive krypton within the containment vessel creates a major problem that should be solved as soon as possible. The radioactivity levels are so high that no one can safely enter the building to carry out the procedures necessary to keep the reactor in a safe shut-down condition and diminish the hazard of releases of radioactive water into the Bay.

There are fans operating inside the building that keep the temperature down in the face of heat still being generated by the reactor. This cooling system has been in continuous operation for a year without the maintenance specified in their usual operation guidelines. The high humidity of the building is especially deleterious to the continued operation of the fans. Their failure would permit the temperature within the building to rise, which in turn would cause the pressure in the building to rise above that of the outside atmosphere. Should this happen, radioactive gas would leak out through seals and gaskets that have not been adequately tested because of high radioactivity levels. In contrast to such uncontrolled releases, the proposed controlled release of the radioactive gas could ensure that expected levels are not exceeded. We are reviewing the proposed monitoring procedures being carried out by the Department of Health and Mental Hygiene and the Department of Natural Resources of the State of Maryland.

The estimate of the whole body exposure to persons at the site boundary over the 60-day period would be 0.2 mrem. The significance of this amount of radiation should be viewed in the context of the exposure that all human beings receive from natural radioactivity, that is, from cosmic radiation, from the earth, and from radioactive material that all human beings have always had within their bodies. For example, the radioactive potassium within our body and other sources of internal radioactivity amounts to an exposure of about 25 mrem per year; cosmic radiation averages 45 mrem per year; and terrestrial radiation in this part of the country averages 25 mrems per year, the total of which is several hundred times as great as that which would result to persons maximally exposed to the released krypton. The exposure would be less than that resulting from variations in natural radioactivity in different parts of our State.

We believe that the proposed release of radioactive krypton is the safest possible course of action if properly monitored. We wish to assure you that we intend to verify the monitoring process and report any deviations above the predicted radiation levels immediately.

The citizens of the States of Maryland and Pennsylvania have a legitimate concern over the methods used in the clean-up of Three Mile Island. We agree completely that the primary determinant of these methods should be the health and safety of all human, animal, and vegetable life. It is in consideration of all factors known to us at this time that we concur in the controlled release of the krypton gas now in the atmosphere inside of the containment building.

Sincerely yours,

Henry N. Wagner, Jr., M.D.
Chairman, Maryland Governor's Committee
on Three Mile Island

dmm

cc: Mr. Charles R. Buck, Jr.
Secretary, Department of Health and Mental Hygiene
Fifth Floor
201 West Preston Street
Baltimore, Maryland 21201

Mr. James B. Coulter
Secretary, Department of Natural Resources
Tawes State Office Building
580 Taylor Avenue
Annapolis, Maryland 21401

Florence L. Shelly
Box 157 Thompson
Pennsylvania 18465

March 31, 1980

Nuclear Regulatory Commission
1717 H. Street N. W.
Washington, D. C. 20585

Dear Sir:

I wish to register my strong disapproval of the venting of radioactive Krypton-85 gas from TMI-2, on several grounds.

1) The effects of radiation are additive. Therefore even the smallest dose can affect life.

2) The effects of radiation are multiplied as the radioactive particles are concentrated as they go up the food chain, so that even miniscule doses can be concentrated into large doses by passing through plants and animals to humans.

3) In discussions by the NRC and its staff at the time of the accident Commissioner Ahearne asked about the adequacy of the monitoring during the accident at TMI-2. Mr. Albert Gibson answered, "Unfortunately all of the monitors were off the scale". Mr. Galinski, "Let's see, was the stack radiation monitor also off the scale?". Mr. Gibson, "Yes, sir, it was". Mr. Galinski, "So, we don't really know what went up there." Mr. Gibson, "That's correct." Even without knowing "what went up there" the Nuclear Regulatory Commission's Environmental Monitoring Group reported that by mid-April, 1979 13,000,000 curies of Xenon 133 had been released on the people of the area. (and who knows how much more?).

By Metropolitan Edison's own calculations of a worst design basis accident, 88,000 curies of radioactive material would be released translating into a 320 millirem dose. How then can the Nuclear Regulatory Commission say that the accident at TMI-2 only resulted in a dose of 85 millirem to the people?

Since the effects of radiation are additive and the people of the area have already been subjected to 13,000,000 curies of radioactivity, I must object to any more venting of radioactive gases.

Instead, I join those who have suggested that TMI-1 must be used to help solve the problems of the mounting volumes of radioactive water and gases, temporarily, until permanent <u>safe</u> disposal has been worked out.

Respectfully submitted,

Florence L. Shelly

Florence L. Shelly

cc: Senator John Heinz of Pennsylvania
Dr. Russell Peterson, President of
National Audubon Society

March 31, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D. C. 20585

RE: VENTING RADIOACTIVE GAS K-85 ADJACENT TO HABITATED RESIDENTIAL AREAS

Dear Sirs:

My family and I live only 60 miles down-wind (prevailing winds) from the Three Mile Island nuclear power plant owned and operated by General Public Utilities Corporation.

One year ago my wife and I were in a state of anxiety on a 24 hour basis because of the nuclear disaster occurring on March 28, 1979. We constantly checked the wind direction hoping that it was not blowing radioactive clouds of poisonous gases over our home. I had made plans to evacuate if the radioactive poisons _involuntarily_ escaping into the atmosphere increased and the wind direction began blowing them toward my home and family. My two children are pre-schoolers aged 3 and 4½ years old.

To _voluntarily_ release hazardous, poisonous, radioactive gas such as K-85 into the air we breathe and to permit it to be carried uncontrolled by the winds across habitated areas of Pennsylvania countryside would be a far greater catastrophy than the _involuntary_ release occurring on March 28, 1979.

GPU is patently guilty of propagating a string of lies lasting for more than one year from the present time. The only truth devolving from GPU corporate officers' penchant for untruths is that thier disregard for the public health of people living in communities within a hazardous radius of their contaminated plant is total and absolute. Inasmuch as their utility will shortly be in a state of bankruptcy, any cost proposals made by GPU are irrelevant.

Let's get a few facts in proper perspective with a real-life situation. K-85 is a poisonous atomic gas of incomparable hazard to human and animal life. It does not dissipate or combine with other elements which change it into a less harmful state such as chemical poisons would be expected to do. K-85 remains in the air indefinitely as far as the lifespan of we and our children are concerned.

The common jargon used by GPU and your agency hide the real dangers involved. Radioactive gas is not released into "the atmosphere." It is released into the troposphere -- the air we actually breathe and live on -- the air that is really at issue, not atmospheric air a hundred miles above the surface of the earth. We rely upon the rain to clean our troposphere of ordinary pollutants by washing them down to earth. Would you propose nature clean its air of K-85 by washing it down to earth too?

The characterization of the inept attempts of GPU to deal with a highly radioactive contamination site at Three Mile Island as a "clean-up" operation grossly misrepresents the seriousness and danger of the site to the public. Plant personnel are shown with mops and pails as if they were merely trying to make the place look neat. True facts reflect a site of radioactive contamination greater and more intense than any other located on the surface of the earth immediately juxtaposed to large areas of habitated residential communities.

Consider the terror and fear in people involved by "nerve gas", a tasteless, odorless, colorless poison gas manufactured for the Army in this Country and others. Comparing the toxicity of "nerve gas" to K-85 renders "nerve gas" a minor threat to human life.

The nuclear power industry demonstrated on March 28, 1979, and on subsequent dates that nuclear technology is not suited to the generation of electrical energy. Propagandized myths of cheap, safe, dependable electricity will not materialize into fact now or in the future. Indeed, at this point in time any iteration of such myths should subject its utterer to criminal prosecution.

A final word. The credibility of this Commission specifically and the Nuclear Regulatory Commission in general is nearly nonexistent. Any decision by this Commission which would _intentionally_ poison the air United States citizens breathe merely because it is not "practical" to do otherwise, will effectively put an end to this unfortunate nuclear/electric venture and terminate an era whose promises proved to be impossible to fulfill.

Very truly yours,

Louis M. Busch

Louis M. Busch, Esq.
74 Cherry Lane
Macungie, Pa., 18062

cc: Richard S. Schweiker
John Heinz

13 Pine Lane
Conyngham, Pa. 18219
March 31, 1980

Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

Dear Sirs:

It is our understanding that the NRC will issue a decision on April 8, 1980 concerning the GPU's proposal to release the radioactive krypton gas contained inside TMI unit 2. We wish to comment on this proposal.

First, GPU has not publicly given reasons supporting their contention that the krypton gas must be released at this time. Secondly, if the gas must be released now from Unit 2, why have not other methods for its removal been considered? The residents of the Harrisburg area have for the past year been subjected to random and unannounced radiation doses. It is too soon to observe the effects in terms of future cancers; therefore permission to release the krypton gas would show a definite lack of concern on the part of the NRC for the health of Pennsylvania residents. We urge you to consider alternate methods for the removal of the krypton gas, if it is necessary, such as releasing it into the undamaged and unused unit 1 Reactor. If such a method would be more costly than releasing the krypton into the environment, it would be preferable to the continued threat to our state's health.

We strongly urge you to issue a negative decision on the proposal to vent the krypton gas.

Sincerely,

Jill and Wayne Evans

March 31-1980

T. R. Drake
1209 W. 18th Street
Santa Ana.
California - 92706
Phone - 1-714-836-6356

Dear President
United States
of America.

Just a quick note with a possible Solution regarding the Exhaustion of the gas at 3-Mile Island.

I suggest evaluating the possibility of the gasses into a number of high altitude Balloons which would gradually deflate at the maximum altitude.

Please re-direct for consideration.

Keep up the good fight and best wishes.

Sincerely.

T. R. Drake

3/31/80

Dear Nuclear Power Represenative,

My name is Samuel C. Phillips. I am 15 years-old. I have a brother whose is 11 years-old his name is Jamie L. Phillips. I feel that nuclear power is a good idea. But, we need to do alot more research on it. I am a church going person and so is my family. I think that nuclear power started way back in the beginning. I also think nuclear power is one of the apples that is found hanging on the tree of life.

God told Adam and Eve that there were somethings that man shouldn't know the meaning of. Just as Adam and Eve ate one of the apples from the tree of life I feel the scientists of today are about to pluck or have already plucked the apple of nuclear power from the tree. I feel once we find out the secret or the idea behind nuclear power this could be a sign that the end of the world is coming.
This is taken from Genesis chapter 3.

I heard from some of my friends that the method for the new power plants will be "Cyrogenics". We have just finished studying cyrogenics in Science class at my school. I understand that this is a method of supercooling which startes at -150 F and descends. This will crystalize the substances used to operate the new nuclear pwer plants.

I live in Reading, Pennsylvania there is a nuclear power plant at Three Mile Island and there is going to be a plant built at Limerick. This would mean that my family and the other people of Reading will be playing the part of a piece of salami. Sandwiched between these 2 plants!!!

I did a report on a news article from the Reading Eagle it told about the nuclear gases that were released and how the people who lived in Baltimore, Maryland were scared. Also how vetenarians are starting to say that there are more still born baby cattle this year than ever in the Middletown area.

I am a singer at my church so I will use a couple of songs to express my point.

One of the greatest songs ever written about this country of ours is " God Bless America!" But how can God bless America if we keep destroying it with things such as Dangerous Nuclear Gases!!

3/31/80

Also one of the most popular songs that was written in the late 1970's was "You Light Up My Life!" I would like to see this song come true but not to the point when "I'll go around glowing like a Nuclear Reacter!!!!"

Signed: One of the next

Human Light Bulbs.

P.S. Is this REALLY God's will????

I am sending along a self-addressed envelope and a copy of my Baltimore, Maryland report.

Waiting to here your reply!!!!!!

Sam Phillips
Current Event:

Miss Lapi
3/12/80

TMI Gas Seen No Hazard

The people of Baltimore, Maryland were frightened when radioactive gas was released from Three Mile Island on Monday March10, 1980. The officials siad that there is no health danger for Maryland residents. Henry Nathan, one of the spokes -man for the department of Health and Mental Hygiene saidthat, "No such danger will come to the residents of Maryland.

Plant workers released 47 millicuries of radioactive gas into the atmosphere on Monday.

Henry Nathan says the Department of Health has planned no special investigation of the water or milk in Northeastern Maryland.

J. F. PINK ASSOCIATES

DIV. OF SCIENTIFIC COMPUTER APPLICATIONS CORPORATION

ENGINEERS

ECONOMIC ANALYSES
COMPUTER CONTROL
UTILITY SERVICES

P. O. BOX 25
HUNTINGDON VALLEY, PA. 19006
(PHILADELPHIA AREA)
215-947-3489

March 31 1980

The Nuclear Regulatory Commission
1717 H St. N.W.
Washington D.C.
20585

Dear Sir:-

Ref. Three Mile Island - Venting of Kr85

Senator John Heinz has informed me that you will be making a decision about permission to vent the gas from the TMI system this week. I would like to offer a vote of support for proceeding with this and other necessary activities just as expeditiously as possible.

Obviously with the great publicity accorded this item, the decision is not a technical one. The amount of radiation and the dilution as well as the time extension for its release -- all can be kept well within the lowest levels of safe exposure, for even birds. However, the more important item at stake is the continued use of Atomic energy, and for this, a prompt clean-up and a rapid restart of this unit is essential.

Venting should proceed promptly for the following reasons.
1. There is no question of safety or danger in the release.
2. The unit should be decontaminated quickly and as expertly as possible within practical safety standards (not ridiculously stilted super-safe levels as proposed by the uninformed), since every day of delay is mounting a cost figure that is comparable to the cost of a real nuclear accident. I say this because delays beget further contests and delays in administration. because the plant itself is deteriorating. because promptness will instill confidence on the part of the public. because the plant should be restarted and shown to be a dependable contributor to the power system of the country.
3. The only alternatives to shutting down this plant (and the corollory that other if not all other nuclear plants will be shut down) are coal and oil plants. These are much worse environmental hazards and are economically inferior. The other alternative - conservation is retrogression and beyond a reasonable and efficient level.- unthinkable.
4. America needs the low cost power which this plant is capable of generating.

I trust your decision will be for progress and expeditious restart.

Yours very concernedly,

John Pink

J. F. Pink

gc
~~CC Sen Heinz~~

121 Evergreen St.
Harrisburg, PA 17104
March 31, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20585

Gentlemen:

I am writing to voice my concerns about the clean-up activities at Three Mile Island nuclear power plant and the possible reopening of the plant.

I understand that venting of the krypton-85 gas is proposed for the near future. I heard on the radio today that the Dauphin County Commissioners are not in favor of this proposal unless you can prove to them that this method is not harmful to local residents. I agree with the Commissioners. But, I remain sketical as to the Federal government's ability to assure us of this fact, especially since the experts seem so divided on the issue of the possible health consequences of exposure to low-level radiation. The unconfirmed and undisputed cases of abnormalities in hundreds of animals within the five-mile radius of TMI, and now some of the local residents, is my main concern. I attended the national debate held in Harrisburg on Friday, March 28, and at no time was this mentioned until a local resident bought up the question at the end of the debate, which still remains unconfirmed or undisputed.

Just how do you expect the citizens of this area to accept your credibility when all our questions are not being answered? The very same thing is happening here now to the animals (the antinuclear experts say "what the animals first") that happened to the animals as a result of testing in Utah and Nevada. I get very angry when I hear that in the 1950's, during testing of the Abomb on a 3-4,000 mile area in Nevada and Utah, that the dust blew across the plains carrying radiation with it, resulting in leukemia deaths of children, cancer increases and mutations in animals. And, you want us to believe that krypton gas release into the atmosphere here is so safe. All the guarantees in the world didn't do those children in Nevada much good, did they? I'm not saying these deaths and cancers were intentional, but just trying to show a point of simarilarity that when all the dangers aren't explored, dangerous consequences are possible.

I believe that you should make known all the possible alternatives to clean-up TMI, and sparing no costs, the safest method should be pursued. I for one am sick of hearing the words "cost effective", "profit", "dividends declining", and others over the health and welfare of the citizens and land in this area. If you can assure me and others that this gas release is the safest way to dispose of it, then I say "do it."

In reference to reopening TMI, I say "CLOSE IT". Met Ed has shown over and over athat it is incapable of operating a secure (e.g., the recent security guard episode) and safe power plant. I also heard on the radio today that PUC is being flooded with mail from GPU elderly dividend holders that their source of income is threatened. I have empathy for their economic problems in this day of outrageous inflation, but I also believe that when you invest money you must be realistic to know that your investment could decline or even fall "flat on its face".

I repeat again, economics should not be a matter of consideration in this matter.

I would appreciate any comments or answers to my questions you have in regard to this letter.

Thank you

Lovena K. Salvaggio

Lovena K. Salvaggio
(A local citizen who has been terroized by TMI)

cc: Senator John Heinz
Rep. Allen E. Ertel
County Comm'r Steve Reed
Public Utility Commission
The Paxton Herald

332 Valley Road
Etters, Pennsylvania 17319
March 31, 1980

Commissioner Bradford:

Please explain to us the reasons for the N.R.C.'s acceptance of the "licensees estimates" in the tables on pages 1-5 through 1-7 in Nureg 0662. We wouldn't take Met Ed's word for anything so important, why should you? The integrity of government employees is much too easily compromised, as we have found in the past year. You should make certain that it has been the Commission's findings, and no other groups' findings, that appear in your report.

Please send copies of NUREG-0600. Investigation into the March 28-79 TMI Accident by Office of Inspection and Enforcement. Investigative Report No. 50-320/79-10; also the Lewis Report Wash 1400 - the reactor safety report; A copy of your speech "Lightening the Nuclear Sled: Some uses and misuses of the Three Mile Island Accident" which was given at NYU on November 21, 1979; and finally a copy of the 1980 Nuclear Regulatory Commissions Annual Report.

Sincerely yours.
Charles Lind
Helen M. Hocker

Monday, March 31, 1980

Gentlemen —

I __beg__ you __not__ to release the "low-level" gas into the air from TMI. People have been frightened and victimized enough by Met-Ed. their license should really be revoked — they're a danger to __us__ as well as to __themselves__

I understand there is a better & __safer__ way to get rid of this dreadful waste — by a method called "cryogenic" — I have been given to believe that Philadelphia Electric has the equipment to use this process — however — it takes a __little__ longer to get rid of the waste — & is more __expensive__. And there we probably have the reason why Met-Ed doesn't

(over)

(2)

want to use it! After all — ~~they~~ the __G.P.U.__ & __Met-Ed Hierarchy__ __don't__ have __their homes__ & __families__ __near__ __TMI__ — People who believe so much in Nuclear Power should be __forced__ to live as __near__ __as possible__ to them — __right on grounds__ — then they could admire their handiwork every day!

Now — I'm sure that you fellows ~~to~~ think this "low-level" radiation release is perfectly safe — but how much radiation (low-level of course!) has already been released on these people? After all — some animals have already died — & now we do have increased cases of __hypothyroidism__ in __infants__ — __Low-level radiation__ accumulates in the body — how much of a dose do you want to give

(3.)

these people? And what about the psychological effects upon them? Doctors in the area there are treating people already for disorders related to TMI. Haven't these poor people been damaged enough?

yours for a non-polluted America — Let's make the words of the song - "America the Beautiful" - really mean something - Let's Give a Damn —

Lois Grimm
702 North 10th st
Reading, Pa 19604

April 1, 1980.
Camphill Village
Kimberton, Pa. 19442

Nuclear Regulatory Commission
PO BOX 311
Middletown
Pa. 17057

To the NRC,

I am outraged that you are considering venting 57,000 curies more of Krypton gas. I live 60 miles from TMI and I don't want any more radioactivity vented at all.

Freeze TMI and seal it with the cryogenic process. Put health before profit.

Very Sincerely,

April 1, 1980

Daniel R. Muller
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Muller:

I am writing to you to express my concerns and fear over current plans to release 53,000 curies of radioactive Krypton gas from the damaged Three Mile Island nucelar reactor. Although officials of both Metropolitan Edison and the Nuclear Regulatory Commission continue to claim that venting gas in this manner poses no serious health threat and is the safest possible alternative, I am forced to view their opinions with extreme skepiticism. Met Ed's obvious interest in the cheapest possible route to re-activiating TMI and continuing the expansion of nuclear energy is clear and the NRC is made up largely of scientists and businessmen who have had a continuing stake in nuclear power for many years and have acted as advocates for the industry in both personal and institutional capacities. Instead, I must remind you that radioactive Krypton has been shown to cause several types of cancer and birth defects and that no safe level can possibly be definitively established on either a long or short term basis for this gas. In addition, history has continually shown us that the future effects of dangerous substances are often much greater and more damaging than anything that might be anticipated at this time. Finally, we also know that the reassurances we are currently hearing from supposed experts sound remarkably similar to those given countless times in the past that have proven to be lies. Residents living in Nevada and Utah areas subjected to fallout from nuclear tests in the 1950's were consistently told (when they were told anything at all) that they had nothing to fear and need only go inside to avoid any danger. Many of these residents are now dead of radiation-induced cancer. Niagra Falls citizens lured to Love Canal by the pleasant deceptions of the chemical industry also learned much too late how little faith to put in the words of "experts". I could continue to cite many similar incidents, but I know you are as familiar with them as I. I would only ask you one question. Do you believe the assurances of safety sufficiently to go to Middletown, Pennsylvania, with your family on the day radioactive gas is released into the atmosphere?

I am not a resident of Middletown, but I feel for the anger and fear of those who live there. I do not believe anyone has the right to subject human beings to the dangers these people have already faced and must continue to deal with as a result of our reckless energy programs. At the same time, my fears are also my own. As a resident of Philadelphia, I live in a direct line of the prevailing winds from TMI and I am not at all confident of my own safety. I am sure that most of those who stand any chance to be exposed to this radiation feel much as I do and cannot believe that there are any interests more importnat than the health and safety of people in this area. You may feel that my fears are groundless and that you as a government expert have a better grasp of the realities of this situation. Who was it that made other "informed" governmental reassurances in other instances? Who assured us that nuclear accidents were impossible? I, we, are not failing the government or losing faith through our unwillingness to believe in your reassurances--you are failing us by your refusal to respond to the needs and desires of those most directly involved. Radioactive Krypton gas is a threat to the lives of millions both today and in the future. Safer alternatives do exist. I urge you to use your power to utilize those better choices and prevent this unnecessary disaster from occurring.

Sincerely,

Robert Harris

Robert Harris
329B Kater Street
Philadelphia, Pennsylvania 19147

K. 2, Box 189, Lowell,
(Benton Co.), Ark. 72745;
April 1st, 1980.

Rep. John P. Hammerschmidt,
U.S. House of Representatives,
Washington, D.C. 20515.

Subject: Partial Disposal of Radioactive Krypton from the Three Mile Island Plant.

Dear Mr. Hammerschmidt:

I suppose that the subject krypton is so inert chemically that it will not absorb onto such as activated carbon — or else that would have been used.

If the above is true, the next alternative is to get it high above the population and release it to mix in air; — ?? If so, maybe portions of the air, plus subject krypton, can be pumped into thin balloons, (such as those made with du Pont's "Mylar"), and helium added in sufficient proportion for buoyancy, then released to go up 5-10 miles before bursting or being pierced; i.e., burst because of low external pressure or other means.

If the building containing the krypton contained a volume equal to "ten balloons-full", and a quantity equal to 2000 grams — for example — one would leave about 1000 grams in the building if gas, (air + Kr), was pumped out to fill ten balloons, and air was bled into the building as replacement. However, if there is "large, free, interior volume", one might be able to so connect other balloons within the air-lock entrance so that they could expand within the interior of the building as "air + Kr" is pumped outside into the "transport balloons". If this could be arranged, then one might — for example — be able to reduce the krypton in the interior of the building to a total of 200 grams. Then, when re-diluted with outside air, the krypton's concentration would be 10% of what you started with.

P. 2, J.L.G. → J.P.H.

If you are willing, please pass a copy of this to a responsible party in the Nuclear Regulatory Commission, and perhaps another copy to the Dept. of Energy.

In case you want some oral discussion, my telephone is 1-(501)-751-7499.

Very truly yours,
John L. Gring,
(retired chemist).

730 Smoke Pipe Lane
Harleysville, Pennsylvania 19438
April 1, 1980

Nuclear Regulatory Commission
P. O. Box 311
Middletown, Penna. 17057

Gentlemen:

I urge you to begin considering the people as your primary concern. To date you have allowed and endorsed Metropolitan Edison's claims that the Krypton gas must be vented or risk a criticality. In fact, the venting of the gas is merely a convenience for few, workers at Metropolitan Edison, at the risk of many, the people of central Pennsylvania.

The people have reached their limit! Although we aren't supposed to know, the people are aware that there are other ways of dealing with the gas. In fact, we know that studies initiated by your own agency have actually advised against venting the gas. That your own task force, which assessed clean-up operations at TMI, indicated that the data which is being cited could be interpreted either way.

The utility has been making the choices. It chose, almost a year ago, to not use equipment made available to it to deal with the krypton. It chose to not take any measures until the cry of time and equipment failures could be sounded with a false sense of urgency. Now the utility wants to choose to vent the gas to gain a few extra minutes of work time per person in the clean-up.

Before proceeding with the venting, I urge you to come before the people and answer their questions. Can you assure the people, with complete confidence, that the Krypton will not hurt them? Can you assure the people that the radiation contained in the Krypton will be evenly dispursed, thus assuring the radiation dose which is so routinely recited? Can you assure the people that only Krypton gas would escape and would be isolated from any other radioactive isotopes inside the containment? (In answering these questions please be aware that theoretical models do not provide any assurance or degree of certainty for the people since it is so often disparate from the real world. Theoretically, the accident itself could not happen.)

The public does not trust Metropolitan Edison, and the NRC, by backing this irresponsible utility, is devestating its own credibility. The NRC should lead the way. They should publicly reveal that other ways of dealing with the Krypton such as freezing and subsequent entombment are feasible and in the public interest.

Please do not allow the Krypton to be vented. The independent studies of the air, soil, and water around TMI by Japanese scientists indicates that radiation doses have been greatly under-reported by American officials. This is certainly not reassuring to the general public that future releases will be safe or that the company provides reliable information when it disagrees with what it considers to be its own best interests.

Thank you for your attention to this very important matter.

Very truly yours,

Marcia J. Ehrhart

(Mrs.) Marcia J. Ehrhart

cc: Gov. Thornburgh

LEPOCO

LEHIGH-POCONO COMMITTEE OF CONCERN

• BETHLEHEM, PA. 18018 • 691-8730
555 Main Street

April 2, 1980

President Jimmy Carter
The White House
Washington, D.C. 20500

Dear President Carter,

When the emergency at the Three Mile Island Nuclear Generating Plant was declared to be over, most people believed that the radiation emminating from the reactor would finally cease. This will not be the case if a proposed Metropolitan Edison plan for decontaminating the stricken reactor is carried out. Over 40,000 curies of radioactive Kr 85 gas is still present in the reactor containment building and it must be removed before clean up operations can begin. Met Ed wants to remove the gas by venting it into the atmosphere in a series of "contolled releases". The Utility is in the process of seeking permission from the Nuclear Regulatory Commission to start the releases of the radioactive gas.

During the accident at TMI, the people of eastern Pennsylvania were exposed to numerous releases of airborne radiation. We still do not know how much radiation was contained in each release or which areas of the state effected. Scattered radation measurements suggest that the airborne contamination was significant and wide spread. One day after the accident, the New York State Department of Health in Albany monitored airborne radioactive xenon-133 gas levels which were 1000 times higher than normal (Science, Vol. 207. p. 639). In the atmosphere the gases Xe and Kr behave in an almost identical manner. Albany is also a long way from Harrisburg (250 miles). Radioactive gases released from TMI therefore, pose much more than a local problem.

Carl Abraham from the regional Nuclear Regulatory Commission in King of Prussia had the following comments to make regarding the dangers of Kr 85. "... the decay of krypton gives off a type of electron called a Beta particle. The Beta particle is not a very penetrating particle but it can give you quite a dose to the skin. It does go into the skin though it doesn't go through the skin." "... if you enhaled this gaseous krypton then the radiation exposure would be to the lining to the lungs and the epithelial cells of the lungs which are very sensitive to radiation. The Beta is strong enough to go into that layerof thelungs and would give you quite a lung dose."

We strongly oppose the planned releases of Kr 85 from TMI. Met Ed has admitted that other ways of removing the gas exist. They contend that venting the Kr into the air is the most economical method. Met Ed's choice of this plan reinforces one's feelings that the utility is more concerned with its financial problems than with the health of its customers and neighbors.

The long term health effects of Kr 85 are not known. Until the nuclear weapons tests of the 60's our air contained only a minute amount of the gas. It is also a long lived isotope with a half life of 11 years. Since krypton is an element with no major environmental sinks, the Kr 85 will remain in the lower atmosphere for man years and spread over a wide area. What effect the ever increasing amount of Kr 85 released by the nuclear power industry will have on people or on the environment is, at present, anyone's guess.

To conclude, the planned release of radioactive gases from TMI poses a serious health threat to people living in a wide area. The releases are totally unnecessary. We deplore Met Ed's choice of the "cheap and easy way". It was this kind of thinking which helped cause the accident in the first place.

Sincerely,

Al walker (iv)

Al Walker for LEPOCO

116 Sheldon Avenue
Frankfort, New York 13340
April 2, 1980

John Collins
National Regulatory Commission
Washington, D. C.

Dear Sirs:

I would like to know if the possibility of removing the krypton gas has been explored in full. By your past reports, you have stated that 57,000 curries of krypton gas can be safely emitted into the air and cause no more harm than the amount we normally take in by various other means.

Your problem is the people in three mile island area have rejected the release and that they have lost faith in you and they want the plant closed. Perhaps you can restore your faith if by a remote possibility you have overlooked moving the gas to an uninhibited area, land or sea. If you have and this could be a possibility I may or may not have a plan. If I do, it's with your ingenuity and power. The fear of gas and steam from a plant can be the fear of the past. I would like to hear from you before I look for information elsewhere.

This could be a great safety factor in restoring confidence in atomic energy we need. It should not be stopped and should continue to be built with its present status so that we could get off our knees to the oil cartel and restore our standards by stopping inflation and recession. The fight should be to save America by atomic energy not to stop it.

Sincerely,

Dominick F. Mazzola

DOMINICK MAZZOLA

cc: Radiation Biologist Reginald [redacted] Gotchy)
Wash DC

General Public Utility Corp
Middletown PA

AMERICAN ASSOCIATION OF MEAT PROCESSORS

224 EAST HIGH STREET ELIZABETHTOWN, PA. 17022 (717) 367-1168

April 2, 1980

The Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D. C. 20585

Gentlemen:

Our organization's headquarters is located just about 6 miles from the Three Mile Island nuclear plant. So, we hope you will give special consideration to our recommendation.

We feel that the NCR should proceed with the release of the krypton gas and should begin the cleanup operation. Since no one was hurt or injured in any way, we are convinced that the safety precautions built into the system worked in spite of human error. So, we urge you not only to proceed with the cleanup of Unit 2, but also with the start-up of Unit 1.

We feel that the tremendous added cost to us as consumers of electricity that must be purchased elsewhere is a needless burden.

The hysteria that characterizes the seemingly endless tirade of the professional activists against TMI must give way to the common sense point of view shared by the vast majority of citizens both in the TMI area and throughout the nation.

Sincerely,

Robert L. Madeira

Robert L. Madeira,
Executive Director

RLM:HMC
cc: W. L. Hancock, President
Senator Richard Schweiker
Senator H. John Heinz III
Congressman Robert Walker
Governor Richard Thornburgh

24 APR 1980

38 East Main Street
Apt. 1
Middletown, Pa. 17057
April 2, 1980

The President of the United States of America
The White House
1600 Pennsylvania Avenue
Washington, DC 20515

Dear President Carter:

I appreciate your willingness to take time from your busy schedule to discuss with Stephen Reed, our State Representative, the concerns of Central Pennsylvanians' about the proposed venting of the krypton-85 gas at Three Mile Island.

I, a resident of Middletown, a mother of an almost five year old, and pregnant oppose the proposed venting of the gas at TMI. Being 40 years old and at a high-risk pregnancy age with a due date of June 2nd, the proposed venting plan has produced extreme anxiety, evidenced by tension head-aches in the past month. I don't want this gas released because I feel extremely vulnerable in my condition. I also feel, during the release of this gas, that the environment of my home will be unsafe for my unborn child nor a safe place to bring home a newborn. Instinctively, a bird doesn't build a nest on a flimsy limb that will easily be broken by a gust of wind, nor will it expose its young to danger. Therefore, I too a thinking being, do not intend to stay in Middletown during such releases, & will not bring my child into what I consider an unsafe environment.

I do not savor the idea of having my baby in an unfamiliar hospital, delivered by an unknown doctor, and without my husband present. (My husband is a dairy farmer, employed by his father. Lack of help doesn't allow him to leave his job or the area at will.) I also don't relish bringing my newborn child home to an unfamiliar, but safe, environment. I have concerns about who will care for my daught-

ter while I am in the hospital, as she will accompany me out of the area. The financial burden will be heavy too.

I have difficulty in accepting the NRC's environmental assessment that the doses are very low level and would produce no adverse health effects. Normally, I'm a trusting person; but the continuous reports -- no matter how much radioactive gas is released -- that the releases are within federal regulations and "no negative health effects are expected" disturbs me. The Heidelberg Report considers the U.S. standards too lax. How do I reconcile the two standards? What about the mental stress experienced by the people in this area? That never seems to be considered in the assessments, i.e. the health effects of this stress! At this point I feel I'm being brainwashed. It is my understanding that there have been no longitudinal studies done on low-level exposure to radiation. The studies based on overdoses, i.e. Hiroshima, etc. don't

(4)

apply in our situation. Why were nuclear power plants allowed to be built near large population centers when no one really knows the real effects of low-level radiation? It appears people were deceived by the government and their health and well being totally ignored.

I too have concerns about the accumulatory effects of low-level radiation on my family and myself. No one seems to discuss this issue -- especially the NRC. Due to complications before birth and illness since birth, my almost five-year-old has already had more than her share of low-level radiation from X rays, in addition to the constant doses from TMI. She doesn't need any additional doses; neither do I. I had many X rays as a child because my mother had tuberculosis, and as a teenager I had radiation treatment for a fungus ear infection. Ironically, at the recommendation of a doctor of nuclear medicine, just two days before the TMI acci-

(5)

dent last year, I underwent radioactive thyroid scans to determine whether I had any tumors.

I dislike the fact that people who don't live in Middletown are in total control of making decisions governing the quality of my life, i.e. the methods that will be used in the cleanup of Unit II and the effects they will have on my health. Our opinions seem never to carry any weight. I live with TMI every day. The towers jutting up on the horizon or seeing Met-Ed employees all over town act as constant visual reminders. This produces constant anxiety. I'd like to forget a little, but I can't!

President Carter, I request that you do everything, within your power, to prevent the release of the krypton-85 gas at TMI into the atmosphere, as I believe it is unsafe to do so. Please take into consideration our physical and especially our mental health. I believe the mental anguish and stress produced

(6)

by these releases will cause me and many other residents of Middletown and the surrounding area more harm health-wise than perhaps? the actual release of the gas. I do not wish to re-experience the stress, terror and anxiety that I felt last year, at this time, when I fled Middletown with my daughter. We have only lived in Middletown not quite two years, and the TMI accident has been one of a series of very stressful incidents that has wrecked our lives since we moved to Pennsylvania, but perhaps the most life threatening. I don't need any additional stress on my marriage and family relationships. What is life when it becomes pure survival of the fittest?

I request that you take the following actions:

1) Have an alternative to venting be built immediately with unlimited funding from the White House.
2) Have the best experts examine the

(7)

situation at TMI and develop contingencies to handle all the "dangers" Met-Ed the Governor's Commission, and Joseph Hendrie keep shouting about.

3) Have independent radiation monitoring analysis and assessments of all steps in the cleanup.
4) Have a special assistant on site who has direct access and reports personally to you.

President Carter, I ask that you remember me and my family and the other residents of this area who are opposed to the venting in your prayers. Many people feel economically trapped here. I wish you and your family a joyous Easter.

Sincerely yours,
Cynthia Ann Hertzler (Mrs)

2823 O'Neill Dr.
Bethel Park, PA 15102
April 2, 1980

Nuclear Regulatory Commission:
1717 H St. NW, Washington DC 20585

Gentlemen:

Re: <u>3-mile Island - release of Krypton</u>

Thoughts of our family re your decision to be made next Tuesday:

My daughter (age 20) thinks nuclear power is too dangerous for man to handle - an evil which should be abandoned, as we can never have complete safeguards.

My husband feels we may need nuclear power, but coal would be better source of energy.

I feel it is dangerous because of possibility of earthquakes or natural disasters exploding a plant, as well as attacks from enemies who could drop a conventional bomb on a nuclear power plant & have the effect of a "nuke" bomb. However - the power itself ~~cannot~~ isn't evil - it is mankind's use or misuse of it which will make the difference - how much do we want electricity? how much do we want planet Earth??

Consensus of opinion: <u>if the reason for releasing krypton would be to prevent a "pressure cooker" type of situation building inside the reactor, then it may be a necessary calculated risk - the lesser of two evils.</u>

If it is to be released so that repairmen can save the financial investment of the power company & government, then there is no excuse to release it.

Your problem will be the credibility gap between the people & those with a financial stake in the matter. Only the experts really know what kind of danger is

trapped inside that krypton gas - if even they know, for sure. All you can do is consider all "data" &

<u>Let</u> your <u>consciences</u> <u>be</u> your <u>guide</u> -

May God be with you in your decision making & show you a way out of your dilemma - His way.

Most important of all - may <u>you</u> be with God!

You have our prayers & good wishes in this most difficult task.

Sincerely,

Mrs. Margaret Huff

(over)

14 APR 1980

April 3, 1980

President James Carter
The White House
1600 Pennsylvania Ave
Washington, D.C. 20515

Dear Mr President,

I am a housewife and have lived in Middletown, Pa. all my life and I would prefer to keep living here for the rest of my life. I have a husband and two children and I am very concerned for them, especially my children, Angela 6, Gene 2. I feel we've been exposed to enough.

There is no doubt in anyones mind how harmful Krypton 85 is and not to mention the emotional stress we have been under since the first accident last March.

I demand another alternative to venting be built immediately with unlimited funding.

I also want independent radiation monitoring analysis and assessments of all steps in the clean up. I cannot believe anything that Met-Ed and the NRC are telling us. We've been lied to from the beginning. They are not looking out for the public, they are looking out for their dollars. Bring in the best experts to examine the situation and develop contingencies to handle all the "dangers" Met Ed is yelling about.

Your support against any venting and the re-openning of T.M.I. is greatly needed now!

Sincerely Yours.
Debra J. Manfred

Andrew C. Burger
1000 Briarcliff Road
Middletown, PA 17057
April 3, 1980

NRC
P. O. Box 311
Middletown, PA 17057

ATTENTION: John Collins

Dear John:

I thought it was very nice of you to appear before our Middletown Council. I am sorry that the crowd turned the meeting into a debate between pro-and anti-nuclear sentiment instead of questions concerning radioactive Krypton.

It is important to re-emphasize the fact that people who fear this venting should be able to leave this area at no cost to themselves. Some people cannot afford to leave. In our phone conversation I thought you agreed, but I must have misunderstood.

It is my understanding that 50 curies of radioactive Krypton are vented per year under normal operating conditions. The 57,000 curies you plan to vent is an equivalent to 1,140 years worth of radioactive Krypton under normal conditions.

I believe your attitude toward psychological stress will delay the venting. In my opinion, the venting will be delayed until summer with winds not so strong. Of course, one Wednesday evening several weeks ago you told me there was no urgency to vent anyway.

Also, I thought you said the stacks would be set higher for safety purposes. Now I understand they won't be.

John, are there any conclusive studies for a release of 50,000 curies of radioactive Krypton? I hope our children won't be "guinea pigs" again! Could you please send me any conclusive studies.

A statement was made that no one was afraid. A recent study was made by Elizabethtown College that showed 51% of the people surveyed are afraid. I am sure you must base decisions on that fact.

I noticed one report stated the computer will update the operator every hour. Is this the same computer that John Kemeny called twenty years out-of-date?

Will it be written that the wind must reach a certain rate? If you would only vent when the wind blows Southeast, it would require less of an evacuation. If the NRC would use some basic common sense, you wouldn't have the problems with stress.

Sincerely,

ANDREW C. BURGER

AB/ma

cc: President Carter
Commissioner Ahearne
Commissioner Bradford
Commissioner Gilinsky
Senator Gekas
Congressman Ertel
Governor Thornburgh
Lt. Governor Scranton
County Commissioner Reed
County Commissioner Hetrick
County Commissioner Minnich
Senator Schweiker
Senator Heinz
Representative Dinnini

River Hill Farm
RD 2
Holtwood Pa 17532
April 3, 1980

The U.S. Nuclear Regulatory Commission
Director, TMI Support Group
Division of Nuclear Reactor Regulation
Washington, D.C. 20555

Dear Sirs:

Subject: TMI Clean-up, Public Comments on NUREG 0662, 3/80

After reading NUREG 0662, the Haller Report and Mr. Dieckamp's letter to the Commission of March 4, 1980, I would like to respectfully submit the following comments:

1. It is very difficult to understand why NRC has treated this clean-up as a "normal" procedure and has not taken an active, intensive role in directing its operation. Met Ed's first request to deal with the noble gas problem is dated November 13, 1979* In all the alternatives listed, the time required to install equipment and process the gas without major off-site releases has gone by while NRC deliberated and now we face possible machine deterioration with NRC and Met-Ed asking to vent because it is cheapest and fastest. You seem to me to have added to the problem by lack of expeditious action, and we as residents are now to suffer releases because of a lack in what Kemeny called "a fundemental change in attitude."

2. Credibility in the utility and the regulatory agency is low at this time. NUREG 0662 will further lower this credibility because its overall impact to a "civilian" is: clean-up will utilize those processes which are cheapest or fastest, NOT THOSE WHICH GIVE THE SMALLEST POSSIBLE DOSE TO THE AREA. Money seems more important than safety.

All you are accomplishing by going this route is to swell the ranks of those who oppose nuclear power in this area. Every day, more people who have previously believed that the "experts" have the answers see in your own documents that the decisions are being based on finances, not public protection. In my opinion, this will eventually lead to the public rejection of electrical generation through the use of nuclear power. If you believe that is a mistake, and it should be part of our energy mix, then you had better make the TMI clean-up of utmost priority, with as close to zero releases as can be obtained. If it can be "made safe", to prove that by releasing Krypton 85, and other aerosols as the first step is a grave error in judgement. Local people say constantly to each other," If the government can bail out Chrysler, it can bail out Middletown." All of us are now aware the Krypton is the first release, and from there on in it gets

*Haller Report

worse. We search the Haller Report to see if it is yet known how far into the walls the contamination has gone: will they need jack-hammers? Will there be dust released containing Cesium and Strontium ? Will NRC say, if we sit by for a release of Krypton 85, that has set some kind of a precedent for the future release of worse substances?

Many are reading of the huge controversy over the safety of the current standards in 10 CFR. Arguments in the public press over BEIR III, Dr. Mancuso's data on higher rates of cancer deaths at Hanford from exposure to "low level" radiation and his subsequent firing with Batelle to finish the study, Dr. Bross, Dr. Alice Stewart and Dr. George Kneale, the Heidelberg Report of errors in theoretical projections of as much as 1,000 times, Dr. Upton of NCI here last year saying definitively "all radiation is unsafe".... these are having their impact. We have an asbestos plant in this area where local people are now dying of the effects of another industry where the standards were thought to be adequate and have proved wrong. In my opinion, this does not prove that we are all "stressed" and emotionally hyped-up, this proves that we realize the clean-up will generate dangerous materials and are tryng to make the regulatory agency respond to the emergency having PUBLIC HEALTH as the top priority and to take the lead role, not a passive review capacity.

When we met with Dr. Hendrie on March 18, 1980 he said there is a risk of bankruptcy for Met-Ed if the clean-up is difficult. The Haller Report says this also. He further stated the license is "like flypaper" and the company cannot abandon the plant. However, u der questioning, he admitted all NRC could do if they did "walk away" is cite them and fine them. That does not clean up the mess. If the situation is in truth that serious, I would like to see NRC tell President Carter new actions, such as a federal take-over are needed, and do it SOON, not waiting until the situation is more deteriorated. I am also under the impression that clean-up heading to decommissioning will differ substantially from clean-up heading to re-opening. In my opinion, if you try to open up either unit again, you will face uncontrolled civil disobedience by the local people. Read the local editorials, such as the Intelligencer-Journal of March 21 and 27, 1980.

3. The local NRC staff here has really behaved magnificently under fire. Dr. Collins and his men are under the most intense pressure from all of us. Their refusal to make decisions without the full involvement of the five Commissioners is proper: it is a tacit admission that this is not business as usual. Of course it is not business as usual; it is the most serious accident in the industry known(outside the Soviet Union) No one has ever cleaned up such a situation before, and no one really knows how to do it. In my opinion, NRC has not treated it with sufficient seriousness, and seems to regard it as one of 72. Your men on the spot deserve better support than that. It ranks in Mr. Dieckamp's priorities as Number Four* This is intolerable.

*Haller report.

In summary, it would appear the Commission should take the following steps in regard to the entire clean-up, including NUREG 0662 as only the first of a related series of steps to resolve TMI:

1. Declare the situation a national emergency.

2. Give it top priority, with NRC and DOE in the lead role, not a passive response role.

3. Commit themselves to the goal of public protection first, finances second with the aim of as close to zero releases as possible, rejecting Appendix I and others as the basis for operations.

4. Commit themselves to a complete decommissioning of both units.

5. Commit themselves to a removal of the wastes from the site and their transport to an approved dump facility as rapidly as possible.

6. Deny early site review for any other sites in this region permanently.

I appreciate the opportunity to express my views on the issue. I hope the resolution of this problem will be expeditious or as Dr. Hendrie said, we may face "recriticality" again.

Bite the bullet, sirs.

Sincerely yours,
Walden S Randall
Walden S. Randall

1419 Ford Ave.
Harrisburg, Pa. 17109

To.

Nuclear Regulatory Commission, Middletown Office, JohnT. Collins and superior
Penna. Dept. /Enviro. Rescs.Bur. of Radiation Monitoring, Thom. M. Gerusky
President Carter, Senators Schweiker and Heinz, Representative Allan Ertel.

(Each adressee's response and action will be welcomed)

Gentlemen:

AS one: a. who has a family living ten miles from T.M.I.
b. who has fairly broad scientific training
c. who realized the need for maintenance at T.M.I. before inaccessability of Unit II causes a meltdown in the event of pump failure.
and d. not affilliated with any pro or anti-nuclear group I

I would like to offer some observations and facts that may be overlooked by politicians or nuclear specialists to which rational responses to the public will avoid the extremes of a 5day high dose of krypton 85 and radiation, or the indiscriminate low level venting with its longer psychological concern for those who over-emphasize its risk.

The following fact:
Krypton 85 is approximately three times as heavy as air and even when vented from a 160 feet high stack and helped by wind and diffusion will sink to earth quickly.

Observation:
1. Your program will need to involve coordinaion between ground-based chemical and radiation monitoring teams, meterorologists, and a communications link back to Unit II, say for one day at first.
2. Necessarily, you should consider the hour by hour levels and diffusion and the avoidance of pockets of odorless and colorless Krypton through concern for both radiation and respiration and appropriately interrupt venting as necessary.
3. In view of the fact that commitment to a fixed timetable of 5 Or 60 days prevents accounting for the directions of the four winds during these periods in advance, so as not to subject any direction to more of a concentration than another....in view of this, it seems innappreptiate to set a timetable and expect nature to cooperate. Its more sensible to take the levels and winds a day at a time and regulate the release while monitoring constantly, if it takes numerous monitors or over 60 days the public would be more confident of its safety than considerations of politically expedient extremes or technically-precise but opposite periods.
4. In light of the fact that the whole area around T.M.I. is populated the 5 day shot could expose one area to significantly greater krypton than others if the wind did not change during the agreed timetable.

What concerns me, as a person with a slight respiratory problem, as well as a family in the area, is that technical recommendations of 60 days as promoted originally should shift to 5 days at bureaucratic request and be viewed seriously without a discussion of the above concerns.

As a student in 1956 the Atoms for Peace program visited the city I lived in complete with a government-funded brochure for each visitor describing the U.S. commitment to more nuclear energy. Now that something is wrong the same government must commit its resources for the numerous ground monitoring teams, detectors, and communications, and not leave our future in the hands of economically-motivated Met-Ed and their inherent limited finances which affect extent of safety.

Please advise on your action or recommendations. Sincerely,
Dale Miller
4/4/80 Dale L. Miller

April 6, 1980

To Whom It Should Concern,

I have just been advised by an article in the San Francisco Chronicle that the events at the Three Mile Island nuclear power plant one year ago did not constitute a serious accident. In fact, the article went on to say, the only damage done was psychological damage to residents of the surrounding area. As I understand it, at the time of what I prefer to continue to call the accident, a certain amount of radioactive steam was released into the air. A piece of equipment, a valve, malfunctioned, and in addition there was a certain amount of operator error. In the days following the release there formed a large bubble in the core of the reactor that presented a potentially very hazardous situation. Luckily for all of us, this situation resolved itself in what we are told is a satisfactory manner. Today, a year later, nobody has yet been able to enter the reactor. Clean-up procedures are impossible, and now the Pennsylvania utility company is asking to be allowed to release further radioactive gas into the atmosphere. Both this, and the release of many gallons of radioactive water into the Susquehanna river show a height of irresponsibility that is amazing to me. But what is most unbelievable, most puzzling, is the failure by the President and by the Nuclear Regulatory Commission, to admit to the graveness of that accident, to face the possibilities in store for future generations. By refusing to face the consequences of this accident, we are condemning ourselves to repeat it, and perhaps with much more tragic results.

The residents of Three Mile Island, and especially the farmers (some of whom have been farming the area for generations), have alot more to be worried about than phantom technological vagueries. You have no doubt been advised of the very high incidence of miscarriage, stillbirth, and mutation among the farm animals in the area. If you haven't, then all you need do is contact the farmers, who have been keeping records and are trying to get attention paid to the frightening and devastating statistics they are accumulating. The gestation period for their animals is much shorter than our human one. Isn't it therefore a wise thing to do to take advantage of this early warning, and take into account what it may mean for the next human generations? What is to be gained by denying what is happening? How will it help our research and our lives and livelihoods to ignore a bad mistake instead of learning from it?

I would like to have a family, and live to become very old, and enjoy grandchildren. I would like to sit by my fireplace and be able to look forward to a future for the next generations where they might not have hairdryers, or electric popcorn poppers, or myriad other pieces of wasteful 'energy saving' devices. I would hope that they would have strong arms and legs, and healthy muscles, and good red blood so they could perform most duties easily for themselves. I would hope that their future would be free of fear of the extinction of their species by a technology that they no longer understqnd, and which no longer has the best interests of freedom, life and happiness as a raison d'etre.

It is no longer enough, or even desirable, for scientists to create and inventors to invent merely to perpetuate jobs, or to earn profits, or just to be original. Scientists and technologists have a moral duty to the population of this planet to go beyond the realm of pure science. They must have ethical considerations in everything they undertake, in order to insure that they do not destroy everything that came before. The leaders of the next generations, should there be any, cannot be just politicians, just technologists, they must be scholars, and educators, and people of conscience. Otherwise, we do not stand a single chance.

Sincerely,

Evelyn Lincoln

Evelyn Lincoln

P.S. I would appreciate your reaction to this letter.

April 6, 1980

Chairman John Ahearne
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Chairman Ahearne:

I strongly urge that some type of funding be made available so that independent specialists can review and comment on all Environmental Assessments and EIS.

My reasoning is because once again I am trying hard to analyze information in which I have no training. However, in order to make your agency more responsive to citizens I feel it is my duty to comment on NUREG 0662.

First, I am disturbed that an EIS was only announced in November 1979--8 months after the accident at TMI. Secondly, if you and the utility really understood the credibility problems--an alternative to venting would have been developed in April 1979. Finally, this utility is designed to produce electricity not cleanup a class 9 accident. The fact that utility money controls the cleanup will continually cause public furor over the next 5 years.

Following my comments:

1. - You should list the wind speed necessary for purging in the months of April to December. Because you omitted it and I can't get the utility or NRC to agree on an MPH, I doubt that it will be done properly or adhered to strictly.

2. You have segmented Epicor and now possibly K-85 gas disposal from EIS because of indecisiveness.

3. Is K-85 really the dominant radio-nuclide in the containment?

4. Why did you allow the utility until November 13, 1979 to submit plans for venting That's an incredible 8 months after the accident and I understand they barely looke at other alternatives.

5. Will gasses have to be disposed of from the reactor vessel? How much?

6. Access will still be restricted to a degree if the K-85 is purged because S won't be operational until early 1981 (plenty of time for alternatives to be b

7. If the K-85 is not purged, which is more important repairing the instrum planning the decontamination.

8. Does the building air cooling system run continuously?

9. Have you considered that while alternatives to purging are construc a serious need develops that Mr. Denton's plan could be effected quick

10. If cooling fans fail does a .7 PSIG to 1.0 PSIG jump really release more than a couple of curies a day?

11. How sophisticated are your contingencies if certain instruments fail in containment?

12. Do you choose purging over cryogenic because you know utility management controls and integrity are inadequate?

13. Any pre-planned venting constitutes a significant psychological and physical environmental impact. This is why the Dauphin and Lebanon County Commissioners have voted on resolutions not to condone venting. Also Harrisburg Patriot News, Middletown Press and Journal, Elizabethtown Chronicle, Lebanon Daily News, and Lancaster Intelligencer--all East Shore papers--donot condone venting.

14. The beta exposures are very close to what each citizen is allowed for one year. I realize no one will be out-of-doors all of the time, if you allow venting, however the calculations may be in the low range, wind directions on release may be predominantly in one direction and really not everyone will be monitored individually. Once again a risk that is not acceptable to the citizens of this area.

15. Does 300 MR/hr. exposure to gamma require the same protective gear as 1200 MR/hr?

16. Table 4.1 is not understood and I am not always free on Wednesday nights or Saturday mornings to speak with someone at the NRC Office.

17. How much is "very little airborne Sr 89/90" (Pg. 5-2). Just a little can be alot.

18. If you allow purging, what if wind speed decreases from 15.2 MPH to 7.5 MPH one minute after purging starts? Do you have the sophistication to be responsive to stopping and will you stop?

19. Can you have another type of hydrogen control subsystem installed that will do better than ALARA or is it too costly?

20. Does the utility have management controls capable of maintaining a safe filter system used for the proposed purging?

21. The historical meteorological data used--who developed it? Does it truly reflect actual conditions?

22. Page 6-5 shows a higher beta based on continious prescence and average annual meteorological conditions. Does this mean if average wind speed for May 20-23 was 16 mph that regardless of actual mph you will release but perhaps at a lower cfm on those days?

23. What is an occupancy factor of 70% mean?

Because a majority of the citizens only received their copy of Nureg 0662 at the Liberty Fire Hall meeting any questions related to the document would have been limited at that time. I realize it was available at the Middletown NRC Office but because of very limited evening hours many could not stop in. Perhaps in the future the Post Office and Public Library could be used for distribution with at least a little publicity in the local paper. Also in conjuction with a public meeting, why not use Public-TV with an audience and allow a 2 hour call in?

I am extremely displeased with NRC responsiveness to utility and citizen needs. I feel indecisiveness and buck-passing are rampant. Unfortunately I donot have any suggestions to rectify the above because I have exhausted myself analyzing NUREG 0662. The governmental system must work for <u>all</u> of us some of the time--not work <u>all</u> of the time for some.

Please be certain that all Commissioners receive a copy of this letter.

Sincerely,

Donald E Hossler

Donald E. Hossler
501 Vine Street
Middletown, PA 17057

CC: Congressman Allen Ertel
Dauphin County Commissioner Stephen Reed
Pa. State Senator George Gekas
Richard Vollmer, NRC
U.S. Senators Schweiker and Heinz

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MOBILE, ALABAMA
36602

April 7, 1980

Nuclear Regulatory Agency
Washington, D. C. 20013

Gentlemen:

While I have no idea of the volume of krypton gas that must be gotton rid of, it occurred to me that perhaps large high pressure compressors along with "secure" tanks such as those used for oxygen or acetylene might be filled until the level of gas was safely diluted with fresh outside air let in during compression of the krypton.

Obviously it would be a costly process and much fresh air would have to be brought in to reduce the excess negative pressure while pulling out the krypton.

Then, the tanks could be buried. Hopefully, the tanks would last the one-half life of the radioactive gas.

If there is no way to contain the gas for a long period, then perhaps the cylinders could be taken to a "remote area" where they could be vented slowly and safely.

Yours respectfully,

Julien E. Marx

JEM/ja
Honorable Paul Doutrich
cc: Mayor, Harrisburg, Pa.
Mr. Bob Wilcox, Repair Division, Three Mile Island

4-7-80

Dear Chairman Ahearne,

I have just completed reading a March 4 letter from Herman DiecKamp to you.

On page 1, he indicates that, related to purging, "total activity released during this one time operation is also less than is released annually from the average."

My understanding is that a normal operating reactor releases about 50 curies of Krypton a month. The 57,000 curies proposed purge is over a hundred years of releases, for one normal reactor.

Secondly, I would hope you will review the solidification of resins carefully. It appears to be a sound idea. I feel the nuclear industry prefers to send its problems and related radioactivity around (proposed purging, tritiated water, improperly packaged waste).

According to the DireKs report recriticality and possible uncovering of the core are remote possibilities.

Finally, I am amazed that Herman DiecKamp must suggest, on the last page, a joint management review. It would be my hope that this is on-going.

Management controls appear to be a major source of problems encountered in this on-going accident.

We all want this accident cleaned-up — but safely — not quickly with the sole idea of getting #1 on line.

Sincerely,

Don Hossler
501 Vine St.
Middletown, Pa
17057

CC- Congressman Allen Ertel

Route 4, Box 545
Lebanon, Pa. 17042
April 7, 1980

Nuclear Regulatory Commission
Middletown, Pa. 17057

Dear Sirs:

I am a resident of Lebanon County. living within a 20 mile radius of TMI.

The intent of this letter is to register my opinion on the venting of gas from TMI and the restarting of Units I and II.

My family and I want to go on record as being in favor of immediate venting of the gas, in favor of the immediate restart of Init I and the clean up and restart of Unit II as soon as possible.

I fail to understand why a vocal minority and an hysterical media should take over the decision making process in this or similar instances.

I fail to understand what the motive would be for the NRC and Met Ed to propose venting, if it were unsafe. The people of the NRC certainly should be more knowledgeable of the entire situation than anyone around. I'm sure none of them would purposely endanger or injure another person. I'm sure their employment would be in less jeopardy if they continually avoided making a decision than if they took a stand.

As for Met Ed, if their employees thought things were so unsafe, they would be leaving in droves rather than standing by, absorbing the guff, and performing their duties.

I fail to understand how the Lebanon County Commissioners and the Mayor of Lebanon can complain about the high cost of electricity and in the same breath oppose progress in the cleanup of Unit II and the restart of Unit I by asking for more study. Explain to me how that demonstartes leadership.

I fail to understand how we can accept: loss of life on the highways, loss of life by lung cancer (and at the same time have governemnt support of the tobacco industry), loss of life by the use of drugs, loss of life and environmental pollution by capsizing oil rigs, super tanker crashes, uncontrolled oil well blowoffs, loss of life from black lung and mine cave ins. The list goes on and on.

Nowhere do I hear the cry for the abolition of coal, oil, cars,ships, tobacco, and booze. In fact most of the protesters at the state capitol last week drove there in cars, the smell of marijuana filled the air, and the booze flowed freely.

Several months ago the doctor suppected that I suffered from a hiatus hernia. I was directed to the Hershey Medical Center for tests. Because they decided that people should train on me, I underwent approximately 30 x rays. This is more radiation than I could possibly gather from TMI, if I stood nude at the least advantageous spot on the island during the venting.

Governor Thornburg has now said he felt more study is necessary before a deicision on venting can be made.

The necessary information is on hand. There need be no more study.

At the moment the President of the United States grovels in the dirt before the Iranian militants. The Congress of the United States

argues about pork barrel legislation and reelection. The bureaucracy goes about justifying its existence, fattening its payroll and raising our taxes. The Governor pleads for more time,more input, more indecision, and more expense, all at our expense. The local government is bullied into the same position as the Governor.

Where are the leaders? Where is the leadership?

Please take a stand. Please move forward. The Indians fought the advance of the railroad. The public fought the idea of flying. They told Columbus he was nuts , when he said the world was round. Fifty years ago no one believed we would walk on the moon.

Nuts on Nader and phooey on Fonda. General Motors has done more for the consuming public than Nader will ever dream of doing. Fonda has done more for the Communists than she will ever do for the United States.

The time for firmness is at hand. You have accepted a task. Honor the trust that has been placed in you. Vent the gas, cleanup Unit II, and put both Unit I and Unit II back in full production NOW.

Sincerely yours,

Donald H Umberger

Donald H. Umberger

DHU/fbu

NEWBERRY TOWNSHIP BOARD OF SUPERVISORS

R. D. #2, Box 4 • York Haven, Pa. 17370
(717) 938-6992

April 7, 1980

John F. Ahearne
United States
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Commissioner Ahearne:

On November 23, 1979 correspondence was sent to the Nuclear Regulatory Subcommittee informing them of the resolution passed by the Newberry Township Board of Supervisors at their November 20, 1979 meeting. The resolution, passed unanimously, opposed the release of Krypton 85 into the atmosphere.

Recently the Dauphin County Commissioners passed a similar resolution opposing the release of Krypton 85 into the atmosphere.

Enclosed is a copy of the official resolution as taken from the minutes of the Newberry Township Board of Supervisors.

We hope your staff has informed you of the resolution passed by Newberry Township and the related resolution passed by Dauphin County. Please consider these resolutions in your final decision, relative to the Krypton 85 release.

Respectfully submitted,

Bruce I. Smith

Bruce I. Smith
Chairman
Newberry Township
Board of Supervisors

Enclosure (1) One

Nov. 20, 1979
Meeting

Krypton 85 Motion by Smith, seconded by Brothers, three affirmative that be it resolved the Board of Supervisors oppose the release of Krypton 85 into the atmosphere by Metropolitan Edison.

NEW BUSINESS

1980 Budget Motion by Brothers, seconded by Smith, three affirmative to tentatively approve the proposed budget for 1980.

Occupational Privilege Tax Solicitor to contact West Shore Tax Bureau relative to format for O.P.T.

Sewer Ordinance The Department of Community Affairs recommended a sewer ordinance be established in order to set aside funds each year, in the event the present sewer plan does not materialize. Solicitor to research same.

Byron Nelson Circle Addition Residents on Byron Nelson Circle to be notified of the recommendation of the Engineer; which has not been accomplished by the Developer.

TMI Steering Committee Public Meeting to be held December 12, 1979, Newberry Elementary School, 7:30 P.M. Quest Speaker to be Walter W. Cohen, Penna. State Consumer Advocate.

Building Permit Officer Recommendations Motion by Smith, seconded by Brothers, three affirmative to have Permit Officer coordinate with the Solicitor, a proposal of the necessary ordinances in conjunction with the recommendations.

Heritage Committee Board to consider developing Heritage Committee. Considerations to be reviewed at the next meeting.

West Shore Tax Bureau Resolution Motion by Smith, seconded by Brothers, three affirmative to rescind the resolution relative to the West Shore Tax Bureau in the minutes of November 7, 1979.

West Shore Tax Bureau Representative and Alternate Motion by Smith, seconded by Brothers, three affirmative to approve resolution of West Shore Tax Bureau and appoint Henry Clemens, representative and William Dugan as alternate to the West Shore Tax Bureau.

ADJOURNMENT

Properly moved and seconded to adjourn at 10:00 P.M.

Henry W. Clemens
Secretary

TESTIMONY ON DECONTAMINATION OF THE THREE-MILE-ISLAND UNIT-2 REACTOR BUILDING'S ATMOSPHERE

TO: The U.S. Nuclear Regulatory Commission (N.R.C.)
1717 H Street, N.W.
Washington, D.C. 20555

FROM: Daniel M. Lipkin, physicist
1717 Bantry Drive (215)-646-7522
Dresher, Pennsylvania 19025

ATT'N: Samuel J. Chilk, Secretary, N.R.C.

DOCKET No.: 50-320 DATE: April 7, 1980

also ATT'N: Director, TMI Support Staff, N.R.C. Office of Nuclear Reactor Regulation (N.R.R.)
Harold R. Denton, Director, N.R.C./N.R.R.
John T. Collins, Jr., Chief, N.R.C./N.R.R. Effluent Treatment Systems Branch
Robert J. Budnitz, Director, N.R.C. Office of Nuclear Regulatory Research
John F. Ahearne, Chairman, N.R.C.
Peter A. Bradford, Commissioner, N.R.C.
Victor Gilinsky, Commissioner, N.R.C.
Joseph M. Hendrie, Commissioner, N.R.C.
Richard T. Kennedy, Commissioner, N.R.C.

other cc: additional distribution as per attached list.

REFERENCE: N.R.C. Document NUREG-0662, "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere". Hyphenated-page locations noted in the text below refer exclusively to that document.

Dear Sirs:

Your referenced document NUREG-0662 indicates great difficulties of four different methods for removing Krypton gas contamination from the TMI Unit-2 Reactor Building, in comparison with the technically simple alternative of venting that gas into the public air space. My testimony will show that one of those four methods, based on the admittedly feasible (page 1-6) use of charcoal to adsorb Krypton gas, has been unimaginatively if not clumsily conceived in both of the versions described (pages 6-9 to 6-16), and should be capable of approximately twenty times greater simplicity if modified in ways that should be obvious to those skilled in the technical arts involved. As a citizen, I am greatly disappointed at this performance of agencies that have been invested with the public trust.

For the purpose of my discussion, and essentially only by way of illustration, I shall take as a goal the reduction of the Krypton concentration in the TMI Unit-2 Reactor Building's Atmosphere (henceforth, "TMI-2" or just plain "R2") to 1/100 of its present value. This does not represent an ultimate limit of relatively simple applications of

the charcoal-adsorber technology involved; and it does not approach the idealized goal of 100,000:1 reduction of the Krypton concentration that is implicitly adopted in NUREG-0662 (data on pages 3-1 or 5-2, plus data on pages 6-2 or 6-28; consistent with data on page 6-13). But a reduction by "merely" 100:1 would provide a useful and practical solution of the Krypton contamination problem: At present, approximately 1/4 of the gamma radiation that would affect workers inside TMI-2 is indicated as being caused by sources other than the Krypton gas (page 4-2); therefore, a 100:1 reduction in the concentration of the Krypton gas would bring its gamma radiation down to a level 33 times smaller than that of the other (and unventable) sources of gamma radiation already in the reactor building, and would thus constitute a quite handsome improvement of the situation.

In a proper use of charcoal adsorber technology, important advantage can and should be taken of the fact (stated on page 6-9 but not exploited in NUREG-0662) that charcoal loses its ability to adsorb Krypton if it is exposed to even moderately small levels of humidity. This fact permits previously adsorbed Krypton to be largely flushed out of a charcoal tank if desired, and thus permits Krypton gas to be transferred between a small number of such tanks in a controlled manner. Such transfers, if programed in a readily understood manner, will in principle permit the available Krypton to be concentrated with a high degree of precision into a single one of the tanks. Proper engineering insight can thus eliminate any need to consider the monstrous scenario of hundreds of charcoal adsorber tanks (page 6-13) that is painted in NUREG-0662.

I shall consider refrigerated charcoal adsorber to be used, maintained at an ordinary food-freezer temperature of 0 ^{o}F. (page 6-11) whenever it is in the process of being used to adsorb Krypton from suitably conditioned air (completely dehumidified and dried air -- pages 6-9, 6-10). In that context, the charcoal adsorber scheme described in NUREG-0662 is stated to require the use of 150 charcoal-containing tanks (page 6-13), each of volume 42,300. gallons (implied on page 6-10). This number, 150, of such tanks does not, however, serve as a fair basis for comparison, because it corresponds to much more than the targeted 100:1 reduction in the Krypton concentration in R2. It can readily be shown that 59 or 60 of such tanks would, however, be needed for a 100:1 reduction of the Krypton concentration by the refrigerated-charcoal adsorber method described in NUREG-0662, and this does provide a fair starting figure on which to base comparisons. By contrast with this last, approximate figure of 59 or 60 tanks of charcoal, the method that I shall describe requires the use of only 3 separate tanks of charcoal of the individual size indicated, and therefore presents a dramatically different picture as regards practicality.

Consider there to be provided three separate bodies of charcoal adsorber, each having the single-tank volume already indicated, and designate them as L, M, and N for brevity. A Krypton "transfer" cycle, utilizing two of these three charcoal bodies, is executed in three steps, as follows:

(a) Filtered, dried, and heated air from the reactor building R2 is circulated through the first charcoal body, L, and returned to R2 in a closed circuit of air flow, as a preparatory step, to remove any moisture that the body L may contain. (Both in this step and in the step (b) that follows, a net preponderance of cooling would be applied to the air returning to R2, to avoid any rise of the air pressure inside R2, and indeed to forestall or compensate such a rise of pressure due to any outside causes.)

(b) When L is dry, the closed-circuit flow of air between R2 and L is continued, but now the filtered and dried air entering L is not heated, but instead is refrigerated to 0 $^{\circ}$F., to cool L down to that temperature and permit it to adsorb Krypton gas maximally well (page 6-10) from the R2 air flowing through it.

(c) When L has come to equilibrium in its Krypton content and will adsorb no further Krypton (i.e., when "breakthrough" occurs -- page 6-10), valves are operated to disconnect L from R2 and to connect L instead to the second charcoal body, M, which has previously been dried and refrigerated to 0 $^{\circ}$F. Closed-circuit air flow is now established between the two charcoal bodies L and M, with the following special provisions:

c.1. The air that is to enter M is first dried and refrigerated, to maintain M at 0 $^{\circ}$F. and permit it to adsorb Krypton maximally well. (No moisture, or heat, are introduced into M during any part of a transfer cycle.)

c.2. The air that is to reenter L is heated and humidified, to cause L to lose its ability to adsorb Krypton (page 6-9), and thus in effect to flush out nearly all of its adsorbed Krypton into the circulated air, from whence the Krypton is available to be adsorbed by M.

In the course of effectuating the provisions c.1. and c.2., the heat and the moisture that are removed as waste from the circulated air before it is allowed to enter charcoal body M are shunted back usefully to aid the process of heating and humidifying the air entering L. The combined process c.1.,c.2. causes the Krypton initially present in the charcoal bodies L and M to become preponderantly concentrated into M, and largely removed from L; this process is allowed to run to completion as measured by stabilization of the Krypton-85 radioactivity levels in the respective bodies L and M, after which the communication between L and M by air flow is disconnected.

Repetition of the transfer cycle (a)-(b)-(c) continually transfers Krypton from R2 to L, and then from L to M as a temporary receiver, leaving the charcoal body L depleted in its Krypton content at the end of each transfer cycle and therefore able to adsorb more Krypton from R2 during the next such cycle.

By using available information concerning the initial Krypton-85 radioactivity in R2 (pages 3-1, 6-37, 6-5, 5-2), and concerning the amount of this radioactivity that can be adsorbed into a first tank of refrigerated charcoal adsorber (page 6-13), and by further assuming

that as much as 50% of the volume of a charcoal tank is actually occupied by air when the tank is apparently filled with charcoal, detailed and conservative numerical estimates can be made of the fractions of the initial Krypton radioactivity that will be found in the building R2 and in the various charcoal bodies at the end of each Krypton transfer cycle. The mode of calculation that must be employed is quite evident from information given in NUREG-0662 (esp. page 6-13). Estimates of this type which I have made will be detailed at a later point. But a preliminary example of such estimates is that, by using only the two charcoal adsorber bodies L and M, of the volume previously indicated, nine repetitions of the described transfer cycle (a)-(b)-(c) will reduce the Kr-85 radioactivity in building R2 nearly to 52% of its initial value, and will transfer nearly 47% of that initial radioactivity into the charcoal body M. Up to this point, no use has been indicated for the third charcoal body, N.

As the concentration of Krypton into charcoal body M cyclically proceeds, and directly due to that rising concentration in M, the residual amount of Krypton that is left in the charcoal body L at the end of each transfer cycle inevitably increases too, progressively diminishing the ability of body L to adsorb fresh Krypton from building R2 during the next succeeding transfer cycle; therefore the rate of decontamination of R2 would tend to slow down undesirably -- if no further changes were made in the process so far described. At such a point, however, the charcoal body M can be placed into closed-circuit circulated-air communication with the third charcoal body, N, and most of the Krypton that has been accumulated by M can be flushed out of M and adsorbed into N, leaving M sufficiently depleted in Krypton content that it can usefully resume participation in the R2-to-L-to-M transfer cycle and restore a steep rate of extraction of Krypton from R2.

The operation that involves flushing M's Krypton content into N will be termed a Krypton "storage" cycle; on a regular basis, a single such storage cycle would be executed each time that a set number of consecutive transfer cycles had been made. From numerical experimentation, when the three bodies of charcoal adsorber L, M, and N are of equal volume as supposed, it appears to be appropriate to execute 9 transfer cycles, then one storage cycle, then 9 more transfer cycles, then one storage cycle, etc., so that every tenth cycle would be a storage cycle, all the rest being transfer cycles. This ratio of 9 to 1 is not at all critical for success; and quite different cycling programs than the one here described can equally well be employed to produce the same end result.

Before giving further numerical estimates of the progress expected of this Krypton decontamination process, it is worthwhile to be more explicit in delineating the nature of a Krypton storage cycle, although no physical operations are involved in it that are much different (apart from sequence) from operations already encountered in a Krypton transfer cycle. Thus, a Krypton "storage" cycle is executed in three steps, as follows:

(d) The charcoal bodies M and N are placed into closed-circuit circulated-air communication with one another, the circulated air being dried and refrigerated before it enters N, but being heated and humidified before it reenters M. This process drives most of the Krypton out of M and concentrates it into N, and is continued until it reaches completion. (At this point, the charcoal body M contains moisture, which must be removed before M can resume participation in transfer cycles.)

(e) The charcoal bodies L and M are next placed into closed-circuit circulated-air communication with one another, and heated air is circulated through both of them, the circulated air being, however, dried before entering M (moisture that is removed as waste from the air stream before it enters M is shunted back to L). This process dries any moisture out of M, and traps the moisture in L.

(f) After M is dry, the closed-circuit circulation of air between L and M is continued, but the air is now both dried and refrigerated before it enters M, and is heated and humidified before it reenters L, just as in step (c) of a transfer cycle. This ensures that most of the residual Krypton in L and M will be concentrated into M, and completes the reconditioning of M to a dry, cold state suitable for use in a resumption of the transfer-cycling (a)-(b)-(c).

If the processes of transfer-cycling and of storage-cycling, that have been described as a means for extracting Krypton from the building R2, seem complicated, it is only because I have attempted some precision in describing them: they are actually quite simple from a technical standpoint. Thus, the combined total volume occupied by the charcoal in all three of the adsorbing bodies, which is about 17,000 cubic feet, is only the air volume in a medium-to-large-size private home. The physical operations that are essential to the decontamination process under discussion are only the heating of air, the cooling of air, the humidification of air, the dehumidification and drying of air, and the forced circulation of air, all of which are common technology. As to forced flow of air out of the building R2 for the described purpose of closed-cycle circulation, a flow rate of 1000 cubic feet per minute (CFM) of filtered air represents a capability that is already (page 6-1) being installed at TMI-2 as part of the proposed "purge" system for venting the Krypton. Although an air flow rate of 1000 CFM represents less than what is commonly used in single-home central air-conditioning, it is still adequate to move 2,000,000 cubic feet of air (one reactor building's content) five times in a week -- and to change the air in one of the charcoal adsorber bodies under discussion more than 10 times in an hour. Because the Krypton decontamination process under discussion involves rather large and abrupt temperature changes of circulated air, the heat or cold supply rates that are involved do need to be much larger than those involved in single-home central air-conditioning; but the supply rates can be minimized by using well known counter-flow heat-exchange techniques affecting waste heat or cold, and, at any event, should not prove larger than those required for, say, a supermarket (if indeed suitable facilities do not already exist in some unrecognized form at the site).

With the immediately preceding discussion of air flow rates and the like, as background for a preliminary understanding of the degree of difficulty or simplicity of the Krypton decontamination method I have described, the performance that can be expected for that method

is described, and conservatively described, I believe, by the numbers given in the accompanying Table 1. In Table 1, the first column counts the process cycles that are gone through; the second column tells the type of each process cycle; and the remaining four columns predict the amounts of Krypton that will exist in the reactor building R2 and in the three charcoal adsorber bodies L, M, N at the end of each cycle; those Krypton amounts are expressed to three significant figures, as decimal fractions of the total amount of Krypton initially located in the reactor building.

As is shown by the third column of Table 1, on line 77, the Krypton concentration in the reactor building R2 should be down to below 1% of its initial value, after 77 cycles have been performed. At a processing rate of perhaps four cycles per day, the entire Krypton decontamination of R2 could therefore take less than 3 weeks from start to finish.

In discussing the foregoing example of a practical Krypton decontamination method, it is not my intention to suggest, as NUREG-0662 does (pages 6-9 through 6-14), that the charcoal adsorber tanks be used for permanent storage of the Krypton removed from the reactor building. Instead, the adsorbers should only be regarded as a temporary storage means for the Krypton, until such time that it can be dealt with by methods permitting its greater concentration for final disposal by burial, but requiring longer times to implement (e.g., pages 6-23, 6-32). This provision of temporary storage would suffice to accomplish the primary public-safety goal of permitting expeditious access to the damaged #2 reactor core for the purpose of safe disassembly of that core; and it would do so without risking the public distress (pages 1-3, 6-7) that might attend venting of the Krypton gas.

I hope that the discussion and analysis presented here may straighten out the perspective from which the Krypton decontamination problem is viewed, and prove useful in expediting an acceptable solution to that problem.

Sincerely yours,

Daniel M. Lipkin

Daniel M. Lipkin, physicist

TABLE 1: Estimated Progress of the Krypton Decontamination

Ordinal No. of Process Cycle	Type of Process Cycle (see text)	Fractional Krypton Amounts at End of Cycle: in Reactor Building, "R2"	in First Charcoal Body, "L"	in Second Charcoal Body, "M"	in Third Charcoal Body, "N"
0	(initial state)	1.000	0.000	0.000	0.000
1	transfer	0.925	0.00129	0.0742	0.000
2	transfer	0.856	0.00245	0.142	0.000
3	transfer	0.794	0.00351	0.203	0.000
4	transfer	0.737	0.00448	0.258	0.000
5	transfer	0.686	0.00536	0.309	0.000
6	transfer	0.639	0.00615	0.355	0.000
7	transfer	0.596	0.00688	0.397	0.000
8	transfer	0.558	0.00753	0.435	0.000
9	transfer	0.523	0.00813	0.469	0.000
10	storage	0.523	0.000275	0.0158	0.461
11	transfer	0.483	0.000942	0.0544	0.461
12	transfer	0.448	0.00155	0.0893	0.461
13	transfer	0.415	0.00210	0.121	0.461
14	transfer	0.386	0.00260	0.150	0.461
15	transfer	0.359	0.00306	0.176	0.461
16	transfer	0.335	0.00347	0.200	0.461
17	transfer	0.313	0.00384	0.222	0.461
18	transfer	0.293	0.00419	0.242	0.461
19	transfer	0.275	0.00450	0.260	0.461
20	storage	0.275	0.000286	0.0165	0.709
21	transfer	0.254	0.000634	0.0366	0.709
22	transfer	0.236	0.000951	0.0549	0.709
23	transfer	0.219	0.00124	0.0715	0.709
.	.	.	.	.	.
.	.	.	.	.	.
.	. (etc.)	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
68	transfer	0.0149	0.000445	0.0257	0.959
69	transfer	0.0141	0.000457	0.0264	0.959
70	storage	0.0141	0.000294	0.0169	0.969
71	transfer	0.0134	0.000307	0.0177	0.969
72	transfer	0.0126	0.000319	0.0184	0.969
73	transfer	0.0120	0.000331	0.0191	0.969
74	transfer	0.0114	0.000341	0.0197	0.969
75	transfer	0.0108	0.000350	0.0202	0.969
76	transfer	0.0103	0.000358	0.0207	0.969
** 77	transfer	0.00989	0.000366	0.0211	0.969
78	transfer	0.00948	0.000373	0.0215	0.969
79	transfer	0.00911	0.000379	0.0219	0.969
80	storage	0.00911	0.000294	0.0170	0.974
81	transfer	0.00869	0.000301	0.0174	0.974
82	transfer	0.00832	0.000307	0.0177	0.974
83	transfer	0.00797	0.000313	0.0181	0.974

Distribution List

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Union of Concerned Scientists
1725 I Street, N.W.- Suite 601
Washington, D.C. 20006

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Union of Concerned Scientists
1208 Massachusetts Avenue
Cambridge, Massachusetts 02138

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The White House Office
1600 Pennsylvania Avenue, N.W.
Washington, D.C. 20500

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Council on Environmental Quality
722 Jackson Place, N.W.
Washington, D.C. 20006

National Commission on Air Quality
499 S. Capitol Street, S.W.
Washington, D.C. 20003

President, Metropolitan Edison Co.
P.O. Box 542
Reading, Pennsylvania 19640

Douglas M. Costle, Administrator
U.S. Environmental Protection Agency -- A-100
401 M Street, S.W.
Washington, D.C. 20460

David Hawkins, Ass't. Admin./A,N,R.
U. S. E. P. A.
401 M Street, S.W.
Washington, D.C. 20460

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3239 Pebblewood Lane
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Montgomery County Commissioner
Courthouse, Norristown, PA 19404

Louise Bradford, Staff
Three-Mile-Island ALERT
315 Peffer Street
Harrisburg, Pennsylvania 17102

Gail Bradford, Staff
March 28th Coalition
1037 Maclay Street
Harrisburg, Pennsylvania 17103

Lt. Gen. John W. Morris
Chief of Engineers
The Pentagon
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1. TO WHOM IT MAY CONCERN,
I ADAM D. GARRETTE
I KNOW, THAT I KNOW
HOW TO RELEASE, THE POISEN
CRIPTONE GASS,
THAT TRAPPED IN 3. MILE ISLAND.

2. I AM 1000 PER. CENT SURE THAT
MY WAY IS SURE, SAFE,
THAT NO ONE, WILL GET HURT,
HEALTH DAMAGE, OR POISEN.

3. EVEN IF THEY LIVES 500 YEARS
OR MORE.

4. I HAVE DRAWN SOME TANKS
THAT YOU CAN MAKE AND USE
OR YOU MAY HAVE ~~SOME~~
SOME TANKS ALL READY MADE
UP SIMILAR TO MY WAY.

5. THE TANK ARE MADE, WITH
FLAT BOTTOM, TOP AND SIDES,
FOR EASY, LOADING, ~~A~~ SAFE
HANDLING. A.D.G. SAFE

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OUT VALVE
FOR FILLING
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Date 4/4/80

6. ON THE INTAK, HAVE A CHECK VALVE
WITH 1. ONE WAY, IN. AND NO WAY
OUT.
CONNECT TO THE CHECK VALVE, HAVE
A GATE VALVE, FOR FILLING
SO WHEN THE TANK IS FULL OF
CRITTONE GASS,
IT CAN BE CUT OF.

7. ON THE OBJECT SIDE OF THE FRONT
OF THE TANK, HAVE A GATE VALVE
FOR RELEASING THE GASS.
WITH A CHECK VALVE LETTING
OUT THE GASS,
CONNECTED TO THE TANK.

8. YOU CAN FILL THE TANK WITH
A VACCUM PUMP,
CONNECTED TO THE GATE VALVE
OPEN VALVE, START PUMP,
SO WHEN THE AMMOUNT OF
PRUSSURE GET IN THE TANK,
YOU WANT, CUT OF PUMP.
CLOSE VALVE.
AND DISCONNECT. A.D.G.

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P. G. (3)

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9 USE CARGO PLANE OR PLANES, FOR LOADING THE TANKS ON AND MOVING THEM.

10 AFTER ALL TANKS ARE LOADED, CONNECT ALL OF THEM TOGEATHER BY THIS METHOD. ON PAGE 10. NO.1. NO.2. AND SO ~~ON~~ ON UNTIL THE LAST.

11 NO.1. RELEASE, CONNECT TO NO.2. INTAKE, NO.2. RELEASE CONNECT TO NO.3. INTAKE, NO.3. RELEASE CONNECT TO NO.4 INTAKE. AND SO ON UNTIL THE LAST TANK.

12 ON THE LAST TANK, CONNECTED TO THE RELEASE VALVE, PUT A PRESSURE GUAGE ON SO YOU CAN TELL HOW MUCH GASS YOU ARE LETTING OUT AT ONE TIME

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12A. AFTER PLANE OR PLANES ARE LOADED. AND TAKE OF TO A SECRET PLACE. FOR DISCHANGING SUCH AS. THE DESART. OCEAN— AND SEA. OR YOU MAY CHOOSE A PLACE OF YOUR OWN.

14 WHEN YOU ARE 1000 THOUSANDS ND. OF FT. HIGH AWAY FROM EVERY BODY AND EVERY THING

15 CONNECT A HIGH PRESSURE AIR HOSE TO NO. 1. TANK, INTAKE KEEP NO.1. CLOSE, DONT TURN ON AIR.

16 OPEN ALL VALVES BETWEEN NO.1. AND THE LAST

17 HAVE A GUAGE ON THE LAST TANK SO YOU CAN TELL WHEN THE GASS GET LOW IN ALL TANKS.

A. D. G.

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18. PUT A PIPE ON THE LAST TANK
CONNECTED TO THE RELEASE
VALVE AND CONTROLL
GUAGE.
GOING TO THE OUT SIDE OF PLANE

19 OPEN GATE VALVE ON LAST TANK
ALL THE WAY.
NOW OPEN THE CONTROLL GUAGE
TO THE AMMOUNT OF GASS YOU
WANT TO RELEASE AT ONE
TIME.

20 WHEN GASS GET LOW IN ALL TANKS.
TURN ON THE HIGH PRESSURE
AIR IN NOL. TO FORCE OUT
THE GASS THAT LEFT IN TANK.

21 WHEN ALL TANKS ARE EMPTY OF
CROTANE GASS.
CLOSE ALL VALVE

R. D. G.

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Pg (6)

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22 I HEARD OVER THE TV. THAT
3. MILE ISLAND WANT TO
RELEASE, A SMALL AMMOUNT OF
CROTANE GASS AT ONE TIME
THAT THE OFFICIAL SAID
WOULD DO NO HARM, TO ANY ONE

22 IF THE SMALL AMMOUNT OF
GASS, WAS LET OUT FOR ONE HOUR
IN 3. MILE ISLAND
IT WOULD BE IN A SMALL AREA

23 THAT SAME AMMOUNT OF GASS,
RELEASED FROM THE PLANE
IN 1. HOUR
GOING 500 MILES A HOUR OR
MORE, WOULD BE SPREADED.
FROM 500 TO A 1000 IN ONE HOUR
IT WOULD ~~WOULD~~ BE SPREADED
SO THIN, AND SO FAR AWAY FROM
EVERY BODY.
THERE WOULD NOT BE ANY
DAMAGE TO ANY ONE HEALTH,
LAND, POULTRY, CATTLE OR ANY
THING ELSE. R. D. G.

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FREE ESTIMATE WITH A SMILE

8 G (7)

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24 WHEN PLANES ARE LOADED, AND TAKEN OFF, YOU SHOULD TELL THE PEOPLE THAT YOU ARE MOVING THE CRIPTONE GASS. BUT, DONT TELL THE PUBLIC WHERE. NOT EVEN THE PAPERS, THING PEOPLE DONT KNOW OF THIS KIND DONT HURT THEM

25 I BELIEVE THAT THE MOST OF THE PEOPLE, AROUND 3. MILE ISLAND THAT, COMPLAINING IS REALLY NOT SICK, HURT, OR EFFECTED BY THE CRIPTONE GASS. OR RADIATION. IT IS ALL IN THEIR MINDS.

26 DO IT MY WAY, AND MAKE EVERY BODY HAPPY ESPICALLY 3. MILE ISLAND PUBLIC

A. D. G.

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8 G (8)

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Date 4/4/80

27 NOW YOU KNOW HOW TO RELEASE THE GASS OR GASSES IF IT HAPPEN IN ANY OTHER PLANTS, AGAIN.

A I HEARD ON T.V. STATIONS THAT IT WOULD COST MANY $ MILLIONS OF $ DOLLARS TO CLEAN UP THE CRIPTONE GASS PROBLEM.

B. MY WAY WILL WORK, AND WILL SAVE YOU A FEW $ MILLION $ DOLLARS

C I WOULD LIKE A BONUS OF A FEW $ THOUSAND DOLLARS. FOR MY TIME, BY AND GETTING ~~YOU~~ OUT OF A BIG PROBLEM IN 3 MILE ISLAND

D BUT YOU MAY DELAY ~~BECAUSE~~ MY PLAN BECAUSE I AM NOT IN THE BIG BRASS, AND YOU DONT KNOW ME

THANK YOU

Adam D. Garrette

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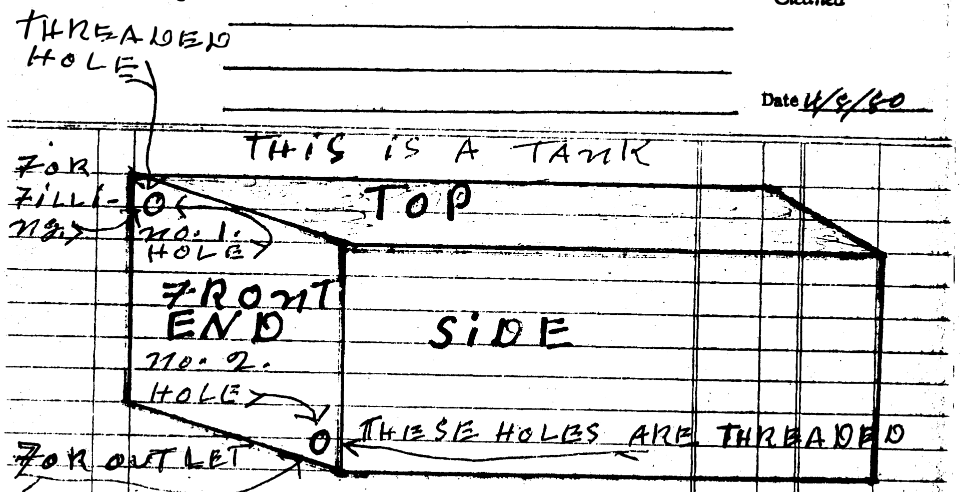
Date 4/8/80



No. 1. TOP

To INSTALL TOP, INTAKE VALVES.

1 PUT ON A NIPPLE. → VALVE
2 PUT ON CHECK 1 WAY IN
3 PUT NIPPLE ON CHECK VALVE
4 PUT OF SET GATE VALVE ON NIPPLE

~~No. 2. BOTTOM HOLE~~

No 2. BOTTOM SAME AS No 1.
TURN CHECK VALVE AROUND

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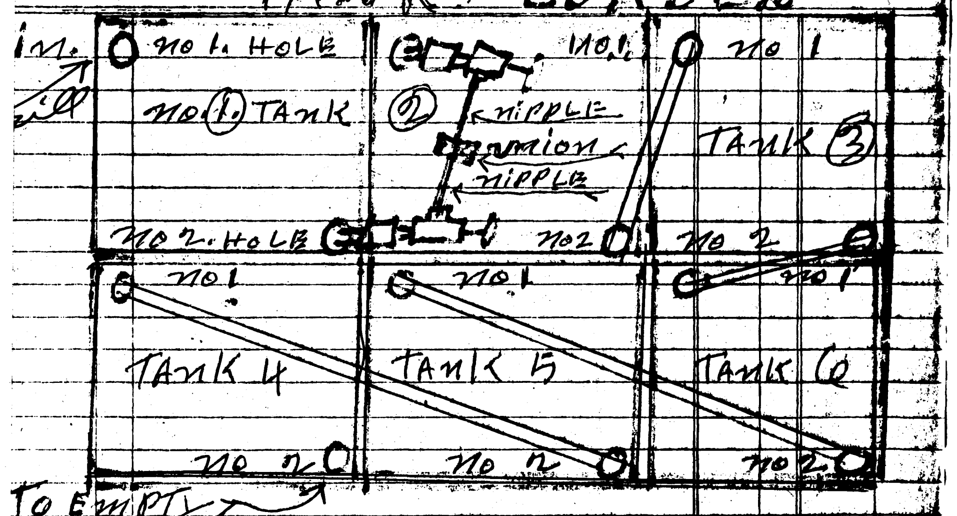
TANK: LOADED

Date 4/8/80



A FOLLOW THE LINES FROM ONE TANK TO ANOTHER WILL SHOW YOU HOW TO CONNECT ALL NIPPLES, VALVES, AND UNIONS. AND SO ON AND ON. IF YOU HAVE MORE TANKS.

B ALL No. 1'S ARE IN, No 2. OUT.

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Date 4/3/80

1 MR. PRESIDENT OF U.S.A.
WASHINGTON. D.C.

2 MR ROBERT REID
MAYOR OF MIDDLETOWN P.A.

3 GOVERNAR THORN BURG
HARRIS BURG P.A.

4 BABCOCK AND WILCOX
PO. BOX. 1260
LYNCHBURG VA
24505

5 NUCLEAR REGULATORY COMMISSON
WASHINGTON D.C. 20555

6 K.Y.W. CHANNEL 3. NEWS
PHILADELPHIA PA
INDENPEANCE MALL E. 19106

7 W.H.P. CHANNEL 21 NEWS
3300 N. 6. ST. BOX 1507
HARRIS BURG PA

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Date 4/4/80

8 METROPLATION EDISON
3. MILE ISLAND
MIDDLE TOWN PA.

9 C.B.S. CHANNEL 2. NEWS
51. W. 52 ST. N.Y.C

10 A.BC. CHANNEL 7. NEWS.
1330. AVE. OF AMERICA
N.Y.C. 10019

A. COPY HAVE BEN SENT
TO ALL ~~NA~~ NAMES
MENTION ABOVE

Adam D. Garrette

10402 Orousay Cir.
Huntington Beach, CA 92646
4/8/80

Director, TMI Support, NRR
NRC
Wash D.C. 20555

Dear sir:

I would like to offer the following comments on NUREG-0662, "Environmental Assessment for Decontamination of TMI-2 Reactor Building Atmosphere", including Addenda 1 & 2.

1. I am pleased to see that the reactor building purge alternative is not only within 10 CFR 20 limits, but also within 10 CFR 50 and 40 CFR 190, both of which are much more restrictive than the former. Limiting beta skin to 15 mrem is reasonable and commendable. The corresponding total body gamma would be 0.3 mrem which is negligible in comparison to the 100 mrem we all get each year (rain or shine) from our natural environment. It would be far easier to measure the increase in background radiation in going to Denver than it would to measure it in the vicinity of TMI.

2. One potential problem I see in the radiological environmental monitoring program, as described in section 7.2, is that the air grab sampler may not be able to keep up with the shifting directions of the plume. In fact, releases may be "forced" to be directionalized so as to provide the sampler with something to sample. Such directionalization may inhibit certain plume directions, even in cases where wind conditions and dispersion are more favorable. In short, I don't see much benefit in mobile units with air grab samplers unless the mobile units are at least as mobile as the wind.

Yours truly,

James J. Drasler

City of Lebanon

LEBANON, PENNSYLVANIA

17042

MUNICIPAL BUILDING
400 SOUTH EIGHTH STREET

April 9, 1980

Dr. Harold Denton
Nuclear Regulatory Commission
Middletown, PA 17057

Dear Doctor Denton:

I am sure I need not remind you that the physical well-being of the citizens of Central Pennsylvania is the primary concern of their elected officials. In attempting to assure the public of this fact, I am afraid that some have done the politically expedient thing--opposed the Krypton venting at TMI--without any assurance that there is a reasonably safe alternative.

I support the NRC's preliminary recommendation on venting the gas and am confident that your interests and ours in Central Pennsylvania are one and the same--to accomplish a safe, reasonably swift clean-up at the island.

However, there is a strong point being made regarding the mental stress of area residents. In addition, the venting of the gas in the very near future will give rise to feelings of frustration and anger on the part of those who are convinced their voice falls on deaf government ears. In this respect, I would urge a short-term delay in the venting and a stronger, more concerted effort to establish a factual, responsible, public information source which may enjoy a greater degree of public confidence than that now experienced by the NRC. The Governor's request for participation by the Union of Concerned Scientists may be a step in this direction.

Many impressionable and cynical citizens rely on self-serving media opinion, ill-informed and biased reporters, and on over-simplified distortions of technical information in lieu of an alternative information source. The role of leadership is not one of simply echoing the masses but of attaining the public good. If that end is served by allaying unreasonable levels of fear, such efforts should become part of the process.

On behalf of the citizens of this community and myself, I thank you for your efforts and applaud you for your fortitude.

Sincerely,

Thomas J. Edkin

Thomas J. Edkin, COUNCILMAN and DIRECTOR
DEPARTMENT OF PUBLIC SAFETY

cab

cc: Governor Richard Thornburgh

50 Campground Road
Dillsburg, PA 17019

9 April 1980

Director, Three Mile Island Support
NRR
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: TMI recovery operations

Dear Sir or Madam:

Having considered the information available to us, we would like to express our support of the NRC proposals to conduct a controlled venting of the krypton 85 presently trapped inside the Unit 2 containment structure. The slow-venting technique appears to be an expedient yet prudent means of establishing a workable environment within the containment, permitting the further cleanup and eventual return to service of Unit 2.

Either the five-day or the 60-day schedule would appear acceptable, so long as the more rapid air change rates required in the five-day plan were balanced with incident meteorological conditions to insure thorough dispersion of radioemitters. We can see a possibility of dispersion problems in calm or inverted conditions, particularly in an attempt to complete the venting in five days (working with figures of 44,000 curies krypton concentration in 2,000,000 cubic feet of containment air, and two complete air changes).

Additionally, we would like to request that Unit 1 be permitted to return to service as soon as practicable after necessary modifications and inspections are complete, thereby reducing Metropolitan Edison Company's purchased power requirements.

As Metropolitan Edison subscribers, and as parents of young children who are entitled to a future without energy or environmental crises, we appeal to you to reject the loud but thin protests of a handful of demagogues and ignorants, and restore to us the promise of a stable, safe, clean, nuclear energy future.

Sincerely yours,

Paul A. Lee

Paul A. Lee

Jennifer L. Lee

Jennifer L. Lee

JACOB A. MYERS
CHAIRMAN
NELSON A. PUNT
VICE-CHAIRMAN
ROSEMARIE C. PEIFFER
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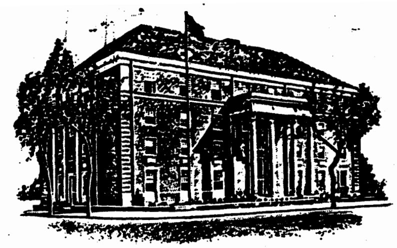


SANDRA J. WHITTAKER
CHIEF CLERK
JOHN H. BROUJOS
SOLICITOR
WM. C. COSTOPOULOS
ASSISTANT SOLICITOR

Commissioners of Cumberland County

COURT HOUSE, CARLISLE, PA. 17013

BE IT RESOLVED:

It is in the public interest to provide for the health and welfare of the people of Cumberland County by cleaning up TMI as soon as possible. The Nuclear Regulatory Commission and the Environmental Protection Agency staffs have determined that it is safe and proper to vent the Krypton 85 gas to expedite the clean-up process and restore some sense of tranquillity to this community; and

BE IT FURTHER RESOLVED that the Government should exert the necessary leadership to accomplish venting of the Krypton 85 gas.

RESOLVED this 9th day of April, 1980.

Jacob A Myers	Cumb Cty Counc
Earl R. Keller	Carlisle Borough Council
Doug Marshall	Mayor of Wormleysburg
John R Murray	President - New Cumberland Council

April 9, 1980

Arnold, Md. 21012

Daniel R. Muller — Acting Director for the Division of Site Safety and Environmental Analysis, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

Comments on NUREG 0662 , Dated March, 1980

As both Kemeny and Rogovin have pointed out, massive changes will have to occur in the nuclear industry and the NRC to implement the 'Lessons Learned' of Three Mile Island, and in this past year, these changes have not been forthcoming. This agency, the NRC is clearly inable in it's present configuration of adequately regulating nuclear power to protect public health and safety. It remains "buisness as usual" at the NRC, and this is precisely the problem. NUREG 0662, and the plan to vent 57,000 curies of Kr-85 is an example in at least 3 regards of the profound trouble in the NRC.

The selection of Argonne National Labs for the contract for the 3 Mile Island Clean-up Environmental Impact Statement is indicative of the mindset of the NRC that has been widely criticized, Argonne receives much of it's funding from the DOE and the DOD for weapons related research, and it's charter mandates the development and promotion of nuclear power. It is typical of the governmental - military- nuclear - industrial beauracracy that led us to the brink of disaster at TMI. The crises in credibility and beleiveability of the NRC are seriously intensified by the choice of Argonne for this contract. I recommend Dr. Karl Z. Morgan of Georgia Tech, and Dr. Terry Lash of the Natural Resources Defense Council be appointed to the oversight body of this EIS. The close involvement of the citizens of Central Pennsylvania and near by areas, of the radiation protection departments of the U.S. Public Health Service and the Food and Drug Administration, and HEW are essential for this EIS to be meaningful.

The Negative Declaration of Environmental Impact contained in NUREG 0662 is a serious breakdown of the legal process in this case, and this is not acceptable. Governor Thornburgh of Pennsylvania has received agreement from the Union of Concerned Scientists to review clean up plans, and submit their analyses for the Governor's use in forming his recommendation on the clean up, and the matter of the Kr-85. NRC must therefore cooperate fully with this independent and non-biased assessment, and refrain from selecting the Kr-85 disposal option before publication and review by the public of the UCS findings and of the Governor's findings.

There has been a pattern of incomplete information, misleading statements, abuse of power, withholding of documents and other data, incomplete review, violations of public participation, and conflict of interest by the NRC in the TMI accidents, the clean up,and the present decesion making process. This cannot and will not continue. The NRC will be held accountable for the effects of their decisions, and the citizens of the Susquehannah Valley region demand a complete, fair, and legal Environmental Impact Study of all aspects of the clean up at Three Mile Island.

Part I- Decision Making Process

— Severely inadequate and unbalanced consideration of other options in NUREG 0662 - 12 mos. after accidents, NRC rejects non-purge options due to cost and time problems, why were charcoal absorbtion etc. not obtained before now ?
— NUREG 0662 (Purge plan) is a violation of NEPA, Sec. 102 A & C due to segmentation of clean up, and no examination of short and long term environmental and socio-economic impacts
— Public participation process totally inadequate, delay in availability of NUREG 0662 and Addendum, insufficient review & comment period
— Insufficient consultation with Pennsylvania and Maryland,, such as the Md. Governor's Commission On the TMI Clean up, and the Regional Planning Council
— No mechanism for publication and review of non- NRC staff recommendations, i.e.- Epicore II process, deficient as it was, resulted in 47 comments, of which 45 were profoundly critical of NRC plan, but there was no public review of these comments, and NRC apparently did not consider these comments at time of decision
— No independent. impartial, non-biased source of information on Unit 2 Options
— No mechanism for public and independent review of Met Ed Purge proposal, except at prohibitive expense for non-professionals of 10¢/page

Part II- Technical Considerations

— Incomplete and totally inadequate accident analyses and risk liklihood asse ssment
— No breakdown of relative source and levels of total Containment radiation, to enable informed analyses of Kr-85 cloud importance has been provided, relative impact of Kr-85 to other gamma & beta sources (water, chemicals on walls, etc.) in terms of workers ability to remain in Containment has not been provided
— Crucial unanswered questions about behavior of Kr-85 plume in environment, (atmospheric dispersion, effects on farm land and animals of plume, effects on Susquehanna R., Chesapeake Bay surface environments, effects on Atlantic Ocean downwind of plume, etc.) Also long term effects on climate, as byproduct of activation of other elements in atmosphere, also questions of accuracy of NRC dose rate calculations, questions of inhalation and skin dose effects on susceptible individuals have not been addressed
— No quantified assessment of social/ economic / psychological impacts of purge have been presented
— No mention was made of retro-fitting fans that will run reliably for 1 year in Unit 1 Containment, and transfering Kr-85 to Unit 1, until other decontamination & storage options are tested and available
— No building air samples have been specifically analyzed for Sr-89/90, Plutonium, etc. - Also decay products of traces of Kr-133 etc. were not mentioned — also saturation and failure of HEPA filters during 60 day purge was not mentioned

Part III- Alternate Recommendations

— Clean up methods selected should be the result of the review and comment process outlined in NEPA
— An advisory board of scientists, health physicists, epidemiologists, and enginerrs, and others from outside the Utility / NRC/ Argonne Labs spheres of influence should conduct an investigation, hold hearings, and make published recommendations on clean up
— Funding should be provided for informed public participation, alternate scientific and legal advice, and related costs
— Full public disclosure should be made of Unit 2 status, exact timing of aspects of the clean up, and potential impacts
— Unit 1 Containment should be retrofitted for long term storage of Kr-85, pending selection of ultimate disposal option.

April 10, 1980

To the:
Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C.

Comments on Proposed Venting
of Krypton 85 from TMI Containment

I would like to raise some questions as response to your invitation to public comment on the proposed venting of Krypton 85.

Why is an environmental impact statement being released at this time?

In public meetings both Robert Arnold and Harold Denton have downplayed the necessity for immediate entry into the containment building and have indicated minimum current risk. It was my understanding that the Council on Environmental Quality was preparing an Environmental Assessment for the whole cleanup, and that only overriding danger requiring immediate action would trigger an EIS.

Why is venting so necessary when other dangers possibly preclude entry?

Access without protective clothing or self-contained breathing apparatus has been cited as the major reason for getting rid of the Krypton.

The Governor's Commission report states that there is a 200 rem (not millirem) reading at the surface of the standing water. It also presumed high levels of Strontium 90 and Cesium 137 in the containment building. NRC has also warned MetEd in its current request to enter the containment building April 15, that there exists a dearth of oxygen to protect a man in an emergency failure of brea thing apparatus. Xenon has been listed as present in the building's atmosphere. Even after the formal venting, the EIS indicates some Krypton 85 will remain.

It would seem logical to expect venting to dislodge and circulate Strontium and Cesium as air is being forced in and out of the building. The descriptions of "radioactive rain" created by condensation would also seem logically to disperse radioactivity inside the building. Filters might protect the population offsite, but it would still seem irresponsible to expect workers to breathe what's left even after Krypton venting. How much will have been gained by venting?

Can we be sure that no Iodine 131 will be released with the Krypton?

We are told that all the Iodine 131 has decayed. Yet, if the Krypton levels have risen by 13,000 curies from November to February, it would seem that dangerous byproducts continue to be manufactured by the core even under natural circulation. Why not Iodine?

Can we be sure that no other radioactive substances will be released?

A February story in the Patriot cast some doubt on your assurances that the filters will protect us from all radioactivity other than Krypton. This story indicated a possible time lag for release of isotopes. It implied a saturation and release pattern of the filters. Is there any basis for this?

Your Environmental Impact Statement indicates that before venting the stack will be "uncapped." Does this stack contain any trapped unmeasured radioactive material which might be emitted during the first days of your proposed venting?

Is it possible to make the containment repairs with a robot?

During the first weeks of the accident we heard about Herman the Robot. He was finally sent home because using him would breach the containment. If we are going to breach the containment anyhow, is it possible that some remote control mechanical means might measure and repair in there?

Why can't we just concrete over the whole thing?

Dr. Irwin Bross, a respected scientist, has proposed this and I have heard no specific detailed rebuttal. Can we be sure that exploring the containment is really public necessity, not just scientific curiosity or corporate maneuvers to get TMI back on line?

What studies can you cite to prove that Krypton will do me no harm?

I am being asked to accept that it is an inert gas and will not do me bodily harm or enter the food chain. Dr. Kendall of the Union of Concerned Scientists is quoted as saying that Krypton is a very nasty substance. No scientist has minimized the gamma damage possibilities. Even my layman's questions and reading admit that the beta emitters, when inhaled, can enter the blood stream, migrate and cause damage to muscle, gut and gonads. If you cannot offer me absolute proof, you have no right to make statements that it is absolutely harmless.

Why are you so sure that dilution and disperson of the gas in high winds will give me absolute protection?

I continue to question that a little radioactivity over a long time may not be as dangerous to me as the same radioactivity over a shorter period offered in larger doses. The answer I am always given is that my chances in either case of breathing in dangerous amounts are very small because of the dispersion of the gas.

I would like to point out that we live in a stagnant air basin which has been compared to a bowl with a lid on it. Krypton is supposed to be heavier than air. Why wouldn't it collect in basements or swampy areas along the Susquehanna given our air basin conditions?

The laws which govern configurations of plumes show that some may rise in V-shaped funnels which you seem to envision, but others rise only to drop to the ground and travel at that level. Some bounce along the ground. What if I happen to be standing at one of those contact points? What guarantees do I have when I can't see it or smell it?

Why is monitoring being done only within the seven mile radius?

Venting only in high winds could indicate Krypton will not drop to the ground within the immediate area. But might it not then drop down 10 miles away? or 20? or 50? Conventional plumes have been measured for 40 or 50 miles, even up to 75 miles. Detectable elevated levels of Xenon gas were monitored during the accident as far away as Albany, N.Y. Under these conditions will a 7 mile monitor be enough to tell the operator that he can proceed with assurance that he is venting at acceptable levels?

What has been done to upgrade the skill of the operators who would open the vent?

In February radiation was loosed offsite for 16 hours without either MetEd or NRC being aware of it. In December Robert Arnold admitted that he had recently had to undertake another reorganization of personnel because management capabilities were so poor. John Collins was quoted as saying he would not let any low level waste leave the island from August to January because the workers were not competent to load the trucks. Are these the people I am supposed to trust to vent just a little lethal gas at precise moments in a precise way?

Has anyone studied the synergistic effects of Krypton?

Suppose I work in the Manheim asbestos plant, or load chemicals, or plate metal at acid vats or smoke two packs a day. Is Krypton then safe and harmless or could it be not doubly but triply dangerous?

Or the cumulative effects?

Suppose I am already subject to this area's chronic sinusitis or have asthma or other lung conditions? Suppose I am elderly or an infant. Could we replicate another Donora?

I have already received 13 million curies of radioactivity I don't need and never wanted. That doesn't include the part you couldn't measure because your instruments went off scale or your calibration was not up to date. It does not tell me the alpha and beta which was seldom even measured by your instruments. The cumulative totals of what you say I have gotten are not available in the public document room despite several public statements to that effect. And even that famous 100 millirems standing naked at the north gate for the duration statement is a figure arrived at by a committee which reached a consensus on that figure. Some people on that Interagency Task Force figured the dose much higher, some lower. During the accident I remember oneday when the DOE team read their monitors six times as high as everyone else. The team was discredited and their figures thrown out. Can you be sure they were not right? How can I accept these figures as a guide to how much more I should be allowed to tolerate?

Background levels have been rising every year. My children are already living with Strontium in their bones that I never had. Who is to say what level is enough and what level is too much? Who can say when .4 of a curie more is not the level which tips the scales into disaster? Will my children find out too late?

Why do monitoring agencies continue to talk about warnings after releases not before?

Mr. Gage of EPA tried to reassure the public that they need not worry "because they would always hear about the day's releases on the 6 o'clock news." Why is it that none of the people involved seem to be able to understand that you can train and monitor all you want but what people really want to know is what you expect to do that day so that they can leave the area?

To date no-one has had the common decency even to give us simultaneous immediate notification of accidental releases. We ask that and more. Give us advance warning.

What precedents are we setting?

If we agree that we can get rid of Krypton simply by venting, will we likewise be asked to accept a little Tritium, a small amount of Cesium? This is not all the Krypton to be expected in the cleanup. Will the rest also be vented later if we accept this first batch?

Why not buy time by venting the containment of Unit 2 into Unit 1?

There you have no deteriorated seals, a ready-built container. And you have bought all the time you need to convert it to any acceptable form you wish.

I do not believe you understand

There are too many unknowns. There is too much history of finding out about dangers to the public health years after we are reassured that nothing can possibly go wrong. In short there have been too many lies. We have never had any real assurance that health and safety have ever come before engineering, profit and expediency. Getting poisoned by an accident is something we may accept as fate. But we cannot help but read and learn that it was caused by stupidity and bungling. Do you really expect us to gather our children and march into the showers laughing and singing all the way?

Beverley Davis
200 Gettysburg Pike
Mechanicsburg, Pa. 17055

Alan S. Peterson, M.D.
243 Shultz Road
Lancaster, Penna. 17603
April 10, 1980

The Nuclear Regulatory Commission
1717 H. Street N.W.
Washington,DC. 20585

Gentlemen,

I have just read your "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere." (NUREG-0662). As a physician I have several concerns, questions and suggestions.

"We cannot prove, and we no longer assume, that, there is a threshold (below which there is no radiation damage)." "I think all agree that we have no reason to assume that any level of radiation is utterly safe." -Arthur Upton, M.D.. Ca-A Cancer Journal for Clinicians. Vol. 29, #5, Sept.-Oct. 1979.

"The Environmental Protection Agency, which has responsibility for establishing federal guidelines and generally applicable standards for the protection of the environment from radiation and radioactive materials is currently developing new guidance in this area." "Areas of Part 20 identified by the NRC staff as needing improvement include:...(3) Standards for exposure of the general public,.." - U.S. NRC news release Vol. 6 #12, week ending March 25, 1980.

The foregoing quotations are part of the basis of my conclusion that a separate Environmental Impact statement on the purging of the reactor building atmosphere is

essential. Not to respond to this need is to "take the cheapest, quickest way out" and to negate before study the possible biological short or long term effects.

Questions which are raised by your NURG-0662 include:

1.) What other radioactive materials might be "masked" by the large amount of Krypton-85 in the reactor building? I do not believe this is investigated to a sufficient degree in your assessment.

2.(I understand that maintenance of instrumentation and equipment required to keep the reactor in a safe shutdown condition can be attained with protective clothing although this might prove a bit awkward. Therefore I do not believe Kr-85 must be vented to prevent a criticality.

3.) The question of occupational safety vs. public safety I feel is a key one. For biological and genetic reasons I would rather see a few exposed than many, since, as Dr. Upton says there is no safe threshold. Also I believe the workers have a choice of whether they wish to work in this occupation or not. The public living in the area has no option if venting occurs.

4.) I feel the risks involved in "long-term surveilance" requirements of storage of Kr-85 are no greater than the venting, most likely much less. As the previous NRC quote states, the current standards of exposure to the general public need improvement. Besides, don't we have a gigantic radiation waste problem anyway? I would rather have it contained than released. All we have to do is contain this Kr-85 for a few decades compared to over a thousand for plutonium. Nuclear engineers keep telling us that is no real problem.

5.) I do not feel your conclusion on page 1-4 (that there is no significant environmental impact) is valid. There is no biological data presented for this presumption to be made.

6.) From a non-engineer's viewpoint, your best choice would be the selective absorption process system. It is the cheapest alternative to purging, allows a minimal offsite dose (even if an accident occurs), is in use presently elsewhere and is simple to operate (pg 6-37), would delay only 1½ to 2 years (pg 6-33), should be very low occupational exposure based on previous operating experience (pg 6-37) and could be designed for remote and maintenance free operation of storage. (pg 6-35.)

It is your job to show a thorough and open evaluation of the evidence. The public should be convinced that everything is above-board and that there is not some effort behind closed doors to manipulate the evidence. It must be absolutely clear to the public that engineers are responsible and that risks are reflected as accurately as possible in your risk/benefit calculations. I do not feel this has yet been done for the previous reasons, and neither does the general public. The future of nuclear energy rests with how you handle this situation publicly, not in further engineering breakthroughs.

Thank you for listening. I hope and pray you are.

Yours truly,

Alan S. Peterson, M.D.

Alan S. Peterson, M.D.

217 North Bishop Ave
Clifton Heights, Penna 19018

10 Apr. 80

Nuclear Regulatory Commission
Wahhington, D. C.
(Attn. Dr. Denton)

Dear Sir:

Instead of venting the Krypton gas into the air as proposed why couldn,t it be vented into large baloons which in turn could be released high into the atmosphere by plane and not affect the town of Middletown, Pa.

I have followed theevents at T.M.L since it happened and have not read of the possibility of releasing the gas into baloons and I think it is worth giving it a try as I believe that with this method larger amounts can be released.

Yours Truly

B. N. Kemble

B. N. KEMBLE

1 Woodthorne Ct. #5
Owings Mills, Md. 21117
Apr. 13, 1980

Richard H. Vollmer
Director, Three Mile Island Support
NRR, U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Vollmer,

I am enclosing a comment on NUREG-0662 Addendum 2. Thank yourfor your kind assistande in this matter.

Yours truly,

Kenneth May

Kenneth May

Comments on NUREG-0662 ADD. 2

Environmental Protection Agency Regulations (40 CFR 190.10(b)) for radiation exposure for non-workers near a nuclear power plant limit dosages to 50,000 curies of krypton-85 per gigawatt year of electrical energy. As I understand it, this addendum proposes the release of a greater amount of krypton-85 in only 120 days. Accordingly, I believe that the amount of krypton released should be scaled down to a level more in congruence with EPA standards. Alternatively, the surrounding population should be evacuated when the gas is being emitted or, at the very least, be given the opportunity to, and assistance in, evacuating the area at the times of emissions should they so desire.

4/14/80

TO: U.S. Nuclear Regulatory Commission
Three Mile Island Site
P.O. Box 311, Middletown, PA 17057

FROM: Tanya Richter, 102 E. Locust St. Annville, PA 17003

COMMENTS ON THE NRC STAFF REPORT "ENVIRONMENTAL ASSESSMENT FOR DECONTAMINATION OF THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING ATMOSPHERE"

I am opposed to the proposed venting of the TMI Unit 2 containment building atmosphere for a variety of reasons.

The first reason revolves around a well founded lack of trust in the NRC to insure that the public interest both mental and physical is the primary consideration in decisions made concerning the clean-up operations.

A perusal through the history of agencies charged with protecting both workers and the general public from radiation exposure reveals a record that is hardly stellar. For instance, the Federal Radiation Council, the U.S. Public Health Service and the Atomic Energy Commission permitted underground uranium workers in the Colorado Plateau to work in high levels of radiation until 60 had died of lung carcinoma. These same agencies then opposed the action then taken by the Secretary of Labor when he took unilateral action and lowered the maximum permissible exposure level in uranium mines. Many other examples can be cited which reveal a long term, continuing disregard for long term affects on human health. For instance, increased cancer deaths resulting from nuclear weapons testing in the west are now coming to light along with deaths of shipyard workers who serviced nuclear submarines at naval shipyards. Numerous accidents and radiation releases at nuclear power plants would have remained unknown to the public if not for the press.

This is not a track record which would inspire me to place the health of my children under NRC care. Yet in spite of this record, the NRC patronizingly tells us that our doubts in their veracity are unfounded and proclaims those who question their decisions as "emotional" and "irrational."

Both the NRC and Metropolitan Edison must have realized immediately after the accident that the gases in the containment building would have to be removed in order for cleanup to proceed at the facility. Here it is a year later and now we are told that "it is likely that future accidental releases or operational incidents will occur if storage is continued. The possibility of future accidental releases is also increased by continued reliance on unmaintained equipment." The obvious question is, why weren't plans made immediately, then implemented to remove the gases in a manner which would have less of an impact on the public? I'll take the liberty of answering my own question. On August 14, 1979 Robert Arnold of Met Ed/GPU told a meeting of state and municipal officials at the Hershey Motor Lodge and Convention Center that decontamination of the damaged Unit 2 reactor "will require the venting of radioactive gases into the

atmosphere beginning as early as next spring for a period of about 51 days."[1].

I contend that never was any other method of removing Kr^{85} ever seriously considered. It was a foregone conclusion that the gases would be vented. Only public outcry to the contrary prompted the NRC to cursorily examine other methods.

In exploring alternatives to venting, I was interested to read some material written by Geoffrey G. Eichholz, Professor of Nuclear Engineering at the Georgia Institute of Technology which stated that "The major advantage of the cryogenic distillation process for adsorptio[n] of noble gases is its present high technological level."[2] He goes on to say that "liquid air plants have been in existence for decades, and thus considerable knowledge has been assembled on materials of construction, valves, compressors, distillation column design, modes of operation and reliability. Specific cryogenic processes recovering natural krypton from air have also been operated for some time. Because of this, projected capital and operating costs for a fission-product noble-gas removal system are well defined." [2]

Why didn't the NRC include estimates from independent engineering firms rather than take the figures given by the licensee?

Possible "future uncontrolled releases of Kr^{85}" from storage is listed as one of several disadvantages for each of the alternatives to venting. If the nuclear industry cannot safely store 57,000 curies of the relatively short-lived Kr^{85}, how can we possibly expect them to store radionuclides which are far more dangerous and long lived? The implications are truly frightening!

The assessment gives none of the background data from which the NRC staff drew information in order to arrive at their conclusions. While it may have been impossible to include this in the assessment document, it should have been more accessible.

A body of knowledge is developing which suggests that low level ionizing radiation is far more harmful than was originally suspected. Subsequently, nothing less than a conservative public health posture to radiation exposure is acceptable. I do not perceive the NRC embracing such a posture. In fact, I'm quite confused as to exactly what the NRC posture is because of statements made at many of the innumerable TMI-related meetings which I have attended during the past year. I have heard NRC representatives state in one breath that "we do not assume a threshold" and in the next breath talk about us living with background radiation, living in Denver for a week, getting a chest x-ray. These latter statements suggest that the NRC still accepts the threshold hypothesis and that, well, if we get this much all the time, a little more from venting the krypton won't hurt much.

1. "Radiation Release at TMI is Forcast", The Patriot, Harrisburg, PA August 14, 1979.

2. Eichholz, Geoffrey, Environmental Aspects of Nuclear Power; Ann Arbor Science Publishers, Inc., Ann Arbor, Mich. 48106, 1976

Regional Planning Council
2225 North Charles Street Baltimore, Maryland 21218 (301) 383-5838
Milton H. Miller, Chairman C. Bowie Rose, Sr., Vice Chairman Walter J. Kowalczyk, Jr., Executive Director

April 14, 1980

Mr. Bernard Snyder
TMI Support Group
Office of Nuclear Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Snyder:

Members of the Regional Planning Council and its staff have reviewed the Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere and wish to submit the following comments.

The Regional Planning Council, in previous statements, has supported the position that there should not be release of radioactive material from the cleanup process before the preparation of an Environmental Impact Statement. We also recognize the need for timely action by the NRC when it finds that public safety requires release of material before the EIS is completed.

The information in the Environmental Assessment indicates that sooner or later utility and NRC staff will have to enter the reactor building to determine what cleanup procedures will be most appropriate. The Assessment also suggests that planned release of the Krypton 85 gas is required to prevent more serious accidental releases. While it is better to release the gas under ideal meteorological conditions than by unplanned, accidental leaks, the Assessment fails to mention a time period or deadline for releases of the gas.

In addition, the Assessment suggests that most radiation monitoring efforts will be within five miles of the plant site. There appears to be a deliberate absence of information in the Assessment on desired wind conditions for release of the radioactive gas. We urge that the gas be released to the atmosphere only after Maryland health officials are notified in advance so that proper monitoring stations can be established. In addition, the NRC should determine if more up-to-date information on meteorological conditions around TMI exist since preparation of the EIS for the plant.

Finally, we feel that because the Assessment does not provide any requested or suggested time schedule for action, the NRC should delay actual

release of the gas until the proposed study by the Union of Concerned Scientists is completed. This study, if completed in four to six weeks, should provide an independent analysis of the proposed action within a reasonable time period.

Sincerely yours,

Walter J. Kowalczyk, Jr.
Executive Director

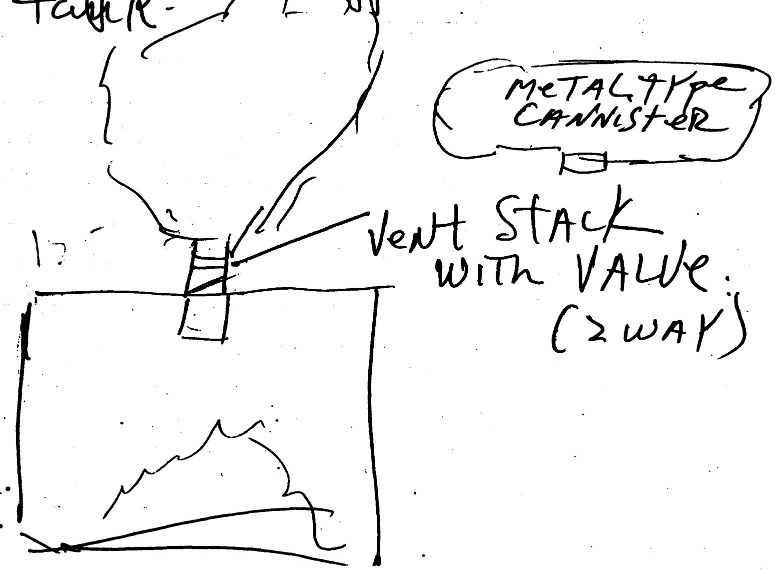
cc: The Honorable Walter S. Orlinsky
The Honorable Barbara Risacher
Mr. John Seyffert
Dr. Steven Long
Mr. Robert Corcoran

April 15, 1980

Dear Sir—

With reference to the problems you are having venting Three Mile Island nuclear plant, I have a suggestion that may help:

Why not vent into a disposable type balloon or tank.



use either a lead coated balloon or capapsible type envelope

after the receptical is full move it to a disposal site either shaft or some other non enviremental site.

this will probabaly get some of the pressure off your agency

S. Volpe
LT. U.S.A.F. Retired

April. 15 1979

The NRC Commissioners
NRC
Washington D.C. 20555

Dear Commissioners,

It distresses me greatly that you are proposing a plan to release the krypton gas from Three mile Island over a 5 day as opposed to 60 day period; once again you seem to be disregarding the health and welfare of not only residents who live close to TMI but also those of us who live within a 100 mile radius.

It is sad enough that you are willing to vent the gas rather than force the more expensive - and most likely safer - procedures possible (such as freezing the liquid and bombarding it with neutrons), but to increase the output concentration of krypton gas - which anyone who thinks about it can see will make where the fallout lands less safe - is an obscene manipulation of your power.

Also do you plan to hold public hearings on your proposal or are you once again going to hide the facts of what you are doing and just force us to accept your actions?

Joseph H White III
801 Crooked Lane
KOP PA 19406

Sincerely yours
In peace & love
Joseph White III
Joseph H White III

205 Sunset Drive
New Cumberland, Pa.
17070

April 15, 1980

Nuclear Regulatory Commission
P. O. Box 311
Middletown, Pa. 17057

Dear Sirs:

As a resident who lives only six miles from the Three-Mile Island nuclear plant, I want you all to know that I don't like your plans for venting the radioactive krypton gas. But even more than that, I don't like the existance of these nuclear plants in my neighborhood, especially when one has become essentially a nuclear waste dump.

My wife is so upset with it all that she desperately wants to move out of the area in order to protect our three young children. If the economic situation were more suitable, we would be moving and probably will be moving once mortgages improve. Our modern ~~kiztra~~ history has taught us not to trust our government experts with our personal health and welfare, and as a result all the cleanup designs you have offered scare us.

Right now, the only ones I can trust regarding TMI are Dr. Kendall and the Union of Concerned Scientists. I will believe what they tell us, and I pray that the NRC will listen to them. I also would have much more faith in the NRC if they announced that TMI would be closed forever once its cleaned up. I really love this area and would rather not move! But I could never live here in peace again if these facilities were reopened.

If, as I suspect the NRC will, the venting is done; I'd much prefer the shorter five-day period than the longer plan. Five days would be much less disruptive to our personal lives as there would be little trouble in taking my children elsewhere for that time period. I also hope and pray that the proper weather conditions are selected for the venting.. I'm sure that a five-day period could be predicted well enough to find conditions that will disperse and scatter the gas rapidly and carry it far enough away as to make it insignificant to all. But I'm also sure that there are other meterological circumstances that would tend to dump the gas in local areas of unacceptable concentrations--and leave it there for hundreds of years! That's also another reason why I favor the short venting plan over the 60-day one. A 60-day program probably wouldn't be too weather selective and might tend to leave greater long term deposits of radiation in the area than a discriminate 5-day release.

Above all, though, I would much prefer a program that involved no releases and no long term storage, and I don't understand why all your alternatives offered only one or the other and not both of these advantages. This tends to make me feel the alternatives were selected to make venting "look" best because it was cheapest. And once again I must say that these kind of actions turn my ears away from the NRC to the UCS as the UCS has stressed the individual safety of citizens for years.

Sincerely,

Dean G. Newhouse

Dean G. Newhouse

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 11 1980

OFFICE OF THE ADMINISTRATOR

Mr. Richard H. Vollmer
Director, Three Mile Island Support, NRR
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Vollmer:

The U.S. Environmental Protection Agency (EPA) has reviewed the "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere," (NUREG-0662 plus addendums 1 and 2). This assessment was prepared to evaluate the impact of releasing the krypton-85 in the Three Mile Island Unit 2 reactor building to the environment.

In our opinion, the most acceptable option is to purge the reactor building atmosphere and release the krypton-85 to the environment in as short a time period as is possible, using actual meteorological conditions most favorable to dispersion. We are also in favor of the monitoring program as described on p. 6-45. This choice is based on the very low environmental and public health impact that would result from the release of the krypton-85. Also, a controlled release would eliminate the large occupational radiation exposures which would be experienced for the other control options.

Our assessment of the off-site doses for the purging option are in general agreement with those made by the NRC staff. We calculate a maximum skin dose of 20 mrem to an individual continuously present at the site boundary during the release period based on average annual meteorological conditions. The whole body dose to the same individual is 0.2 mrem equivalent. These estimates are further reduced by using an occupancy factor, similar to that used by the NRC staff, to produce an estimated skin dose of 14 mrem and an estimated whole body dose of 0.15 mrem equivalent. These doses are well within the EPA environmental standards for the exposure to radioactivity of the individuals involved in the normal operations of the uranium fuel cycle (40 CFR Part 190). Although these standards are not strictly applicable to this situation, they do provide us with a reasonable yardstick for measuring the relative seriousness of this exposure.

We estimated the health risk of releasing the krypton-85 to be 0.0001 excess deaths to the 1,750,000 population within 80 kilometers of Three Mile Island. This estimate was made using the average annual meteorological data from the Three Mile Island area and uncorrected population data from the 1970 census. However, discharging the krypton-85 under favorable meteorological conditions, which results in greater dispersion and dilution, would further reduce the health risks, as pointed out by the NRC staff. "Favorable meteorological conditions" means that combination of wind speeds, wind directions, and atmospheric stabilities which would promote the rapid dilution and dispersion of the air being exhausted from the containment vessel.

The total health risk, both to the public and to workers, is much smaller for the fast purging option. The occupational health risk is 0.00022 excess deaths (1.1 person-rem) for the fast purging option compared to a range of 0.0084 excess deaths (42 person-rem) to 0.051 excess deaths (255 person-rem) for the other control options.

The accident risk assessment by the NRC staff is incomplete since no values are assigned to the probabilities of occurrence of the various accidents. However, it appears that an uncontrolled, large release of krypton-85 could happen accidentally within the period required for installation of control systems. More important, however, is the potential for a more hazardous accident given the unknown condition of the reactor itself and the limited reactor monitoring instrumentation. While it would be helpful in this decision process to have quantitative information on probabilities, delays in obtaining it may be inimicable to public health and safety. We believe it prudent to reduce the likelihood of reactor accidents which could be more hazardous than the release of the krypton-85. Thus, we conclude that the most acceptable option is to release the krypton-85 from the reactor building.

We do, however, suggest that the discussion on the environmental impact of the non-filtered particulates (p. 6-4) be expanded to include sizing and distribution after dispersion.

We would also suggest that the NRC indicate that the cumulative environmental impacts attributable to this cleanup action and the EPICOR II action will be included in the the discussion and assessments in the forthcoming programatic environmental impact statement (EIS) on decontamination and disposal of radioactive wastes (44 FR 67738).

Should you have questions regarding these matters please contact Ms. Betty Jankus (202-755-0770) of my staff or Mr. Jack Russell (202-557-7604) of the Office of Radiation Programs.

Sincerely yours,

William N. Hedeman, Jr.
Director
Office of Environmental Review (A-104)

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

April 15, 1980

Chairman John Ahearne
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Ahearne:

In view of the intense public concern expressed recently about the proposed venting of Kr-85 from the damaged TMI reactor, I would like to suggest a possible mechanism for alleviating some of this concern. Why not encourage and fund local radiation monitoring efforts for the duration of the planned release? This arrangement would allow independent, local verification and monitoring of the information provided by the utility and the USNRC, and may reduce some of the fear and anxiety experienced by those who distrust both. Perhaps the State of Pennsylvania should be asked to assist or oversee this effort. The principal objective, however, should be to create independent, locally-controlled monitoring arrangements which local citizens feel they can trust. Similar arrangements should be considered at all operating plant sites.

This suggestion arises from my eight years of social impact assessment work on nuclear and coal fuel cycles and decentralized solar technologies. Our group has considerable experience (initially funded by AEC in 1972) in community impacts of large and small energy technologies. I would be pleased to discuss the suggestion further if you are interested.

Sincerely yours,

Elizabeth Peelle

Elizabeth Peelle
Social Impact Assessments

EP/le

cc: R. Braid
B. H. Bronfman
R. J. Budnitz - NRC
R. M. Davis
M. Firebaugh - ORAU
G. Flanagan
W. Fulkerson
R. S. Livingston
F. C. Maienschein
F. Mynatt
H. Postma
M. W. Rosenthal
T. Row
D. Trauger
A. M. Weinberg - ORAU
T. Wilbanks
H. Zittel

April 16, 1980

Donald I. Hoover
412 West Pine St.
Palmyra, Pa. 17078

General Public Utilities Corp.
100 Interpace Parkway
Parsippany, New Jersey 07054

ATTN: William G. Kuhns, Chairman

Dear Sir:

For GPU Corp. and Met-Ed to put the greed of money, before the welfare of the citizens, taxpayers, and Met-Ed consumers is simply appalling.

Your consideration for your stock holders well-being must be gratifying to them, but hardly a consolation for the people who are going to sacrifice their hard-earned money to pay for an accident they did not cause. Please do not tell me that the "poor" stockholders would be made to suffer, since they are known to be generally in the upper class.

Your insistence to vent the Krypton Gas at the expense of the populace and to save your stockholders money is dreadful. It simply tells me that Met-Ed, GPU, DER, and the NRC just does not "give a damn" about the public's welfare. We are an expendable entity in your eyes and will be sacrificed for a less equitable and a less expensive method of cleaning up the reactor. The cryogenic method would be the safer way to dispose of the radioactivity, but then that would be more expensive for GPU and for it's "poor" stockholders.

Some day you will meet your maker and will have to answer for your actions, but you have a consolation in that the God above is a forgiving God.

Sincerely,

Donald I. Hoover

Donald I. Hoover

cc: NRC, Ahearne
Gov. Thornburgh
PUC, Shanaman
Sen. Heinz
Met-Ed
DER
Fred Williams, WAHT

---

26 Medbury Rd.
Wallingford, Pa. 19086
April 16, 1980

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa. 17057

Dear N.R.C.:

After reading the March 23rd issue of the Philadelphia Inquirer, which discussed alternatives to venting radioactive Krypton, I am convinced that Met. Ed. is only concerned about disposing of Krypton gas by the cheapest possible method, not the safest. I am tired of money being more important than people's welfare. Without people, money is nothing.

This letter is to voice my objections to the venting method of Krypton disposal. I believe the cryogenic equipment should be used to solidify the Krypton. It can then be properly contained and stored. Put yourselves in the place of the people living near TMI. (or Limerick, or any other nuclear facility). Haven't the people of Middletown experienced enough exposure and trauma?

Sincerely,
Victoria Lease
Speech therapist - Phila.

X

PENNSYLVANIA CHAMBER OF COMMERCE

The one spokesman for all business and industry

222 North Third Street
Harrisburg, Pa. 17101
Area Code (717) 238-0441

April 16, 1980

Mr. John Ahearn, Chairman
Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, DC 20555

Dear Chairman Ahearn:

The Pennsylvania Chamber of Commerce is a statewide organization which represents over 2000 businesses and industries in the Commonwealth.

We urge you to initiate the venting of the contaminated atmosphere from TMI's Unit II Reactor Building.

We support an expeditious clean-up of Unit II, of which the next major step is venting of the krypton 85 gas. We are convinced that of the four proposed methods for decontamination: (1) a cryogenic system, (2) a pressurized storage system, (3) a charcoal absorption system, and (4) venting, that the fourth method, venting in as short a period as possible, considering health and safety, is preferable.

We have arrived at this decision through information provided by the DER, NRC, and the "Report of The Governor's Commission on TMI", on P. 106 it states that it,

> would not oppose an NRC decision to vent the krypton gas, provided that dose levels projected in the environmental impact assessment are acceptable.

We believe that projected risks of permitting the contaminated atmosphere to remain in its present state exceed any risk of venting. Limited monitoring capability, possible core start-up, or leakage from the primary system requiring additional water could be consequences of extensive delay in the decontamination process.

On the other hand, the risk of venting is minimal when one considers that the maximum amount of radiation received would be .1 to .2 millirems if an individual were to stand at the nearest point to the plant through the entire venting period. This small amount would still permit the plant to meet the legally acceptable limit for operating plants of 5 MR/year and we view such an atmospheric release as safe relative to normal amounts of radiation received from living on earth today.

Even so, we encourage careful monitoring by EPA's office in Middletown and its 18 monitoring stations along with an active public information program. Furthermore, we would be pleased to help in any way possible. Thank you for your consideration of this most important matter.

Sincerely,

Robert Hibbard

Robert Hibbard
President

RH/klk

cc: Lt. Governor William W. Scranton, III
Clifford L. Jones, Secretary - DER
Robert A. Shinn, Director - GEC

PENNSYLVANIA CHAMBER OF COMMERCE

The one spokesman for all business and industry

222 North Third Street
Harrisburg, Pa. 17101
Area Code (717) 238-0441

April 16, 1980

The Honorable Dick Thornburgh
Governor of Pennsylvania
225 Main Capitol Building
Harrisburg, PA 17120

Dear Dick:

The Pennsylvania Chamber of Commerce urges you, following the report of Dr. Henry Kendall's panel, to recommend to the Nuclear Regulatory Commission that a safe initiation of the venting process for the contaminated atmosphere from Three Mile Island's Unit II Reactor Building be undertaken as soon as possible.

The Chamber supports an expeditious clean-up of Unit II, of which the next major step is venting of the krypton 85 gas. We are convinced that of the four proposed methods for decontamination: (1) a cryogenic system, (2) a pressurized storage system, (3) a charcoal absorption system, and (4) venting, that the fourth method, venting in as short a period as possible, considering health and safety, is preferable.

We have arrived at this decision through information provided by the DER, NRC, and your Commission's statement on P. 106 that it,

> would not oppose an NRC decision to vent the krypton gas, provided that dose levels projected in the environmental impact assessment are acceptable.

We believe that projected risks of permitting the contaminated atmosphere to remain in its present state exceed any risk of venting. Limited monitoring capability, possible core start-up, or leakage from the primary system requiring additional water could be consequences of extensive delay in the decontamination process.

On the other hand, the risk of venting is minimal when one considers that the maximum amount of radiation received would be .1 to .2 millirems if an individual were to stand at the nearest point to the plant through the entire venting period. This small amount would still permit the plant to meet the legally acceptable limit for operating plants of 5 MR/year and we view such an atmospheric release as safe relative to normal amounts of radiation received from living on earth today.

Even so, we encourage careful monitoring by EPA's office in Middletown and its 18 monitoring stations along with an active public information program. Furthermore, we would be pleased to help in any way possible. Thank you for your consideration of this most important matter.

Sincerely,

Bob

Robert Hibbard
President

RH/klk

cc: Lt. Governor William W. Scranton, III
Clifford L. Jones, Secretary - DER
John Ahearn, Chairman - NRC ✓
Robert A. Shinn, Director - GEC

PSI: **PARASCIENCE INTERNATIONAL**
1025 Miller Lane, Harrisburg, Pennsylvania 17110 U.S.A.
— Larry E. Arnold, director

April 16, 1980

The Honorable Richard Thornburgh
Governor of the State of Pennsylvania
Capitol Building
Harrisburg, Pennsylvania

Dear Mr. Thornburgh:

This communication is in response to your public position to solicit and evaluate responsible viewpoints on the atmospheric purge of Kr-85 from the containment vessel of Three Mile Island Unit 2.

As a preface to the following recommendation, you should know that unlike yourself and 99.9 percent of the local citizenry we have actively opposed Metropolitan Edison's operations at Three Mile Island for many years -- a statement the utility's top management will readily acknowledge.

In the Spring of 1977 we were one of a handful of southcentral Pennsylvania residents who appeared before the Atomic Safety and Licensing Board on TMI-2 and testified in opposition to issuance of an operating license for Unit 2. Among the more than 20 points we raised that we found inadequately addressed were multimode failures, emergency warning and planning, and Class IX accidents at TMI-2. The NRC Staff laughed at us, and the ASLB Commissioners refused to consider (along with our other contentions) Class IX events as realistic.

Soon afterwards, at our request Representative Jeffrey Piccola (R-104th) arranged for a tour of TMI in early summer 1977. Jack Herbein, whose name you will recognize, gave Rep. Piccola and us a "cook's tour" of Unit 2. Designed to allay our fears about TMI, this tour managed instead to enhace our concerns about the facility's safe operation; unfortunately, Rep. Piccola chose rather to place credence in the mellifluous pronouncements of the Met-Ed spokesmen.

In July 1978 we authored an insightful and, as it proved to be nine months later, highly accurate article published in HARRISBURG MONTHLY MAGAZINE: "MELTDOWN! Tomorrow's Disaster at Three Mile Island." It described a Class IX multimode accident at Unit 2. For this we were vilified by Met-Ed's president; the publisher's Federal grant was terminated after inquiries launched by Met-Ed; and Jack Herbein wrote a lengthy monograph pointing out the "errors and misrepresentations" of "MELTDOWN!"

On March 28, 1979, we were vindicated -- though the victory seems a Punic one. In the aftermath of that fateful day, the credibility for accurately assessing conditions at TMI seems clearly to lie with us and not Metropolitan Edison or the NRC, Mr. Thornburgh.

From this long anti-nuclear background we make this recommendation: <u>that you support the proposed atmospheric purge of Kr-85 within Unit 2's containment</u>.

"today's frontiers are tomorrow's understanding..."

In our view this position, recognized as highly unpopular among the populace and thus politically hazardous, is nevertheless the sanest recommendation to make at this stage in the on-going crisis at TMI.

Let us give you the reasons behind this perhaps surprising stance.

First, contrary to what NRC official Richard Vollmer told incensed citizens at Middletown's Liberty Fire Hall last month, Kr-85 *does* occur naturally in this planet's atmosphere. In southcentral Pennsylvania, Kr-85 contributes 20-30 picoCuries per cubic meter to the annual background radiation level. Our independent calculations indicate a vented Kr-85 dose of 17 picoCuries per cubic meter at the 10-mile radius for the two-month (pr osed) purge, an effective increase of 340-510 percent over natural background. Extrapolated to the North Gate at TMI, the Kr-85 post-purge level would increase approximately 285,000 percent.

All that sounds like a lot, but with assistance from Margaret Reilly, DER Bureau of Radiation Protection, we find this level converts to about 0.3 microRads (millionths of a Rad) at 10 miles and 0.2 milliRads at the North Gate. This latter value coincides with the figure originally given by the NRC, incidentally.

Compared to the normal bi-monthly background dose from natural sources of 14 milliRad (or Rem), this is for practical purposes a *truly minute increase*. It is reasonable to state that moving to Pittsburgh -- which has a higher natural level of background radiation -- would be radiologically more detrimental on the dose-alone basis, for example.

Second, between 1955-1970 the total Kr-85 in the *whole* Northern Hemisphere of the planet increased, thanks to the Nuclear Industry, a *whopping 1500 percent!* Between 1970-1980, again thanks to the Nuclear Industry, the worldwide Kr-85 dose equivalent to the skin surface was projected by the National Council on Radiation Protection to rise *588 percent* from 0.034 to 0.2 millirem per year. Yet few people in this area have complained (even know, we suspect) about this situation -- even though it should be far more disturbing than the quantities of Kr-85 proposed to be purged from Unit 2.

Clearly, we do not suggest Kr-85 is harmless.

The National Council on Radiation Protection, in its 1975 Report # 44 entitled "KRYPTON-85 IN THE ATMOSPHERE -- Accumulation, Biological Significance, and Control Technology," defines skin first and lung tissue second as the most easily damaged parts of the body by Kr-85 emissions. However, states the NCRP # 44: "The absence of an observed excess of skin tumors in A-bomb survivors ...argues that skin is appreciably less susceptible to radiation carcinogenesis" than suspected. While monitoring of A-bomb victims has been admitted less than commendable, had skin been severely injured by bomb radiation one would think it difficult to overlook entirely. Thus, on accepted radiological research, one should not expect much (to be conservative) skin injury from the purge dose.

Conversely, a study compiled by the Pennsylvania Thorasic Society in 1979 found that several environmental irritants, when inhaled into the lungs, engender elastin -- a substance which damages lung tissue. We have strong suspicion that Kr-85 is one such irritant, and therefore the purge of Kr-85 has a secondary physiological impact that, to our knowledge, has not been addressed by Metropolitan Edison or the NRC.

Our recommendation does not ignore this hazard, as we anticipate health impairments physiologically -- and *certainly* psychophysiologically. Because of a long-term post-accident health investigation conducted privately, we are likely *more* aware of the physiological effects of even extremely low-level radiation emissions upon the public around TMI than are most so-called experts on radiation -- certainly moreso than the batch of radiologists who addressed the pro-nuclear Radiation and Health Conference at Hershey Medical Center last September. Consequently, we made this secondary recommendation if (or more reasonably, when) venting is approved: that the Pennsylvania Health Department seriously examine and tabulate reports of tachycardia, sore throats, reddened and sore eyes and skin, extreme lethargy and similar radiation sickness ailments that will be experienced by a segment of the population surrounding TMI during this period.

That factor and recommendation considered, we still believe it prudent and expedient to purge this radionuclide because of a third and (in our view) the over-riding reason:

A far greater danger lies in failure of containment equipment that is keeping TMI-2 from going for its second Class IX and fourth near-meltdown. This equipment requires maintenance not given in more than a year.

We understand that Met-Ed vice-president Robert Arnold has recently stated it is *not* this equipment maintenance that is the main reason for his company's advocating the purge of krypton. This we find a surprising statement; but even if true, our position would not be altered for Met-Ed's track record in describing and predicting events at TMI is not what one could call noteworthy for accuracy.

Having personally foreseen the March 28, 1979, accident at TMI-2 nine months before it happened, we now perceive *an imminent series of malfunctions associated with Unit 2's reactor.* It is of utmost importance that containment entry occur soon; if not, the crisis developing will force venting of Kr-85 anyway -- but it may well come too late.

If Unit 2 could sit for years without further problems developing, we would take the position of many anti-nuclear associates regarding Kr-85 purging and tell Met-Ed to "sit on it." But as you should have learned by now, the public is still held hostage to a nuclear terror in our midst. Ignoring hard decisions will not make the dangers at TMI simply evaporate into non-existence.

The incontrovertible fact, from our perception, is that if containment entry is not made soon and time-consuming thorough surveillance and repair of safety-assuring equipment undertaken (which, we submit, cannot be accomplished by sending in work crews for very short durations in a Kr-85 environment, as the TMI Legal Defense Fund suggested April 15), you, the NRC, Metropolitan Edison, and southcentral Pennsylvania are going to be facing the same kind of "unthinkable" crisis that terrorized us all less than 13 months ago!

There is not sufficient time to install a selective absorption system or cryogenic distillation devices.* Unless both we and the consultants who have advised you and the NRC have overlooked a simple and quick solution to this situation, there is no other position we can recommend, distasteful though it is to us.

In the vernacular, this area has "bought it" because its people refused to inform themselves about the dangers of nuclear reactors until the 'impossible' jarred them into awareness. Now all of us face, and some are suffering, the consequences of that blindness.

We hope, though we become increasingly doubtful, that your awareness on this issue of nuclear power plants has likewise been awakened.

As stated earlier, we recommend you support the proposal of Kr-85 purging and urge that it be accomplished soon.

We also recommend and urge that you abandon your current non-committal stance on nuclear power plants in the Commonwealth and vociferously oppose the licensing of new reactors while pursuing all means to expediently phase out those currently on-line. Southcentral Pennsylvania came within minutes of being uninhabitable for decades (WASH-1400 Report). We don't want another portion of Pennsylvania, or our own home for that matter, in that precariously jeopardized condition again. And as Governor of this magnificent state we don't think you want that either.

Available to be of assistance on this issue, we remain

Most sincerely yours,

Larry E. Arnold

Larry E. Arnold

* You might like to ask the NRC why they didn't order installation of a cryogenic distillation system the day after the accident, a system that NCRP Report # 44 said was 98 percent effective in Kr-85 removal and has been "developed and operated on a significant scale" way back in 1971. NRC's John Collins could only tell us that his agency was "busy with other things" at the time -- so apparently the NRC has neither the expertise-in-depth nor ability for multimode response to a reactor accident as serious as the last one at TMI-2.

Furthermore, Robert Arnold (no relation) has said one reason Met-Ed did not favor cryogenic distillation was because cylinder storage of the Kr-85 poses contamination leakage problems. If the Nuclear Industry can't safeguard the ecosystem from a radionuclide with a half-life of only 10.7 years in the case of Kr-85, how can they expect -- and how can you condone their claims -- to isolate much more biologically destructive radioisotopes like Cs-137, Sr-90 and Pl-239 (with a half-life of 24,000 years)?

Is this the legacy you wish to leave to the people of Pennsylvania at the completion of your term as Governor?

cc: Rep. Jeffrey Piccola
Sen. George Gekas
Congressman Allen Ertel
U.S. Senator John Heinz
President Jimmy Carter
Robert C. Arnold, Vice-President of Metropolitan Edison
John Collins, NRC in charge of TMI
Acting NRC Chairman Ahearne
Chauncey Kepford and Judith Johnsrud
"The Paxton Herald"
Three Mile Island Alert

Irwin D.J. Bross, Ph.D.
Director of Biostatistics
Roswell Park Memorial Institute
666 Elm Street
Buffalo, N.Y. 14263

April 16, 1980

William J. Dircks
Acting Executive Director
for Operations
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Dircks:

Having received NUREG-0662 and the Report on the Special Task Force from Jona Souder on April 10, 1980, I was unable to submit the enclosed brief critique by the deadline. In view of the fact that I have promises in writing from the Nuclear Regulatory Commission that I would be sent all such materials but these promises were not kept, I suggest that circumstances make some relaxation in deadlines appropriate. I have finally received the materials in conjunction with legal actions by Ms. Holly Keck.

However, on the positive side, it did make it possible to include data from the Pennsylvania State Health Department. Contrary to the statements of that department, the figures given for the three years, '77, '78, and '79 for infant deaths in a 10-mile radius of TMI-2 in the same 6-month periods (e.g., 20, 14, 31) shows significant increase in the death rates. An elementary statistical analysis (using the binomial distribution) shows that the increase in the mortality is statistically significant at about the 1% level. This makes it comparatively easy to estimate that the purging will produce at least 50 excess infant deaths in the area and somewhere between 500 and 5000 total casualties.

While I realize the NRC has orders from the top to go ahead with the purging at TMI-2, this will be a rerun of Big Smoky. However, I would like to remind all of you of one thing. In view of the warnings that you have received here and elsewhere, the approval of purging would be a criminal action--reckless endangerment or negligent homicide at the least. When babies start dying (for whatever reason) after the purging, the public revulsion will be such that all involved in this fatal decision will, I believe, be brought to trial on criminal charges or will be faced with damage suits. If you don't care about other humans, think of what might happen to you.

Very sincerely yours,

Irwin D.J. Bross, Ph.D.
Director of Biostatistics

IDJB/mak
Enc.

CRITIQUE OF ENVIRONMENTAL ASSESSMENT FOR
DECONTAMINATION OF THREE MILE ISLAND UNIT 2
REACTOR BUILDING ATMOSPHERE (NUREG-0662)

The Nuclear Regulatory Commission (NRC) has considered a series of five options for dealing with the Kr-85 in the containment of Unit 2 of the Three Mile Island (TMI) complex and has recommended venting the radioactive gases into the atmosphere ("purging"). This recommendation is based on a cost-benefit analysis in NUREG-0662 that involves two serious mistakes in the method of calculation. If these mistakes are corrected, the priorities for the five options are effectively reversed.

The first mistake is to calculate the cost-benefits from the standpoint of the utility although it is the responsibility of the NRC to make the calculations from the standpoint of the public. What this means is that the public health costs have been virtually ignored (there are in fact <u>no</u> estimates of mortality or morbidity either for workers or the general public). Admittedly, the $75,000 price tag on purging is cost-beneficial to the utility when compared to a multi-million-dollar price tag for the alternatives. When, however, the costs to the public are also considered, the purging option is completely unacceptable from a public health standpoint. As will be detailed later, a conservative estimate is that the venting will produce at least 50 infant deaths.

The second mistake in the cost benefit calculations is that the analysis considered deals with only the first step in the clean-up process instead of the entire process. For example, the rationale given for purging is that it would allow early entry of workers into the containment as the first step in the clean-up . Thus, on page A-2-1 it is argued "Each 1/2 hour entry is estimated to result in a dose of 0.3-0.5 R if the Krypton has not been purged. If the Krypton has been purged, the comparable dose is 0.2-0.4 R. Therefore, failing to purge the Krypton would add...about 0.1 R (per entry)." What these figures actually show is that purging fails to produce a safe work environment, so in practical terms the operation would be about as hazardous after purging as before it. After purging (but to conform to NRC permissible levels), a worker could work no more than two days per year.

Another way to see that the Kr-85 exposures are not the limiting factor in the clean-up is to consider operations at a later stage where the worker would have to be near the radioactive water. Here the level is 120 R per hour. In a single 8 hour shift a worker would get a dose of 960 R, about a lethal dose of radiation, and the additional 1.6 R from the Krypton would make little difference in the health effect.

The previous examples point up how superficial the cost-benefit analysis in NUREG-0662 actually is. The disposal of Kr-85 cannot be considered without considering the disposal of the half a million curies in the radioactive water. To evaluate the options on Kr-85 it is essential to have the comprehensive programatic plan for the clean-up at hand.

In analysis of long-term cost-benefits rather than first-step consequences alone, a series of key questions must be answered before

any final decisions should be made. Is this reactor mortally wounded and beyond repair? (Any realistic appraisal would lead to a "yes" answer.) Given the present state of the art in decontamination, is it realistic to plan on putting workers into the containment? (The cited NUREG-0662 figure on dosages from water, walls, etc., indicate this can never be done within the NRC 5 R per year limit.) Is there any way to stabilize the reactor environment without putting humans inside? (Yes, entombment could largely be carried out by remote operations.) Would purging be necessary with entombment? (No, all the radioactivity would stay inside the containment and be stabilized in concrete, including the radioactive water.) Long-term cost considerations gives an entirely different cost-benefit picture than single-step analyses and permit options that the NRC has refused to consider seriously.

The second strategic mistake in the cost-benefit analysis of NUREG-0662 is the failure to deal with public costs rather than private costs. Such analysis requires a strong effort to base estimates of health costs on factual evidence instead of on the meaningless Mickey Mouse Arithmetic (spurious calculations) of section 6.1.4 on "Environmental Impact". While NRC has accepted MMA calculations (as they are called in the trade) for many years, a competent public health panel would not accept these numbers as relevant to health costs.

Factual evidence does exist but has been ignored by NRC. For example, the Pennsylvania Health Department has just released statistics which can provide direct estimates of the effect of purging on infant mortality in the area. Overall long-term morbidity and morality can be estimated from the genetic damage indicated by the infant mortality, roughly by multiplying up by a factor between 10 and 100.

According to a health department survey, there were 31 deaths within a 10 mile radius of TMI in the 6 months after the March 28, 1979 accident and an infant mortality rate of 17.2 per 1000. This latter is about 20% above the statewide average of 13.3 per 1000 and is an even greater increase above previous local rates. Deaths in the same area in the same months for 1977 and 1978 are reported as 20 and 14 so that the 31 deaths in 1979 may represent a 50% increase. While the evidence is not conclusive, there is a strong prima facie case that at least 5 or 6 (and possibly twice as many) of the 31 deaths are due to releases of radioactivity from TMI.

The Pennsylvania Health Department claims these figures "could not support a suggestion of a significantly higher (death) rate" since the 15.7 rate "was actually a decrease for the Three Mile Island area because during the prior six months the rate was higher, 17.2." What the 17.2 shows is that the death rate has been consistently high, probably because of malfunctions and releases prior to the accident. As for the decrease, there is a well-known annual cycle of these rates with the peak in January and the lowest values in July or August and there is also a steady downward trend. This decrease should have been expected.

The health department also refers to "wildly fluctuating" death rates but this is what is found around reactors because of the accidental releases. It certainly does not absolve TMI. So the actual data (but not what was said about the data) actually confirms that there was an excess death rate at TMI.

If the purging option is carried out, what will this do to the death rates in infants? According to the Special Task Force report (I-1), "Estimates are that about 65-80 curies of radioactive gas escape into the environment each month--less than 10% of the normal radioactive gas releases from a similar operating nuclear reactor." The purging would release an estimated 44,000 curies of Kr-85 into the atmosphere. This is about 50 times the release claimed for TMI after shutdown and 5 times the "normal" release on an annual basis. A five-fold increase in radiation exposure at these low levels could be expected to produce a corresponding increase in infant deaths.

Roughly speaking, the observed 20% excess infant mortality would become a 100% excess after the purging. A doubling of the infant death rate is intolerable from a public health standpoint even if the utility can save millions of dollars.

Numbers of deaths are perhaps easier to understand than rates. An excess of 5 deaths in 6 months is 10 deaths per year. Multiplying by 5 gives an estimate of 50 dead babies from the purging of Kr-85. For NRC to sanction this is unconscionable.

The overall health effect in the population of 2,500,000 within 50 miles of TMI can be roughly estimated by multiplying the infant deaths by a factor of 10 to 100 to obtain total casualties between 500 and 5000. Many of these casualties would not occur for 20 years or more so that the purging would be a kind of time bomb which would produce justifiable anxiety in the entire population exposed. A cost-benefit analysis from the public rather than a private standpoint indicates an environmental impact of an order of magnitude which might be described as a "deliberately engineered disaster". The purging option should never have been recommended by the NRC.

Comm. John Aherne

To: Nuclear Regulatory Commission
Re: Venting
Date: April 17, 1980

A "normally" operating nuclear plant emits about 50 curies/year of Krypton, which permeates even protective clothing. How would 57,000 curies of Krypton affect our "normal background" when vented in a 5 to 60 day period? Why, with other alternatives available, would you select the type "clean-up" which adds the most background to the public? Didn't you know you would have this residue? If you knew this, why didn't you start implementing a safe disposal system for Krypton 10-12 months ago? There are alternatives to venting, more costly but safer to the general public - which did not cause the accident. If storage containers leak after 10 years, the radioactivity from Krypton will have been naturally reduced by 50%. After 20 years, the amount of radioactivity will be only 25% of the original.

If Krypton is vented, what prevents this heavier element from settling in "pools" which will increase "normal background" radiation level and pose a potential problem 100-150 years, at a conservative guess.

Is it only another appeasement ploy to limit emissions to 0.1% or 1% or 10% of "normal background" levels? By leaks and planned emissions, how long until our area has a "normal background" level of radioactivity as high as your favorite city, Denver?

Can you assure the public by facts - not guesses - that radioactivity contributes nothing detrimental to our life?

Thank you,

Charles W Emerick, Sr.
Genevieve B. Emerick

Charles W. Emerick, Sr.
Genevieve B. Emerick

(Mr. & Mrs. C. W. Emerick, Sr.
489 Willow St.
Highspire, Pa. 17034
(717-939-9037)

DEPARTMENT OF BUILDING & SAFETY

VENTNOR CITY, N. J. 08406

VENTNOR CITY HALL
ROOM 4
[illegible]

April 17, 1980

To Whom It May Concern:

After hearing on TV about the cost and problem of getting rid of the gas at Three Mile Island, I have been giving it some thought about a possible solution.

The ideas I have probably have been thought of before, but perhaps not. I realize there is much to be thought about and I do not know anything about the type of gas, such as can it be compressed, is it heavy or light, is it flamable, can it be mixed with other gases, will it dissipate in air and what type of materials will it penetrate? There are many more solutions which would have to be thought out by the proper people. However, my thought was to put the gas into balloons alone, or in a balloon within a balloon with helium or a lighter gas, to take it many miles above earth and detonate it with a radio controlled charge. Perhaps phosphorus, dye or smoke could be mixed with it to follow it's path. It could be released at night when the wind is null or perhaps larger balloons could be used and towed to an area and released and detonated. The balloons could be filled perhaps one mile above TMI by hose with the use of choppers or helium balloons to a platform or such, or perhaps a hose line held up by balloons miles up the gas could be released without being put in a balloon first.

I don't know the answer, I wish I did, but perhaps these ideas may be of some help.

Respectfully,

Warren Dagrosa

Warren Dagrosa
Plumbing & Heating Inspector
Ventnor City

P.S. This just could be the old lead balloon trick?

cc: WPVI TV, Gov. Thornburg, Public Service Electric & Gas

Met-Ed GPU

Metropolitan Edison Company
Post Office Box 480
Middletown, Pennsylvania 17057
717 944-4041

Writer's Direct Dial Number

April 18, 1980
TLL 191

TMI Program Office
Attn: J. T. Collins, Deputy Manager
U. S. Nuclear Regulatory Commission
c/o Three Mile Island Nuclear Station
Middletown, Pa. 17057

Dear Sir:

Three Mile Island Nuclear Station, Unit II (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Comments Concerning NUREG 0662

Enclosed, please find the Metropolitan Edison Company comments on NUREG 0662, Environmental Assessment for Decontamination of the Three Mile Island Unit II Reactor Building Atmosphere and Addenda. These comments are submitted to meet the close of comments date of April 18, 1980.

Sincerely,

G K Hovey

G. K. Hovey
Director, TMI-II

GKH:LJL:hah

Enclosure

cc: B. Snyder

METROPOLITAN EDISON COMMENTS ON NUREG-0662

1. Page 1-3, paragraph 2, line 11: In addition to accidental small releases, there will be small releases associated with each airlock entry and with each reactor building entry.

2. Page 1-5, Table 1-1: Occupational dose for the selective absorption process system is approximately the same as for the cryogenic processing system, since both systems separate and store the Krypton 85 for a period of time.

3. Page 3-1, paragraph 1, line 8: The average concentration of Krypton 85 based on analyses taken since the November 13, 1979 submittal is about 1.04 μCi/cc.

4. Page 3-2, paragraph 1, line 2: Less restricted access to the reactor building is definitely required.

5. Page 4-5, Table 4-1: For accidental releases, Reg Guide 1.145 requires the use of 0.5% or 5% probable meteorological conditions. The appropriate number for TMI is 6.8×10^{-4} sec/m^3.

6. Page 6-1, paragraph 1, line 3: The system modification will allow throttling of flow from about 50 CFM to 1000 CFM, not just stepwise flow increases.

7. Page 6-3, paragraph 2, line 7: Only periodic entry into the auxiliary building is required during purge. Continuous stationing of an auxiliary operator in the auxiliary building is not required, since all major components associated with the purge are controlled from the control room.

8. Page 6-4, paragraph 3, lines 4-9: 6.7×10^{-6} sec/m^3 does not represent the average annual meteorological dispersion condition at TMI. This number was imposed by the NRC as a Technical Specification condition and is conservative by at least a factor of two (2).

9. Page 6-5, paragraph 1, line 6: Maximum skin dose off-site may not occur at the site boundary, but at a distance to about 2 miles.

10. Page 6-26, paragraph 1, line 12: Metropolitan Edison agrees that extra steps may be able to be taken during design, engineering, and construction stages to reduce worker exposure from a cryogenic processing system. The extent of these changes could, however, significantly increase the already lengthy 20-30 month time period estimated for system implementation.

11. Page 6-33, line 23: Metropolitan Edison does not believe that a selective absorption system can be installed in one and one-half years, unless all NRC Regulatory Guide and Code Requirements are waived. It is assumed that the NRC agrees, since this paragraph mentions imposing only "standard industrial criteria."

12. Page 6-35, paragraph 2, line 10: Metropolitan Edison believes that any Krypton 85 storage system would have significant surveillance

12. and maintenance requirements. For this reason, occupational exposure associated with the selective absorption process should be approximately the same as for the cryogenic processing system.

13. Page 6-37, paragraph 2, line 5: The absorber/stripper column is not likely to be available "off-the-shelf." Special construction of this column would be required.

Enclosure 2
TLL 191

METROPOLITAN EDISON COMMENTS ON NuREG-0662 Addendum 2

1. Page 6-39, paragraph 1, line 6: The purging alternative using the hydrogen control subsystem also was planned for use only under meteorological conditions favorable to atmospheric dispersion.

2. Page 6-39, paragraph 1, line 8: The reactor building purge system is not capable of low rates of 5,000 - 50,000 CFM unless modifications are made. Even after a modification is made to allow manual throttling of the fan vortex dampers, Metropolitan Edison is not certain that flow rates as low as 5,000 CFM can be attained. This concern was expressed to NRC representatives at a meeting on March 20, 1980.

3. Page 6-40, paragraph 2, line 4: Each train is capable of a single 25,000 CFM flow rate. By modifying the fan vortex damper control, lower flow rates may be obtained. Flow rates as low as 5,000 CFM may be possible, but the lower flow throttling limit will not be known until the system is modified and tested. Metropolitan Edison is proceeding with modifications and with procedure writing to support use of the reactor building purge system. The procedure is being written to use only the "B" reactor building purge train.

4. Page 6-41, paragraph 2, line 4: The hydrogen control system must be used until purging at the minimum reactor building purge system flow rate can be accomplished without exceeding the range of the stack radiation monitor (HPR-219a). Based on not exceeding a stack Krypton 85 concentration of 2×10^{-2} µCi/cc and using 5,000 CFM flow, use of the reactor building purge system can start when reactor building air Krypton concentration is 0.46 µCi/cc. The lower flow limit capability of the reactor building purge system will determine the point at which a shift to this system can be accomplished. As a result, the time of purge using the 1000 CFM is not necessarily fixed at 50 hours.

5. Page 6-45, paragraph 1, line 3: Metropolitan Edison agrees that instantaneous off-site concentrations of Krypton 85 will exceed the concentration specified in 10CFR20, Table B. However, the Table B concentrations are limits for average concentration. Therefore, the requirements and intent of 10CFR20 will be met.

6. Page 6-46, note b, line 3: The last five words should read " and t is in hours."

7. Page 6-46, note d: The units of "3" in the numerator should be mrem/hr.

8. Page 6-47, paragraph 1, line 13: Although the April/May meteorological conditions are historically more favorable than summer conditions, Metropolitan Edison believes that the purge could be conducted safely and expeditiously during the summer. However, we agree that it is prudent to complete the purge as soon as possible.

THOMAS K. GILHOOL
CHIEF COUNSEL
ERIC I. E. BELLER
MICHAEL CHURCHILL
ELIAS S. COHEN
FRANK FINCH III
ANTHONY E. JACKSON
DEBORAH KAPLAN*
HARRIET N. KATZ
FRANK J. LASKI
LYNN C. MALMGREN
PRATHER RANDLE
JAMES J. RAGGIO
ALBERT J. SLAP
EDWARD A. STUTMAN
DAVID G. DAVIS
ADMINISTRATIVE OFFICER
* Admitted in District of Columbia only.

PUBLIC INTEREST LAW CENTER OF PHILADELPHIA
pilcop
1315 WALNUT ST., 16th FL., PHILA. 19107 215 · PE 5-7200
F. JOHN HAGELE
CHAIRMAN OF THE BOARD
EDWIN D. WOLF
EXECUTIVE DIRECTOR
1974-1976

April 18, 1980

Commissioner Victor Gilinsky
U.S. Nuclear Regulatory
Commission
1717 "H" Street, N.W.
Washington, D.C. 20555

Dear Commissioner Gilinsky:

On behalf of the TMI Legal Fund, the enclosed Comment to the Commission's Environmental Assessment for the Decontamination of the Three Mile Island Unit 2 Reactor Building atmosphere (NUREG-0662) was recently submitted to Mr. Richard H. Vollmer.

We are particularly concerned about the contents of the Environmental Assessment and therefore request that you take the time to read the enclosed Comment before making a decision as to whether to vent the krypton gas.

After a thorough evaluation of the situation, we are convinced that maintenance and data collection in the containment building can begin immediately without venting the krypton, and that worker safety need not be diminished in the process. A decision not to vent the gas would, at the same time, avoid increasing the psychological stress evident in the population and avoid potential additional adverse health effects.

If you have any questions concerning our Comment, we would be most happy to try to address your questions.

Sincerely,

Judith A. Dorsey

Judith A. Dorsey, Esquire

JAD/at

Enclosure

AFFILIATED WITH LAWYERS COMMITTEE FOR CIVIL RIGHTS UNDER LAW

COMMENT TO

NUREG-0662

THE NUCLEAR REGULATORY COMMISSION'S ENVIRONMENTAL ASSESSMENT FOR THE DECONTAMINATION OF THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING ATMOSPHERE

TMI LEGAL FUND

TABLE OF CONTENTS

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TMI LEGAL FUND

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Bruce Molholt, Ph.D.

Judith A. Dorsey, Esq.

Jean Royer Kohr, Esq.

Bruce Molholt, Ph.D.

1315 Walnut Street - Suite 1600

Philadelphia, Pennsylvania 19107

(215) 735 - 7200

I. SUMMARY STATEMENT

The NRC Environmental Assessment proposes venting as an urgently needed, superior method for the removal of 57,000 curies of krypton-85 gas from the TMI-2 containment building atmosphere. The NRC proposal is replete with errors of both fact and judgement.

1) There is no emergency at hand. Data may be collected and containment facility equipment may be inspected and maintained without removal of the krypton-85 gas. There is adequate time to implement an alternative system for krypton-85 removal from the containment building atmosphere.

2) Venting of krypton-85 gas into the air which surrounds TMI-2 carries definite genetic and carcinogenic risks to the people of nearby communities. For a population which has already endured severe psychological stress, the proposed venting will only exacerbate this state of stress.

3) The proposed venting cannot be controlled due to meteorologic uncertainty. The monitoring as described by the NRC is incapable of providing sufficient information for the protection of people in communities surrounding TMI-2.

We urge that data collection be initiated, that the containment building equipment be inspected and maintenance begun at TMI-2, but that the krypton-85 gas be retained until an alternative system has been installed for its safe and efficient removal.

II. INTRODUCTION

The Nuclear Regulatory Commission's Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere is grounded upon the premise that immediate, less restricted access to the containment facility is necessary. Once that premise is accepted, it follows that krypton-85 in the atmosphere of the containment building must be vented, as the licensee proposes, because of the length of time needed to install equipment in order to remove the gas by alternative methods. This premise is false. We do not disagree that immediate access is at least highly desirable, if not necessary. Nor do we disagree that krypton-85 will have to be removed eventually from the containment building in order to proceed with the clean-up operation. We do <u>not</u> agree, however, that less restricted access is <u>immediately</u> necessary. Rather, now, without venting, the containment building can be entered for the purposes of inspection, maintenance and data gathering.

Unlike the general public, workers who enter the containment facility can be protectively clothed and equipped with self-contained breathing apparatus. Thus they will be protected from beta-particles emitted from krypton-85, which particles comprise 99.6 percent of the emitted irradiations and constitute the greater health hazard. In addition, these radiation workers will be carefully monitored for exposure to nuclear irradiation, an advantage not available to the general public.

While inspection, maintenance and data gathering proceed,, proper equipment can be installed at the TMI-2 site for safe removal of the krypton-85 gas without adverse health effects to surrounding communities. By the time this gas has been removed,a comprehensive Environmental Impact Statement on the entire clean-up process should have been completed. At this time actual clean-up can begin, with the assurance that the public will not unduly suffer as a result of that clean-up.

The NRC's refusal to acknowledge the feasibility of entry into the containment facility without venting places the agency, and the public it is supposed to protect, in a classic Catch-22. The public is asked to choose between intentional release of krypton-85 gas into the air that they breathe and the potential for further uncontrolled releases. The public is further asked to believe that intentional releases are superior to uncontrolled releases.

No release of krypton-85 gas is acceptable, intentional or otherwise. No release is necessary, intentional or otherwise.

The Environmental Assessment contains nothing to support the conclusion that an intentional release can be controlled in such a way as to prevent human and other environmental exposure to krypton-85. We believe that there are no such data in the Environmental Assessment because *no such data exist*. To permit krypton-85 releases,which involve some health dangers,without necessity is inconsistent with the ALARA standards, which require that radiation releases be kept to the absolute minimum reasonable.

There is a lack of supporting data for many other statements put forth and conclusions drawn in the Environmental Assessment. (Specific instances will be addressed in *Section IV. Insufficiency of the Environmental Assessment Data Base*.) Without supporting data, the public cannot possibly evaluate the conclusions drawn by the NRC. Hence, the public right to comment is rendered meaningless.

It appears that the reason for the lack of supporting data lies in the fact that the NRC staff has relied largely, if not entirely, on information it has received from its licensee in assessing the request for venting, its necessity, and alternative methods for the removal of krypton-85 gas. As a result, throughout the document, the virtues of venting krypton-85 from the TMI-2 containment building atmosphere are extolled, while potential adverse health effects are either downplayed or blatantly ignored. Although four alternative methods are considered in the Assessment document, in these cases the potential adverse health effects are maximized, as are their costs and delays in implementation.

It must be obvious to all that the licensee has a particularly strong vested interest in skewing, at least subconsciously, the information it submits to the NRC in order that the least expensive alternative is rendered most tenable. For this reason it is imperative that the NRC seek independent assessment of the issues at stake in venting of krypton-85. It is time for the agency to take charge of the most severe commercial nuclear accident in the history of the United States, and, in so doing, to make public health, safety and welfare top priorities of the Nuclear Regulatory Commission. The failure of the NRC to do so only hastens the demise of the nuclear industry.

Even though the NRC has conducted one psychological survey of its own, is aware of 14 other studies on the psychological stress induced during the accident at TMI-2 and in the year afterward, and has been confronted by hostility in public meetings concerning the proposed venting of krypton-85, it remains oblivious to these concerns in the Environmental Assessment. (These considerations will be expanded in *Section III.B. Psychological Effects of Venting*). Through continued display of this struthian attitude, the NRC only aids and abets public distrust and hysteria.

Finally, it should be made clear that the NRC is guilty of illegal segmentation of the TMI-2 clean-up process in the issuance of this Environmental Assessment. Nuclear Regulatory Commission regulations, N.E.P.A. and CEQ guidelines all require that the NRC prepare a programmatic Environmental Impact Statement *prior to any clean-up actions*, where such actions are major and will significantly affect the quality of the human environment. Through its isolation of the krypton-85 venting from the TMI-2 accident and the clean-up process itself, the NRC ignores the fact that the public and the environment have already been exposed to huge quantities of irradiation, and that future additional exposures are likely as the clean-up proceeds. At the time of the accident and the two weeks following, the public and the environment were exposed to at least 20 million curies of

released radionuclides, mostly fission products of uranium-235. Given these huge prior releases of irradiation, it is totally unacceptable for the NRC to rely as it does upon:

- the requirements of 10 CFR Part 20,
- the design objectives of Appendix I to 10 CFR Part 50,
- the limits of 10 CFR Part 100, and
- the applicable requirements of 40 CFR Part 190.10;

in determination of the nature of further planned releases of radionuclides which it will permit to be released. To do this is a misplaced attempt by the NRC to hide behind extant, irrelevant regulations and to ignore the realities of the accident at Three Mile Island. (See *Appendix E. NRC Advocacy.)*

Although krypton-85 emissions include gamma irradiation only 0.4 percent of the time, there is sufficient krypton-85 in the containment building atmosphere to provide about 0.8 rem/hour whole body gamma irradiation. Another 1.2 rem/hour whole body gamma irradiation comes from the containment walls and sump. Hence, venting the krypton-85 would decrease total gamma irradiation by only 40 percent, allowing workers 2.5 hours of access time instead of the 1.5 hours they have at present.

III. POTENTIAL HEALTH EFFECTS OF PROPOSED VENTING

"Despite widespread recognition of the hazards of radiation, there is no comprehensive program to protect the public from its hazards."

- E. B. Staats, Comptroller General
U.S. General Accounting Office (1)

A. Adverse Health Effects of Krypton-85

The major contaminating radionuclide of the containment building atmosphere at TMI-2 is krypton-85, a noble gas. In this sub-section, we discuss adverse health effects of krypton-85 and xenon-133, another radioactive, noble gas released by nuclear fission of uranium-235. We also briefly discuss other radioactive isotopes which may contaminate the containment building atmosphere as aerosols or particulates derived from the sump. Since krypton-85, if released into the environment, will interact with humans as a source of low level irradiation, these effects in general will be discussed in the following sub-section.

Common misconception has it that radioactive, noble gases are not dangerous because they neither travel through the food

chain nor are they metabolized by the human body. This is obviously not the attitude of the NRC as they propose to vent the containment facility of krypton-85 in order to render the building safer for data collection and equipment inspection and maintenance. Yet, if this 57,000 curies of krypton-85 is released, it will persist in the environment for long periods due to its slow rate of decay (half-life of 10.7 years) and its inertness (2).

Krypton-85 is dangerous any time it becomes juxtaposed with any portion of the human body. The gas decays to rubidium-85, a stable isotope, releasing an energetic (0.67 MeV) beta-particle in the process. Rarely, only 4 per 1,000 disintegrations, krypton-85 also releases a gamma ray as it decays. Like any other radionuclide, krypton-85 is especially dangerous in high concentrations, as in the containment facility atmosphere at present. As it is more than five times as dense as air, krypton-85 tends to seek out and accumulate in low-lying areas unless adequately dispersed by high convection and therefore may also be found in high concentrations in th environment if the proposed venting is initiated (See *Section V. Meterologic Criteria for Venting*).

The major target organ at risk to high concentrations of atmospheric krypton-85 is the lung, which will be exposed to both beta-particles and gamma rays resulting from radioisotopic decay. Outside the lung, these beta-particles travel less than 6 feet in air and are blocked by clothing, so that exposed skin is the only organ affected if within a few feet of the isotope. The beta-particle travels less than 1/10th inch in human tissue (3).

The gamma rays, on the other hand, may travel for miles in air and are not blocked by protective clothing. The human body is transparent to gamma irradiation. Hence, to a protectively garbed worker or to a person more than six feet away from the plume, only the gamma irradiation of krypton-85 is important, whereas for an unprotected worker or a person enveloped in a krypton-85-containing plume, beta-particle emissions are more important.

Although krypton-85 is poorly soluble in water, it may be transported by the circulatory system to fatty parts of the body where it accumulates (4). This is due to the partition coefficient of krypton-85 of 0.5 air-to-fat (3). Krypton-85 retention by experimental subjects has been shown to be proportional to their percent body fat (5). Fat pads which become impregnated by krypton-85 for long periods include those of upper thighs and buttocks and those of the female breast (6). These areas are important because thighs and buttocks reside close to the gonads of both men and women, and irradiations arising there may give rise to birth defects due to irradiation of developing germ cells. The female breast is acutely sensitive to radiation-induced carcinogenesis (7). In the case of this organ, beta-particles, which produce much more damage per ion track than the gamma rays,* are emitted less than 1/10th of an inch from their target epithelial cells in the mammary ducts or glands (8).

*Ionizations (free radicals) per ion track are measured in terms of linear energy transfer (LET), which determine the radiobiological effectiveness (RBE) of radiation.

Although krypton-85 is not employed for radiospirometry, another krypton isotope, krypton-81, is currently being adopted with some success (9, 10). More epidemiologic evidence is available from studies with another radioactive, noble gas, xenon-133, which has been used for the past six years in radiospirometry (11). Initial results show substantial retention of xenon-133 by lung (12) and bladder (13) and a correlation with specific organ site carcinogenicity (14). Another radioactive, noble gas, radon-222, has been well-studied and is highly carcinogenic, especially for the lungs. As radon-222, unlike krypton-85, is transuranic, we shall not discuss its carcinogenic properties further here.*

In conclusion, individuals who have breathed krypton-85 are at an increased risk to cancer of the lung and of organ sites with high fat content. They also are at increased risk to bear children with birth defects due to genetic mutations introduced into the germ line by irradiation of gonadal tissue.

No mention was made in the Environmental Assessment of other potential atmospheric contaminants in the containment building, such as strontium-90, cesium-137 or any of the transuranics, such as plutonium-244, which are present in the sump due to both normal contamination of coolant water by fission products and wide-spread disintegration of fuel-rod cladding.** These reactive radioisotopes may contaminate the TMI-2 containment atmosphere as aerosols or particulates maintained by the 75°F, 90 percent humid condition.

*Although releasing an alpha-particle, its RBE is not too much greater than that of the 0.67 MeV beta of krypton-85.

**Resnikoff (15) has estimated this to be 75% on the basis of krypton-85 levels rather than the 31% estimate of NUREG-0557.

The Environmental Assessment is incomplete without a description of the atmospheric concentration of these isotopes and to what degree they will be removed by filtration prior to the proposed venting.

B. Adverse Health Effects of Low Levels of Irradiation*

"Exposure to ionizing radiation, in any dose except zero, results in a transfer of energy in discrete quanta, which may be responsible for DNA strand breakage and possible ultimate carcinogenesis." (16)

Although there has been a great deal of controversy surrounding the adverse health effects of low levels of human irradiation, it has become increasingly clear the *NO LEVEL OF RADIATION IS SAFE* (17-20). Ionizing radiation interacts with human tissue by creating a track of free radicals within the aqueous environment of cells. From less than a hundred to several tens of thousands of free radicals may be created per ion track as the particle or ray transcends human tissue. The number of free radicals produced per ion track depends upon the energy of the particle or ray -- its mass, speed and charge if it is particulate (alpha or beta); or its frequency if it is a photon (gamma or x-irradiation). It is rare that the particle or ray itself intercepts DNA, the chemical blueprint which passes along genetic information as cells divide and individuals produce progeny. More often, genetic damage is induced by radiation when one of

*See *appended affidavit by Karl Z. Morgan, Ph.D.*

the highly reactive free radicals produced along the ionization track diffuses a short distance and interacts with a base in DNA to alter it functionally. Altered bases in DNA are unable to pair with complementary bases in the opposite strand of the DNA duplex and are often repaired by excision and replacement utilizing the opposite DNA strand as template. Following the excision of a damaged DNA base, it is occasionally replaced at random with any of the four possibilities—adenine, guanine, cytosine or thymine.* This random replacement of a DNA base which has been damaged by interaction with an irradiation-produced free radical forms the functional basis of radiation-induced genotoxic effects, including mutagenesis, carcinogenesis and teratogenesis. (For a detailed analysis of the ideas summarized in this paragraph, please consult references 21-24.)

The above mechanism is described in detail in order to demonstrate how beta-particles or gamma rays emitted from krypton-85 are able to induce long-term adverse health effects in human populations, even at low levels of contamination by the radioactive gas. There is no threshold below which krypton-85 or radiation from any other source is not dangerous. This lack of a threshold for carcinogenesis has been difficult to prove experimentally due to the large number of test animals which must be employed to show statistically significant effects at low doses. As the major mechanisms of radiation-induced carcinogenesis are equivalent to

*Error-prone repair of base damage in DNA appears to be correlated with sensitive stages in the cellular replication cycle when the DNA is not accessible to normal repair enzymes (25).

those of chemical carcinogenesis, i.e., transmission of the radiation-induced insult by chemical free radicals, we may gain significant factual insight into the lack of a carcinogenic threshold from the recent "ED_{01} study"* performed with 24,000 mice and the chemical carcinogen 2-acetylaminofluorene (2-AAF). In this study, the lowest dose of 2-AAF utilized, 30 ppm, was so weakly carcinogenic that 5,000 mice were employed for this concentration alone. The results of this massive study, costing over $1 million, conclusively prove that there is no threshold below which chemical carcinogens fail to induce cancer, provided one employs a large enough population to see the effect (26). The ED_{01} study helps to define why low doses of radiation, which produce low concentrations of free radicals, have lower, but demonstrable, adverse health effects proportional to those seen at higher doses.

There are several human epidemiologic studies with ionizing radiation which confirm the adverse health effects deriving from low level exposures. From their evaluation of the benefits vs. the carcinogenic risks of mammography in 280,000 women involved in the Breast Cancer Detection Demonstration Project (BCDDP), the American Cancer Society and the National Cancer Institute jointly concluded that the risks outweighed the benefits for women under 50 who were asymptomatic and without family history of breast cancer (27). Despite the low doses of

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*Effective dose which affects one percent of the experimental test population.

x-rays used in mammography (a few millirems whole body irradiation, or a fraction of the annual background irradiation), it was concluded that more cancers were being induced by the procedure than were being detected in younger, asymptomatic women. This lack of a threshold for mammography frequency vs. incidence of breast cancer in women may be seen in the following Figure (28).

Figure 1

BREAST CANCER INCIDENCE AS A FUNCTION OF NUMBER OF MAMMOGRAPHIES (28)

520 W. H. M. Ellett and A. C. B. Richardson

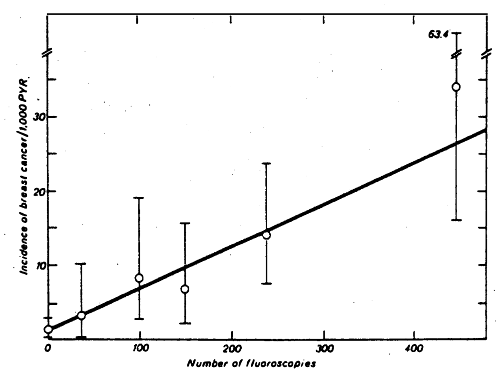

Figure 2
Incidence of breast cancer per 1000 persons per year at risk (PYR). The error bars represent 90% confidence intervals, and the line is the best-fitting, weighted, least-squares regression line.

Recently, similar restrictions have been suggested for other radiological diagnostic procedures by the American Cancer Society (29). These radiological diagnostic procedures, such as annual chest and dental examinations by x-ray, also expose people to fractions of the radiation dosages received from natural background sources. Yet they are deemed carcinogenic hazards by the ACS and may be inducing more long-term adverse health effects than they discover, if over-utilized. It has long been observed that radiologists, even with modern shielding, are at an increased risk to develop cancer (30).

The comprehensive report by the U.S. National Academy of Sciences on the biological effects of ionizing radiation (BEIR) concluded that low level irradiation from all sources combined would eventually be responsible for the induction of 220,000 cancers in our present population (31). Background irradiation is a fact of life, but is by no means innocuous. Background irradiation fluctuations have been associated with human cancers (32), congenital malformations (33) and birth defects (34). *The human genetic legacy is a fragile thread which accumulates rather than casts out genetic aberrations. We cannot tolerate any further insult to our pool of DNA, this core of our genetic legacy.*

A continuing source of contamination with low level irradiation derives from fission products associated with atomic testing programs and the production of power from nuclear plants. Sections of southwestern Utah suffered 2.5 fold increases in leukemia in the years following atomic testing at the Nevada test site some 100 miles to the west (35.)* Following a large

*See *Appendix B. Atmospheric Testing.*

series of atmospheric tests in the southern Enewetak atoll, children were born without thyroid glands (athyroidism) in the northern atoll (36). A similar iodine-131 release from TMI-2 for two weeks after the accident may have increased the number of hypothyroid births in Lancaster county to ten times the expected frequency (37). In four counties downwind from the reactor (Lehigh, Lebanon, Schuylkill and Berks), there were no cases of hypothyroidism before the TMI-2 accident and eight cases after (equivalent nine month periods, ref. 37). In 56 counties of Pennsylvania upwind from the reactor, the hypothyroidism frequency was eight in the nine months before and six in the nine months after the accident, in which it was admitted that 15 curies of iodine-131 were released* (38). (See *Appendix C. Fetal Hypothyroidism.)*

Similar increases in adverse long-term health effects have been seen in high cancer rates, especially leukemia, multiple myeloma and pancreatic cancer, among workers in Hanford and Portsmouth nuclear naval shipyards (39-43).

Perhaps the most compelling treatise on the "Biological Effects of (Low Levels of) Ionizing Radiation" may be found in the Heidelberg Report (44), which cites some 40 references in addition to those described above. The essential conclusion of this comprehensive treatise is as follows:

> "Even small radiation doses (mrem range) are able to cause impairment of vital organs and manifest

*Takeshi (45) has independently calculated that over 5,000 curies of iodine-131 were released on the basis of xenon-133 levels.

and fatal disorders of the organism. Many results of radiobiological experiments and extensive statistics prove this. In particular, many irradiation experiments have been performed on animals in order to determine the risk to man of radiological testing and handling methods." (44)

C. Psychological Effects of Venting

Although their findings may have been premature,* the Kemeny Commission concluded that the only adverse health effect of the accident at TMI-2 was severe psychological stress (38). This severe psychological distress continues to exist today, exacerbated each time the citizens of communities proximate to TMI-2 learn of accidental or new or planned releases of radionuclides into their air or water supplies.

The Nuclear Regulatory Commission has sponsored a study of psychological stress as a result of the TMI accident (45). Yet no information from this study, or 14 other studies acknowledged in the Addendum 1, was included in either the Environmental Assessment or its addenda (see *Section IV. Insufficiency of the Environmental Assessment Data Base*). From recent hearings with the NRC, both in Washington, D.C., and in the communities proximate to TMI-2, it is safe to assume that a great measure of distrust exists and that severe psychological stress has continued and will increase in the eventuality that the proposed venting is initiated.

*The Report was issued seven months after the accident, two months short of normal human gestation and 5-30 years short of the latent period for cancer development.

The adverse health effects induced by severe psychological stress are difficult to measure, but they are capable of profoundly and irreparably changing peoples' lives. There is no doubt that the proposed release of krypton-85 gas into communities adjacent to TMI-2 will adversely affect the psychological health of people residing in these communities. For this reason alone, krypton-85 should not be removed from the TMI-2 containment building atmosphere by venting or purging into the outside air.

For further information relevant to this sub-section, please consult the attached affidavit by Robert W. Colman, Ph.D., a psychologist registered in the Commonwealth of Pennsylvania and Appendix A. Psychological Stress.

D. Risk to Workers

The following Table outlines the levels of radiation hazards to workers inside the TMI-2 containment building atmosphere before and after the proposed venting of krypton-85 gas.

Table 1

TMI-2 CONTAINMENT FACILITY ATMOSPHERIC IRRADIATIONS

Protective Clothing	Venting	Kr-85 beta	Kr-85 gamma	Other gamma
Without	Before	150 rad/hr*	0.8 rem/hr	1.2 rem/hr
	After	0 rad/hr	0.0 rem/hr	1.2 rem/hr
With	Before	0 rad/hr	0.8 rem/hr	1.2 rem/hr
	After	0 rad/hr	0.0 rem/hr	1.2 rem/hr

*Skin dose, equivalent to about 75 rad/hr lung dose (3)

It is readily seen from Table 1 that the dangers from exposure to krypton-85 beta-particles in the containment facility, which are by far the more hazardous to human health, may be reduced to zero either by the proposed venting or by protectively suiting the workers in decontamination suits equipped with self-contained breathing apparatus. The health risks to workers inside the containment facility from gamma irradiation are not diminished by protective clothing. As 60 percent of this gamma irradiation (1.2 rem/hr whole body dose) emanates from the containment facility walls and sump, the proposed venting of krypton-85 would reduce gamma exposure by 40 percent.*

If a worker were to receive his/her permissible quarterly quota of gamma irradiation (3 rem, assuming protective clothing and extrinsic air supply), it would be possible to remain in the containment building for 1.5 hours at present. Venting of the krypton-85 gas to the outside air would only increase this maximal exposure time to 2.5 hours.** Thus, by hiring more workers to do the data collection, maintenance and survey work, the licensee can avoid exposing the public unnecessarily to krypton-85, in line with the tenets of the ALARA concept, while at the same time not increasing the adverse health risks to each individual worker.

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*The Haller Report (46) puts the krypton-85 contribution to gamma irradiation at 25 percent, which figure Commissioner Hendrie has judged too small (47). We derive 40 percent from the estimates of a spokesman for the re-entry team (48).

**The re-entry team spokesman's estimate was an increase from 1 to 1.5 - 1.75 hours (48).

Radiation worker access times of up to 90 minutes are long in terms of routine inspection, maintenance and repair activities associated with the nuclear industry (49). In some cases, such as the routine welding of thermal exchanger plates which lose their seals frequently due to stress induced by high temperature differentials on the two sides of the plates, these worker access times are as short as *one minute* (50). The gamma irradiation levels inside the containment facility at TMI-2 at present are not high in terms of the nuclear industry.

It should be made clear here that we are not arguing that it is safe for radiation workers to go into the containment facility for any period of time, as *any amount of radiation exposure is dangerous to human health.* We are merely arguing that, given that the licensee must gather data and both inspect and maintain extant equipment while preparing a comprehensive Environmental Impact Statement for the clean-up operation, these activities may proceed at present in the absence of venting the krypton-85 without further increasing the risk to workers.

The worker is at a distinct advantage when dealing with the health hazards of krypton-85 as compared to the citizen outside the containment facility. He can be protectively clothed in an air-tight suit completely impermeable to penetration by either atoms of krypton-85 gas or the beta-particles emitted in 99.6 percent of the disintegrations by the gas. He can be monitored for gamma irradiation arising from 0.4 percent of the krypton-85 disintegrations in order to limit whole body exposure. These advantages protect the worker from skin, lung and whole body doses of irradiations associated with krypton-85 gas.

In addition, the worker has agreed by contract to enter the containment facility and take part in the data collection and equipment inspection and maintenance, activities for which he will be compensated by the licensee. No such informed consent exists for the public, however, who have neither approved of the proposed venting nor are guaranteed compensation should they suffer adverse health effects from the krypton-85 gas.

> "We just don't expose people to radiation.
> It has to be for a really good reason."
>
> - A physicist employed by GPU, parent utility of the licensee (51).

We agree totally with the spirit of this sentiment, not only for the workers inside the containment facility, but also for the public on the outside as well.

E. Increased Risk to People in Surrounding Communities

The accident at TMI-2 and the contamination of the environment by radionuclides therefrom will provide the first large prospective study of low-level radiation health effects on human populations. This is the conclusion of an article published in the British Medical Journal (52). The population mentioned are innocent people, potentially victimized by an accident in which they had no part, who are now asked once again to be used further as guinea pigs by the Environmental Assessment.

As was discussed in *Sub-section III.B.*, there is no known threshold below which radiation fails to induce cancer. This lack of a threshold is inherent in the "person-rem" concept, utilized

extensively throughout the NRC Environmental Assessment. The person-rem concept treats the product of population and radiation dose to which the population is exposed as a constant, regardless of population size or radiation dose. For example, *the total adverse health effects* of 1,000 person-rems will be the same whether 10 people are exposed to 100 rems each, or 10,000 people are exposed to 100 millirems. Of course the adverse health effects in the 10 people exposed to 100 rems each will be easier to find due to the small population size and a high proportion that will be adversely affected. Yet the same magnitude of total adverse health effects will be manifest in the 10,000 people receiving 100 millirems, albeit now a much smaller fraction of this larger populace will be affected. The reason the person-rem concept is valid is that the targets for radiation-induced carcinogenesis (or mutagenesis) are not people, but *cells*. The mechanisms by which radiation irreversibly transforms cells to the malignant state were discussed in *Sub-section III.B.*

Continuing our example above, if 1,000 person-rems irreversibly alter a total of ten human cells, these ten altered malignant precursor cells could be distributed one each to all 10 in the smaller group receiving 100 rems. In this case, each individual will potentially develop cancer, dependent upon such vagaries as the immunological health of the individuals during the subsequent 5 - 30 year latent period for cancer development. More than likely, because of random probabilities (determined by the Poisson equation), in our smaller group of 10, two will develop two malignant precursor cells due to carcinogenic "hits" by radiation, six more in the group of 10 will develop one malignant precursor clone each, and two will escape unscathed. With the 10,000 population exposed to 100 millirems each, however, the ten malignant precursor cells will be distributed to ten different individuals. So, in essence, the number of potentially afflicted individuals increases slightly the *lower* the irradiation dose.*

Cells which are irreversibly altered in their DNA may either give rise to cancers, if they are somatic cells, or birth defects in subsequent generations, if they are spermatogenic or oögenic cells. *A SINGLE ALTERED CELL FORMS THE BASIS OF BOTH CANCERS AND BIRTH DEFECTS.* In addition, if a fetus is irradiated, a clone of cells arising from the irreversibly afflicted cell may be obliterated or severely altered, forming the functional basis of congenital malformations. It is well known that radiation is carcinogenic, mutagenic and teratogenic. The point here is that, as a single cell is the target of such radiation-induced effects, and, as there is no threshold below which radiation fails to induce carcinogenic, mutagenic or teratogenic damage, *the beta-particles and gamma rays emanating from krypton-85 in the environment carry a real and measurable health threat to all people in communities surrounding TMI-2 who come in contact with krypton-85.* There is a potential

*This is seen even more clearly if only one person receives the entire 1,000 person-rems, i.e. a dose of 1,000 rems. The total effect is now one death, since 500 rems is the lethal dose of radiation in humans.

health threat from even one atom of krypton-85, depending upon when it spontaneously disintegrates. At present there are approximately 3 x 10^{25} atoms of krypton-85 (50 moles) in the TMI-2 containment building atmosphere. Within the next 10.7 years, half of these atoms, 1.5 x 10^{25} (15 septillion), will disintegrate whether they are still in the containment facility, stored in a condensed state in a few gas bottles or scattered amongst the fat pads of people in adjacent communities following the proposed venting. The disintegration of just one krypton-85 atom releases a beta-particle which creates thousands of free radicals as it travels 2.5 mm in human tissue. If a single free radical so produced intercepts DNA and induces irreversible alteration, we now have a precursor cell for one of the adverse health effects we have considered above.

In the Environmental Assessment it is proposed that the 57,000 curies of krypton-85 be released into the environment in 60 days.* The person-rem concept outlined above belies the entire premise of the dilution of this radionuclide into the environment. Surely it will be difficult, if not impossible, to prove that any radiation-induced adverse health effects have arisen from krypton-85 released into the atmosphere around TMI-2. Yet more adverse effects may befall the community outside the containment facility than inside, were the krypton-85 to be retained, due to the 1,000 to 4 ratio of beta-particle to gamma ray emissions. For this

*In Addendum 2, the NRC proposes to lessen this release time to five days. Increased health hazards inherent in a lessened krypton-85 venting time will be dealt with in a separate comment.

reason alone, venting of krypton-85 into the air of the environment outside the TMI-2 containment facility should not be attempted. We find the apparent attitude of the licensee, a willingness to trade off slightly increased adverse health effects from gamma irradiation to its workers for potentially more detrimental health effects to the population at large, from beta irradiation, an irresponsible stance.

In the next two paragraphs we present dose estimates for maximal and average contaminations of the environment by the proposed krypton-85 release in order to assess potential adverse health effects.

In the case of maximal contamination by krypton-85, we assume venting of 1,000 curies within 6 hours into a steady wind of 10 knots, which plume intercepts a quiescent valley within a few miles of Three Mile Island. Since krypton-85 is heavier than air, it could easily settle into this valley, similar to fog which accumulates in low lying areas overnight. The 1,000 curies released represent 10,000 cubic feet of presently contaminated air or larger volumes once the "bleed and feed" cycles have been initiated. If we assume that 5,000 cubic feet of this contaminated air descend into a inhabited valley of one million cubic feet to a depth of 20 feet, then the habitable zone of this valley could become .5 percent contaminated by krypton-85-containing air from the reactor building. Krypton-85 easily seeps into cracks around doors and windows, or even more easily enters if either of these are open. The dose to each occupant could be 25-30 millirems whole body gamma irradiation and 6 rads skin dose (3 rads lung dose) of beta-particles in a single night.

Although the above scenario is quite possible for people residing near TMI-2, the population within a 50-mile radius around the reactor would receive on the average a much smaller dose of irradiation from krypton-85. In our calculations,* we assume the following: 1) that 2,000,000 people live within a 50-mile radius of TMI-2; 2) that the population everywhere encounters the diluted krypton-85 gas for at least one day out of the 60 days proposed venting; and 3) that on the days of krypton-85 exposure, the air from the containment building has been diluted one-million fold (to 10^{-6} µCi/cc) prior to human contact. Using these parameters, we conclude that 10 cancer deaths could be induced by the venting of the 57,000 curies of krypton-85 from the TMI-2 containment building atmosphere.

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*Calculations:

1) In a population of 2,000,000, 20 cancer deaths can be expected to be induced per 10 mrad dose per year (53).

2) The radiobiological effectiveness of both beta-particle and gamma ray emitted from krypton-85 is about 1, therefore for these irradiations mrad = mrem.

3) Hence, combining (1) and (2), for each 10 mrem dose, we can expect 20 eventual cancer deaths.

4) For krypton-85, 10^{-6} µCi/cc/day = 4.8 mrem (54).

5) Hence, for one day's exposure to 10^{-6} µCi/cc of krypton-85 in the population considered we will have 20 x 4.8/10 = 10 cancer deaths.

IV. INSUFFICIENCY OF THE ENVIRONMENTAL ASSESSMENT DATA BASE

There is a paucity of data in the NRC Environmental Assessment. The public is once again being asked to "Take our word for it." In the face of the Rassmussen report's prediction that an accident such as the TMI-2 "occurrence" could happen only once every 20,000 reactor-years (55) and the underestimates of both time and resin efficiency needed for the EPICOR-II clean-up of water from the auxiliary building (56), plus repeated misstatements, both during the course of the TMI accident itself and its aftermath, neither the NRC nor its licensee retain public credibility. (See *Appendix D. Leaks and Coverups.)*

Both the NRC's statutory mandate and its responsibilities to the public in this unprecedented situation bar any NRC authorization for release of krypton-85 without a full determination that such action is the safest and most practicable alternative available for removal of this gas from the TMI-2 containment building atmosphere. NRC has not adequately considered that variety of factors which bears upon the dangers to the environment and to public health by its proposed venting of krypton-85. In the following paragraphs, we address various sectors of the Environmental Assessment which omit data essential for the interpretation of feasibility and health risks to communities proximate to TMI-2. We strongly urge that such information be made available and fully evaluated before any decision is reached concerning the proposed venting of krypton-85 gas.

Although three types of containment building atmospheric samples have been taken weekly for the past year, the Environmental

Assessment presents minimal information from only two of these approximately 150 samples. This information, that the containment air contained 0.78 μCi of krypton-85 per cc in November 1979 and 1.0 μCi/cc presumably in March 1980, could be taken to mean that radionuclides are continuing to be produced inside the reactor core and are accumulating inside the containment building. If so, at what rate are radionuclides being synthesized and at what rate are they accumulating? How will this potential accumulation affect the containment building atmosphere in the months after the proposed venting of the 57,000 curies of krypton-85 gas? Will further venting be necessary after the presently contaminated atmosphere has been purged? In order to validly judge what is happening in the containment building atmosphere, the public should be informed of the exact radionuclide concentrations on a week-by-week basis, information readily available to the NRC and its licensee.

What is the precise radionuclide inventory of the TMI-2 containment building atmosphere? In particular, as there has been extensive fuel rod damage, how much plutonium and other transuranic isotopes contaminate the atmosphere as aerosols or particulates produced in the sump?

There is no estimate in the Environmental Assessment as to how long a protectively clothed worker could spend maintaining and inspecting equipment or collecting data, either at present or after the proposed venting of krypton-85. This information is vital in the consideration of the necessity for venting. Similarly, there is no information as to the present need for equipment maintenance and inspection, although it is obvious that equipment will function both more efficiently and for a longer time under these conditions. The public, given the lack of urgency as defined by the Environmental Assessment, is hard put to believe that the present situation, which has existed for over one year, is an emergency. If there is such an emergency, given that a worker can spend up to 1.5 hours inside the containment facility before exhausting his or her quarterly quota of 3 rems, why isn't some data collection and equipment inspection and maintenance being conducted at present?

Although we are assured in the Environmental Assessment that "purging of Kr-85 to the atmosphere can be performed under well-controlled conditions," we are dubious that this is the case. Before controlled release is a credible concept, the following questions must be answered in a future Environmental Assessment:

1) What meteorologic criteria will be considered in determining whether to vent or not to vent?

a) Wind speed?

b) Wind direction?

c) Variations in speed and direction?

d) Relative humidity?

e) Barometric pressure?

f) Chance for an inversion?

g) Chance for precipitation?

2) How long will the period of venting last on an "ideal" day?

3) At what time of day will venting be initiated?

Fearless forecasts notwithstanding, each of us knows the vagaries of the weather to be virtually unpredictable and certainly uncontrollable, more susceptible than any other aspect of our environment to the whims of Mother Nature. "Well-controlled conditions" are never defined in the Environmental Assessment. We suspect they do not exist. However, such conditions, if definable, must be clearly explicated in the Environmental Assessment for an adequate public assessment of potential adverse human health risks inherent in the venting of krypton-85 gas from the containment facility.

Presumably the function of monitoring is to shut off the venting process if too much radioactivity is detected off-site due to insufficient diffusion and dilution of krypton-85 into the outdoor air. Yet there are no monitoring criteria spelled out in the Environmental Assessment. How many monitors will be placed around the containment facility? At what distances will the monitors be placed? Will instantaneous monitors be available at 5 miles? Ten? Twenty? Fifty miles? Given that krypton-85 is over five times as dense as air, at what height will the monitors be placed? Will special monitors be placed in basements, wells and other low-lying areas? How many of the monitors will be manned? Will they be manned for the entire venting period, which may be up to 24 hours per day? How many electronic, remote-sensing monitors will be deployed? How many will be film-type, giving indications of excessive radiation doses only in retrospect? In order to be of use in controlling the proposed venting of krypton-85, these monitors must provide instantaneous data relevant to radioactivity densities (fluxes) in all directions from the TMI-2 facility for distances up to 100 miles away (see *Section V. Meterologic Criteria for Venting*). The Assessment provided by the NRC gives no assurance whatsoever that this will be the case. High school science teachers are to be trained as monitors. How many? For what periods of time will they monitor, during or after periods of venting, or both? When will these high school science teachers complete their training course? What funds are available for their training and employment as monitors of krypton-85 diffusion?

The data base of the Environmental Assessment is also woefully deficient in information concerning psychological stress to surrounding communities even though a plethora of such data is available. In Addendum 1 the NRC has outlined fifteen separate studies which analyze the psychological stresses induced by the TMI accident and by subsequent releases of radionuclides. One of these studies, that conducted by the Mountain West Research and Social Impact Research groups, was supported by the NRC itself (45). Yet none of the results of this or any of the other psychological studies has been made available in either the Environmental Assessment or its appendices.

The following questions must be answered concerning psychological health in order to assess the impact of krypton-85 venting on the well-being of populations in nearby communities:

1) What are the results of the fifteen psychological studies, especially as relevant to potentially severe stress which may be induced by the proposed

venting of krypton-85 gas from the TMI-2 containment facility atmosphere?

2) What will be the effects on any population for which monitoring has revealed excessive radiation exposures warranting immediate cessation of venting?

3) Is evacuation being considered for populations receiving excessive doses due to meteorologic uncertainties, e.g., a sudden inversion, and what would be the effect of such an order for evacuation on the psychological health of the so-ordered community?

4) What are the chances of civil disobedience if the proposed venting of krypton-85 gas is initiated?

V. METEOROLOGIC CRITERIA FOR VENTING

The least credible section of the Environmental Assessment deals with meteorologic criteria for venting of the krypton-85 gas from the containment building atmosphere at TMI-2. Constant assurances notwithstnding, there is no adequate way to control the weather. Furthermore, as extensively addressed in the previous section, there are no supporting data for the methodology of assessing which meteorologic criteria are beneficial for venting, how long and under which conditions venting would occur and how frequently venting would be accomplished under ideal conditions.

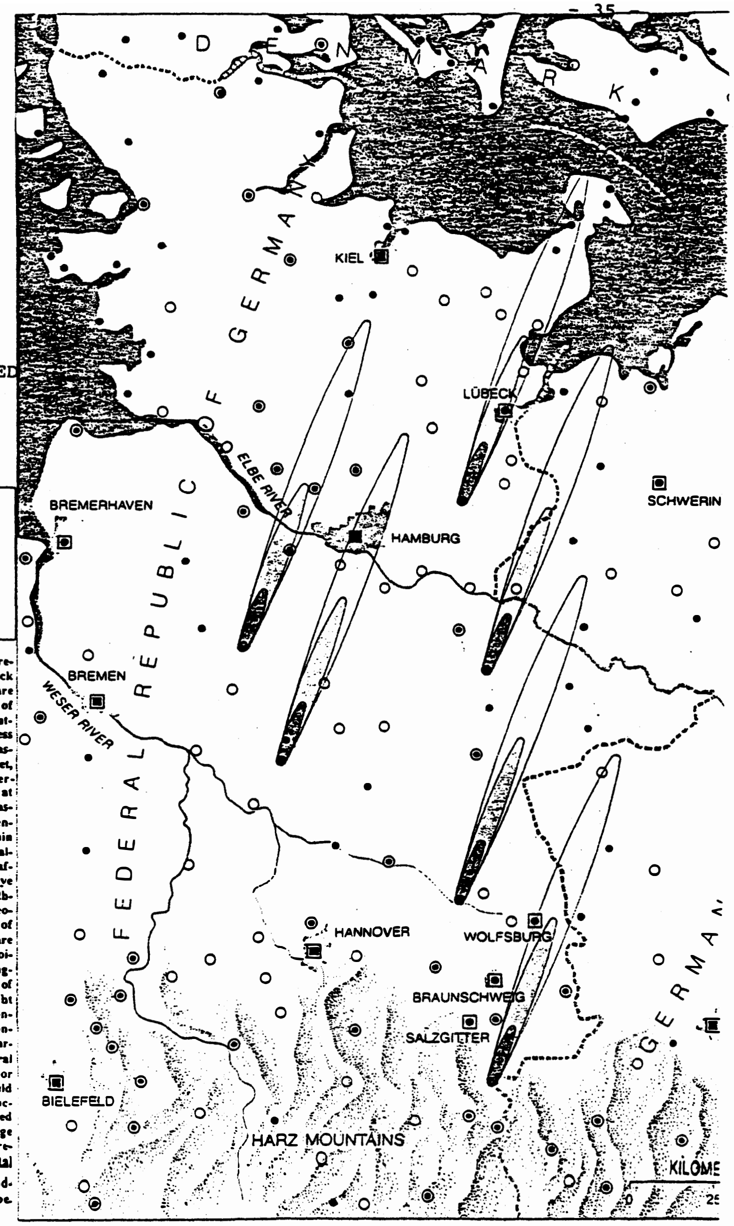
Krypton-85 is approximately five times denser than air and therefore settles into low-lying areas such as valleys and basements in the absence of adequate convection. The proposed venting will take place from a 160-foot stack. On a calm day, the krypton-85 will settle in a uniform pattern around the base of the stack and then spread outward by diffusion in all directions, seeking out and being retained by low-lying areas. Although windy days provide immunity from krypton-85 contamination upwind, downwind there may be a greater concentration of the radionuclide than there would be on calm days. Depending upon wind speed, fluctuations in wind speed, wind direction and fluctuations in direction, the krypton-85 may travel with the plume for miles downwind with relatively little dispersion until it is stalled by either a geographical or meteorological obstacle, at which point krypton-85 would tend to settle out of the plume. In gas warfare, advantage is taken of these properties of plumes to intercept and decimate enemy stations (see Figure 2, next page, ref. 57).

Figure 2

PLUME DISPERSION PATTERNS AS EXPLOITED IN GAS WARFARE (ref. 57)

- 0–10,000
- 10,000–25,000
- 25,000–100,000
- 100,000–250,000
- 250,000–1,000,000
- MORE THAN 1,000,000

POTENTIAL CIVILIAN CASUALTIES resulting from a hypothetical chemical attack on a battlefield in north-central Europe are suggested by the equal-dosage contours of this map. The solid colored dots represent battalion-size targets (a square kilometer or less in area), each attacked with GB bombs releasing a total of six tons of nerve gas per target, a quantity intended to inflict about 20 percent casualties on troops carrying but not at first wearing gas masks. The weather is assumed to be cool, dry and overcast with a gentle southwesterly breeze. Most people within the light-color areas would be poisoned, although not fatally; their vision would be affected, and they would suffer protracted eye pain, headache and difficulty breathing. Within the medium-color areas unprotected people would be incapacitated for a period of days. The innermost, dark-color areas are those in which people would be severely poisoned; only young adults near the outer fringes of each area would have a good chance of surviving, and many of them would be brought to the brink of death, collapsed and in convulsions. Under more stable atmospheric conditions, for example at night with clear or partially clear skies, all the areas would be several times larger; under less stable conditions, for example in warm, sunny weather, they would be smaller. Normally there would be wind fluctuations over the 10-hour period considered here, altering the shape of the equal-dosage contours. The six attacks illustrated would release only a fraction of a percent of the total amount of nerve gas that could be expended in a large-scale chemical war in Europe.



Many of the nerve gases employed in such gas warfare have molecular weights below 100, i.e., they have analogous densities and dispersion patterns dependent upon meteorological conditions, as does krypton-85. In addition to these nondispersive plume effects, even in strong winds there is sufficient swirling and creation of low pressure vortices on the downwind side of the 160-foot stack to bring a considerable portion of the emitted krypton-85 cascading down to ground level at the point of emission (44).

The Environmental Assessment relates that "Kr-85 has the unique capability of infiltrating and diffusing through protective garments." This capability may not be as hazardous to workers within the containment facility atmosphere as to people on the outside, as workers can be outfitted with absolutely airtight suits such as those worn on the moon or during deep-sea diving (if need be). The infiltrating and diffusing capabilities of krypton-85, however, are much more insidious for farms and homes which may be intercepted downwind by the gas-containing plume. Closed doors and windows will provide little barrier against krypton-85.

It is not uncommon for noble gases such as krypton-85 and xenon-133 to be detected 100 miles or more from their source of emission. A few years ago, during an inversion in the Rhine Valley, krypton-85 was detected in Freiburg, 140 km (84 miles) from the closest nuclear power station, the Kernkraftwerk Süd plant at Karlsruhe (44). Following the accident at TMI-2, considerable xenon-133 was detected at Albany, NY, over 200 miles away from the reactor (58). These examples show that meteorologic dispersion patterns are often far from ideal, and may result in unanticipated contaminations of

radionuclides into urban areas 100 miles or more away. It bears repeating that some large urban areas are within 100 miles of TMI-2.

The NRC Assessment estimates that venting could be completed within a 60-day period. It is ambiguous from the Assessment itself as to whether this is 60 days' total elapsed time or 60 days of venting with interstitial non-venting days. From the comments of the second Addendum, however, it is possible to infer that the latter alternative appears more likely to be the interpretation intended by the NRC and its licensee. Initial venting would proceed, according to the Assessment, at 100 cubic feet per minute, increasing to 1,000 cubic feet per minute by the end of the purge. Mathematical calculations show that *continuous* venting according to this scheme would require 13.8 days. If the NRC and its licensee are proposing that venting be completed within a 60-day period, then venting must occur for an average of at least 6 hours per day. Although meteorologic criteria for venting were never defined in the Assessment, if we assume that these criteria are not met at least half the time, then the average venting period must be increased to 12 hours per day on the days permitting venting. Alternatively, the NRC and its licensee may anticipate that only one-fourth of the days will correspond to responsible meteorologic criteria, and that dumping of krypton-85 into the atmosphere on those days will be a 24 hour per day activity. Given the vagaries of the weather, this latter scenario seems especially dangerous. Hence, short pulses seem more sane, yet even 6 hour releases must be accomplished every day to keep on schedule. We are left with the impression that whatever the meteorologic criteria implied by the Environmental Assessment, they cannot be very stringent.

VI. MONITORING THE RELEASE OF KRYPTON-85

Ideally monitoring should provide a mechanism whereby people are protected from the adverse health effects posed by krypton-85 gas. Obviously the best possible protection of the populace is that they be exposed to *no krypton-85 gas*. Yet the Environmental Assessment provides such a sketchy description of the monitoring system that one wonders if the NRC really cares at all, or just threw this section in to pacify an hysterical public.

Many of the data needed for public assessment of the Environmental Assessment are missing (these points have been extensively addressed in *Section IV*). We now address what the monitoring system *should be* as there is insufficient information available in order to judge what it *is*.

Monitoring must be contemporary with krypton-85 release, that is, points downwind for up to 100 miles should instantaneously feed back krypton-85 levels to the emission site. Maximal permissible levels of, for example, 1.5 mrad/hr beta-particles must be established. If maxima are exceeded at any monitoring station, automatic shutdown of the venting operation must proceed immediately. Emergency provisions for evacuation of finite areas should be made ready in the event that certain higher levels, for example, 15 mrad/hr,

are achieved at any monitoring station. Although it would be useful epidemiologically, it will do populations no good at all in terms of preventive medicine to utilize passive monitors which will yield information days or weeks after high level exposures have been realized.

In several places in the Environmental Assessment, the NRC, and presumably its licensee, display callous, if not fraudulent, attitudes toward the tolerated maximal acceptable radiation exposures to the public. Scenarios which expose people up to 1700 mrem beta skin dose at the boundary site are exonerated as but "a small fractions of the limits set forth in 10 CFR Part 100." Yet, the footnote to this section of the *Code of the Federal Register* reads as follows:

> "The whole body dose of 25 rem referred to above corresponds numerically to the once in a lifetime accidental or emergency dose for radiation workers ... However, neither its use nor that of the 300 rem value for thyroid exposure as set forth in these site criteria guides are intended to imply that these numbers constitute acceptable limits for emergency doses to the public under accident conditions."

VII. LACK OF NECESSITY OF VENTING

> " ... the staff believes that it is in the best interest of the public health and safety to purge the reactor building promptly prior to completion of the Programmatic Environmental Impact Statement."

> "These potential pathways are sealed by seals which are presently inaccessible for maintenance because of high ambient radiation levels."

The above quotes are from the Environmental Assessment, pages 4-5 and 4-4, respectively. The entire Assessment is based upon the faulty premise that venting of the containment building atmosphere is vital to equipment maintenance and inspection and the collection of data. The public has been blackmailed into accepting this premise with the spectre of greater nuclear catastrophy hung over their heads, unless they accept and potentially breathe 57,000 curies of krypton-85 gas vented into their air. Yet venting is not vital to data collection or to equipment inspection and maintenance. These activities can be begun now by a protectively suited and masked worker. If, as the NRC and its licensee contend, equipment deterioration is imminent which may lead to core recriticality, why have workers not been performing these functions during the past year? Why are data collection and equipment inspection and maintenance not being conducted now? If indeed there is a state of emergency, why wait until we are all further imperiled, even during the 60 days of proposed venting?

Surely, as a part of the overall clean-up operation, krypton-85 must be removed from the containment building

atmosphere. Venting, however, is the least responsible means to achieve this end, a means to which the nuclear industry has become accustomed, as the average nuclear reactor releases about 1,300 curies of krypton-85 into the atmosphere each month. It is intolerable that our population is asked to accept this additional burden to its background irradiation load, let alone now to be subjected to 30 times as much, as is proposed in the Environmental Assessment. As Commissioner Gilinsky has pointed out, the 57,000-curie release of krypton-85 from the TMI-2 site would be greater than the sum produced by all operating reactors per year (59).

As there is no emergency and as workers can enter the containment building at present to initiate data collection and equipment inspection and maintenance, adequate time exists to implement responsible alternative methods for removal of krypton-85 from the atmosphere. These alternative methods are considered in the next section.

There is a consistent obfuscation of the issues in the justification section of the Environmental Assessment. "Less restricted access ... is necessary ..." is the phraseology frequently employed. Less restricted access to the containment facility is not *necessary*, it is merely economically *desirable* from the standpoint of the number of workers needed to complete a given job. That is, it is desirable because it is less expensive. The presently available 1.5 hours per worker access time would be only increased to 2.5 hours if all krypton-85 were vented. For every three hours of work inside the containment facility, the licensee must employ three workers now instead of two after venting.

Further obfuscation derives from the continual reference in the same section of the Environmental Assessment to not only "repair or replace nuclear instruments, to maintain the reactor building air cooling system," but also to "decontaminate the building, its equipment and piping," and even to "remove the fuel." These latter two references are clearly out of the purview of the Environmental Assessment and irrelevant to the issues described therein. It must be re-emphasized that submission of a complete Environmental Impact Statement must be accomplished before *any* issues of containment building or reactor core clean-up are addressed.

In summary, there is no necessity for venting the krypton-85 gas into the outdoor atmosphere in order to perform routine data collection and equipment inspection and maintenance within the containment facility. Protective clothing allows up to 1.5 hours work time for workers prior to receiving their quarterly quota. This is a much longer access time than available to workers involved in other routine inspection, maintenance and replacement functions associated with nuclear power plants (49, 50). There is adequate time to install alternative systems for krypton-85 removal from the TMI-2 containment facility atmosphere.

(See *Appendix E. Necessity of Venting.)*

VIII. ALTERNATIVES TO VENTING

The Environmental Assessment champions venting as immediately available and of short duration. In the absence of any emergency, this rationale means merely that venting is the least expensive alternative, since extant fans are able to blow krypton-85 gas out over filters and into the atmosphere outside. Four other advantages to venting are offered in the Environmental Assessment. These are listed below, along with our replies:

Advantage to Venting (E.A.)	Reply
1) Controlled releases can be maintained within applicable federal regulations;	1) Use of applicable federal regulations only evades public health responsibility;
2) Purge has a small general population accident dose impact when compared to other alternatives;	2) As admitted in the Assessment, purge has the largest mrad population exposure of all methods;
3) Purging to the atmosphere eliminates the need for long term surveillance of Kr-85;	3) The gas with a half-life of 10.7 years will contaminate a large area for a long time;
4) Purging of Kr-85 to the atmosphere can be performed under well-controlled conditions ...	4) Releases cannot be controlled due to meteorologic uncertainty and monitoring difficulties.

Of these "other advantages," numbers (1) and (3) are answered in more detail below in order to introduce our discussion of alternatives to venting. We have dealt extensively with numbers (2) and (4) in previous sections of this comment.

The "applicable federal regulations" cited in the first "other advantage" above are the "design objectives of 10 CFR Part

50, Appendix I, and the applicable requirements of 40 CFR Part 190.10," which regulations are not to be exceeded. Currently these regulations allow for discharges which cause the ambient air to be no more than 10^{-5} µCi/cc of total radionuclides or to inundate a bystander with 25 mrem whole body irradiation or 75 mrem to the thyroid gland. It will be recalled that in *Section III* we created a scenario in which people were exposed to 25-30 mrem as a reasonably achievable high dose and that, if the population at large were exposed for a single day out of the 60 days of proposed venting to 10^{-6} µCi/cc krypton-85, an order of magnitude under the regulatory limitation, eventually 10 cancer deaths could arise within a 50-mile radius of Three Mile Island. There are no data in the Environmental Assessment which convince us that these estimates are exaggerated. In the latter of the two federal regulations cited, 40 CFR 190.10, the key word is "applicable." Not until January 1, 1983, will emission of krypton-85 be limited to 50,000 curies per gigawatt-year. But the regulation should be used at present as a guideline by the NRC, a clear signal to this *regulatory body* that these radiation releases should be kept to an absolute minimum whenever possible. Interestingly, in the past year, TMI-2 has produced only 2.4 megawatts from the residual heat in the reactor core, and, hence, by this rule would be limited to only 120 curies of krypton-85 emission, if this portion of the regulation were in effect at present. Even in the normal operating year, the proposed 57,000 curies would be twice too large to release over a one-year period, let alone 60 days. It is clear that the licensee hopes to evade its responsibilities

to the public in every way and to trade off as much public danger for reduced expense at TMI-2 as possible.

Similarly, the Environmental Assessment has been myopic in its insistence upon the "bleed and feed" method of purging gases from the containment facility. This method of air removal is clearly only beneficial for the venting alternative, since the subsequent purge cycles will be progressively more dilute with respect to krypton-85 concentrations. There are three alternatives to air removal by the "bleed and feed" method:

1) displacement,
2) internal removal of krypton-85, and
3) either of the above plus venting the krypton-85 residuum.

These alternatives for the removal of the atmosphere of the containment facility are discussed along with selective adsorption and cryogenic methodologies for krypton-85 capture in more detail below.

Displacement of the containment building atmosphere has the advantage of allowing the majority of the krypton-85 gas to be removed without dilution by outside air. This makes the total volume of air dealt with 2 million cubic feet instead of 23 million cubic feet by the "bleed and feed" technology in the Assessment, rendering concentration methods and eventual storage problems an order of magnitude easier. Displacement of the containment building atmosphere could be accomplished in a number of ways, and this should be considered a viable alternative to the "bleed and feed" method proposed in the Environmental Assessment.

A second alternative method for removal of krypton-85 from the containment building atmosphere without dilution by outside air is to place either a selective adsorption column or cyrogenic device within the containment building itself and continuously cycle the atmosphere through either of these devices. Should construction of either device be cumbersome within the containment facility, alternatively, either selective adsorption or cryogenic devices could be placed within the auxiliary building and fed with extant gas lines from the containment building, returning the decontaminated air to the containment via extant return lines.

Should either of these alternatives to dilution by outside air be feasible, it is possible that they could afford ≥ 95 percent krypton-85 removal in much shorter times than those predicted in the Environmental Assessment. With ≤ 5 percent of the krypton-85 remaining, it would be possible to reconsider a venting program for the remaining ≤ 2,350 curies over a 60-day period, or 40 curies/day. These releases, although still posing a finite health danger to the surrounding communities, would constitute less hazard than the exorbitant 1,000 curies/day of the Assessment.

We support as the method of choice for krypton-85 condensation the selective adsorption process. Liquid fluorocarbons have the advantage over other potential krypton-85 adsorbents, such as ammonium or benzene clathates, in adsorbing krypton at lower pressures and concentrations of the gas. If allowed sufficient interaction with the Freon 12, up to 99.9 percent of the krypton-85 may be removed in a single passage over the column and

the final, relatively pure krypton-85 tapped off and stored within a few 1.54 cubic foot gas cylinders. In practical reality, the final volume of krypton-85 storage would be most logically related to the temperature of the gas at various concentrations due to thermal emissions accompanying radioactive decay. Larger volumes of gas would facilitate less need for refrigeration, and vice versa. We recommend that these gas bottles be stored within the containment building, perhaps within a small concrete shed there constructed. Maintenance and monitoring for escaped radioactivity would be facilitated by extant equipment, and should some leakage occur, the public would be no worse off than at present with a containment building full of krypton-85 gas.

Should there be some unforeseen problems with the selective adsorption method, as a second alternative to venting, we support the cryogenic procedure, which employs liquid nitrogen to freeze krypton-85. This methodology is more elaborate than selective adsorption and, hence, more privy to pitfalls, such as contamination of the krypton-85 by oxygen and other gases. Also there may be more difficulty in storing the final, frozen product, should continued temperatures of -250°F be necessary. However, in our opinion, cryogenesis is definitely superior to venting, charcoal adsorption and gas compression as methods for krypton-85 removal.

The selective adsorption technology is available from the Nuclear Division of Union Carbide Company at Oak Ridge, TE, which is under contract to the Nuclear Regulatory Commission. Similarly, an extant cryogenic apparatus is available for purchase or leasing at the Limerick site, some 100 miles from Three Mile Island.

Finally, it must be re-emphasized that these alternative systems for atmospheric removal and krypton-85 condensation are not urgently needed at this time. There is no emergency at present. Either methodology for krypton-85 condensation, selective adsorption or cryogenesis, could be initiated and employed over the next 12-24 months without blocking data collection, equipment inspection and equipment maintenance within the TMI-2 containment facility.

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AFFIDAVITS AND APPENDICES

Comments to NRC Environmental Assessment on TMI-2 Venting

TMI Legal Fund

(215) 732 - 1928 x 50

AFFIDAVITS

OF

KARL Z. MORGAN

ROBERT W. COLMAN

Statement of Karl Z. Morgan Regarding Release of Kr-85 Into the Environment of Three Mile Island

Fortunately most of the noble gases available in the Three Mile Island Reactor Number Two and related facilities have decayed to insignificant levels since the accident. The Xe-131m (12 day half life) and Xe-133 (5.3 day half life) are at such a low level that they would be difficult to measure. Most of the Kr-85 (10.7 year half life) that was trapped in the system, however, is still there and is likely to be released to the environment in future recovery or decommissioning operations unless special precautions are taken. It is fortunate that the amount of Kr-85 present is very low because of the long half life and the short period of operations of this reactor before the accident.

In spite of the low population exposure from the release of the Kr-85, I believe measures should be taken to prevent this release. The reasons may be summarized as follows:

1. There is strong evidence that low level radiation exposure is far more harmful than was generally believed a decade ago and that the risk of radiation induced cancer increases with the accumulated radiation dose. Even a few cancers is not a good thing.
2. The ALARA philosophy would suggest that since it is reasonable to remove the Kr-85, we should take measures to do so in these operations.
3. Techniques for removal of Kr-85 are well developed but must be tested on a large scale before they are applied to nuclear reprocessing operations. This application at Three Mile Island could be considered a useful pilot study for future operations.

4. Because of the long half life and the inert property of a noble gas, the hazard from release of Kr-85 is one to the entire world. The risk probably drops off as the 2nd or 3rd power of distance from the release site but Kr-85 dose to the world population will be very significant after year 2000 if the nuclear industry continues to expand and if commercial fuel reprocessing is done on a large scale.

Thus, I believe this is an opportunity for the NRC in good faith to show support for ALARA and to conduct a valuable experiment that must be undertaken if nuclear energy is to have a long range future.

Karl Z. Morgan
School of Nuclear Engineering
Georgia Institute of Technology
Atlanta, Georgia 30332

Ruth O. Salley
Notary

Notary Public, Georgia, State At Large
My Commission Expires Oct. 3, 1980

Georgia Institute of Technology

BIOGRAPHICAL SKETCH

MORGAN, KARL Z. - Neely Professor

Education

A.B., University of North Carolina	1929
M.A., Physics, University of North Carolina	1930
Ph.D., Physics, Duke University	1934

Employment History

Lenoir Rhyne College, Chairman, Physics Department	1934-1943
University of Chicago, Metallurgical Laboratory	1943
Oak Ridge National Laboratory	
Director, Health Physics Division	1943-1972
Georgia Institute of Technology, Neely Professor	1972-Present

Experience Summary: During the period as Chairman of the Physics Department at Lenoir Rhyne College research in cooperation with Duke University in the field of cosmic ray showers, meson lifetime, etc., was carried out. While at the University of Chicago, Morgan was one of a group of six persons who developed and established the new science and profession of health physics. At Oak Ridge National Laboratory he was Director, Health Physics Division from its inception. He directed over 200 persons engaged in research, engineering, and applied activities. At Georgia Tech Morgan teaches courses in health physics, works with M.S. and Ph.D. students on their thesis programs, and is in charge of developing an undergraduate health physics curriculum.

Current Fields of Interest

Health Physics, radiation protection, diagnostic x-ray exposure, internal dose from radionuclides, environmental exposure, radiation protection standards, nonionizing radiation, safe operation of the nuclear energy industry.

Major Reports and Publications

Over 300 papers and publications have been written. Those of major importance over the past few years are as follows:

1. "Common Sources of Human Exposure to Ionizing Radiation in the United States," American Engineer, July 1968.
2. "Ionizing Radiation: Benefits Versus Risks," Annual Meeting of the Health Physics Society, June 16-20, 1968, Denver, Colorado; and published in Health Physics, Vol. 17, No. 4.
3. "Assumptions Made by the Internal Dose Committee of the International Commission on Radiological Protection," Sixth Annual Meeting of the Gesellschaft fur Nuclearmedizin, Wiesbaden, Germany, September 26-28, 1968; published in Proceedings, 1969.

Major Reports and Publications (continued)

4. "Redirecting Health Physics Studies to Areas of Greatest Interest," First European Congress of the International Radiaton Protection Association, Menton, France, October 9-11, 1968; Published in Proceedings, 1968.
5. "Development of Health Physics as a Profession," Proceedings of First International Congress of Radiaton Protection, Rome, Italy, Vol. 1, 3, Pergamon Press, 1968.
6. "The Need for Standardization Procedures in the Application of Ionizing Radiation to Medical and Dental Patients," Seminar sponsored by the National Center for Radiological Health, Rockville, Maryland, November 15, 1968, Seminar Paper 003.
7. "The Proper Working Level of Radon and Its Daughter Products in the Uranium Mines of the United States," Hearing on Radiation Standards for Mines, Washington, D.C., November 20, 1968; Congressional Record, 1968.
8. "Supplemental Statement on the Proper Working Level of Radon and Its Daughter Products in the Uranium Mines of the USA," Supplement to Testimony presented on November 20, 1968, Washington, D.C.; Congressional Record, 1968.
9. "Future Opportunities in Health Physics," Health Physics Society Midyear Topical Symposium, Los Angeles, California, January 29-31, 1969.
10. "Risks from Diagnostic X-Rays," Yale Scientific, Vol. XLII, No. 5, February 1969; Reprinted from Yale Scientific in the Journal of the American Radiography Technologists, Vol. XIV, No. 4, Winter 1969.
11. "Radiation Standards for Reactor Siting," Testimony presented before the Joint Committee on Atomic Energy at its Hearings on Environmental Effects of Producing Electrical Power, Phase 2, January 1970; Congressional Record.
12. "Energy Pollution of the Environment," Midyear Symposium of the Health Physics Society, Louisville, Kentucky, January 28, 1970; Proceedings published in USPHS-BRH Series, BRH/DEP-70-26, Oct., 1970.
13. "A Time of Challenge to the Health Physicist," Presidential Address presented before the Second International Congress on Radiaton Protection, May 8, 1970, Brighton, England; Health Physics, Vol. 20, May, 1971, pp. 491-498.
14. "My Opinion--You Can Drastically Cut X-Ray Exposure Below Today's Levels," Consultant, March/April, 1970.
15. "History of the Health Physics Society," published as part of the RSNA Symposium on the Crtical History of American Radiology (Nov. 1970)
16. "Standard Man-Standard Patient," Medical Radioisotopes: Radiation Dose and Effects, AEC Series 20, p. 87, June 1970.
17. "History of the International Radiation Protection Association," published in Proceedings of the RSNA Symposium on the Critical History American Radiology, November 1970.
18. "Criteria for the Control of Radioactive Effluents," IAEA Symposium on Environmental Aspects of Nuclear Power Stations, UN Building, New York, August 1970, Proceedings published, this paper is IAEA-SM-146/10; synopsis published also in Environmental Studies, 1971.

Major Reports and Publications (continued)

19. "Maximum Permissible Levels of Exposure to Ionizing Radiation," International Summer School on Radiation Protection, Boris Kidric Institute of Nuclear Sciences, Cavtat, Yugoslavia, September 20-30, 1970; Proceedings published in 1971 under title of "Radiation Dosimetry."
20. "President's Report on the General Assembly of IRPA," Brighton, England, May 1970, Health Physics, Vol. 20, No. 5, 1971.
21. "History of Radiation Protection," Symposium Commemorating the 75th Anniversary of the Discovery of X-Rays, Milwaukee, November 13-14, 1970; Materials Evaluation, Vol. XXIX, No. 3, March 1971.
22. "Why the 1968 Act for Radiation Control for Health and Safety Is Required," Radiology, Vol. 99, No. 3, pp. 569-588, June 1971.
23. "Excessive Medical Diagnostic Exposure," Third Annual National Conf. on Radiation Control, Scottsdale, Arizona, May 3, 1971; published in Proceedings.
24. "Health Physics and the Environment," International Symposium on Rapid Methods for Measurement of Radioactivity in the Environment, Neuherberg, Federal Republic of Germany, IAEA-STI/PUB/289, Vienna, 1971.
25. "Adequacy of Present Radiation Standards," presented at the Environmental and Ecological Forum, Silver Spring, Maryland, January 20, 1971; Proceedings of Forum published in 1972, USAEC-TIC-25857.
26. "Proper Use of Information on Organ and Body Burdens of Radioactive Material," presented at the IAEA/WHO Symposium on the Assessment of Radioactive Organ and Body Burdens, Stockholm, Sweden, November 22-26, 1971, IAEA/SM/150-50; Proceedings of Symposium published by IAEA.
27. "Health Physics Measures to Implement New USAEC Regulations Relating to Radiation Exposure of the General Public," Budapest, May 1971; Proceedings published by Akademiai Kiado, Budapest, Hungary.
28. "The Need to Reduce Medical Exposure in the United States," outline of testimony presented before the Health and Welfare Subcommittee of the Senate Committee on Labor and Public Welfare on Senate Bill S.3327, May 15, 1972, Washington, D.C.; published in Congressional Record, 1972.
29. "Comparison of Radiation Exposure of the Population from Medical Diagnosis and the Nuclear Energy Industry," Transactions ANS, 15:1, 64 (June 1972).
30. "Environmental Impact of Natural and Man-Made Ionizing and Non-Ionizing Radiations," Second International Summer School on Radiation Protection, Herceg Novi, Yugoslavia, Aug. 1973; Proceedings, 1973.
31. "The Need for Radiation Protection," Radiologic Technology, 44, 6, p. 385 (1973).
32. "Exposure in the United States," and "Mogliche Folgen einer Ubermassigen Medizinischen Strahlenbelastung in der Vereinigten Staaten von Amerika," Rontgen-Blatter, 27, 127 (March 1974).
33. "Reducing Medical Exposure to Ionizing Radiation," American Industrial Hygiene Journal (May 1975).

Major Reports and Publications (continued)

34. Two chapters in text, Environmental Problems in Medicine titled "Exposure to Non-Ionizing Radiation" and "Ionizing Radiation Exposure," W. D. McKee, Editor; Chas. C. Thomas Publisher, 1974.
35. "Types of Environmental Health Physics Data That Should be Collected and Evaluated in a Nuclear Power Program," in Environmental Impact Statements for Nuclear Power Plants, 1975, Pergamon Press, Chapters by K. Z. Morgan in test, Environmental Impact of Nuclear Power Plants, by R. A. Karam and K. Z. Morgan, GEORGIA INSTITUTE OF TECHNOLOGY SERIES IN NUCLEAR ENGINEERING, Pergamon Press 1975.
36. "The Bases for Standards and Regulations," in Environmental Impact Statements for Nuclear Power Plants, 1975 Pergamon Press, Chapters by K. Z. Morgan in text, Environmental Impact of Nuclear Power Plants, by R. A. Karam and K. Z. Morgan, GEORGIA INSTITUTE OF TECHNOLOGY SERIES IN NUCLEAR ENGINEERING, Pergamon Press 1975.
37. "Release of Radioactive Materials from Reactors" and "Ways of Reducing Radiation Exposure in a Future Nuclear Power Economy," in Nuclear Power Safety, GEORGIA INSTITUTE OF TECHNOLOGY IN NUCLEAR ENERGY, Pergamon Press.
38. "Transportation of Radioactive Material by Passenger Aircraft," Report to Joint Committee of Congress on Atomic Energy, Report No. 1 - Sept. 17, 1974, U.S. Government Printing Office.
39. "Health Physics - Past, Present, and Future," presented at First Asian Regional Congress of the International Radiation Protection Assn. in Bombay, India, Dec. 1974; published in Proceedings.
40. "Suggested Reduction of Permissible Exposure to Plutonium and Other Transuranium Elements," J. Am. Ind. Hygiene 36, (8), 567 (Aug. 1975).
41. "Effects of Radiation on Man - Now and in the Future," in Energy and the Environment -- Cost-Benefit Analysis; Pergamon Press, 1976, Chapters by K. Z. Morgan in text, Energy and the Environment, Cost Benefit Analysis, by R. A. Karam and K. Z. Morgan, GEORGIA INSTITUTE OF TECHNOLOGY SERIES IN NUCLEAR ENGINEERING, Pergamon Press 1976.
42. "Programs Needed for Education and Training of Health Physicists," Proc. Am. Phys. Soc. Meeting, December 1974.
43. "Recent Developments in Fast Neutron Personnel Dosimetry Using Track Etch Methods," presented at Congress of the International Radiation Protection Assn., Holland, May 1975; published in Proceedings.
44. "Medical Radiation Protection," presented at Health Physics Meeting, Buffalo, New York, July 15, 1975.
45. "Ways of Reducing Exposure in a Future Nuclear Power Economy," presented at American Public Health Association Annual Meeting, Chicago, Illinois, November 18, 1975.
46. "A Course on Non-Ionizing Radiation Protection for State and Local Health Officers," Proceedings of Health Physics Society, Denver, Colorado, February, 1976.
47. "The Particle Problem," Third International Summer School on Radiation Protection, Herceg Novi, Yugoslavia, published in Boris Kidric Institute Series, August-September 1976.

Major Reports and Publications (continued)

48. "The Linear vs. The Threshold Hypothesis," Third International Summer School on Radiation Protection, Herceg Novi, Yugoslavia, published in Boris Kidric Institute Series, August-September, 1976.
49. "Current Problems and concepts of the Health Physicist," Third International Summer School on Radiation Protection, Herceg Novi, Yugoslavia, published in Boris Kidric Institute Series, August-September 1976.
50. "Use of Recycle Plutonium in Mixed Oxide Fuel in Light Water Cooled Reactors," testimony presented at public hearings on MOX fuel, Washington, D.C., Nov. 1976.
51. "Keeping Dose Commitments ALAP," Proc. ANS National Topical Meeting, 71, Tucson, Arizona, October 6-8, 1975.
52. "Radiation-Induced Health Effects," Science 195, 157, 344 (January 28, 1977).
53. "The Dilemma of Present Nuclear Power Programs," Proc. of Hearings Before the Energy Resources Conservation and Development Comm., Sacramento, Cal., February 1, 1977.
54. "Comments on Operation of the Kerr-McGee Cimarron Facility and the Karen Silkwood Case," before the Congressional Small Business Comm., April 26, 1976.
55. "Data Interpretation," Proceedings of Workshop on the Utilization and Interpretation of Environmental Radiation Data, Orlando, Fla., March 1-3, 1976.
56. "Rolf M. Sievert: The Pioneer in the Field of Radiation Protection," Health Phys. 31, 263-264 Sept. 1976.
57. "Health Hazards from Diagnostic and Therepeutic X-Ray," Proceedings of Conference on Diagnostic Imaging, Chicago, Ill., Sept. 27, 1976.
58. "Yes is the Answer to Question of R. H. Thomas and D. D. Busick, 'Is It Really Necessary to Reduce Patient Exposure?'" J. Am. Ind. Hygiene 37, 665-667, Nov. 1976.
59. "The Linear Hypothesis of Radiation Damage Appears to Be Non-Conservative in Many Cases," Proceedings of Fourth International Congress of the International Radiation Protection Association, Paris, France, April 25-29, 1977.
60. "The Need to Reduce Medical Diagnostic Exposure," J. Am. Ind. Hygiene 38, 6, June 1977.

Professional Activities, Memberships, and Honors

Member:

Health Physics Society, First President in 1956

International Commission on Radiological Protection, Chairman for 20 years of committee publishing present and past Recommendations on Maximum Permissible Internal Dose of Radioisotopes

National Council on Radiation Protection, Chairman for 20 years of committee publishing present and past Recommendations on Maximum Permissible Dose for Internal Radiation

Professional Activities, Memberships, and Honors (continued)

American Association for the Advancement of Science
American Industrial Hygiene Association
Research Society of America
Radiation Research Society
American Association of Physics Teachers
International Radiation Protection Association, First President, 1968

Associate Fellow: American College of Radiology
Fellow: American Physical Society and American Nuclear Society

Awarded the first gold medal for meritorious work in the field of radiation protection by the Royal Academy of Science of Sweden in 1962 jointly with Walter Binks (England), 1962

Distinguished Alumni Award and Honorary Doctor of Science Degree from Lenoir Rhyne College, 1964 and 1967

Honorary membership in Sigma Pi Sigma, the physics honor society, from Berea College, 1957.

First Distinguished Service Award of the Western Chapter of the Health Physics Society, 1968

Distinguished Achievement Award, Health Physics Society, 1973

Honorary member of Fachverband fur Strahlenschutz, 1973

Editor-in-Chief, Journal HEALTH PHYSICS

Consultant on Radiation and Reactor Problems with a number of Government agencies including the Nuclear Regulatory Commission, Environmental Protection Agency, Bureau of Radiological Health, HEW, and the joint Committee on Atomic Energy of Congress of the United States and a member of President Carter's Panel on Energy Policy.

OBSERVATIONS OF PSYCHOLOGICAL EFFECTS OF THREAT OF VENTING KRYPTON 85

Robert W. Colman

Since the accident at Three Mile Island (TMI) in late March of 1979, I have been in a position to observe the responses of people of the Middletown and Harrisburg area both to the accident and to later threats of radiation releases. During that time, I have been Coordinator of a Masters Program in Community Psychology at Pennsylvania State University's Capitol Campus in Middletown, have taught in college classrooms, and functioned as a psychologist doing organizational development work with various regional human service agencies. In addition, I have attended numerous public meetings about TMI, in Middletown and elsewhere in the area, conducted both by NRC officials and by local anti-nuclear groups. In these various capacities, I have conducted interviews with local residents about their reactions to the TMI accident and its aftermath. (See Attachment No. 1 for a curriculum vitae.)

Based on the above, I have been able to draw several conclusions:

1). As a result of the accident, people in the area have experienced a loss of control over their own lives. Many of them were driven to evacuation by fear of radiation at the time of the initial accident, and many fear being so driven again on the event of further radiation releases. In this sense, they have become sensitized to the threat of ionizing radiation. (See Attachment No. 2 for a letter to the editor outlining these matters published in <u>The Patriot</u>, Harrisburg, October 30, 1979.)

2). Changes in public behavior of local people in meetings with NRC officials indicate increasing levels of frustration and anger. The tone of public comment has become more hostile, and anger appears to be closer to the surface. People repeatedly express the concern that their opposition to the venting of Krypton is either not being heard by the NRC, or, if heard, is not being attended to. These concerns were particularly evident in comments made by local residents at the meeting with NRC officials at the Liberty Fire Hall in Middletown on March 19, 1980. (For further documentation, see the NRC transcript of that meeting and of a later meeting of Ahearne, Bradford and Gilinski with Harrisburg area people, held in Washington on March 21, 1980.)

3). The resolve of local people to oppose venting of Krypton has grown firm. At the same time, the organizational development of the anti-nuclear movement in the area has been sufficient to support popular opposition to venting. News articles in national media on March 21 and 22, 1980 suggested the possibility of rioting in the streets in the event of venting. On the basis of my experience and observation, it seems that a much more likely outcome is a well-planned, well-organized campaign of civil disobedience. The local and national anti-nuclear movements can support such a campaign, and should it occur, the campaign would draw both large numbers of people and major international attention from the press. Such a development could conceivably force a new decision, not to vent.

4). It is important that people in the area experience a sense of regaining control over their lives by affecting decisions made

about venting. Local people may achieve this goal by successful legal actions in the courts to halt venting.

5). This local need to regain control would be more directly met by an NRC decision not to vent in clear response to public concern.

COMMONWEALTH OF PENNSYLVANIA :
: SS
COUNTY OF DAUPHIN :

I, ROBERT W. COLMAN, A.B., M.A., Ph.D, do hereby depose and say that the facts contained in the foregoing paper titled "Observations of Psychological Effects of the Threat of Venting Kryton 85" are true and correct to the best of my knowledge and belief.

ROBERT W. COLMAN

Made this 4th day of April, 1980.

NOTARY PUBLIC

MY COMMISSION EXPIRES:
DORIS J. UBER, Notary Public
Harrisburg, Dauphin Co., Pa.
My Commission Expires Feb. 15, 1983

ATTACHMENT NO. 1

October 1979

CURRICULUM VITAE

Name: Colman, Robert Wheeler

Place of Birth: Butte, Montana

Date of Birth: 12 March 1940

Address: The Pennsylvania State University
Middletown, Pennsylvania 17057
717-783-6036

P. O. Box 3328
Harrisburg, Pennsylvania 17105
717-238-4492

Degrees:	Degree	Field	Date	Institution
	A.B.	Social Relations	June, 1962	Harvard College
	M.A.	Psychology	June, 1966	University of North Carolina at Chapel Hill
	Ph.D.	Psychology	August, 1967	University of North Carolina at Chapel Hill

License Status: Licensed as a Psychologist, Pennsylvania Certificate No. PS-001632-L.

Work Experience:

1978-Present — Coordinator, Community Psychology Program (MPsSc)

1970-Present — Assistant Professor of Social Science and Psychology, The Pennsylvania State University. (On leave, 1974-1975).

Teaching areas have included social psychology, social conflict, social movements, small groups, community organizing, and graduate and undergraduate internship supervision.

1967-1970 — Assistant Professor of Psychology, New York University.

Teaching areas included social psychology, attitude change, personality psychology, and research seminars (for the Psychology Department) and general social science seminars (for the Metropolitan Leadership Program).

1967 — (June and July) Research Associate, Department of Psychiatry, University of North Carolina Medical School.

1966-1967 — Graduate Research Assistant, under the direction of Stuart Valins.

1965-1966 — Graduate Teaching Assistant.

1964-1965	Graduate Teaching and Research Assistant, under the direction of John Schopler and John Thibaut.
1964	(June to September) Psychologist I. Montana State Hospital, Warm Springs, Montana.
1962-1963	(June, 1962 to September, 1963) Psychological Assistant. Montana State Hospital, Warm Springs, Montana.

Grants and Awards:

1973	Russell Sage Foundation Contingency Fund Grant.
1971	Institutional Grant from the National Science Foundation.
1969	Institutional Grant from the National Institutes of Health, Bio-Medical Support Grant to New York University
1968-69 & 1967-68	New York University Arts and Science Research Fund Grant.
1965-66 & 1963-64	United States Public Health Service Fellowship in Social Psychology.
1958-60	Harvard College Scholarship.

Organizations:

Member, Eastern Psychological Association.

Member, Society for the Advancement of Social Psychology.

Research:

The Creative Process: A psychological approach. Unpublished Bachelor's thesis, Harvard College, 1962.

Bargaining and contract formation with an intrinsic power manipulation. J. Thibaut, R. Colman, J. Kahan and M. Miller. (Reported in Thibaut, J. The development of contractual norms in bargaining: Replication and variation. Journal of Conflict Resolution, 1968, XII, 102-112).

Comparisons of three creativity measures. Unpublished Masters thesis, University of North Carolina, 1966.

Commitment and attitude change as a function of rewards for a consonant act. Unpublished Doctor's thesis, University of North Carolina, 1967.

Onward and upward with the task. (Review of Bales, R. Personality and interpersonal behavior). Contemporary Psychology, 1970, 15 (12), 739-740.

Recipe for a jury. J. Schulman, P. Shaver, R. Colman, B. Emrich, and R. Christie. Psychology Today, 1973, 6, 37-44, 77-84.

Paper Presentation:

Problems in the measurement of human emotion. Second Annual Conference on Pennsylvania Statistics. Middletown, Pennsylvania, April, 1971.

Symposium Participation:

The training of "honest to God" community psychologists. Pennsylvania Psychological Association, Hershey, May, 1974.

Jury selection in political trials. American Psychological Association, Montreal, 1973.

Problems in making social psychological assessments of others: Selection of the jurors in the Harrisburg conspiracy case. New England Psychological Association, Boston, 1972.

Alternative institutions. Harrisburg Defense Committee, Harrisburg, March, 1972. (Chair).

Sociology and anti-war politics. (Ad hoc session). Eastern Sociological Society Convention, Boston, April, 1972.

Organizing for social change in a mental hospital. (Ad hoc session). Eastern Psychological Association Convention, Boston, April, 1972.

Invited Lectures:

Privacy and individual rights, 1976 Legislative Conference, Women's Legislative Exchange, Harrisburg.

Patients' rights. Gettysburg College, January, 1974.

The rights of mental patients. Harrisburg Area UN Association, December, 1972.

The rights of mental patients. Harrisburg ACLU, November, 1972.

Alternative education. Central Dauphin East High School, Harrisburg, Pennsylvania, March, 1972.

The psychology of institutionalization. Harrisburg State Hospital, February, 1972.

Consulting:

Consultant on survey methodology, Neighborhood Strategy Area, uptown Harrisburg, 1979.

Consultant on questionnaire design, Park Street Church, Harrisburg, 1977.

Social Psychological Consultant, Metropolitan School of Columbus (Ohio), 1973, 1974.

Consultant on jury selection, Camden 28 Defense, 1973.

Consultant on jury selection, Harrisburg 7 Conspiracy Defense, 1971-1972.

Colman -4-

Research Consultant, Harrisburg State Hospital, 1971-1972.

Consultant on pre-trial prejudice, Legal Aid Society, New York, 1969.

Seminars Attended:

Fifth Vermont Conference on the Primary Prevention of Psychopathology, June, 1979.

"Deinstitutionalization and Dehumanization," Pennsylvania State University College of Medicine, 31 January, 1977.

Northeast Cities Conference, Hartford Institute and National Conference on Alternative State and Local Public Policies, Hartford, 10-12 December, 1978.

"Basic Issues of the Therapeutic State," Georgetown University Law Center, 9-10 October, 1975.

"Dissenting Life Styles," Dr. Leo Alting von Gesau; and "Social and Political Implications of Measurement," Dr. Ivan Illich; both at CIDOC, Cuernavaca, Mexico, Summer, 1971.

Community Involvement:

Workshop leader, (How to overcome apathy) Training and Orientation Session, Tri-County Commission for Community Action, Harrisburg, October, 1979.

Member, Pennsylvania Bar Association Special Committee on Legal Services for the Mentally Disabled, 1979.

Member, Planning Council, Three Mile Island Alert, Harrisburg, 1979.

Member of the Board, Women in Crisis, Hummelstown, PA, 1979.

Member, Planning and Prevention Committee, Dauphin County Mental Health/Mental Retardation, Harrisburg, 1979.

Member of the Board of Directors, First Pennsylvania Feminist Credit Union, 1977-1979.

Member of the Board, Women's Training and Support Program, Dauphin County Commission for Treatment and Program Development, 1977-1978.

Co-facilitator, Community Organizing Workshop, Harrisburg, 1975-1976.

Coordinator, Harrisburg ACLU Task Force on The Rights of Mental Patients, 1972-1973.

Member of the Executive Board, Harrisburg Center for Peace and Justice, 1972-1974.

Member of the Executive Board, Harrisburg Chapter, Harrisburg Defense Committee, 1971-1972.

Member of the Advisory Board, Harrisburg Hospital Mental Health/Mental Retardation Center, 1971-1972.

[illegible] any part of anything for or against him." Indeed, he took offense decades ago at reporters who tried to sensationalize the incident, and wanted to tell the Kennedy family he would testify in its behalf in any libel trial. But then Rose Kennedy called him "and really got on my butt" to shut up; now he's neutral.

After Kennedy pulled into his driveway, did he hide? The answer from Kennedy's press aide is unequivocal: "I spoke to the senator and he informs me he was not hiding."

THE COP'S recollection differs: "He had gotten down in the front seat of the car," Whitten told reporter Kamholz. This was not information freely volunteered; the reporter had asked if "the story about hiding in the back seat is true," and the former policeman reluctantly set the facts straight on exactly where in the car Kennedy had been hiding.

Did Kennedy receive special treatment in court? Magdelene Andrews Poff, The Daily Progress reporter at the time, recalls seeing no Kennedy name on the arrest blotter, but discovered five warrants with Kennedy's name in a court cash drawer. The judge, now dead, "threw me out of court."

If you want to believe the Kennedy version of all this, he was innocently driving along, perhaps a little fast, perhaps with his rear lights out, when he was put upon and convicted by a pack of vindictive Virginians.

But if you believe the cop and the local reporters, as I do, a pattern of character emerges: in 1951, faced with flunking a Spanish exam, he panicked and persuaded a ringer to substitute for him, and for that was expelled from Harvard; in 1958, with a sheriff on his tail, he panicked and tried to escape and was convicted; in 1969, when his companion drowned, he panicked and left the scene of the accident for nine hours until someone else discovered his car.

When in big trouble, Ted Kennedy's repeated history has been to run, to hide, to get caught, and to get away with it.

A Thought

"I don't know of anything better than a woman if you want to spend money where it will show." — Kin Hubbard.

[illegible] bring outside food in to perhaps four million starving people. It might, you see, just get into the bellies of the Pol Pot people.

[illegible] they "didn't know" what was going on.

This time, the whole world knew — and did nothing until now.

ATTACHMENT NO. 2

Our Readers Write

TMI Is A Mental Health Hazard

EDITOR:

THE HARRISBURG AREA has changed since the Three Mile Island accident in late March. People in the region no longer see the man-made world around them as safe. People have a new sense of personal vulnerability.

Pro-nuclear sources are suggesting that the accident is an indication of the safety of nuclear power, not its dangers. They say that this is so because containment was not breached, a full meltdown did not occur, and because there is debate over physical health effects of the relatively low levels of radiation which were emitted.

This position ignores any psychological damage produced by the disaster and its aftermath. In fact, the damage done offsite seems largely to have been psychological. And it is the psychological effects which most interest people from outside the area. Understanding the nature of these effects is critical for understanding the meaning of TMI.

We can draw on disaster literature for help. (Disasters are sudden, unexpected events which damage property and people. By this standard definition, the TMI accident was clearly a disaster.) Psychological damage seems to come from two sources: immediate stress from the disaster's impact itself, and continuing sensitization to the possibility of future disaster.

The stress effects are usually short-lived, if painful. They include depression, irritability, agitation and anxiety. The stress can lead to disruption of work and relationships. The problems people experienced during evacuation fall into this category. (Interestingly, disasters tend to agitate and disrupt people, and not to drive them crazy: Anxiety is a more likely result than schizophrenia.)

In Harrisburg, the continuing sensitization effects are the most interesting. People still twitch a bit when they hear the term "radiation"; they respond quickly and negatively to threats of future radioactive releases from TMI. I hear that outside researchers are beginning to refer to a "Harrisburg hysteria." Why, they seem to ask, is there so strong a reaction here, if the accident was minimal in its immediate impact?

As it happens, the events at TMI could hardly have been better designed to produce long-term sensitization. Three characteristics of the events were particularly important. First, in coming so close to a meltdown, we were exposed to a near-miss situation, so that we could imagine all possible scary outcomes from an almost incredibly large threat. Second, we were all vulnerable, since radiation respects no high ground. Third, and now perhaps most important, it was a high technology accident, compounded by human error. Since the same people — Met-Ed and NRC — show every indication of planning to use the same high technology, we are exposed to a continued vulnerability. And outsiders wonder why local people act concerned?

One additional consideration. Direct stress effects, as I said, are usually short-lived. However, there is increasing evidence in the literature of latent traumatic neuroses from disasters. In other words, people can have anxiety symptoms which show themselves in behavior only under additional, later stress. It is for this reason, along with continuing sensitization to threat, that reopening TMI, Unit 1 or 2, would be a serious mental health hazard.

The best corrective for feelings of vulnerability is success in trying to regain control over one's life. Locally, the clearest way to do this is to work successfully to close TMI.

—Robert W. Colman, PhD
Harrisburg

(Editor's Note: Coordinator of the Community Psychology Program at Pennsylvania State University at Middletown.)

The Patriot, Harrisburg
Oct 30, 1979 p. 22

The Harrisburg area has changed since the Three Mile Island accident in late March. People in the region no longer see the man-made world around them as safe. People have a new sense of personal vulnerability.

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APPENDIX A

PSYCHOLOGICAL STRESS

Neighbors of TMI: 'Keep your krypton!'

Associated Press

MIDDLETOWN, Pa. — Hundreds of angry, shouting residents of the Three Mile Island area jammed a local fire hall last night to denounce plans to vent radioactive gas from the crippled nuclear plant.

"Keep your krypton!" chanted many of the 500 people in the hall. The hall has a capacity of 400, and police said that 100 to 200 people were outside, unable to get in, and that many of them pounded on glass windows and doors.

The U.S. Nuclear Regulatory Commission (NRC) had called the meeting to explain and discuss its proposal to vent the radioactive krypton from the sealed containment building, as well as possible alternatives to venting, but the meeting turned into one of the most hostile among the scores held since the Three Mile Island (TMI) nuclear accident last March 28.

Officials trying to explain the venting plans were interrupted frequently by the audience. "This is going to be a long evening for all of us," said Richard Vollmer, director of the NRC's technical support staff at TMI, and someone in the crowd yelled, "You earned it!" Others cheered lustily.

Metropolitan Edison Co., operator of the damaged nuclear power plant, wants to release 57,000 curies of krypton 85 so that it can start cleaning up the reactor containment building. It has been seriously contaminated since the accident, the most serious commercial nuclear breakdown in the nation's history.

John Collins, the NRC's chief of operations at the plant, said the maximum radiation dose anyone not actually on the plant site could receive from the venting would be about a fifth of a millirem. A chest X-ray involves a dose of about 35 millirems.

This month, the NRC staff recommended that plant operators be allowed to go ahead with the venting. The five NRC commissioners will have the final approval, and that cannot be given until next month, after the public has had 30 days to participate in discussions about the plan. Another meeting will be scheduled solely to hear public reaction to the report.

Metropolitan Edison Co., operator of the plant, wants to release 57,000 curies of krypton into the atmosphere from the containment building.

Krypton is byproduct of nuclear fission and has spread through 2 million cubic feet of air inside the huge containment building since a serious reactor overheating accident last March 28.

NRC told of a community living on the brink of fear

By Aaron Epstein
Inquirer Washington Bureau

WASHINGTON — Six neighbors of the Three Mile Island nuclear power plant yesterday gave the federal Nuclear Regulatory Commission (NRC) here a portrait of a community in crisis — people on the edge of mental breakdown and violence, families leaving their communities for good.

They told of animals dying of mysterious diseases, vegetation wilting and wildlife vanishing and of residents who fear the cumulative effects of radiation they cannot evaluate. They said that no one believes anything that a politician or an official says.

The encounter was similar to a meeting in Middletown, Pa., on Wednesday night, when angry citizens overflowed a local informational meeting called by the NRC staff. The citizens berated and denounced NRC officials and their plans to release radioactive gases. On Thursday night, a similar scenario was followed during the NRC hearing in nearby Elizabethtown.

The three meetings are the first at which citizens from the area have angriy confronted nuclear policymakers with their fury and frustration since the nuclear reactor at Three Mile Island (TMI) was crippled nearly a year ago.

Yesterday, for slightly more than an hour, the six residents — a nurse, a farmer, a hospital administrator, a psychology professor, a minister and a homemaker — described their fears and the fears of others in the community.

The meeting was held at the citizens' request, and the six said they were a representative cross-section selected after the NRC had responded to the request.

They were disturbed by the latest announcement of a planned release of the radioactive gas, krypton, from TMI, but they said their anxieties ran far deeper.

A resident protests at NRC meeting in Elizabethtown

"The people of the state of Pennsylvania feel we've been sold down the tubes by everyone," said the nurse, Nancy Prelesnik of Hershey. "We are crying out to you to really listen to us."

For the most part, the three of the five commissioners present did listen, attentively and with apparent sympathy, but they spoke little and did not commit themselves to any course of action.

Afterward, however, John F. Ahearne, a physicist recently appointed by President Carter as temporary chairman to give the NRC more direction, said he would speak to the two absent commissioners and set up another meeting to consider the citizens' complaints.

The Rev. William Vastine of New Cumberland told Ahearne that by now "your credibility is so shattered that you don't have a chance in a carload to convince us (that the TMI plant is safe). I would like very much to believe, but hundreds of thousands don't believe. . . .

"The greatest contribution you can make, my friend, is to close those plants.' . . . We have had it."

The core of the problem, said psychologist Robert Colman of Harrisburg, is the TMI neighbors' "absolute distrust" of their government at all levels.

As a result, according to Jane Lee, a farmer from Etters, "We're concerned about these people that are on the verge of cracking up mentally."

The commissioners heard stories of rowdy community meetings, including one at which an official was nearly attacked by a teacher who became "a raging wild man," and they heard of mothers who are afraid to leave their children alone in case of another nuclear emergency.

"I'm getting scared," Colman said, and another citizen added, "It's a very explosive situation."

Accusing the commissioners of remaining in their "ivory tower" in Washington, the citizens urged them to go to the TMI area themselves and face the frightened people.

Each time radioactive materials have been released from TMI, one of the citizens said, "it's just a little bit, but the key word is 'cumulative.'"

Yet the residents still have no way of knowing how much radiation has accumulated in their bodies," Ms. Prelesnik said.

"You certainly should have" figures giving that information, Ahearne agreed.

He wondered, though, if no one believes the NRC, as the citizens were saying, would anyone believe its figures?

One resident replied that NRC figures would help but that "we have faith only in ourselves." A group of citizens not appointed by politicians should take on the job of getting the truth to the people, he said.

Among the six residents' other recommendations: health and environmental studies, federal money to clean up TMI and help the area's sagging economy and appointment of a health expert and an environmentalist as NRC commissioners. Most of the current commissioners have science backgrounds.

Ms. Lee distributed reports from area health surveyors and veterinarians indicating that animals, from cats to cows, within five miles of TMI have been suffering increasingly from bone and muscle ailments and breeding and respiratory problems since 1976.

She reported defoliation of trees, disappearance of wildlife and painful deaths of birds and other small animals.

"The entire system down there is being affected by something," she said. "It is eventually going to filter down to us."

Already, some residents are alarmed by the recent discovery that an abnormal number of children — four times for the amount expectable — were born with serious thyroid defects in three Pennsylvania counties during the last nine months of 1979.

One of the counties is adjacent to the Three Mile Island reactor, which has emitted radioactive iodine, a known cause of thyroid disease. Officials have said, though, that those defects almost certainly could not have been caused by radiation from the reaction.

The Philadelphia Inq
March 17, 1980

'Venting' gas at TMI: Playing the cruelest game

The staff of the Nuclear Regulatory Commission has recommended that krypton gas trapped in the damaged reactor at the Three Mile Island nuclear plant be released into the atmosphere as soon as possible. There is a "strong possibility" that the five-member commission will soon approve the staff proposal, according to one commission member.

It is imperative that no radioactive gas be vented. The potential for harm to the residents of the area around Three Mile Island, and the health threat such a release poses to their offspring, is too great to permit that to happen. Despite claims by NRC officials that the levels of radiation to be vented are within federal safety limits, it is a scientific fact that *all* exposure to radiation poses potential harm to present and future generations.

The NRC and Metropolitan Edison Co., operators of the reactor, are playing out the cruelest of all psychological games with the people of Pennsylvania by asserting that the alternative to venting is a far more terrible risk, involving leaks of highly radioactive water also trapped in the reactor. In other words, get radiated now at low doses, or face the prospect of massive doses later. That is the option being given to individuals living near the reactor.

Officials have known since a few days after the accident last March 28 that the krypton gas had to be removed before clean-up could occur. From that time on, Metropolitan Edison has remained steadfast in its plan to vent the radioactivity into the atmosphere. It may be a futile exercise now to point out that if someone in authority had rejected that idea outright, and instead demanded that the company begin a search for equipment to remove the gas safely, that the equipment could be nearing readiness now.

There is technology to do so. Philadelphia Electric Co. has purchased cryogenic equipment — which liquifies gases through use of extremely low temperatures, facilitating their containment and safe removal — for its Limerick reactors under construction in Montgomery County. After the accident, the company offered to make that equipment available to Metropolitan Edison officials, according to a PE spokesman. Adapting the cryogenic equipment to the enormous clean-up operation at Three Mile Island would take time and money, but technically it is possible, experts say.

NRC officials now admit operators are "flying blind" in their job of monitoring conditions inside the reactor because measuring equipment there no longer functions. They say that equipment must be repaired and repaired soon to assure that the reactor core doesn't overheat. Again, they raise a specter so terrible that, they hope, it reduces the hazards of venting to relatively small levels of risks to the public.

The NRC plans to solicit public comment on the staff proposal to vent the krypton gas. NRC Commissioner Victor Gilinsky has suggested that the commission itself go to Middletown — site of the reactor — to hear what the public has to say about the plan and to carefully explain it to area residents. His proposal is a good one. The people of central Pennsylvania have every right to believe that their safety and concerns are being completely ignored by those persons making decisions about TMI. Perhaps if the NRC members see and hear the fears many people have about the venting plan, they will not be so casual in shrugging off the potential health hazards of the proposal.

There is one question the residents near the reactor should most definitely ask the five commission members: Why has the NRC resumed licensing nuclear plants without requiring them to have equipment on hand, or at least readily available, to treat radioactive gases like krypton in the event of future accidents such as Three Mile Island? It is an answer the NRC owes to the people of central Pennsylvania and all Americans.

Intelligencer Journal
March 20, 1980
page 1 of 2

TMI Anger Boils Over

Public Tells NRC Officials: 'We Are Sick, We Are Tired, We Are Angry'

By John Drybred
Intelligencer Journal Staff

MIDDLETOWN — There was hooting and howling, chanting and crying, waving of signs, wearing of costumes, selling of soda and potato chips, and strolling television players Wednesday night in Middletown, where members of the Nuclear Regulatory Commission and other experts tried to explain the proposed venting of krypton gas from the Three Mile Island facility.

NRC members came to the Liberty Fire Hall here to explain the venting proposals, plus alternatives, to the people of the area. "Is it more preferable to have a controlled release or an uncontrolled release?" John Collins, deputy director of of the NCR's TMI technical support staff, asked at one point.

The people of the area showed at every opportunity that they didn't believe anything the experts said, and they didn't want that krypton gas vented. "We are sick. We are tired. We are angry," said one woman in the audience.

Some spoke emotionally, and said they didn't believe the experts. Others spoke rationally, and said they didn't believe the experts.

If recommendations to vent the gas are accepted by the NRC, venting of krypton gas could start next month at TMI. Wednesday night's hostile crowd said they oppose that venting. Some held signs that said: "There will be no venting."

The large brick Liberty Fire Hall holds 400 people, according to an announcement made at 7:35 p.m. By 7:15 p.m., the hall was packed. All the chairs were filled. All the standing room was taken.

People stood outside and beat on the doors to get in. A fire company spokesman announced that the doors would be locked, and that anyone who opened a door would be "removed from the building," even if police had to do it.

A man, standing in one corner of the room, voiced a prediction when the hooting and howling and yelling at the NRC officials began early in the meeting.

"Everytime one of those guys gets up to say something," the man said about the officials, "they're gonna give him a hard time. So, no one's gonna come out of here knowing anything at all."

The man who said that was being prophetic. Most of the time during Wednesday night's meeting, depending where you sat or stood in that fire hall, much of what was being said was unintelligible.

Those who spoke from the head table were constantly interrupted, insulted, shouted down. A middle-aged woman in the front row leaped to her feet every few minutes, ran up to the front table, shook her finger at one or another of the panelists seated there, and cursed at them.

Clouds of cigaret smoke drifted over the heads of speakers and spectators, choking some of them until finally somebody opened one of the doors to vent the smoke.

On one side of the room, a bay was opened, and women (presumably from the fire company) sold coffee, soda, chips and pretzels to a steady stream of customers.

Some of the television reporters and their camera-and-microphone-operating assistants stayed on the sides of the room. Others wandered through the aisles of angry people — sometimes attached to one another with communication cables — aiming the round eye and the mi-

More VENTING Page 2

Intelligencer Journal
March 20, 1980
page 2 of 2

Venting Of Gas From TMI Triggers Anger Of Public

Continued From Page One

crophone gun at people with hostile comments.

One TV reporter thrust a copy of the "Environmental Assessment for Decontamination" report into the hands of a woman at the end of one aisle. "Here! Pretend you're reading this," the reporter said, motioning to his female camera operator to zoom into a tight shot of the opened report. "We don't want your face," the TV reporter told the obliging woman. "Just your hands, holding the report."

Two men, wearing plastic suits and oxygen masks, held a stuffed, homemade dummy, which had "N.R.C" printed on its hat. One of them led chants and cheers from others in the audience throughout the meeting.

Before the meeting started, the man, who asked for silence in the room, told everybody that the dummy was "Mr. N.R.C.," and that they should "make sure this guy (Mr. N.R.C.) doesn't get away easy."

He said that after the meeting was over, 'We're gonna tar and feather this nice gentleman (the dummy), and send him out of town." There was loud applause at that, and a great waving of signs.

Some of the signs said things like: "Krypton ills (below a skull and crossbones)," "Even Superman Can't Survive Krypton," "With Met-Ed We're Dead," and "Nuclear Bombs and TMI — Activate Either and You're Likely To Die."

Richard Vollmer, director of the NRC's TMI support staff, early in his remarks said: "This doesn't look like it's going to be a particularly good occasion for any of us."

That was another prophectic statement, followed a little later by one from a woman who said she came from Washington, D.C., to get an accurate transcript of what was said at the meeting. She asked for orderliness. She didn't get it.

When Collins stood up to show some slides and explain the various alternatives to venting the krypton gas at TMI, many in the audience yelled insults. When Collins got to the technical jargon of his presentation, one man yelled: "Talk English!" There was loud applause.

At one point, Vollmer said: "Ladies and gentlemen, if we can't hold the meeting, we can call it off." They held the meeting.

The people lined up to speak at two microphones placed in the center aisle. They were supposed to ask questions about what the NRC people were presenting.

They asked some questions. But they mostly made statements. The questions and the statements all got around to the same things: They didn't trust Met-Ed, the NRC, the government. And they didn't want that gas vented.

They stood in unison, at various intervals, waved their sig s, and chanted things like, "Keep your krypton!"

People from Middletown said they'd been promised answers at previous meetings, and hadn't received them. "As of today, I haven't heard nothing from your office," one man said into the microphone."

One woman asked for audience applause as a vote meter as to who wants the gas vented and who doesn't. It was unanimous in favor of not venting the gas, except for one person who apparently misunderstood one of the questions. He applauded for only a split second when there was a call for applause from those who want the gas to be vented. This brought an angry cry from one man of "Where is that bastard!"

Women stood up and spoke in weeping voices about their concern for their children if they breathe the air filled with the vented gas. Men did the same, saying they were seriously considering leaving the area with their families if the gas is vented.

Officials continued to explain that the gas "won't go away by itself," and that some of the people in the area were expressing concern about "living with the TMI loaded cannon in their faces" if the venting of the gas isn't controlled.

A a nuclear medicine expert tried to answer questions about possible harmful effects of radiation on humans by citing reports from experts and studies made around the world.

But the angry people kept bringing up the fact that experts disagree on these studies and reports, and that they believe no one really knows the actual harmful effects of radiation.

At one point, a man from Mechanicsburg asked Vollmer where his family would be during the venting, if it's done. Vollmer said: "I'll be happy to bring them up here."

This seemed to delight the man from Mechanicsburg, who then got from Vollmer the information that he had three children. The man said he won't be at his house when the gas is vented, but he offered it to Vollmer. "...102 Orchard St., Mechanicsburg," the man said. "Bring 'em (Vollmer's children. And your wife."

Venting Stirs Up A Storm At Elizabethtown

Intelligencer Journal
March 21, 1980
page 1 of 3

Intelligencer Journal photo by Barry Zecher

A gas-masked person, protesting plans to vent radioactive gas from Three Mile Island, holds up a dummy, he says represents the Nuclear Regulatory Commission. The dummy's sign reads: "Do you have something I can take for gas?"

By Tom Infield
Intelligencer Journal Staff

Thursday night in Elizabethtown officials of Metropolitan Edison Co. felt the after-shocks of the emotional quake that hit Middletown one night earlier at a public meeting.

The subject was the same: Met Ed's proposal to vent radioactive gas from the disabled reactor building at Three Mile Island.

Protestors — some shouting, some crying, some cursing — poured out their anger at the proposal, one yelling: "How in God's name do you people sleep at night?"

Others in a crowd of several hundred persons at Elizabethtown High School pleaded loudly with the protestors to "shut up and sit down," as one male voice put it.

The meeting was a public briefing by Met Ed about on-going cleanup work at the disabled reactor, sponsored by the state's Department of Environmental Resources.

At the earlier meeting in Middletown, anger focused on staff members of the Nuclear Regulatory Commission, who have recommended approval for the venting of 57,000 curies of krypton gas.

Afterward, the agency's chief regulator, Harold Denton, called the meeting "probably the most raucous assembly we've ever had."

Thursday night it was Met Ed's turn.

Fifteen minutes into an explanation of the how the nuclear plant works, utility senior vice president Robert Arnold was interrupted.

"Why don't you get on with what people want to hear?" an excited young man yelled, leaping to his feet.

People applauded. A half dozen television crews turned their lights toward the young man, who kept up his outbursts.

"Show us on the chart where it leaked today," a woman shouted, referring to a minor radiation release.

"Let the man talk," yelled back a man who looked to be about 60.

Five minutes later, as Arnold began again:

"Tell us where the leak is today, and what you're going to do about it" — woman's voice.

Associated Press Wirephoto

Tom Bainbridge, Lancaster, shakes his finger and protests a plan to vent radioactive gas from Three Mile Island. At right is Robert Arnold of Metropolitan Edison Co. and, in the center, John Collins, an official of the Nuclear Regulatory Commission.

Met Ed Feels Heat At E-town Meeting

"Let us talk. We haven't been listened to since the accident" — another woman.

Somebody suggested a show of hands whether or not Arnold should continue his talk with charts and a pointer. Lots of hands went up on both sides, more on the side of letting the audience talk.

At the microphone on stage, a state official, Richard Boardman, admonished the crowd. He said the meeting had been called for Met Ed to transmit information to the public. He urged that Arnold be given a chance.

"Sit down and keep quiet. You're paid with our tax dollars," said a woman in the second row.

"Do you want a riot on your hands? Let them (audience members) speak," she cried out.

Man to the woman: "I don't want to hear you either. Sit down."

Arnold, in turn, had a suggestion. Why not let members of his staff talk briefly about the krypton? "Then take an hour now for questions and then go back to the briefing."

Hostile voice — "You don't have any choice."

Met Ed officials strode to the microphone. Mike Morell talked about why he proposed the reactor building purge. Beverly Della Loggia talked about radiation monitoring in the plant. And Bill Riethle told about off-site monitoring for krypton gas.

"If you weren't going to let it go, you wouldn't need monitoring," yelled a man from the audience.

An elderly man was given the chance to ask the first question of the question period. No microphones had been placed in the aisles. He had to walk up on the stage. A line formed behind him.

The man's question turned out to be a reading of a newspaper editorial opposing the krypton venting. The editorial was from the Philadelphia Inquirer, which called it "the cruelest of all psychological games."

From in audience — "Ask a question."

The man waved off the interruption and continued reading, to applause.

He wanted to know, why did Met Ed reject an alternative for the gas? Why did the utility reject cooling the gas into a liquid in a cyrogenic process already built for a nuclear plant at Limerick?

"We did look at the cryogenic system at Limerick and we did not recommend it be used," Morrell answered for Met Ed.

The audience wanted more of an answer.

"Money, that's the reason," someone shouted.

"Money," came the echo.

Morrell tried again. "Three reasons," he said.

First, the system would "take an excessively long period of time to put into operation," up to 24 months. The utility has stated a belief that waiting for some such system to be installed could pose a greater risk to the public than venting the gas, because of leaks in the reactor system.

Second, the technology is "not proven."

Third, the cyrogenic process "is not 100 percent effective in removing the krypton anyhow...only 70 to 99 percent."

Arnold said Met Ed had reached "what we thought was in the best interest of everyone concerned."

Voice — "Didn't your decision have anything to do with costs?"

Another voice — "At least admit it."

"I'm confident in my own mind that cost was not the essential factor in arriving at a decision," Arnold replied.

A man in line to ask a question volunteered another solution for getting rid of the gas.

"How about letting some of us 'anti's' — we'll chip in the cost — build a pipeline to all your houses?"

Many in the audience cheered. Met Ed officials were stone-faced.

"We're talking about people with hearts and souls who are being traumatized. What do you do with those psychological casualties?" asked Tom Bainbridge, who identified himself as a Derry Township school teacher from Lancaster.

He got a standing ovation.

"We recognize," Arnold said, "there's a great deal of psychological stress." He said the utility is trying to "minimize" that stress by removing its source — the gas.

He said ridding it in a "controlled manner" was better that the risk of it leaking in an uncontrolled manner.

He said the NRC may even want Met Ed to vent the gas over a period of a "few days" for that reason, instead of the 60 days the utility proposed.

The public will get at least "10 days' notice," he promised.

Arnold, dressed in a gray suit, was calm. "I honestly believe an awful lot of worry is going on over things that do not necessarily warrant that worry," he told the audience.

"How do you sleep at night?" came the reply.

2 —INTELLIGENCER JOURNAL, Lancaster, Pa., Monday, March 24, 1980

Stress Of TMI Restart May Be Considered

By Tom Infield
Intelligencer Journal Staff

Pressure is mounting on the Nuclear Regulatory Commission to permit consideration of public mental stress in hearings on the restart of Three Mile Island Unit 1.

The undamaged reactor has remained idle since the nuclear accident a year ago at Three Mile Island Unit 2. Legal hearings on the restart may begin by late summer.

In a history-making recommendation, an Atomic Safety and Licensing Board said recently the commission "may and should consider psychological stress and community fears."

Both the plant operator, Metropolitan Edison Co., and the NRC's own staff have argued that stress cannot be "quantified" and is not admissable by law in a licensing hearing.

The commissioners themselves said last August they were unsure fears caused by the Unit 2 accident were legally "relevant" to Unit hearings. They asked for arguments on both sides.

A number of studies have at chiatrists from Hershey Medical Center, Drs. Joyce Kalen and Enos Martin, interviewed 200 persons and said the nuclear accident caused "massive collective stress."

For at least some people, the stress lingers. That was made plain at two large public meetings last week dealing with a proposal to release radioactive gas from the crippled plant.

At a meeting in Middletown, NRC officials were shouted down, insulted and called "you animals" by a crowd of 500 mostly-angry residents.

Staffers were admittedly shaken. Harold Denton, the agency's chief regulator, called it "probably the most raucous assembly we've ever had."

The following night in Elizabethtown, Met Ed officials got a dose of virtually the same thing, with protestors pleading: "How in God's name do you people sleep at night?"

Intervenors in the Unit 1 restart hearings said later they hoped the emotion would heap more pressure on the five NRC commissioners to admit mental stress as an issue.

"I would say they're probably going to admit it," predicted Jim Hurst, president of People Against Nuclear Energy (PANE), a citizens group in Middletown.

"I think people have been talking and talking and trying to get the story across they don't want that plant, and they're beginning to scream," Hurst said Sunday.

PANE intervened in the hearings on just the one issue of stress. Other anti-nuclear groups have taken a broader legal approach, among them the Newberry Township Three Mile Island Steering Committee.

"We are hoping they do hear the psychological issue, because it's one of the main issues involving that plant," said Linda Dominoski, a member of the steering committee.

"I think when an industry's been disrupting our lives like they have ours in the last year, there's no way it cannot be allowed as an issue."

Both group leaders said the level of stress will rise even more if Met Ed is given permission to release krypton gas from the Unit 2 reactor building next month.

"I see violence erupting, and I also see a lot of people leaving the area. It's been pushed to that point ... It's a fight for survival down here now," Mrs. Dominoski said.

Removed from that emotion, the licensing board was able to consider only one question: Do the laws governing nuclear power plants permit stress to be weighed as a factor in the determining the impact reopening would have.

The state of Pennsylvania and four legal intervenors filed briefs saying the commission could consider stress.

The board itself concluded that stress probabaly cannot be recognized under one law — the Atomic Energy Act — but is includable under another — the National Environmental Policy Act.

"We recommend that we be permitted to include such issues in this proceeding for the purpose of directly reducing the causes of psychological stress," the three-member board wrote.

However, the panel said it didn't see how stress could be put into a "full-scale cost-benefit balancing."

Met Ed and the NRC staff had argued that the public's stress isn't justified, but the board said it doesn't matter.

"We urge the commission to reject out-of-hand the arguments that the commission should ignore community fears of TMI-1 operation because of the assertion that those fears are irrational," the board wrote.

The board also said "precise numerical quantification" of stress isn't necessary.

The New York Times
March 25, 1980

Stress Caused by Accident Is Studied

Concerned that people living near the crippled reactor at Three Mile Island may be suffering from exposure to chronic stress, a team of mental health professionals began interviewing them last November to assess the psychological fallout from the accident.

This Friday, on the anniversary of the event, researchers from the Western Psychiatric Institute and Clinic in Pittsburgh will begin the second phase of the $375,000 study funded by the National Institute of Mental Health.

Evelyn Bromet, the principal investigator, said that she and her colleagues selected three groups likely to have suffered most: mothers of young children, clients receiving psychotherapy at social service agencies and employees of the nuclear plant.

"Our goal," Dr. Bromet said in a telephone interview, "is to examine the effects of living in a chronically stressful situation. We want to know what happens to people afterwards, and what kinds of feelings the anniversary of the event may trigger."

Dr. Bromet explained that the study would compare these individuals with people living in Beaver County near the Beaver Valley and Shippingport Power Plant, twin nuclear reactors where no accident has occurred.

The results of the November interviews, which took one and a half hours and sought information about anxiety or other emotional upsets in the last year, are now being analyzed and will be published in May, she said.

The second series, pending approval from the Office of Management and Budget, will ask about the individuals' life history in terms of mental health.

Dr. Bromet has requested funding for a continuation of the present study, and an extension that would include a population living near a coal-fired plant.

TMI's neighbors find a refuge in their faith

By Linda Loyd
Inquirer Staff Writer

MIDDLETOWN, Pa. — A year ago, members of Glad Tidings Assembly of God Church, near the stricken Three Mile Island nuclear plant, gathered to hear their minister solemnly say, "I believe we are living in the last days."

The frightened churchgoers prayed, sang, hugged one another and sometimes wept in the following days.

Theenddid not come.

Afterward, many believed that they had been spared only by "God's hand upon the situation," said Eileen Carlson, a housewife who lives near the reactor.

"We really faced death. I was afraid," she said. "The Lord gave me assurance. He took hold of my life."

In the year since the crisis, Mrs. Carlson has made a "stronger commitment" to God, her church and her family. She is not alone.

Several local clergymen say the deepening religious feeling that developed here during last spring's crisis has not worn off entirely. And while life goes on much as before, there has been a lasting effect on religious attitudes.

"There's been a definite revival of people I've never seen in church before," said Bill Moore, a young stock manager at a store, who attends the United Methodist Church in nearby Royalton.

People of all faiths have told their religious leaders that they have a new appreciation of the fragility of human life. Some said they thought more deeply about questions involving the meaning of life, the coming of death, the value of materialthings.

One who says the accident deepened her faith is gray-haired Margaret Posey. She recalled that, before the uncontrolled releases of radiation, "I worshiped my furniture, all three rooms of it." But since then, she said, "I put my furniture in perspective, where it belongs. I realized that all you really have is Jesus and yourlovedones."

Housewife Barbara Burkett, who a year ago took her two young sons to stay with a relative in Delaware, said that after the family members were reunited they spent more time together.

"It did bring our family closer to God," said her husband, Vaughn, a mechanic at Bethlehem Steel.

His wife added, "I saw a stronger love of the Lord because I knew he was watching over us. He had to. Otherwise, it would be all over."

"People have re-evaluated their lives and sort of shifted some of their values," said the Rev. W. Jackson Otto of Wesley United Methodist Church. "There has been a reassessment of things important; this includes a deepening of one's faith.

"It has not happened in earthshaking proportions. Rather, it has been a quiet accomplishment."

The religious revival has not swept the area in a dramatic fashion, clergymen say. Residents are not forgoing worldly possessions or everyday pleasures. Instead, a subtle spirituality is mixing with the unease and the resentment that followed the accident.

"It has touched people's lives in a great way," said the Rev. Richard A. Youtz of St. Peter's Church in nearby Steelton. "It was a great shock, like at the time President Kennedy was killed. Or like during a war. People begin to ask themselves what's most important."

"In a matter of days, almost everything these people had worked for — their homes, their farms, their material possessions — was almost gone," said the Rev. Stephen Sparks, pastor of Glad Tidings Assembly of God. "By Saturday night of the crisis, thousands of families had left the area. In leaving, they didn't know if they'd ever be able to come back."

Once people returned to Middletown, many returned to churches, as well. The surge in attendance has been gradual, though, and not all congregations report a "spiritual reawakening" among their members.

But more than half a dozen local churches do, including Seven Sorrows of the Blessed Virgin Mary, Middletown's only Catholic parish, where daily Mass attendance has doubled and Sunday attendance has improved more than 10 percent among the parish's 4,000 members, according to Msgr. George V. Lentocha.

"The levels seem to stay there," he said. "Once people got the taste of a good thing, they stayed with it."

At Glad Tidings, a Pentecostal church, attendance doubled to 200 in the months after the Three Mile Island accident. The growth has been "so tremendous" that the congregation plans to construct a new building to handle the overflow.

Across the Susquehanna River in tiny Newberrytown, attendance at St. Paul's United Methodist Church has risen 10 to 15 percent from a year ago.

"In light of possible disaster, people have been more aware of their faith and their need of God," said the Rev. Harold E. Millard.

At Valley Baptist Church in Middletown, where membership is up 21 percent, the Rev. Bill Reese said, "The crisis at TMI has brought about more of a unity in Middletown. You can walk down the street and get a genuine hello and a smile. There's a genuine concern for people, and it's overflowing in the church, but not centered in the church."

The Rev. Paul J. Griffith, vicar of St. Michael and All Angels Episcopal Church, said he had detected "a better interpersonal relationship between congregants, a little more warmth and compassion.

"In every church you find some friction and bitterness," he said, adding that "this accident seemed to mellow people's attitudes."

Pastors said the crisis had strengthened family ties.

"One particular couple was having marital difficulty when suddenly a year ago they found themselves out of the area in a wooded campsite with nothing but the husband, wife and child," recalled the Rev. Roland Prouse of First Church of the Nazarene in Harrisburg. "They suddenly realized what their real values were, and it made a strong marriage."

Minutes away from Three Mile Island, at St. Peter's Lutheran Church, pastor David Newhart has counseled congregants "who are not necessarily opposed to nuclear power, but are concerned about the safety and welfare of their families."

"Some see the nuclear plant as a threat; others see it as a means of economic growth," he said. "But they all are very much in love with the area and have concerns about their town and want to protect it."

A year after the accident, an "unsettledness" still pervades the community, "and people are apprehensive," said the Rev. Abe Ediger of Calvary Orthodox Presbyterian Church.

"The economy has suffered. Real estate values have gone down. Opportunities for businesses coming in is negative," said another religious leader. "Whether or not they resume the nuclear reactor, concern is for the future and what's going to happen here."

The Philadelphia Inquirer
March 26, 1980

The fears over TMI cannot be smokescreened

"Why can't the state of Pennsylvania find a few thousand dollars, " Sen. Gary Hart (D., Colo.) asked Nuclear Regulatory Commission Chairman John Ahearne Monday, "to find some local experts to assure the people there that you aren't going to gas them to death?"

During the hearings of the Subcommittee on Nuclear Regulation of the Senate Environment and Public Works Committee, which Sen. Hart chairs, he and his fellow senators heard in intense, and clearly frustrating, detail about the response of the people who live near the Three Mile Island nuclear reactor site to the prospect of venting radioactive krypton gas into the atmosphere.

Mr. Ahearne, in his testimony, reported on the meeting last week at Middletown, Pa. "There was anger," he said, "frustration, bitterness, fear, a complete mistrust of anyone who is in an official position." Then he and other officials of the NRC reiterated their position that the radioactive krypton gas which is trapped in the containment building of the TMI reactor must be disposed of before the clean-up of the reactor itself, with its deadly core material and highly radioactive cooling water, can begin. The NRC's position, and of course that of Metropolitan Edison Co., which operates the plant, is that venting the krypton into the atmosphere will not pose a health hazard to people in the area.

Sen. Hart's more detailed response was to ask: "Why can't the Pennsylvania legislature appropriate $10,000 or $50,000 or $100,000 to hire nuclear experts... to look at this cubic yard of gas and tell people around there it's not going to hurt them?" The context of that suggestion was Sen. Hart's contention that Pennsylvania officials had failed in calming the fears of the people of central Pennsylvania. "I would think the state of Pennsylvania would have some responsibility," he insisted. " This is just one instance of where state governments are not being responsible."

Sen. Hart's criticism of Pennsylvania officials is 180 degrees off-target. Gov. Thornburgh and his aides managed the most reliable and responsible performance of anyone in the TMI crisis. Still, the senator's frustration, perhaps, is understandable, if it is assumed that it is based on ignorance.

If he were to go to the area around TMI, if he had gone to the meeting Mr. Ahearne cited, if he will go to future ones promised by the NRC or, better yet, organize some of his own under his subcommittee's auspices, that ignorance could be erased.

He would perform an important national public service if he would do just that, and begin the process of educating Washington officialdom to a serious and growing social problem of the NRC's and the nuclear industry's — and their predecessors' — own making. Sen. Hart would do particularly well if in scheduling Senate hearings at the site he would insist that the commissioners of the NRC go along — and that everybody listen.

They would hear a great deal, and perhaps come to understand why there is profound — and fully justified — opposition to the venting of the gas.

They would hear from good, solid, skeptical, tax-paying citizens, with not an anti-nuke activist among them. They would hear from people who have been lied to, by Met Ed, by their government — *their federal government* — whose officials bumbled and spun their wheels in impotence in the immediate aftermath of the March 28, 1979, accident — the worst in the American nuclear industry's history.

They would hear from people studious enough to know that the same protestations as are now being made about the krypton venting were made about radiation from nuclear weapons tests in Utah and Nevada in the 1950s, as both U.S. troops and civilians stood by — only years later to be shown to have inordinately high rates of certain cancers and other health damage.

If they heard that, and listened — to the social problem as well as to the still far from certain scientific estimates of potential health damage — they would demand that the gas be disposed of in a way other than spewing it into the atmosphere.

If they don't do that, long-latent cancer and genetic damage may not be inevitable. No responsible scientist is absolutely certain of that, either way. But one thing *will* be absolutely inevitable. That is that the fear, the frustration and the "complete mistrust" of the government will significantly, and dangerously, increase.

THE NEW YORK TIMES, THURSDAY, MARCH 27, 1980

Ongoing Fallout: Fear

By Harvey Wasserman

NEWBERRY TOWNSHIP, Pa. — It's been a year since the accident at Three Mile Island but the air in the community surrounding the plant is thicker than ever with anger and fear. In fact, in seven years of working to stop atomic reactors in my own home town, Montague, Mass., and elsewhere, I've never encountered a community so close to the brink of an upheaval over the nuclear issue.

The reasons are many. For one thing, people in the farm country surrounding Three Mile Island now believe that the plant has been harming their animals since well before the accident. For four years now, Jane Lee, who lives on a farm in the village of Etters, has been collecting affidavits from area farmers on what they call "strange goings-on" with their animals. Their accounts include a frightening array of biological problems in animals ranging from cats to cows. The list includes spontaneous abortions, stillbirths, sterility, mutant offspring, blindness, defective bone structure and sudden death — all without clear causal explanation.

Dr. Robert Weber has also noticed problems. He is veterinarian in Mechanicsburg, 15 miles from the plant, who has practiced in the area for 32 years. Early this month, he testified before the Public Utilities Commission in Harrisburg that since 1976 he has been encountering widespread bone problems among cows in the area. After giving birth, he said, the cows "go down and can't get back up." Dr. Weber said further, in an interview, that in the summer and fall of 1979, "after the plant went bad," he began performing one caesarean-section operation a week on pigs that were unable to dilate properly despite sizeable hormone injections. He said that previously he had been called on to perform only one or two such operations a year. At the moment, he says, he is also performing two such operations a week on goats and sheep; one or two a year had been the normal [illegible].

Privately, both Jane Lee and Dr. Weber suspect that the problems are coming from the power plant, possibly from radiation, possibly from substances sent into the atmosphere through the cooling towers that may be altering the chemistry of the soil.

Charles Connolly, who lives in clear view of the four cooling towers, also has his suspicions. He says that when the reactors were operating, rainfall running off his roof would kill the grass around his house and would wash into his cisterns a milky white substance that would make animals who drank it "lie down and get sick." When the reactors stopped operating, the milky substance disappeared, he said. Mr. Connolly, who has lived on his farm since 1913, says that yields from his farm have dropped noticeably since the opening of the first reactor in 1974 and that since the accident at the second reactor, wild birds, game animals and snakes have greatly diminished in numbers.

In recent weeks, hot debate has developed over statistics indicating increased infant mortality and infant hypothyroidism in area hospitals. One York family has filed suit against Metropolitan Edison, operator of the reactor, over the post-accident stillbirth of their child. One Mechanicsburg couple wonders quietly if the birth of their daughter with the dreaded Down's Syndrome, a genetic defect, might have somehow been linked to the accident. One Hershey woman chose to have an abortion and then had herself sterilized rather than rear an infant where "it will never be clean."

Noone has definitive scientific proof of what health problems the emissions have or have not caused. But local residents are furious that no official study has been done on their animals, and many are nervous to the point of breakdown about what might be happening to them and their children. Some have begun a multi-million-dollar class-action suit for psychological damages stemming from the accident. Many say they would move "in a minute" if they could sell their farms or houses and find jobs elsewhere.

Indeed, there are hundreds here who once welcomed nuclear power into their neighborhood but who now curse Metropolitan Edison, the Nuclear Regulatory Commission and the state. Many are starting to turn public meetings with utility, state and Nuclear Regulatory Commission officials into harsh confrontations. They don't want more krypton gas vented into the atmosphere. They don't want reactor No. 1 restarted. They do want reactor No. 2 dead and buried. Most of all, they want some clear answers about the health of their animals and families.

As a nation we have an obligation to make sure that those answers are forthcoming. There are 67 reactors licensed for commercial operation in this country, and 87 under construction. To my knowledge, none of them is immune to what happened at Three Mile Island and none of us is immune to the kinds of emotions its neighbors are feeling.

Harvey Wasserman, a long-time anti-nuclear activist, is author of "Energy War: Reports From the Front."

The New York Times/Teresa Zabala

Residents of Middletown, Pa., meeting about Three Mile Island.

At least 14 mental health studies have been conducted among affected Pennsylvanians.

Researchers Finding Anxiety in the Air Near 3 Mile Island

By BEN A. FRANKLIN

Special to The New York Times

MIDDLETOWN, Pa., March 26 — When ordinarily law-abiding, solid citizens — housewives, lawyers, mothers and fathers — stand up and shriek in public that they and their children are being driven to the edge of sanity, and that some of them may leave their families or become violent, psychiatrists take notice.

And they are, again, here this spring. As a new decontamination plan at the disabled nuclear plant at Three Mile Island poses still more potential hazards for the people in this area, many of whom are protesting angrily and fearfully, researchers are studying the thousands of Pennsylvanians driven from, or afraid to leave their homes a year after the accident a year ago.

At least 14 separate studies have already generally concurred in finding, as one of the reports says, that "the major health effect of the accident appears to have been on the mental health of the people."

At the same time, while some of the mental health studies are scheduled to keep on monitoring for several years, both the main Federal and state studies on the accident have called the psychic effect "transient." The stress effects, according to the major Federal study, "dissipated rapidly among most groups."

Now, however, some of the mental health experts here say that there are new and worrisome signs that the psychological remission that some reports found to have occurred in the months after the accident may be coming apart.

'A Lot of New Stress'

"There is new data", as one psychiatrist put it. "There is a lot of new stress. We're not sure it hasn't become chronic".

The stress is the announced plan of the Nuclear Regulatory Commission to purge the 200-foot-high, concrete Three Mile Island-2 containment structure of 24 million cubic feet of Krypton-85 by venting the radioactive gas into the June air of Dauphin County — and of the area downwind of the prevailing easterlies along the shores of the broad Susquehanna River.

On Friday, the first anniversary of the accident, the second phase of the largest mental health study — a $375,000 research funded by the National Institute of Mental Health — is to begin, resuming and repeating the set of interviews conducted last year.

In May, Evelyn Bromet, director of psychiatric epidemiology at the Western Psychiatric Institute in Pittsburgh, and the project director, is to report on these re-interviews with the subjects of the study — women with young children who were advised to evacuate a 15-mile radius of the plant, the "at risk" clientele of local mental health clinics and workers at the reactor.

Discouraging Report Expected

On April 8, the state Department of Health's "T.M.I. Stress Study," headed by Peter Houts, a behavioral scientist at the nearby Hershey Medical Center, is to release a report on the accident's effect. Dr. Houts would not discuss the study today, but it is expected to say that data collected as recently as January show continuing, serious mental health problems in the area near the reactor.

Since it was announced a few weeks ago, the Krypton venting plan has stirred an outburst of protest that many here, including some top officials, believe might force officials to use alternative, much more costly and time-consuming methods.

At an unofficial two-hour "forum" taped Tuesday night for broadcast by a Harrisburg television station on Friday, witness after witness spoke in anguished and trembling voices to a panel of Federal, state and local officials.

'Scared to Death'

"I am scared to death," said Mary Enterline. "I have a 2-year-old son and every night when I pull his shade down at bedtime, and look out the window and see the cooling towers, I nearly cry. I am in a panic. I have never considered myself a violent person, but I am beginning to think I am going crazy — I do believe I am."

George Hickernell, a veteran local politician and civic leader, now a commissioner of Lower Swatara Township, a few miles from the reactor, said, "This is a very volatile situation and could be very dangerous. I visualize that we could have some serious incidents and riots."

Robert G. Reid, the high school teacher who is the Mayor of Middletown, joked sardonically at the televised forum that he wished local banks would replace the time and temperature information they now display on their flashing outside clocks with "the radiation count, so I'd know when to run."

The Mayor had just commented that regarding health-related radioactive releases from the reactor, "I'm quite sure they'll never tell us the truth."

Question From 11-Year-Old

John Lesniak, an 11-year-old who came with a tape recorder, asked, "What's going to be the future state of children my age, mentally and physically — mentally?"

"Well, the Kemeny Commission report says the mental effects are the most important," was the answer from Thomas M. Gerusky, the state director of radiation protection.

One young man, a college student, said, "We have Iran, and life goes on — we have Afghanistan, and life goes on. But with this crisis, I am beginning to think it is not going to go on and there is going to be an end to the world."

Obviously, not everyone agrees. In a half-day's stroll through Middletown, a visitor found only one person in a dozen who did not criticize such testimony as "hysterical" and "disgusting," though none had attended any of the recent meetings. These are people who say they accept or endorse the Krypton venting, however reluctantly, as "necessary to get on with the cleanup."

At the David Martin Store, a haberdashery, there is a brisk sale of $4.50 T-shirts, most of them bearing pro-T.M.I. silk-screened slogans: "Hell No, I Don't Glow," "T.M.I. Staff — We Stayed Behind To Save Yours," and "A Little Nukey Never Hurt Anyone." The store has T-shirts saying "I Survived T.M.I.," one version with a tiny postscript that adds, "I Think."

In the Hy-Lo Discount Store on Main Street, the cashier, Marion Munz, a 56-year-old widow was repeating the comment of several others when she said "I'm worrying, but I'm the type who doesn't show my feelings."

A College Survey

"I think that is cognitive dissonance," said Donna Casperson. An instructor at the Harrisburg Area Community College, she had her social psychology class conduct a survey on the street two weeks ago. It yielded an unexpected result.

The tabulation showed markedly greater concern about the proposed Krypton release among respondents 11 to 40 miles away from the reactor than in Middletown, in sight of it.

In an interview, Miss Casperson theorized that "when there is a conflict between beliefs — say that the Krypton is dangerous, on the one hand — and the difficult behavior, on the other, of uprooting one's life and giving up a home and a job to move away from the danger, the theory of cognitive dissonance says that you have two ways to resolve the conflict.

"You can leave. Or you can stay and alter your beliefs — or your demonstration of them — to fit the suppressed anxiety. You can say 'I don't care'".

"Neither way is very good for your mental health", she said.

The New York Times
March 28, 1980

Psychiatrists Fear Chronic TMI Stress

By Ben A. Franklin
New York Times News Service

MIDDLETOWN, Pa. — When ordinarily law-abiding, solid citizens — housewives, lawyers, mothers and fathers — stand up and shriek in public that they and their children are being driven to the edge of sanity, and that some of them may leave their families or become violent, psychiatrists take notice.

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Since it was announced a few weeks ago, the Krypton venting plan has stirred an outburst of protest that many here, including some top officials, believe might force officials to use alternative, much more costly and time-consuming methods.

But the new evidence of deep and continuing stress, shown in mere discussion of the issue at the required public hearings on the plan, has shocked and dismayed many mental health observers here.

At an unofficial two-hour "forum" taped Tuesday night for broadcast by a Harrisburg television station today, witness after witness spoke in anguished and trembling voices to a panel of federal, state and local officials.

"I am scared to death," said Mary Enterline. "I have a 2-year-old son and every night when I pull his shade down at bedtime, and look out the window and see the cooling towers, I nearly cry. I am in a panic. I have never considered myself a violent person, but I am beginning to think I am going crazy — I do believe I am."

George Hickernell, a veteran local politician and civic leader, now a commissioner of Lower Swatara Township, a few miles from the reactor, said, "This is a very volatile situation and could be very dangerous. I visualize that we could have some serious incidents and riots."

Robert G. Reid, the high school teacher who is the mayor of Middletown, joked sardonically at the televised forum that he wished local banks would replace the time and temperature information they now display on their flashing outside clocks with "the radiation count, so I'd know when to run."

The mayor had just commented that regarding health-related radioactive releases from the reactor, "I'm quite sure they'll never tell us the truth."

John Lesniak, an 11-year-old who came with a tape recorder, asked, "What's going to be the future state of children my age, mentally and physically — mentally?"

"Well, the Kemeny Commission report says the mental effects are the most important," was the answer from Thomas M. Gerusky, the state director of radiation protection.

One young man, a college student, said, "We have Iran, and life goes on — we have Afghanistan, and life goes on. But with this crisis, I am beginning to think it is not going to go on and there is going to be an end to the world."

Obviously, not everyone agrees. In a half-day's stroll through Middletown, a visitor found only one person in a dozen who did not criticize such testimony as "hysterical" and "disgusting," though none had attended any of the recent meetings. These are people who say they accept or endorse the Krypton venting, however reluctantly, as "necessary to get on with the cleanup."

At the David Martin Store, a haberdashery, there is a brisk sale of $4.50 T-shirts, most of them bearing pro-T.M.I. silk-screened slogans: "Hell No, I Don't Glow," "T.M.I. Staff — We Stayed Behind To Save Yours," and "A Little Nukey Never Hurt Anyone." The store has T-shirts saying "I Survived T.M.I.," one version with a tiny postscript that adds, "I Think."

But the public forums and official hearings on the Krypton venting proposal, which are not over yet, have spread some distress.

More people than ever before have been reading about, or seeing and hearing on radio and television, frightened neighbors who stand and report "a metallic taste in my mouth" near the plant or "aborted and three-legged calves" on farms downwind.

In the Hy-Lo Discount Store on Main Street, the cashier, Marion Munz, a 56-year-old widow was repeating the comment of several others when she said, "I'm worrying, but I'm the type who doesn't show my feelings."

"I think that is cognitive dissonance," said Donna Casperson. An instructor at the Harrisburg Area Community College, she had her social psychology class conduct a survey on the street two weeks ago. It yielded an unexpected result.

The tabulation showed markedly greater concern about the proposed Krypton release among respondents 11 to 40 miles away from the reactor than in Middletown, in sight of it.

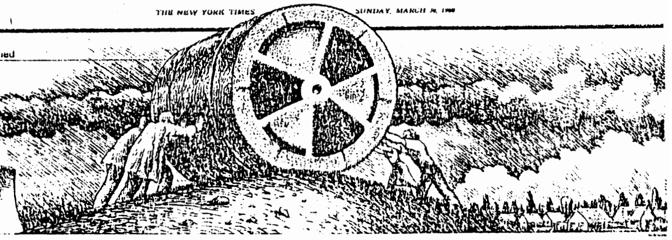
A-19

The New York Times
March 30, 1980

22 E THE NEW YORK TIMES SUNDAY, MARCH 30, 1980

IDEAS & TRENDS Continued

Energy



A Year Later, Three Mile Island Generates Anger

A year ago last Friday — March 28, 1979 — things started to go wrong at a nuclear power plant operated by the General Public Utilities Corporation at Three Mile Island, in Middletown, Pa. Today, in the bowels of the plant, the reactor core is still inaccessible, surrounded by the containment vessel which houses 22 million-cubic feet of air, contaminated by radioactive krypton 85.

In the aftermath of the accident, life has become very hard for General Public Utilities and for the nuclear industry in general. Last week the financially troubled utility sued the Babcock & Wilcox Company, which supplied the nuclear steam system for the plant, for $500 million, charging negligence, while the Commonwealth Edison Company, the nation's biggest nuclear utility, was indicted for conspiracy and making false statements about breaches of security at one of its plants — the first such charges brought against a nuclear power company, according to the Justice Department.

If doubt now hangs over the future of nuclear power in the United States, there is no doubt at all in the hearts and minds of many citizens in the Three Mile area and elsewhere. Over the weekend, antinuclear demonstrations were conducted at power plants nationwide, and scores were arrested in New Jersey, Missouri and elsewhere.

Antinuclear forces have recently been additionally provoked by the nuclear establishment's decision-making process as applied to the krypton bubble inside the plant. If the plant is ever to be cleaned up, engineers and regulators are certain, the krypton has to go. Otherwise, the space is too dangerous for workers.

But many local residents are adamantly determined that it must not be released the way most nuclear experts want to release it: into the open air.

On March 19, staff members of the Nuclear Regulatory Commission and several other agencies held public hearings in Middletown to describe and discuss an environmental assessment of the consequences of venting the krypton. The staff members were repeatedly shouted down by the crowd; and when the public got the microphones, they told the experts just how they felt. For example:

"I can't be rational in the sense of objectivity," one man told the hearing. "No one can live within 30 miles of here and be totally objective. . . . I want to believe you but I do not believe you." Another said: "Even the best minds that are trying to work with us, and I do believe they are sincere, as maybe some people don't but I do. I want to. For the sake of humanity I have to. But the thing is, there are no experts, let's face it." Others blamed the accident — and, by implication, the venting, should it take place — for sinusitis, hypothyroidism, bronchitis, unhatched goose eggs and blind puppies. "We are sick, we are tired, we are angry," one woman told the experts. "I went through a really nice Christian martyr trip trying to forgive you, but I can't any more. I want to say welcome to Nuremberg, because that's what this is going to turn into."

Cancer and other diseases aside, one questioner demanded, "Isn't it true that stress, anxiety and fear will also shorten our lives?" An N.R.C. staff member who replied that indeed such effects were being studied — as they are — was shouted down.

A-20

SCIENCE, VOL. 208, 4 APRIL 1980

Psychiatrists Study Three-Mile Trauma

The first anniversary of the Three Mile Island episode is now upon us (the accident officially began at 4 a.m. on 28 March 1979) and there is no end in sight to the postmortems. One of these is a study which is probably the first of its kind: a disaster survey of a nondisaster. Studies of the psychological aftereffects of natural disasters are common. But Three Mile Island is a case where no physical damage to the population or environs occurred; only psychologically does it rank as a trauma.

The President's commission on the accident reported, 6 months afterwards, that the incident had a demoralizing effect on large numbers of people. Now the National Institute of Mental Health is directing a survey to identify long-range psychological effects on those regarded as the most vulnerable members of the population. The study, headed by Evelyn Bromet of the Western Psychiatric Institute and Clinic in Pittsburgh, involves 1000 people living in the vicinity of Three Mile Island: They are divided into three groups: mothers of small children born within the year prior to the accident (most of whom followed the governor's advice to evacuate), unionized plant employees, and clients of the public mental health system who had been in treatment within 6 months prior to the accident.

Bromet's team of interviewers—all of them screened for antinuclear bias—have already completed phase one of the survey, in which respondents were asked general questions related to their emotional well-being and primary social relationships over the previous year.

Phase two, currently under way, involves reinterviewing all these people, with the idea of gaining a picture of their emotional well-being over the entire course of their lives. (Women who were pregnant at the time of the accident are not included in the survey because the state health department is conducting its own survey with them.)

Constance Holden

The Daily News
April 10, 1980

Monitoring Isn't Better

By George Lobsenz and Scott MacLeod

Before the accident at Three Mile Island, the state government had one air monitor around the state's nuclear power plants to measure radiation in case of a serious nuclear accident.

Although this insufficient monitoring was criticized later by a Presidential commission, it has not been upgraded at plants other than Three Mile Island. The state still has only one air monitor in place at the Beaver Valley and Peach Bottom nuclear plants in Beaver and York counties.

Before the accident at Three Mile Island, the Health Department had no library of information on health matters relating to nuclear power plant accidents.

Although a Presidential commission recommended Pennsylvania upgrade its research resources to handle nuclear emergencies, the Health Department still has no library.

In short, because of these and other apparent weaknesses in state policy, state government is not prepared to respond effectively to health concerns now — one year after Three Mile Island — were another nuclear accident to occur.

Why?

The state officials responsible for the radiation monitoring and the radiation health library suggest bureaucracy is holding up swift, efficient planning in the event of another nuclear accident.

"You can't do it overnight," said Thomas Gerusky, chief of the Bureau of Radiation Protection, who explained he ordered new monitoring equipment four months ago but the supply-purchasing Department of General Services hasn't delivered yet.

"We have the bookshelves, but not the books," said Health Secretary H. Arnold Muller when asked about the state's lack of a radiation health resource library.

The two apparent weaknesses in state nuclear accident planning were among 29 found in a review of state preparedness by United Press International. In all, 17 of the 29 weaknesses related to health plans.

Perhaps the most serious weakness was that a year after Three Mile Island, the Bureau of Radiation Protection still has only one nuclear engineer — although Gerusky and others feel the state should have five nuclear engineers for the 11 nuclear plants operating or under construction in the state.

The job is an important one because the nuclear engineer provides assessments of nuclear accidents to aid the governor in his decision on whether to order a precautionary evacuation of citizens.

The state apparently has not installed a radiation detector at the drinking water works in Midland, Beaver County, downstream from the Beaver Valley nuclear plant.

Despite the recommendation of President Carter's Commission on Three Mile Island for Pennsylvania to stock potassium iodide, a thyroid cancer-blocking agent, in case of another nuclear accident, the state possesses no potassium iodide.

Moreover, the state has established no means of medically treating the hundreds of people who could become severely injured by radiation in the event of a serious nuclear accident.

The state has not devised a plan to ensure that physicians who would be needed to treat victims in a nuclear accident do not themselves evacuate the area as many did during the Three Mile Island crisis.

The state has not yet started a formal program to educate physicians about the health problems associated with nuclear power, radiation sickness as well as psychological stress.

On stress, the st te has yet to look into whether the mental anguish of nuclear power's hazards are so great, or are so potentially great, as to be a factor in a state's endorsement of nuclear energy generation within its borders.

The Health Department, which must provide key medical advice to the governor for his decision on precautionary evacuation of citizens, does not employ a radiologist and must rely on an outside consultant.

A dispute arose after the Three Mile Island accident over which should advise the governor on nuclear health matters, the Health Department or the Bureau of Radiation Protection in the Department of Environmental Resources. It was decided they both should.

The Health Department's policy of withholding tentative research data about the health effects of the Three Mile Island accident has created anxiety among citizens on two occasions. Both times, the information regarding potentially serious health effects was leaked to reporters by insiders who thought the public should know the findings.

A registry of cancer victims across the state is viewed as vital to research on the long-term health effects of the Three Mile Island accident, but funding for the project has been stalled in the General Assembly.

Finally, the state has not undertaken a review of a major debate among scientists over the health effects of low-level radiation such as that emitted from normally operating nuclear plants or the level of radiation released during the Three Mile Island nuclear accident. Some highly regarded scientists expect to find some "surprises."

Tomorrow: Is evacuation possible?

APPENDIX B

ATMOSPHERIC TESTING
(U.S.)

One of the early witnesses Tuesday was Katherine Striemer former director of the CDFA's environmental assessment team, who since termination of the team nearly a year ago has worked in the state Water Resources Agency.

Ms. Striemer was highly critical of the CDFA's failure to adopt the team's findings or the 68 recommendations that it believed had to be made if the CDFA were to come into compliance with the California Environmental Quality Act.

She said "unfortunately" there is very little evidence that any part of the team's report has been incorporated or ever considered in the proposed program of regulations.

"Apparently the department has decided to ignore the finding of its earlier report," Ms. Streimer said.

Ms. Striemer added, "The most striking shortcoming of the proposed program is the lack of defined administrative and scientific procedures that will carry out the mandate of CEQA to identify and avoid (environmental) impacts, to implement safer alternatives and to involve the public in the decision-making process."

The CDFA and county agriculture commissioners have estimated it would have cost $3.8 million a year to implement the environmental assessment team's administrative and enforcement regulations.

If Johnson does not certify the regulations—and most observers see no chance that he will unless major changes are made—then what will happen next is unclear.

Johnson said in an interview the matter should then go back to the CDFA for modification.

CDFA Director Rominger disagreed. He contended the matter would have to go to the Legislature for resolution if Johnson did not sign off on the new regulations.

REPRINTED FROM THE LOS ANGELES TIMES, MONDAY, SEPTEMBER 17, 1979

Concern grows

Radiation: A Deadly Fact of Everyday Life

BY GAYLORD SHAW
Times Staff Writer

DENVER—Because her suburban home is midway between the Rocky Flats nuclear weapons plant and Colorado's largest uranium mine, Carol Watson wondered whether her family was being exposed to higher-than-normal levels of radiation.

Last spring she decided to take samples from her home's water taps to a private laboratory for testing. For $18 per sample, she got some startling news: The water was so tainted by uranium that whoever drank it was receiving an annual radiation dose of 3,000 millirems, roughly 60 times the amount the average American receives from naturally occurring radioactivity in food and water.

Outraged, Mrs. Watson and some of her neighbors switched to bottled water or well water and, banding together in what became known as the "Housewives Mafia," sought to pinpoint the cause.

They quickly gained an ally in Polly Hearn, chairman of the North Table Mountain Water Board, who had been worried for months that the water supplied by the quasi-governmental agency to 7,500 customers in Denver's western suburbs might be unsafe. Mrs. Hearn helped arrange for government tests, which indicated the problem could be traced to Upper Long Lake, a reservoir fed by Ralston Creek, into which the Cotter Corp. dumps waste water pumped from deep shafts of the mine that produces uranium to fuel Commonwealth Edison Co.'s nuclear power plants near Chicago.

The "Housewives Mafia," by circulating petitions and bringing court action, succeeded in switching the water system at least temporarily to another nearby reservoir that had negligible radiation readings.

The issue is far from resolved and the health effects are undetermined, but the episode illustrates a growing public awareness and concern over how radiation is finding its way into everyday life.

33

Even before the accident at Pennsylvania's Three Mile Island nuclear plant riveted the nation's attention on the perplexing controversy, there were signs of increasing anxiety over exposure to low levels of radiation.

In Nevada and Utah, for instance, citizens committees were formed to seek compensation for individuals exposed to radioactive fallout from nuclear tests in the 1950s and 1960s.

In Florida and Pennsylvania residents voiced concern after discovering that radioactive material had been used in the foundations of their homes and businesses.

In Michigan and Louisiana public protests stymied proposals to locate nuclear- waste disposal facilities there.

In California and a number of other states there were demonstrations against new or existing nuclear power plants.

But even with the growing prominence of the controversy, radiation is an issue that confuses most Americans. One reason is the tongue-twisting scientific terminology—words like ionization and picocuries, roentgens and radiostrontium.

Another reason is that radiation comes in many forms. There are, for example, alpha particles given off by decaying uranium, beta rays given off by decaying thorium, gamma rays given off by all sorts of radioactive material.

Radiation sources are both natural, such as rock formations, and manmade, such as nuclear reactors or medical x rays.

And different forms of radiation have different effects on the human body.

Gamma radiation, which can penetrate concrete, is especially damaging to parts of the body that have cells that reproduce constantly, such as the bone marrow, where blood cells are manufactured.

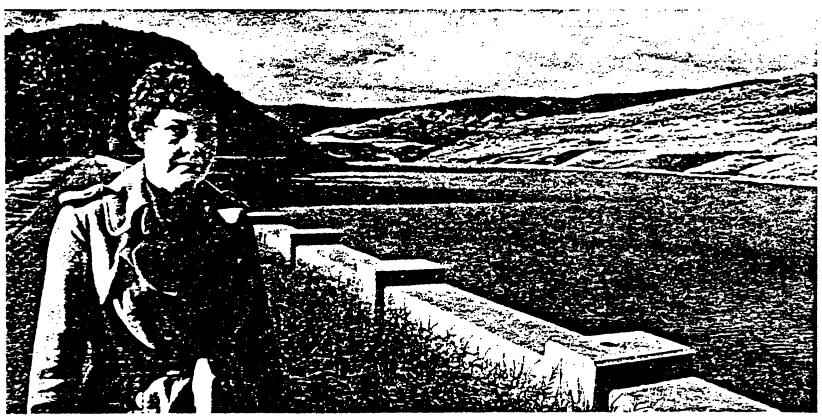
Alpha radiation does not penetrate like gamma radiation; it can be blocked by a single sheet of paper. But if inhaled or ingested, it can concentrate in the body's organs and "create chemical havoc in surrounding cells," said one health expert, who added:

"If cells are damaged by much of this material, the cells try to repair themselves. They may start acting abnormally and reproduce uncontrollably. In a short time a tremendous number of injured, out-of-control cells can proliferate, creating a tumor. When the tumor gets to a certain size, cells break off and circulate in the body and the cancer spreads."

There is a difference of opinion among experts over how much, if any, damage is caused by small amounts of radiation.

And there is debate over whether the social and economic benefits of the nuclear age—such as use of radioactive substances to treat cancer and other diseases, or the electricity generated by nuclear power plants—outweigh concerns over possible harm from low-level exposure.

It generally is agreed that the mean lethal dose of radiation, the level at which half of the people who are exposed will die, is about 500 rems (for roentgen equivalent man). For comparison, the average chest x ray involves an exposure to about 20 millirems (a millirem is a thousandth of a rem), and nuclear plant workers have an average exposure of 760 millirems a year.



WATER SOURCE—Polly Hearn, chairman of North Table Mountain Water Board, at reservoir.

Photo by James A. Cook

But the scientific community is sharply divided over the impact of low-level radiation on the general population. For example, when a National Academy of Sciences committee estimated last spring that low levels of radiation from all sources would lead to the development of 220,000 cases of cancer in the lifetime of today's population, five of the committee's 16 members disagreed, contending the projection was far too high.

In parts of the West even deep wells show high radiation levels.

To compound the confusion, at least 16 separate federal agencies and offices have regulatory authority in radiation exposure, and there are gaps in the patchwork of laws and regulations they enforce—sometimes resulting in Catch- 22 situations.

For example, there presently are no federal rules limiting uranium-caused radiation in drinking water. Like most states Colorado has no rules, either. Thus the drinking water being piped into Carol Watson's home in suburban Denver, although laden with potentially dangerous radiation, violates no standards.

This summer officials of the Environmental Protection Agency in Washington urged Colorado to take "prompt control measures" to reduce radiation in that suburb's water supply. It recommended that uranium-caused radiation be limited to 10 picocuries per liter, a level far below the 80 picocuries of gross alpha radiation found in a liter of Mrs. Watson's water.

If that standard is applied elsewhere, water supplies in scores of communities in Western states could be considered undrinkable, according to Paul Smith, regional director for radiation programs in the EPA's Denver office. This is not only because of widespread uranium mining in the West, but also because undisturbed uranium deposits can cause higher radiation levels in surface streams and underground aquifers.

For instance, Montana officials found that an artesian spring used by 25 families in a rural area near Alhambra, south of Helena, had gross alpha radiation of up to 230 picocuries per liter. "It's all natural —the water is just coming up through uranium deposits," said Larry Lloyd of the state's Department of Health and Environmental Sciences.

The Montana families drilled wells to avoid the uranium contamination, but elsewhere in the West, even deep wells show high radiation levels.

In the tiny northwestern New Mexico settlement of Martinez Camp, complaints from residents that their livestock were becoming ill and losing their hair prompted tests of a water well, which disclosed gross alpha radiation of 300 picocuries per liter. This caused Indian Health Service officials to shut down the well, forcing residents to haul water from a trading post six miles away.

Tests also were under way on more than 100 other wells in the region stretching from Grants and Gallup in New Mexico to Many Farms and Round Rock in eastern Arizona.

This region has been the site of some of the nation's most extensive uranium mining since the late 1940s, and the fact that it has taken more than three decades for authorities to begin to systematically check its water supply for radioactivity illustrates the slowness of the official response to potential radiation dangers.

This tendency toward tardiness in recognizing potential dangers has been displayed before.

Radium is a prime example.

Just before the turn of the century, French scientist Marie Curie discovered that radium could be extracted from uranium ore. In Colorado local legend has it that Madame Curie used ore mined from the mountains west of Denver. Actually the ore came from Bohemia, but soon a booming industry developed here to produce radium from Colorado uranium.

In that era radium was touted worldwide as a miracle substance that "makes old age a joy and prolongs human life," and businesses in Denver and elsewhere hurried to meet demand for the substance. Among the widely sold products was a crock lined with radium salts. These were sold with instructions for the user to fill the crock with water each night, then drink heartily the next day to cure whatever ailed him.

Many locations in Denver had readings of up to 200 times normal.

Twenty-five years after discovering radium, however, Madame Curie was dead of cancer and scientists began concluding that rather than a magical elixir, radium was a dangerous carcinogen. Eventually strong restrictions were placed on its use.

Yet it was only this year, more than half a century after the radium boom fizzled, that officials discovered that a potentially dangerous legacy still lurked in Denver. And the discovery came almost by chance.

An EPA researcher who was looking through old bulletins of the U.S. Bureau of Mines came across references to the National Radium Institute, which was established in Denver in 1913 with the federal government's help. By checking old city directories, authorities found the institute's address—a site occupied in recent decades by a brick plant.

State inspectors went there and found abnormally high radiation levels. The search for contaminated sites broadened, and eventually it was determined that more than two dozen locations throughout the city—including several downtown office buildings, residential lots and even a restaurant parking lot—had radiation readings of up to 200 times normal.

It will cost up to $25 million to decontaminate the sites, officials estimate, but little work has been done because of an unresolved dispute over whether the federal, state or local government—or the current landowners—will foot the bill.

Officials can only guess at the long-term health effects of exposure to the wastes from the radium processing operations. One problem is that they have been unable to locate anyone who worked in the radium plants 60 years ago, leading EPA's Paul Smith to suspect that the workers "never saw old bones."

Across the Continental Divide, residents of the southwestern Utah community of St. George can offer poignant testimony about the effects of radiation on health—they have watched their relatives, friends and neighbors die by the dozens of cancer.

They contend that the deaths were caused by radioactive fallout from the 80 atmospheric nuclear tests conducted by the Atomic Energy Commission at its Nevada testing ground during the 1950s and early 1960s—tests almost invariably timed so that the prevailing winds would carry the radioactive cloud away from Las Vegas and the population centers of California, but toward southwestern Utah.

Federal officials have argued that no scientific evidence can link the cancer deaths in St. George to the nuclear tests, but recently released government documents, some of them kept secret for more than a quarter of a century, disclose that AEC officials knew that as early as 1953 that the St. George region had been subjected to "the highest 24-hour average concentration of fallout ever measured in a populated area."

This spring expert witnesses at congressional hearings said the radiation filtering down on St. George was up to 500 times greater than the level resulting from the accident at Three Mile Island.

But back in the 1950s the residents of St. George knew none of this.

Parents would awaken their children before dawn on days of announced tests and take them to the top of the ridge outside town. "We listened for the rumble and saw flashes and our children were even given school assignments to watch," recalled Mrs. Glenna Orton, the mother of six. The test site was more than 100 miles to the west, so it would take a few hours for a "big, red cloud" to drift over the community.

No one thought much about it until many years later.

"No warnings of danger were really given to us," Mrs. Orton said. "They told us it wouldn't hurt us. We were quite naive and we believed what we were told."

"We are now paying dearly," said Mrs. Irma Thomas, who has lived in the same house on a quiet street in St. George for 45 years. "... Since that time I have counted the number of cancer victims just within a one-block radius of my house, and I have counted 29 victims. Eight of them have died."

Almost everyone in St. George, it seems, can offer similar accounts.

Elmer Pickett, owner of Elmer's Hardware on Main St., recites the cancer or leukemia deaths in his family. "My wife... a niece, 5 years old... a sister, a sister-in-law, a mother-in-law, an uncle, a grandmother and two great-uncles.

"We had nine cancer victims... all since the fallout," Pickett said. "I cannot find anywhere in our family records as far back as I can go any other cancer-related deaths. We have been a very healthy family; the majority of our family on both sides have lived to very ripe old ages... it has all happened since the fallout."

The litany of death, as related in interviews and congressional testimony, continues.

Ruby Mathieson's husband died of leukemia in 1976, the same year her father died of cancer. Her sister and brother-in-law also died of cancer.

Irene Allen lost two husbands to cancer—the first in 1956 and the second about 20 years later.

Darrell Nisson's 13-year-old son died of leukemia. "I finally took him home from the hospital, let him die at home. He didn't die in a hospital, he died in my arms..."

Kay Millett's 3-year-old daughter died of the same disease. "All the time I was growing up (near St. George) I never heard of one single case of leukemia," she said. "I never heard of it at all until just right before our little girl died, two or three others died, and all of a sudden everybody was being touched by the same thing, this rare disease.

"... It's the radiation. It is obvious. We ate it, we walked in it, we breathed it, we washed our clothes in it... and even the little children ate the snow. You know how little kids love snow. They went out and they would eat the snow. They didn't know it was going to kill them later on."

St. George is a close-knit community whose mostly Mormon residents tend to be quietly patriotic supporters of their government, its policies and actions. But the effect of the radioactive fallout has left a residue of distrust and bitterness.

"I don't think a million dollars could ever replace a loved one," Mrs. Millett told a congressional hearing. "I don't think we should even talk about money in this case. I think that the people who were responsible in the Atomic Energy Commission... should be brought to trial and prosecuted as murderers."

"That's just the way I feel about it," she added. "And until that's done, I don't think that any amount of money can ever repay anybody. I feel like that's the feeling of most people who have lost loved ones. They aren't interested in money."

Nonetheless more than 600 claims have been filed with the government by residents of Utah, Nevada and northern Arizona, claiming damages resulting from the radioactive fallout. Despite pressure from congressional committees and governors in the region, federal officials are hesitant to admit liability.

Donald Gonya, a deputy assistant counsel for the Department of Health, Education and Welfare, told one Senate panel that it was impossible to distinguish between people who had developed cancer from radiation and those who were stricken with cancer from other sources.

"Each claimant may believe his or her cancer was caused by radiation exposure," he said, "yet it is statistically more probable in each case the illness was caused by something else."

Dr. Joseph Lyon, a University of Utah epidemiologist and codirector of the Utah Cancer Registry, published a study this year concluding that twice as many children who lived under the fallout died of leukemia than normally would have been expected.

Lyons said his research did not establish that fallout caused the increased cancer rate or that it was responsible for any individual cancer case. But he added: "I think we can say without question there is an association between fallout exposure and the increased incidence of childhood leukemia deaths in Utah."

There also is little question that uranium miners suffer from a cancer rate far higher than the general population. Dr. Joseph Waggoner, a cancer specialist for the U.S. Labor Department, said studies as early as 1961 showed that lung cancer among uranium miners was more than four times greater than normal, but that a decade elapsed before permissible exposure standards were lowered.

Because of the slowness to act, Waggoner said, "we now clearly have a public health problem and an epidemic of monumental proportions on our hands."

Sometimes uranium mining and milling operations expose more than just miners or millworkers to high levels of radiation. Last July 16, for instance, the partial collapse of an earthen dam used to impound radioactive wastes at a uranium mill near Church Rock, N.M., dumped 1,100 tons of uranium tailings and 100 million gallons of radioactive water into a small stream known as the Rio Puerco.

The muddy mixture spread down the stream bed for 75 miles, into eastern Arizona, leaving such high levels of radiation that authorities ordered that signs be posted—in English, Spanish and Navajo—warning people not to go near the stream.

The mill operator, United Nuclear Corp., has begun scraping up the contaminated soil from the stream bed, and authorities say it may take the rest of the year to complete the task.

Federal officials termed the spill the worst of its kind in U.S. history because of the distance it covered, but the volume of radioactive material involved is dwarfed by the 52 billion pounds of uranium tailings piled haphazardly at 22 abandoned uranium mills in eight Western states.

These huge mounds of sand-like material, still containing 85% of the radioactivity of the uranium ore, were the waste products of the secret government push in the 1950s to produce a stockpile of nuclear weapons. Because government officials considered them harmless, they were left for years unprotected from rain and winds.

More recently, after studies indicated the tailings piles could cause more than 1,000 cases of cancer in the next 100 years, Congress voted funds to either move the piles to uninhabited desert locations or cover them with a thick layer of soil—an immense undertaking still in the planning stages.

One of the largest tailings piles is within four miles of downtown Salt Lake City, and Utah officials are pressing for its quick removal. Dr. Lyman Olson, the state's chief health officer, said levels of radon gas—a radioactive gas that results from the aging process of uranium—at the Salt Lake City site are 30 times higher than the upper limit prescribed by the U.S. surgeon general for remedial action. And Olson worries about what the future will bring.

"It is significant to us, and a continual worry, that each time new and better scientific information becomes available, as in the case of our new technique for measuring radon, the extent of the hazard is concluded to be worse than previously thought," he said.

The New York Times
November 27, 1979

Veteran Exposed To Atomic Tests Is Given Benefits

Cancer Was Found Long After He Left the Army

Special to The New York Times

SAN FRANCISCO, Nov. 26 — A former United States Army sergeant who developed cancer years after exposure to radiation from atomic weapons tests today became the first known veteran to win Federal benefits in a case in which the cancer had been diagnosed after the victim left the military.

The ruling by the Board of Veterans Appeals in Washington drew no connection between the veteran's cancer and his exposure to radiation, but the fact that it decided to grant benefits constitutes its first acknowledgement that the two could be related.

The ruling in the case of Orville Kelly, who lives in Burlington, Iowa, was called "very significant" by Jonathan Steinberg, chief counsel for the Senate Veterans Affairs Committee.

Mr. Steinberg said in a telephone interview that the decision might indicate an increase in sympathy on the part of the Veterans Administration toward those who have filed claims asserting that their cancers were caused by exposure to radiation from atomic weapons tests in the Pacific and in Nevada. It is estimated that several hundred veterans have filed such claims.

Mr. Steinberg said that the ruling set no precedent in the judicial sense of the term. He said the Board of Veterans Appeals, the final arbiter in benefits claims, is neither bound by precedent nor subject to judicial review under Federal law. He said the board could be expected to consider similar claims on a case-by-case basis.

Only Eight Cases

But he said Mr. Kelly's case was significant because, to date, the Veterans Administration had granted benefits to cancer victims exposed to atomics weapons tests in only eight cases — all of which involved soldiers whose cancers were diagnosed when they were still serving in the military. Mr. Kelly's cancer, in his lymph system, was diagnosed 12 years after he left the Army.

Mr. Steinberg said the case had added significance because it marked the first decision by the Veterans Administration to award medical and survivors benefits in a case involving a claim of radiation-induced cancer since the Veterans Administration adopted new guidelines for decisions in these cases last summer. Under the guidelines, the board can give a veteran the benefit of the doubt where the veteran claims that his cancer is a result of radiation exposure.

Mr. Kelly, who is 49 years old, said in an interview here today that the ruling was the culmination of a six-year struggle with the Veterans Administration, which had denied his claim on three occasions.

Last year Mr. Kelly founded the National Association of Atomic Veterans, an organization that helps radiation-exposed veterans in filing and pursuing benefits claims with the Veterans Administration. He spoke today at a news conference of atomic test survivors that was sponsored by the University of California Nuclear Weapons Lab Conversion Project, an antinuclear group.

Watched 22 Explosions

Mr. Kelly said today that he witnessed 22 atomic explosions at the Enewetak Atoll test site from November 1957 to November 1958, while he was stationed on Japtan Island, seven miles away. He said his unit wore no protective clothing other than tinted aviators' goggles while watching detonations of weapons ranging up to nine megatons, about 450 times the size of the Hiroshima bomb.

Mr. Kelly said that after being diagnosed as having malignant lymphoma, in 1973, he applied for V.A. benefits in Des Moines, Iowa. His claim was denied the following year, he said, and two appeals last year to the Iowa regional Veterans Administration office were also denied.

The New York Times
March 19, 1980

U.S. Panel Says Atom Tests May Have Caused Deaths

By A. O. SULZBERGER Jr.
Special to The New York Times

WASHINGTON, March 18 — The nation's nuclear weapons testing in the 1950's probably resulted in some deaths or disease, and the Government should accept responsibility for them, a high-level Government panel has told the White House.

Government officials believe that the report, dated Feb. 1, marks the first time that such an admission has been made in an official document.

"This exposure," the report said, "in all probability caused a small number of cases of death or disease, for which the Government should accept responsibility."

The report estimated that, of the 172,000 people living downwind from the nuclear test site, the number of persons who might have been expected to contract cancer from nuclear fallout would range from nine to 96. Of those, the number of fatal cancer cases would range from six to 32, the report said.

Panel Established Last July

Among the 172,000 people involved, about 20,000 could normally expect to die of cancer.

The panel was established last July by President Carter to study and recommend a fair and effective way of dealing with claims for compensation filed by victims of radiation-induced illness ca by exposure to the above-ground testing that took place at the Nevada Test Site between 1950 and 1963.

The panel, called the Interagency Task Force on Compensation for Radiation-Related Illnesses, recommended that an administrative program, rather then court litigation, be used to settle compensation claims. However, it left unresolved a number of administrative and policy questions that must be answered before specific legislative can be proposed.

Even as the report is being studied by White House officials, two other compensation proposals are being considered in Congress and some 965 claims for damages have been filed in Federal District Court in Salt Lake City by residents of Arizona, Nevada and Utah seeking a total of more than $2 billion in damages.

Hearing to Be Held Thursday

A preliminary hearing in the court case is scheduled to be held Thursday. The suit contends that the tests caused either the plaintiffs or their relatives to contract cancer and that the Government failed to take adequate precautionary measures to protect the public.

The panel opposed litigation, which is the approach that will continue to be used to establish compensation if new laws are not passed, on the ground that it is enormously complex, expensive and time-consuming. They also said there was the risk of establishing judicial precedent, which could be harmful in other litigation involving radiation and toxic substances.

"We don't agree with them that the courts are the wrong place" to establish compensation, said Stewart L. Udall, Secretary of the Interior in the Kennedy and Johnson Administrations and one of the lawyers handling the case for those filing claims for radiation-induced illness.

Two relatively similar bills have been introduced in Congress that would establish blanket Government liability for damages to a person residing near the nuclear test sites and who developed a specified illness.

Senate hearings are scheduled to be held April 22 on a bill sponsored by Senators Orrin G. Hatch, Republican of Utah, and Edward M. Kennedy, Democrat of Massachusetts. In addition, a House subcommittee hopes to hold hearings soon on another bill introduced by Representative Gunn McKay, Democrat of Utah.

"The result," the report says of these two bills, "is that the Government would be required to pay substantial money damages to all individuals who developed specified forms of cancer, notwithstanding the fact that very few of these could be attributed to radiation."

The administrative remedy that the report favors would look at the estimate on an individual's dose of radiation and the type of cancer he had, then work out the chances that the cancer was caused by fallout in each case.

"Only persons meeting a legislatively established minimum probability would be eligible for compensation," the report said. "It would be more selective than other alternatives and would reduce further the tendency of a benefit program to be over-inclusive."

The New York Times
March 23, 1980

Fallout Clams Get New Support

Military mistakes generally are paid for in battlefield casualties. Not necessarily so for the use of herbicides in Vietnam and nuclear weapons testing in Nevada in the 1950's. Higher-than-normal disease rates among persons exposed to them have produced numerous court battles for compensation. But the lawsuits have been hampered by a lack of evidence linking the events to disease incidence and by questions of who is to blame.

Last week, two separate documents seemed to admit that such links exist and fix Government responsibility.

A Presidential task force, established in July, reported that postwar nuclear weapons testing probably caused some deaths or disease. The Government, it said, should accept responsibility. The panel recommended avoiding expensive compensation litigation. Already, 985 claims for $2 billion in damages have been filed in Federal court in Salt Lake City by Utah, Arizona and Nevada residents.

The panel suggested the following: Estimate a person's radiation dosage, compute the chances that fallout caused his particular cancer and award or refuse compensation accordingly. Such a procedure, the report indicated, might avoid litigation that would establish judicial precedence for Government responsibility in other incidents — the use of herbicides in Vietnam, for example, exposure to which, say veterans, has crippled or killed.

Vietnam veterans do not accuse the Government, but the chemical companies of negligence in selling Agent Orange and Agent Blue herbicides. Agent Orange contains dioxine, a poisonous chemical and known carcinogen, but one whose effects are known mainly from animal studies. Arsenic, the chemical base of Agent Blue, is a known carcinogen.

Last week two Congressmen released copies of what seemed to be a Veterans Administration memorandum — author and addressee unknown — saying that the chemical compounds can cause cancers among the men and birth defects among their children. The note seems to contradict agency testimony before Congress that the herbicides have not been proved a human health hazard. The agency's comment on the matter is expected tomorrow.

Daniel Lewis
and Caroline Rand Herron

B-8

APPENDIX C

FETAL HYPOTHYROIDISM

Citizens' Voice
February 21, 1980

Apparent Hike in Thyroid Disorders Near TMI Probed

HARRISBURG (UPI) — State medical authorities are investigating an apparent increase in thyroid abnormalities in the vicinity of the Three Mile Island nuclear accident, Pennsylvania health officials announced Wednesday.

Dr. George Tokuhata, director of health research for the state Health Department, said epidemiologists will study a wide range of possible causes of the apparent increase, including low-level radiation from Three Mile Island.

Tokuhata said a routine state survey revealed last month there now was apparently a higher-than-normal rate of hypothyroidism in Lancaster County, which adjoins the nuclear plant, and in five counties downwind.

Hypothyroidism is a disorder which can lead to mental retardation. It can be caused by radioactive iodine, which federal officials said was released in small quantities during the March 28, 1979 nuclear accident.

Tokuhata said he did not believe the low-level radioactive emissions from the nuclear accident were the cause of the apparent increase in hypothyroidism.

But he said there was a remote possibility of a connection, since it could have been caused by being spread through the milk of cows that grazed on contaminated pastures.

State authorities discovered a radiation level of 41 picocuries per liter in milk from a nearby farm a few days after the nuclear accident. The federal health limit is 1,000 picocuries per liter.

Tokuhata said other possible causes that would be investigated were genetic, other radiation sources in industrial and medical facilities and chemicals in foodstuffs.

"There is a remote possibility that radiation was the cause, and there are many other possible reasons. We don't have enough evidence to make any conclusions, except to say the rate (of hypothyroidism) is apparently higher than normal in this area," said Tokuhata.

Tokuhata said the liklihood of a reliable conclusion from the study was already thrown into question. He said authorities lacked sufficient information on rates of hypothyroidism in previous years in Pennsylvania.

"We can't be confident that we'll be able to come to any definite conclusions," he said.

Tokuhata said his study would take at least 2 years.

The routine 1979 state survey of hypothyroidism showed a total of six cases in Lancaster County, a rate of about 1 in 925, or more than five times greater than the expected rate of 1 in 5,000.

Dr. Thomas Foley of Children's Hospital in Pittsburgh, who monitors hypothyroidism as a consultant to the state, said he did not believe the latest occurrences were related to Three Mile Island.

He said some of the cases were differing types of hypothyroidism, indicating that a single environmental source such as nuclear radiation was not the cause.

Two other experts in the field agreed Three Mile Island was an unlikely cause. They were Dr. Jacob Robbins, a thyroid specialist for the National Institute of Health in Bethesda, Md. and Dr. Hugh Pratt, of the Brookhaven National Laboratory in Upton, L.I., who directs studies into radioactive fallout from nuclear weapons tests.

C-1

A-Plant Involved in Probe of Thyroid Ills

The Washington Post
February 21, 1980

By Victor Cohn
Washington Post Staff Writer

A new controversy over the nuclear accident at Three Mile Island appears likely to arise from the discovery that an abnormal number of children were born with serious thyroid defects in three Pennsylvania counties in the latter part of last year.

The condition is known as hypothyroidism, which arises when the thyroid gland is either absent or doesn't produce normal hormone levels. It can lead to grave mental retardation and stunted growth unless it is quickly treated.

State health officials confirmed yesterday that during the last nine months of 1979, 13 hypothyroid babies were born in three counties that might ordinarily expect three such births during that length of time. They said they are about to start an epidemiological investigation that "of course" will have to consider low-level radiation from the accident at Three Mile Island—located adjacent to one of the counties—as one possible cause.

But they—as well as Dr. Thomas Foley of Pittsburgh Children's Hospital, an authority on hypothyroidsm—all said that the conditions could have many possible causes.

They said they know of no cases of hypothyroidism ever caused by radiation at the low level emitted by the crippled reactor, though there is a well-established association between high doses of radioactive iodine—one chemical emitted by the disabled reactor—and thyroid disease. Radioactive iodine tends to concentrate in the thyroid gland, with destructive effects when the dose is high enough.

Radiation specialists from the President's Commission on Three Mile Island and the Nuclear Regulatory Commission said flatly yesterday that iodine emissions from the March accident were far too low to have had any such effect.

"There cannot be any connection: I can say that unequivocally," said Dr. Victor P. Bond, associate director of the Brookhaven National Laboratories for biomedical and environmental sciences, a member of the presidential commission task force on radiation health effects. "For thyroid effects the doses would have to have been thousands of times higher than they were."

Harold Peterson of the NRC's office of standards said a total of 15 curies of Iodine 131 was released from the plant by the end of April, giving a maximum radiation dose of the thyroids of area residents of 8 to 20 millirems.

Background radiation provides 100 millirem per year. Tests of area residents revealed no iodine in their bodies, and none was detected in area animals or in cows' milk, Bond said. To affect fetuses born since the accident would have required a pickup of iodine.

"We would certainly not expect any effect on fetal thyroids from these levels," Peterson said.

A spokesman for General Public Utilities Inc., parent company of the utility that owns Three Mile Island, said no iodine measurements taken were ever high enough to cause fetal thyroid problems.

However, several local groups have challenged the official radiation readings, alleging that insufficient monitors were in place or operating at the time of the accident. Wind currents might have carried radioactive particles over nearby monitors and deposited them in faraway areas without the normal dispersal effect, these groups have said.

None of the hypothyroid cases were in areas that have been described as in the main "plume" or downwind direction of the Three Mile Island radiation.

Six cases occurred in Lancaster County, which is east of Dauphin County, the reactor site. Four were in Bucks County and three in Lehigh County.

Ordinarily one baby in 5,000 is born with hypothyroidism. In 1978 (the last year for which full birth statistics were available yesterday) Lancaster County had 5,500 live births, Bucks County, 6,493, and Lehigh, 3,206.

Unusual clusters, mere statistical aberrations, sometimes occur in many diseases, said Dr. Arnold Muller, secretary of health in Harrisburg.

Also, said both Dr. Foley and Dr. Evelyn Bodin, a Pennsylvania health department pediatrician, a more logical explanation than radiation has been found in three and possibly four of the Lancaster County cases, the group most closely studied so far.

One had a familial or inherited condition and two had a misplaced thyroid gland, a condition not likely to be caused by radiation, Bodin said. The three other Lancaster County cases are still under study, but one was a twin whose twin did not get the disease "so it's untlikely" though not impossible, she said, that the cause in this case was environmental, since both babies were subjected to the same environment.

Another health authority said that many populations, such as the Amish, in Pennsylvania have a high concentration of genetically related diseases.

"I don't think there's any cause and effect" connected to Three Mile Island, Bodin said. Dr. Foley agreed, but called the timing "peculiar and curious," and said "the fact that it did follow the accident raises an issue" that must be settled.

The cases' existence was disclosed in an interview yesterday by Dr. Gordon MacLeod, who was Pennsylvania health secretary at the time of the nuclear accident.

MacLeod became the state's chief health officer on March 16, only 12 days before the accident. Last Oct. 10, he said—after criticizing the state's handling of the problem—that he was asked by Gov. Richard Thornburgh to resign. He returned to his job as a well-regarded professor of public health administration at the University of Pittsburgh.

MacLeod, too, agreed that "it is impossible" to assign any common cause to for the thyroid defects. But he said he was shocked that the health department had made no public announcement and had not started an investigation of possible causes. The first of the affected Lancaster County babies was born last June. Two were born in July, and one each in August, October and November.

MacLeod also said it is "urgent" to look for any possibly undetected cases in babies born at home among the Amish and other Pennsylvanians who often choose home deliveries.

Thyroid problems turned up among Marshall Islanders who were exposed to radiation from the fallout of a U.S. hydrogen bomb test in the Pacific on March 1, 1954.

The first cases discovered nine years later were two children, under 5 at the time of exposure, whose thyroid glands had disappeared.

Staff writers Walter Pincus and Joanne Omang contributed to this report.

C-2

The Philadelphia Inq
February 21, 1980

Birth defects raise a new TMI issue

By Victor Cohn
Washington Post Service

WASHINGTON — A new controversy seems likely to arise over the nuclear accident at Three Mile Island as a result of the discovery that an abnormal number of children were born last year with serious thyroid defects in three Pennsylvania counties — Bucks, Lehigh and Lancaster.

The condition is known as hypothyroidism, which arises when the thyroid gland is either absent or does not produce normal levels of hormones. It can lead to grave mental retardation and stunted growth unless it is quickly treated.

Yesterday, state health officials confirmed that, during the last nine months of 1979, 13 hypothyroid babies were born in the three counties, which might ordinarily expect three such births during that length of time.

The accident occurred in March 1979.

Six cases occurred in Lancaster County, which is east of Dauphin County, the site of the reactor. Four were in Bucks County and three in Lehigh County.

State officials said they were about to start an epidemiological investigaton that would consider low-level radiation from the accident at Three Mile Island as one possible cause.

However, radiation specialists from the President's Commission on Three Mile Island and the Nuclear Regulatory Commission said flatly yesterday that iodine emissions from the March accident were far too low to have had any such effect.

Further, the state health officials and Dr. Thomas Foley of Pittsburgh Children's Hospital, an authority on hypothyroidism, said that there were many possible causes for the conditions.

They said they knew of no cases of hypothyroidism ever having been caused by radiation at the low level emitted by the crippled reactor, although there is a well-established association between high doses of radioactive iodine — one chemical emitted by the disabled reactor — and thyroid disease. Radioactive iodine tends to concentrate in the thyroid gland, with destructive effects when the dose is high enough.

The existence of the cases of hypothyroidism was disclosed in an interview yesterday with former Pennsylvania Health Secretary Gordon MacLeod, who said he said he was shocked that the Health Departmen had made no public announcemer about the births and had not starte an investigation of possible causes.

Pittsburg Press
February 21, 1980

Thyroid Illness In TMI Area Under Study

HARRISBURG (UPI) — Medical detectives are investigating the possibility — believed now to be remote — that an apparent growth in the rate of thyroid abnormalities was caused by the Three Mile Island nuclear accident.

The Pennsylvania Health Department said it had begun the investigation after a routine survey showed the incidence of hypothyroidism was five times greater in some areas near the nuclear plant.

Initial judgments by a variety of thyroid experts was that the Three Mile Island accident probably did not cause the occurrences because the radioactive emissions during the accident were too small to do such damage.

Other possible causes, such as heredity, industrial or medical radiation sources and chemicals in foodstuffs, were also under investigation by state epidemiologists, said Dr. George Tokuhata, director of state health research.

"There is a remote possibility that radiation was the cause, and there are many other possible reasons. We don't have enough evidence to make any conclusions, except to say the rate (of hypothyroidism) is apparently higher than normal in this area," said Tokuhata.

The remote possibility of a connection to Three Mile Island rested with cows that grazed on contaminated pastures. State authorities reported a radioactive iodine level of 41 picocuries per liter in milk from a nearby farm a few days after the nuclear accident. The federal health limit is 1,000 picocuries per liter.

Hypothyroidism is a disorder which can lead to mental retardation. It can be caused by radioactive iodine.

Dr. Thomas Foley of Children's Hospital in Pittsburgh, who monitors hypothyroidism as a consultant to the state, said he did not believe the latest occurrences were related to Three Mile Island.

He explained that some of the cases were differing types of hypothyroidism, indicating that a single environmental source such as nuclear radiation was not the cause.

The routine state survey revealed that the hypothyroidism rate in Lancaster County, adjoining the nuclear plant, was five times greater than normal. Five counties downwind from the nuclear plant also showed higher-than-normal rates.

B-10 Pittsburgh Press, Thurs., Feb. 21, 1980

UPI Telephoto

OUCH — Mary Anne Potami, a nurse at a Harrisburg hospital, draws blood from a baby to test for a thyroid abormality following reports of increased thyroid problems in the area around Three Mile Island.

The Post-Gazette
February 26, 1980

Don't Snub TMI-Thyroid Tie, Pitt's MacLeod Urges

By HENRY W. PIERCE
Post-Gazette Staff Writer

Former state Health Secretary Gordon MacLeod yesterday warned against a too-hasty dismissal of figures that may show an increase in thyroid defects among babies born near the Three Mile Island nuclear plant after the radiation leak March 28.

MacLeod, who said he reviewed the thyroid figures in detail for the first time yesterday, insisted that coincidence alone can't account for an apparent upsurge in cases in Lancaster, Lehigh, Berks and Bucks counties after March 28. All are relatively near the site of the Three Mile Island radiation leak.

MacLeod stopped short of asserting a definite link between the nuclear accident and the thyroid problems, however.

"There's always a possibility some other factor, such as industrial toxins or contamination of the water, could account for it," he conceded.

But he pointed to these figures:

- Eight cases were reported statewide before March 28, and 26 more were reported during the remaining months of 1979.
- Of the 26 cases, 15 were in counties not far from Three Mile Island. Lancaster reported 6 cases, and 3 each were reported in Lehigh, Berks and Bucks Counties.
- By contrast, Allegheny and Erie counties reported only 1 case each after March 28.
- During the last six months of 1978, only 9 cases were reported throughout the state.

But a state health official, Dr. Evelyn Boudin, called MacLeod's interpretation "illogical" and stated flatly:

"We do not have a data base which is sufficient to make the kinds of claims being made."

Dr. Boudin pointed to an absence of thyroid defects from Cumberland and York counties, which also are in the vicinity of Three Mile Island.

Another exception, she said, is Montgomery County, in which 3 cases were reported from June 28 to Dec. 28, 1978, but no cases in 1979.

Dr. Boudin said, however, that state health officials are reviewing the data "the way we would in any public health program."

"We are looking, first, at the individual cases themselves, determining what conditions are associated with them," she said.

At least some cases appear to be a result of inheritance, she said.

It is a known fact that radioactive Iodine 131, which was among the most feared of the substances released during the Three Mile Island incident, can cause thyroid abnormalities in babies.

What is not known is precisely how much of an increase it takes to cause damage. Studies have been carried out that suggest even a very small increase in the exposure levels will add slightly to the number of thyroid cases in a large population. But some authorities consider such figures inconclusive.

Dr. Donald Reid, deputy secretary of programs for the state Health Department, and Dr. George Tokuhata, Health Department epidemiologist, minimized any association between Three Mile Island and the thyoid defects last week.

Tokuhata said there was only a remote possibility the defects were related to the radiation leaks, adding that it would be almost impossible to link the increase definitely to the Three Mile Island incident.

But MacLeod insisted yesterday:

"The situation has to be looked at. This is more than coincidence. I plotted the number of cases by counties this morning. The relationship is striking."

MacLeod resigned as health secretary Oct. 12 and returned to his job as professor of public health administration at the University of Pittsburgh. Since resigning he has been a strong critic of the state's handling of the health aspects of the Three Mile Island affair.

The Philadelphia Inquirer
February 29, 1980

Op-ed

Friday, Feb. 29, 1980

Just a little radiation? Don't believe it

By Bruce Molholt

Several years ago there was a memorable cartoon by Gahan Wilson showing a professor admonishing his students in the laboratory. "Nonsense," he said, holding aloft a flask which fairly glowed with radioactivity. "A little radiation never hurt anyone!" What the students couldn't see, but the readers could, was the professor's other hand was only a skeleton!

A year after the accident at Three Mile Island we are still being told that only a little radiation was released and that this little bit was not dangerous.

It is nonsense to pretend that low levels of radiation and high levels of radiation are different species. This is tantamount to advising beginning drivers to test out their cars at 130 miles per hour. After all, driving your car that fast all the time will get you killed, but a little bit isn't dangerous!

Rather than fast cars, radiation might be better likened to microscopic bullets. These little bullets of radiation can be directed, as from an X-ray gun, or undirected, such as from the radioactive spills at TMI.

Radiation bullets are most dangerous when they strike that most intimate and precious member of our genetic heritage, our DNA. This miniature thread contains the blueprint by which all cellular processes are dictated. Radiation bullets break DNA. Although some of these breaks can be repaired, some cannot. Unrepaired DNA breaks may lead to cellular death, or even worse, to cellular mutation. These mutations are the initial events in carcinogenesis, showing how radiation can cause cancer in man.

Like soldiers condemned to a firing line, DNA is more likely to become shattered the more frequently radiation bullets emit their source. The frequency of radiation emission is measured in *curies*, named for the famous Polish-French discover of radiation, who herself succumbed to cancer after years of handling radium.

Each curie of radioactive material spews out precisely *37 billion* radiation bullets every second (some Gatling gun!). Obviously, a curie of radioactive material is very dangerous, so scientists normally speak of millicuries (37 million bullets per second) or even micro-curies (37,000) bullets per second).

Since the damage caused by emitted radiation bullets is a direct function of the number of curies involved, it is of interest to note just how many curies were lost at TMI between March 28 and April 7, 1979. The number is an astronomical *10 million curies!* These are not millicuries, but million curies. In terms of radiation bullets per second this is 370,000,000,000,000,000 which went up the stacks at TMI. It is no wonder some local residents wanted to get out of the way!

Most of this radioactive cloud was composed of inert gases which, unless breathed, will not interact much with human cells. Fourteen of these curies, however, were in the form of iodine known as I-131.

Iodine-131 is especially dangerous in humans because it is taken up and retained by the thyroid gland. It also emits a very energetic bullet of radiation which easily penetrates cells and destroys DNA. Since I-131 is retained for long periods of time, even a small amount of radioactivity is dangerous.

Ingestion of one milli-curie of I-131 means that the individual's DNA will be subject to 50 billion highly energetic bullets of radiation in three months. In order to make these types of calculations easier to understand, radiation biologists have employed the term rem, which encompasses number and energy of radiation bullets to compare this with an equivalent number of X rays.

As with curies, rems are normally communicated in terms of millirems (thousandths of a rem). Since normal background irradiation is about 130 millirems per year, the equivalent of four or five chest X rays, this sets a lower limit of our exposure (unless you happen to go about encased in a lead shield). In 1925, radiation exposures of 1,000 millirems per week were allowed. It is now 100 millirems per week and soon the federal standard will be 15 millirems per week.

Finally our radiation standards will reflect the experimental reality that there is no safe level of radiation exposure.

This brings us back to the question of TMI. What were the actual levels of radioactivity to which people were exposed? The official answer of the Kemeny Commission was about 250 millirems per person, or about twice the normal yearly background irradiation.

This figure, however, was derived by assuming that the 2 million people living within 50 miles of TMI were all irradiated evenly, which almost certainly they were not.

In the year since the radioactive cloud has dissipated, a new cloud has settled over the Pennsylvania medical community, a cloud of disturbing increases in birth defects. This cloud is the first tangible evidence of potential human damage from TMI, and although controversial, casts doubts on official estimates of radiation levels to which people were exposed. The conclusion of the Kemeny Commission that the most severe biologic effect of the accident at TMI was mental stress may have been premature.

It will be 30 years before we will know just how many cancers were induced by the accident at TMI and even then it may be difficult to pinpoint carcinogenesis to this one event.

A rise in the number of birth defects, on the other hand, is an immediate indication of genetic damage. In two independent studies, these increased numbers of birth defects were seen in the months following the accident at TMI, but not before. In one study, in the three-month period before TMI, a Harrisburg hospital recorded one birth defect, but the number of birth defects rose to seven in the three months following TMI. In a more recent study 13 babies with thyroid nodules were found in three Pennsylvania counties east of TMI. This is more than four times the expected frequency of this pre-malignant condition, a condition which is often associated with I-131 contamination. Could this be I-131 from TMI?

(Bruce Molholt is science director of the Environmental Cancer Prevention Center, Public Interest Law Center of Philadelphia.)

The Philadelphia Inquirer
April 4, 1980

Nuclear beliefs

Facts behind the radiation story

To the Editor:

Science is said to differ from religion in basing its conclusions upon facts rather than beliefs. Unfortunately for the public, this distinction frequently fades as scientists pick and choose just which facts best fit their preconceptions. As in religion, there are many faiths in science.

Recently James T. Brennan of Radiation Management Corp. attacked my Op-ed article, "Just a little radiation? Don't believe it."

He didn't attack the fact that 10 million curies, the radioactive equivalent of 10 tons of radium, were spewed into the air during the week following the TMI accident. He didn't attack the noticeable increases in hypothyroid birth defects downwind after the accident.

Instead Dr. Brennan chose to attack the source of my information that 250 millirems might have been received by one person as a result of radiation released at TMI.

Dr. Brennan is right. The source of my information was not the Kemeny Report, but a report of the Nuclear Regulatory Commission, "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station." I quote from the Appendix of that document, pages A-3 and A-4:

"The maximum estimated exposure would be 200 plus 50 (mR) to an individual located about one mile north-northwest of the station continuously for the entire week following the TMI occurrence."

Hence it is the source of this information rather than the information itself which was in error, and I apologize for this oversight in citation. The NRC itself concluded that an individual could have received 250 millirems of radiation from the accident at TMI. Dr. Brennan said, "If he is not granted this exaggeration, Mr. Molholt's entire argument falls apart." Perhaps my argument is now back together again.

Small amounts of radiation have measurable adverse effects on human populations. Recently both the National Cancer Institute and American Cancer Society (ACS) recommended that mammography *not* be performed on women under 50 who have no symptoms of breast cancer.

Their reasoning was simple: More breast cancers could be induced by this procedure than could be detected after their experience with 280,000 women, despite the fact that mammography exposes women to just a few millirems. Recently the ACS further recommended additional reduction in a wide variety of other radiation diagnostic procedures for the same reason.

We continue to be told by scientists with vested interests in the nuclear industry that no health effects could have arisen from the accident at TMI. In a six-month period following the accident, there were six babies born with defective thyroid glands among 2,500 live births in Lancaster County.

This is 12 times the expected frequency of hypothyroidism. "A statistical aberration," they will reply.

Downwind from the reactor there were 20 cases of hypothyroidism in the nine months after TMI, as compared to nine cases in the nine months before. On the upwind side in Pennsylvania, there were eight cases before TMI and seven cases after. More statistical aberrations?

And if the final cancer statistics show increasing leukemia incidence near nuclear reactor accidents, as they have near atomic testing sites in Nevada and Utah, there will again be more denials from those affiliated with the nuclear industry.

Who has the beliefs and who the facts on a little radiation?

BRUCE MOLHOLT
Public Interest Law Center
Philadelphia.

C-7

APPENDIX D

LEAKS AND COVER-UPS

The Philadelphia Inquirer
September 29, 1979

Spillage is feared at 3 Mile

Reactor-line leak is filling tanks

By Tom Raum
Associated Press

WASHINGTON — A hard-to-repair leak at the Three Mile Island nuclear power plant is hindering cleanup operations and may cause a spillage of radioactive wastes, Senate investigators said yesterday.

The staff of the Nuclear Regulatory Commission (NRC) contended, however, that the radioactive water that is rapidly filling storage tanks at the crippled plant will not be allowed to overflow.

The leak, in a line that removes contaminated water from the reactor, is adding volu e to nearly 1 million gallons of highly radioactive water already in storage at the plant, which is on the Susquehanna River 10 miles south of Harrisburg.

In a letter to NRC Chairman Joseph Hendrie, members of the Senate nuclear regulation subcommittee said they had obtained information that tanks used for storage of the radioactive water are fast reaching their capacities.

"Contaminated water from the damaged plant will exceed storage capaci ty within 40 days and be released into the environment unless steps are taken soon to clean it up and to find additional means to store it," the panel said. Most of the information gathered by the investigators came from interviews with NRC regulators and officials, the subcommittee said.

At a hastily called meeting yesterday afternoon, the NRC staff said the radioactive water could be shunted from the tanks at the Unit 2 reactor to tanks at the Unit 1 reactor. It was the Unit 2 reactor that was involved in the Three Mile Island accident last spring, the most serious in the 25-year history of commercial atomic power. The Unit 1 reactor, which was shut down at the time of the accident, also remains closed during the cleanup of Unit 2.

The NRC staff confirmed that radioactive water may fill the Unit 2 tanks to capacity in about a month, but it said that it would take as long a year to fill the now-uncontaminated tanks at the Unit by spreading the contamination to the unaffected plant.

In its letter, the Senate panel, which has been i vestigating the March 28 accident, asked Hendrie what the NRC planned to do about the leak and the accumulating radioactive water.

"Currently there are more than 1 million gallons of contaminated water stored at the site and the volume is increasing due to a leak in the letdown line drawing cooling water from the nuclear core of the reactor," the senators told Hendrie.

"We are advised that this leak cannot be repaired because of high radiation in the containment" building, where the reactor is located, their letter said.

Reactor operators hoped to keep the contaminated water inside the reactor containment until they determine how to dispose of it safely.

The subcommittee, whose chairman is Sen. Gary Hart (D., Colo.), called on the NRC to describe "what planning is being done by the commission to respond to any future contingency at Three Mile Island site related to management of these highly radioactive wastes."

The NRC's director of nuclear reactor regulation, Harold Denton, was quoted by the senators as saying that as long as radioactive water remained in the reactor containment structure, it might find "sneak paths" to the outside.

The senators' letter was signed by members of the subcommittee as well as by Sens. Jennings Randolph (D., W. Va.), chairman of the Environment and Public Works Committee, and Howard Baker (R., Tenn.), minority leader.

The Three Mile Island accident occurred when the Unit Two reactor was inadvertently deprived of cooling water and badly overheated, causing major damage to the nuclear fuel and releasing radiation to the atmosphere.

Officials have indicated that it may be a year or longer before the concrete structure containing the reactor — the so-called "containment" structure — can be re-entered because of high levels of radioactivity within.

D-1

The New York Times
October 21, 1979

3 MILE ISLAND AIDES SAID TO HAVE WAITED TO TELL OF HAZARDS

U.S. Investigators Disturbed by Testimony Indicating Utility Knew Data Showed Peril

By DAVID BURNHAM
Special to The New York Times

WASHINGTON, Oct. 20 — Federal investigators have obtained testimony indicating that some supervisors at the Three Mile Island nuclear power plant fully comprehended on the first day of the reactor accident there that the possible consequences were more serious than they were reporting to the Government.

The investigators are attempting to determine whether some officials at the reactor may have violated an ambigious Federal requirement that they report dangerous conditions to the Government within 24 hours after they are noted. But, beyond the question of legal liability, most experts agree that public support for nuclear power rests in large part on the expectation that both the industry and Government regulators will be forthright and candid.

The testimony bearing on the understanding of officials at the Three Mile Island reactor on March 28, the first day of the accident, was recently obtained by the independent investigative group established by the Nuclear Regulatory Commission. The group, which is somewhat akin to a special prosecutor, is headed by Mitchell Rogovin, a Washington lawyer.

Accuracy of Instruments

Because of a combination of technical and human failures, the reactor core did not receive enough cooling water to keep the fuel rods from melting, allowing radioactivity to escape. The supervisors received many indications in the first few hours that the core had lost a significant amount of water, according to earlier accounts, which also reported that the officials did not believe the readings that some of their instruments provided.

The testimony obtained by Mr. Rogovin's staff, however, is the first suggestion that the officials believed their instruments and understood the significance of the indicators.

Robert Arnold, a senior vice president of the Metropolitan Edison Company, the operator of the reactor, said in response to inquiries that he believed officials had given the Government all significant information as soon as it was available. The incident at Three Mile Island is the worst accident that has occured in the civilian use of nuclear power.

The special group is not scheduled to make its report public until the end of 1979. Another investigatory group, the President's Commission on the Accident at Three Mile Island, is holding its final set of closed meetings this weekend before submitting its report to President Carter at the end of the month.

Barbara Jorgenson, public information director of the President's commission, said today that there would be no comment about the report yesterday in The New York Times that the commission had voted to recommend a moratorium on the construction of new reactors until its proposals for improving nuclear safety had been adopted.

The moratorium recommendation, which could be reversed in meetings today, Sunday and Monday, would be a considerable blow to the development of nuclear power in the United states even though the panel's recommendation are advisory. Such a recommendation would support the members of Congress seeking a moratorium law and further discourage Wall Street from investing in nuclear power plants.

The testimony about the first day of the accident was given by Brian Mehler, a shift supervisor at the Three Mile Island reactor near Harrisburg, Pa. Mr. Mehler initially discussed what some officials knew about the seriousness of the accident in a conversation with a Federal investigator July 6.

Pumps Were Already Turned On

According to the notes of the investigator, which have been obtained by The Times, Mr. Mehler said that on Wednesday afternoon, the first day of the accident, he was ordered not to turn on a set of pumps that provide oil to the reactor coolant pumps. The order came after a small explosion of hydrogen in the reactor had been noted.

Mr. Mehler told the investigator that he told the supervisors that it was too late because he had already turned them on. "Then someone said, 'Well, that means we don't have any more hydrogen in there,'" the notes show.

Nuclear experts said that Mr. Mehler's account, if accurate, showed that at least some of the Metropolitan Edison officials were worried that turning on the pumps might cause an explosion because of the presence of hydrogen in the reactor.

Virtually the only way this hydrogen could have been formed, the experts said, was if the uranium fuel rods had lost a significant amount of the water that is designed to keep the fuel from melting. The reaction in the core that created the hydrogen also created the radioactivity that escaped into the reactor buidling, some of which was vented into the air outside.

Mr. Mehler, asked earlier this week about the report of his July conversation, said that it was somewhat inaccurate, but he confirmed the company's concern about an explosion.

Declines to Answer Question

When asked whether his answer confirmed the understanding that hydrogen already existed in the reactor, Mr. Mehler said that he would not discuss the matter on the telephone because he had already been questioned about it by Mr. Rogovin's special investigative team.

It was not until more than 24 hours after the conversation described by Mr. Mehler — that is, late Thursday evening or early Friday morning — that Metropolitan Edison told the Nuclear Regulatory Commission that the company thought the core had been uncovered, according to the memory of both company and Government officials.

Mr. Arnold, the senior Metropolitan Edison official now in charge of cleanup operations at the crippled reactor, said he was sure that officials at Three Mile Island had not decided that the core had been uncovered until late Thursday and had immediately passed on their conclusion to the Government.

D-2

Radioactive gas escapes in TMI spill

The Philadelphia Inquirer
February 12, 1980

By Mark Bowden
Inquirer Staff Writer

Small amounts of radioactive krypton gas were released into the atmosphere around Three Mile Island yesterday afternoon when about 1,000 gallons of highly radioactive cooling water spilled inside the nuclear power plant's auxiliary building.

The water spillage was the largest recorded leak of radioactive material at the facility since the major accident there last March, and prompted the evacuation of 11 workers from the auxiliary building, which sits alongside the plant's troubled Unit 2 reactor.

Officials of Metropolitan Edison Co. (Met Ed), which operates the plant, told federal and state regulators last night about the release of the krypton gas from the water into the atmosphere.

However, testing devices monitored by the U.S. Environmental Protection Agency, the Nuclear Regulatory Commission (NRC) and Met Ed did not detect significantly higher levels of radiation downwind from the plant, which is 10 miles south of Harrisburg on the Susquehanna River.

Met Ed officials initially had denied reports that any radioactivity escaped into outside air. But a spokesman later said that a check of monitors atop the building "confirms there was a small release of some radioactive gases, probably krypton 85." In the second statement, Met Ed said that "nearby monitors verified that the gas had been diluted within a short distance of the auxiliary building."

The statement added: "There would be no adverse health effects to workers on the island from such a minute release."

The auxiliary building houses pumps, tanks, pipes and machinery that normally donot come in contact with highly radioactive materials. But during the accident last spring, hundreds of thousands of gallons of radioactive coolant water were pumped from the afflicted Unit 2 containment structure into storage tanksthere.

Most of the largest radiation releases during the accident came from the

(See TMI on 14-A)

auxiliary building, which, unlike the thick concrete containment structure, is not built to house radioactive materials safely.

Robert Reid, mayor of Middletown, Pa., the nearest town to the Three Mile Island site, said a Met Ed official informed him of the accident yesterday, shortly after it happened.

"They told me there was a release of radioactivity inside the plant, but that none got out," Reid said. "That was exactly the same thing they told me last year, and I found out about 20 seconds later that radiation had been released. I guess I'll take their word for it until I hear otherwise."

Gov. Thornburgh dispatched a state radiological health expert to the plant to report on the incident. He also asked Thomas Gerusky, director of the State Bureau of Radiological Health, to monitor reports about the incident through the night.

"The governor is concerned about the situation and is receiving regular reports from all the monitoring agencies involved," said a spokesman on his staff.

Ever since the reactor vessel inside Unit 2 was uncovered and overheated during the accident 10 months ago, coolant water inside an enclosed network of pipes has flowed over the damaged core to keep it from melting down. Small amounts of highly radioactive water from inside this coolant system leak out inside the containment structure constantly, so "make-up" water pumps in the auxiliary building feed water into the cooling system regularly.

No one has entered the containment building since the accident last year. The building is intensely radioactive, and its atmosphere must be constantly regulated to prevent the escape of radioactivity. Work has been under way for many months, however, inside the auxiliary building, which is not as seriously contaminated.

When workers attempted yesterd ay to transfer the flow of "make-up" water from one pump to another inside the auxiliary building, they discovered that water pressure inside the pumping system was low. At about that time, according to an NRC account of the incident, alarms sounded inside the three-story auxiliary building and in the plant's control room. Eleven workers inside the auxiliary building were evacuated.

A two-man inspection team dispatched into the auxiliary building discovered that radioactive water was spilling from a pipe three-eighths of an inch in diameter. The water, which an NRC spokesman said was contaminated with about 60 microcuries (a measure of radiation intensity) per cubic centimeter, drained into the auxiliary building basement and was immediately pumped by sump pumps into storage tanks designed to hold radioactive water.

Sixty microcuries is about one-fourth the level of radioactivity contaminating each cubic centimenter of the 500,000 gallons of water at the bottom of the containment structure. The coolant water that spilled yesterday is much more radioactive than the water that has been stored in large amounts inside the auxiliary building since the emergency last year.

There have been a number of on-site accidents at the plant since last year. The worst, according to NRC spokesman Abraham, occurred last summer when seven men on a clean-up crew received an overdose when they accidently opened the wrong valve inside the auxiliary building. Abraham said yesterday's accident could not be considered "major," even though it involved a large amount of water.

The New York Times
February 12, 1980

Radioactive Water Leaks 2 Hours At Three Mile Island Nuclear Plant

MIDDLETOWN, Pa., Feb. 11 (AP) — A cooling system leaked as much as 1,000 gallons of highly radioactive water inside the crippled Three Mile Island nuclear power plant today, the authorities reported. They said no radioactive material had escaped and there was no health threat.

"The leak has been isolated and stopped," said John Collins, head of operations at the Nuclear Regulatory Commission's office here. "The water has been contained inside the auxiliary building. There has been no indication of airborne activity off-site. There was no danger to any of the workers on the island or off the island."

However, the auxiliary building, which adjoins the one that houses the severely damaged reactor, was evacuated what plant officials called the "local emergency." Eleven workers, wearing protective clothing and breathing gear, were inside at the time.

"We don't have any indication at all that any of these workers received any radiation," said Sandy Polon, spokesman for the Metropolitan Edison Company, operator of the plant that was shut down after an accident last March. "We isolated the auxiliary building, evacuated it, so we could locate the leak and take care of it."

600 to 1,000 Gallons

Mr. Polon estimated the amount of the leak at 1,000 gallons. In Washington, Victor Stello Jr., the nuclear commission's director of inspection and enforcement, gave an estimate of 600 gallons.

Officials said water leaked at a maximum rate of nine gallons a minute from 12:55 P.M. to 2:40 P.M. A sump pump hauled the spilled water to a storage tank.

Plant officials said the leak occurred in routine maintenance of three pumps that add water to the primary cooling system. They said that when one pump was turned on, a leak developed in a pressure switch feeding a three-eighths-inch line.

The system where the leak occurred has been used since the March accident to keep the reactor cooling system supplied with water. The water runs through the reactor's uranium core and contains radioactive isotopes.

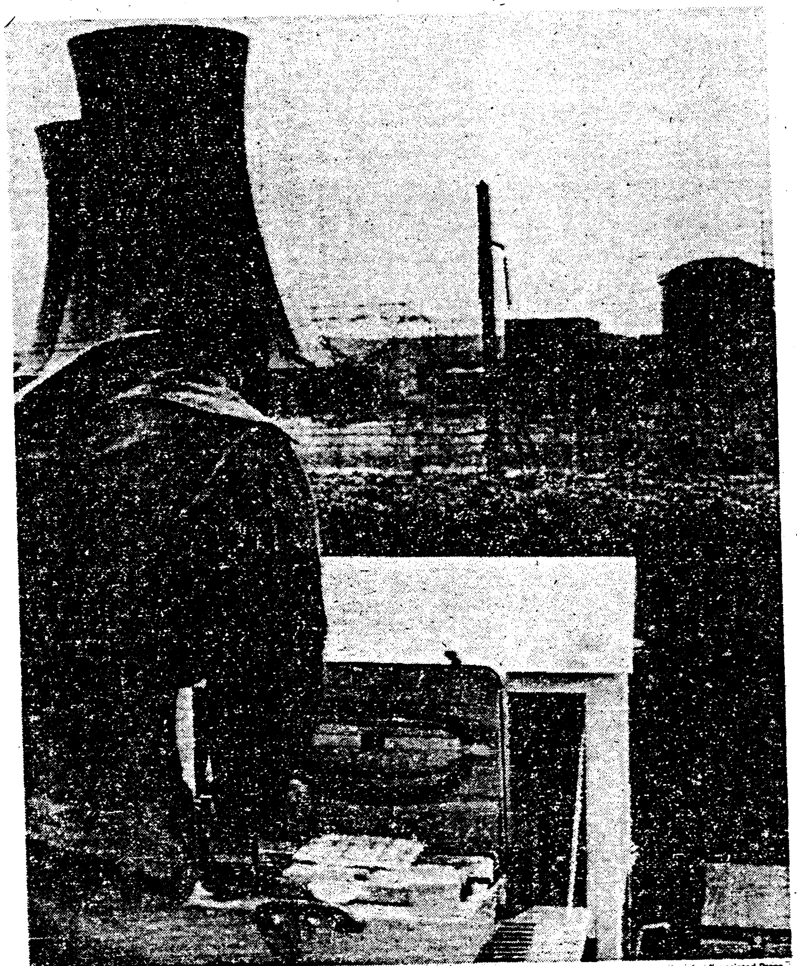
Rate of Radiation

Dave Milne, spokesman for the state Department of Environmental Resources, said the water contained material radiating at a rate of 125 microcuries per cubic milliliter. "That's a significant figure," he said.

In Washington, Frank Ingram, a commission spokesman, said his agency's technical support team at the plant was investigating.

"Our people are checking into the question of releases outside the building. We have heard none reported so far, but that is very preliminary," he said.

Commission officials said the leak had not affected the natural circulation of water that cools the reactor core. When alarms signaled the leak, a backup system was placed in service. The backup system was built after the accident.



Associated Press

A worker at Three Mile Island checks a radiation monitor outside the crippled power plant

State charges TMI officials tardy in alert on radioactive gas leak

D-5

State calls TMI tardy with alert

Delay charged in revealing leak

By Roger Cohn
Inquirer Staff Writer

Pennsylvania officials charged yesterday that the operators of the Three Mile Island nuclear power plant failed to properly notify state and local authorities about Monday's spill of highly radioactive water, which caused radioactive gas to be released into the atmosphere.

Oran K. Henderson, director of the Pennsylvania Emergency Management Agency, said that Metropolitan Edison (Met Ed), which operates the plant, had violated an agreement that requires the company to notify the state immediately of any spill or leakage of radioactive material. Henderson said that state authorities only learned of Monday's incident, in which radioactive krypton 85 gas escaped into the atmosphere, indirectly through an tip from a worker at the plant.

"It was inexcusable," Henderson said in an interview. "They (Met Ed) were bound to notify us and they didn't do it."

The release of small amounts of radioactive krypton gas occurred after about 840 gallons of highly radioactive cooling water spilled inside an auxiliary building next to the plant's damaged unit two reactor, the site of a major accident at the facility last March. The plant has been shut down since that accident.

A spokesman for the Nuclear Regulatory Commission (NRC) said that the amount of radioactive gas released, estimated by a Met Ed spokesman at 200 to 300 millicuries (a measure of radiation intensity), was not large enough to endanger the public

(See TMI on 2-A)

TMI, from 1-A

or the 11 maintenance workers who were forced to leave the auxiliary building.

In a prepared statement, Gov. Thornburgh said he was "greatly concerned about the timeliness of the notification process and the fact that the state first learned of this incident from sources other than the company and the Nuclear Regulatory Commission."

"It is absolutely imperative that the appropriate state authorities be informed directly and immediately of any malfunctions at this or any other nuclear power plant in Pennsylvania," the governor added.

Henderson said that Met Ed officials had signed an agreement with the state to "notify us expeditiously" of any radioactive spill or leakage at the Three Mile Island plant. Under the agreement, he stated, Met Ed was to report any such incident immediately to his office, the State Radiation Protection Bureau, and emergency preparedness authorities in Dauphin County, where the plant is located.

Henderson said that the spill of cooling water at the facility was discovered at 12:58 p.m. on Monday, but that his office did not learn of it until 1:20 p.m., when Dauphin County authorities called to report that they had information indicating that a spill had occurred. The information was relayed to county authorities by a friend of a worker at the plant, he added.

Henderson said that state officials then contacted the plant's NRC representatives who confirmed that a spill had taken place. His office did not receive final confirmation of the incident until 1:40 p.m., Henderson said.

"As far as we're concerned, they (Met Ed) violated the agreement by failing to notify us," Henderson stated.

"I thought we had the system pretty well worked out and that we would get notification of this type of incident," he said. "But here it is, an incident happens, and we don't get any notification.

"We find out about it 25 minutes later through the back door, instead of five minutes later through the front door the way we're supposed to," Henderson added.

A Met Ed spokesman said yesterday that, under the plant's NRC-approved emergency plan, the company is not required to notify any state agency about the type of incident that oc-

(portion missing)

confined to a small area at the plant, he stated.

Met Ed spokesman David Kluscik said that the power company had gone "beyond what we were required to do" by notifying the Radiation Protection Bureau of the spill at 1:30 p.m.

However, Henderson said that call was not made until 1:40 p.m. and that, by that time, state officials had already contacted the NRC staff at the plant. The leak was stopped at 2:30 p.m., according to the company.

Henderson said that he met yesterday afternoon with Herman Dieckamp, acting president of Met Ed and president of General Public Utilities, of which Met Ed is a subsidiary. He agreed that state officials should have been informed of the spill, Henderson said, and he pledged to improve notification procedures at the plant.

In his statement, Thornburgh said that he intended to complain to the NRC about Met Ed's failure to notify the state immediately of the incident.

"The need for swift, accurate and direct communication was one of the most important lessons to come out of the events of last spring," said Thornburgh, citing the worst nuclear reactor accident in history. "I would hope that it hasn't been forgotten."

D-6

The Philadelphia Inquirer
February 13, 1980

Radiation leaks at TMI: Nothing has changed

Monday's accident at the Three Mile Island nuclear plant, in which water was spilled and small quantities of radiation released, demonstrates with frightening clarity that absolutely nothing has changed in the way nuclear plants are run or regulated in the United States, despite all the public assurances to the contrary.

Officials of Metropolitan Edison Co., operators of the reactor, at first denied that any release of radiation had occurred even though there was ample evidence that gas had been vented during the spill. They later changed their story. The utility failed to notify state officials — as they had previously agreed to do — that a portion of the plant had been evacuated. And it took operators 1 hour and 45 minutes to bring the situation under control.

The events of Monday are in many ways so similar to those that occurred last March 28 as to be uncanny.

When the President's Commission on the Accident at Three Mile Island last fall released its exhaustive study, members noted: "Metropolitan Edison did not have sufficient knowledge, expertise and personnel to operate the plantor maintain it safely."

Immediately after the accident, the best minds in the fields of nuclear engineering and safety rushed to the plant to assist. They have provided guidance ever since. Operators were subjected to rigorous retraining. All this took place under the watchful eyes of the Nuclear Regulatory Commission which assuaged critics in the Congress and the public by mounting a highly touted internal shake-up, well aware that its future as a regulatory agency hung in the balance.

"We are learning the necessary lessons from this accident and applying them so that we can even better protect the public," said the industry's top spokesman, Carl Walske of the Atomic Industrial Forum, Inc. last year.

Nothing could be further from the truth which emerged, naked, Monday. It is business as usual at TMI and, it would appear, at the NRC.

The NRC thus far has survived a variety of demands that it be restructured to provide more decisive leadership in emergencies as well as in long-range regulation. Yet only last month, it extended a crucial deadline for installation of safety equipment on operating reactors because 38 of the 68 affected plants had not complied.

In many other of its regulatory actions, the NRC has given every indication that it realizes the pressure is off, that public attention has been diverted elsewhere, and that the tough talk of last year can be modulated.

President Carter, whose commitment to nuclear power dates back to his Navy days, recently revised his position on the expansion of nuclear generating capacity in this country. Although the President used to describe nuclear power as a "last-resort" source of power, he has amended his position, saying that the U.S. must rely on new reactors until alternative forms of energy are available.

The accident at Three Mile Island on Monday was minor. The radiation that leaked out was diffused a short distance away from the reactor.

The significance of that small problem is tremendous, however, for the residents of Middletown, the people of Pennsylvania and all Americans.

The best technology available, the best minds available, and the ever-present knowledge that Three Mile Island serves as the proving ground for nuclear power all failed to produce a combination of effectiveness. It failed — Monday made it inescapably clear — to run even an almost closed-down plant properly. That leaves the obvious question unanswered: Can nuclear power be made safe at all?

D-7

The Philadelphia Inquirer
February 14, 1980

2d radiation leak at TMI this week

By Roger Cohn
Inquirer Staff Writer

Another leak of radioactive krypton gas was discovered yesterday at the Three Mile Island nuclear power plant. It released 10 times as much radioactive gas into the atmosphere as escaped from a leak at the plant Monday, Nuclear Regulatory Commission (NRC) officials said last night.

However, the NRC officials said yesterday's leak, which occurred between 7:30 p.m. Tuesday and noon yesterday, did not threaten the health of plant workers or nearby residents. Monitoring devices just off the plant grounds failed to detect an increase in radiation, the officials stated.

Gary Sanborn, an NRC spokesman, said that the krypton 85 escaped through a leak in a gas-sampling system at the auxiliary building beside the damaged Unit 2 reactor, site of the worst commercial nuclear accident in the nation's history last March.

Sanborn said that the gas released over the 16-hour period measured three curies (a measure of radioactive material based on the concentration of radioactivity). That amount is 10 times times greater than the krypton gas that escaped on Monday after 840 gallons of highly radioactive water spilled inside the auxiliary building.

John Collins, chief of the NRC staff at Three Mile Island, said he did not regard yesterday's leak as "a serious incident."

Metropolitan Edison, which operates the plant, confirmed last night that krypton gas had started to leak Tuesday night from the gas-sampling system. In a prepared statement, the company said that the system had been shut down at 11:40 a.m. yesterday and that Met Ed workers were trying to find the cause of the leak.

The company said that it had reported the latest leakage to Gov. Thornburgh's office, to state environmental and emergency officials.

Met Ed has agreed to notify state and local authorities of all spills and leaks. Page 3-B.

D-8

The Philadelphia Inquirer
February 14, 1980

Met Ed agrees to notify state, local officials of leaks

By Roger Cohn
Inquirer Staff Writer

New emergency notification procedures were put in effect yesterday at the Three Mile Island nuclear power plant in an effort to assure that state and local authorities are notified immediately of any spills or leaks of radioactive material, a spokesman for Metropolitan Edison (Met Ed) said yesterday.

Met Ed, which operates the plant, was responding to state officials' complaints that they were not promptly notified about Monday's spill of 840 gallons of highly radioactive cooling water at the plant.

The state officials said the 40-minute delay in formal notification violated an agreement requiring Met Ed to inform the state immediately of such incidents. Met Ed spokesman David Kluscik said that the company had not believed that the agreement was in effect on Monday.

Kluscik said that now the plant staff would alert the Pennsylvania Emergency Management Agency and emergency-preparedness officials in Dauphin County, where the plant is located, of any radioactive spill or leak.

State officials insisted yesterday, though, that such notification should have been made for Monday's incident, in which small amounts of radioactive krypton 85 gas escaped into the atmosphere. Those officials said they believed Met Ed's handling of the incident would further damage public confidence in the company's operation of the plant, which has been shut down since the worst nuclear accident in the nation's history happened there in March.

"It just seems that Met Ed is prone to making errors," said Thomas Gerusky, director of the state Radiation Protection Bureau. "They should have called us ... I think the damage has been done to Met Ed again. I don't know if they are ever going to come back to credibility."

John Collins, chief of the Nuclear Regulatory Commission (NRC) staff at Three Mile Island, said that the cooling water spilled inside the plant's auxiliary building had a maximum radioactivity concentration of 120 microcuries (a measure of radiation intensity). Cooling water inside the primary system of a normally operating nuclear plant would have a concentration of one microcurie, Collins said.

Meanwhile, in Harrisburg yesterday at a Public Utility Commission (PUC) hearing on whether Met Ed should be permitted to remain in business, Citibank vice president Stewart Clifford said that banks would be reluctant to continue extending credit to General Public Utilities, Met Ed's parent company, unless they believed that the PUC wanted Met Ed to continue operating. A group of banks, led by Citibank and Chemical Bank, have currently placed a ceiling of $292 million on credit available to General Public Utilities.

In a related development, the NRC announced that small amounts of radioactive gas leaked into the atmosphere on Monday and Tuesday at a nuclear power plant in Lusby, Md. The leaks, which occurred at the Baltimore Gas & Electric Calvert Cliffs plant, were considered "negligible" and did not endanger public health, according to the NRC.

Intelligencer Journal
March 21, 1980

TMI Leaks, But Source Not Found

Radiation levels rose mysteriously inside a Three Mile Island plant building and remained higher for several hours on Thursday before falling back to normal, officials said.

"They have not really found the source of the leak...but, whatever it was, it is not presenting a continuing problem to us," said John T. Collins, chief on-site official for the Nuclear Regulatory Commission.

Higher levels triggered an alarm in the Unit 2 auxiliary building about 1 a.m. No workers were inside the building at the time.

Radiation inside the auxiliary building tripled before coming down, Collins said.

Metropolitan Edison Co., the plant operator, said some radioactive krypton gas probably escaped from the Unit 2 auxiliary building. The amount was so small it could not be detected, even on the building's roof.

"We believe some of it was released, although we can't put a number on it," spokesman Sandy Polon reported.

The disabled plant gives off about two curies of krypton gas every day from a variety of small leaks.

"Instead of two curies being released (on Thursday), it may be three. It still is an awful small amount," said Thomas Gerusky, director of the state's Bureau of Radiation Protection.

On-site officials of the U.S. Environmental Resources also reported that no radiation could be detected offsite.

To be sure, the agency sent an air sample from a "krypton-senstive"

TMI Leaks, But Source Not Found

Continued From Page One

monitor placed at the TMI Observation Center to laboratories in Las Vegas, Nev., for analysis.

"I don't expect to see anything," said Al Smith, the EPA's coordinator at the nuclear plant.

The incident was reported to Pennsylvania authorities about 7 a.m. as "an event of potential public interest."

Officials at first thought radioactive water may have leaked from the plant's cooling system onto the floor of the reactor building, giving off gas that escaped through the building's ventilation system.

Later a water leak was ruled out when workers in protective clothing entered the building, looked around and saw no water. The water level in the building's "sump" did not go up either, Polon said.

By Thursday night, plant officials were speculating the leak may have come as a result of maintenance and decontamiation work performed a day earlier in a valve room that adjoins the auxiliary building.

"The assumption is being made that it was probabaly a particulate release," Collins said.

Gerusky called the incident was "just another indication of what's going to happen" until the disabled reactor is cleaned up.

The Philadelphia Inquirer
November 15, 1979

APPENDIX E

NRC ADVOCACY

Met Ed asking to release gas trapped at TMI

Associated Press

HARRISBURG — Metropolitan Edison Co. said yesterday that it wants to vent krypton 85, a radioactive gas, from the damaged Three Mile Island nuclear reactor.

If the Nuclear Regulatory Commission approves, the controlled release would occur during the first three months of 1980, Met Ed vice president Robert Arnold told a public hearing. The gas was created during the March 28 accident when water came into contact with the fuel assemblies, which had deteriorated in the intense heat.

Both commission and state officials at the hearing declined to comment on Met Ed's proposal.

There are approximately 2 million cubic feet of trapped gases — primarily krypton — in the containment building. The amount of radioactivity released during the venting, which is expected to take between 1½ to three months, would be far below federal radiation standards, Arnold said.

For a person standing continuously at the facility's boundary for the duration of the venting, radiation exposure for the skin would be 5 millirems, Arnold said. Whole-body exposure would be one-tenth of a millirem, he added.

Under federal standards, the maximum safe exposure over a year is 15 millirems.

Report on Nuclear Accident Holds Agency Is Unable to Insure Safety

It Urges Strong Chief for Regulatory Commission and Formation of a Consortium to Operate Reactors

By DAVID BURNHAM
Special to The New York Times

WASHINGTON, Jan. 24 — A report to the Nuclear Regulatory Commission on the accident at the Three Mile Island reactor concluded today that the commission as currently organized was incapable of managing a nuclear safety program "adequate to ensure the public health and safety."

Calling for a reorganization, the report stressed the need for a "single chief executive" to direct the regulatory commission.

In addition to urging a reorganization of how the Government regulates nuclear power, the report recommended the formation of an industrywide consortium or a public corporation to take over the operation of reactors from those utilities unable to run them in a safe manner.

The report was prepared at the request of the regulatory commission by an independent investigative team headed by Mitchell Rogovin, a Washington lawyer. Today's report is entirely separate from the one completed in November by a Presidential advisory commission headed by John G. Kemeny, president of Dartmouth College.

"We have found that the Nuclear Regulatory Commission itself is not focused, organized or managed to meet today's needs," the Rogovin team said. "In our opinion the commission is incapable, in its present configuration, of managing a comprehensive national safety program for existing nuclear power plants and those schedule to come on line in the next few years adequate to ensure public health and safety."

Need for Trained Personnel

The group added that, based on its study of the Three Mile Island accident and interviews with experts throughout the industry, "many nuclear plants are probably operated by management that has failed to make certain that enough adequately trained operators and qualified engineers are available on site in responsible position to diagnose and cope with a potentially serious accident."

The report further found that responsibility for safety was badly fragmented among different parties and that, at least until the start of the Three Mile Island accident near Harrisburg, Pa., last March 28 "an attitude of complacency pervaded both the industry and the N.R.C."

John F. Ahearne, chairman of the regulatory commission, called the report "a reasoned and sound document." Two of his colleagues, however, Victor Gilinsky and Peter Bradford, raised a series of critical questions about the reasoning behind some of the report's recommendations. The comments came at a commission meeting in which Mr. Rogovin presented a summary of the $3 million study.

Despite the sweeping criticisms, however, the final report by the Rogovin group did not include recommendations for either a temporary "moratorium" on the construction of new reactors or that serious consideration be given to closing down any reactor whose operator is unable to develop plans to evacuate every person living with a 30-mile radius of the reactor. Those two recommendations were made in the original version of the report, a copy of which was obtained three weeks ago by The New York Times.

Peril of a Meltdown

The special report said the Three Mile Island incident had come close to being "the accident we had been told by many in industry could not happen: a core meltdown."

About two hours after the accident began, the report said, a shift foreman reported for work, noted a valve was leaking reactor coolant into the containment building and blocked off the stuck-open valve.

"If that valve had remained open, our projections show that within 30 to 60 minutes a substantial amount of reactor fuel would have begun to meltdown — requiring at least the precautionary evacuation of thousands of people living near the plant, and potentially serious public health and safety consequences for the immediate area," the report said.

The special team concluded that because of a variety of steps taken by the nuclear industry and the regulatory commission an accident identical to that at Three Mile Island would not happen again.

"However," the report added, "the work done by the Special Inquiry Group over the past seven months has led us to conclude that unless fundamental changes such as those outlined above are made in the way commercial nuclear reactors are built, operated and regulated in this country, similar accidents—perhaps with the potentially serious consequences to public health and safety that were only narrowly averted at Three Mile Island—are likely to recur."

Lack of Leadership Seen

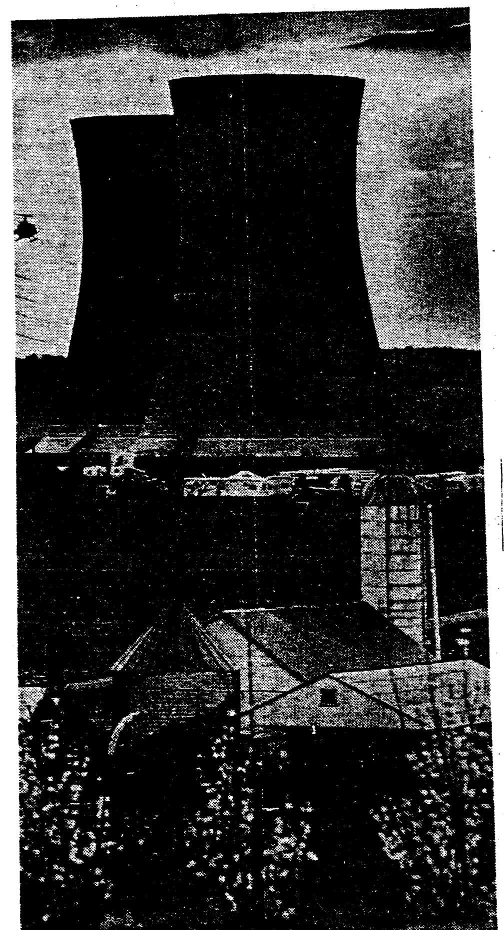
The report charged that the regulatory commission had failed to provide either leadership or management for the nation's nuclear safety program.

"The central and overwhelming need is for legislative and executive reorganization to establish a single chief executive with the clear authority to supervise and direct the entire N.R.C. staff," the report contended. "An effective reactor safety program absolutely requires strong and effective management of this kind."

The Presidential advisory commission headed by Dr. Kemeny also recommended the abolition of the five-man board that heads the regulatory commission and its reorganization into an agency headed by a single administrator similar to the Food and Drug Administration, the Environmental Protection Agency or the Federal Aviation Administration.

Such a plan, however, is not popular in Congress and was not adopted by President Carter in his response to the recommendations of his advisory commission.

"We do not believe that the current Administration's proposal to 'strengthen' the N.R.C. chairman's executive author-



The New York Times / Keith Meyers

A Nuclear Regulatory Commission helicopter flew past cooling towers of the Three Mile Island nuclear plant as its crew checked radiation levels.

ity goes far enough to reach the heart of the problem involved here," the Rogovin team report said.

Call for Consortium

The recommendation for the formation of a nationally chartered operating company or consortium to take over the operation of some reactors was based on a finding, the report said, "that there is a wide spectrum in the capability of the various nuclear utilities to operate existing plants in a safe way."

The report said that for those utilities found unable to manage a nuclear reactor "the company or consortium would either acquire the plants and sell electric power to the utilities for resale to customers" or would operate existing plants on a contract basis.

The report said that the investigation team had sought to determine whether there was evidence of any willful failure on the part of utility personnel to cover up the seriousness of the accident.

The report said that there was no question that the information conveyed to the regulatory commission during the accident was incomplete, in some instances delayed and often colored by individual interpretations. But, it added, there was no evidence that the causes of this breakdown in information flow went beyond confusion and incompetence.

In a letter to the regulatory commission, however, Representative Morris K. Udall, chairman of the House Interior and Insular Affairs, called for further investigation of why on the first day of the accident Federal and state officials "were denied important information" about the status of the plant.

The New York Times
February 17, 1930

Quick Decontamination At 3 Mile Island Sought

WASHINGTON, Feb. 16 (AP) — Federal regulators are looking for ways to speed the decontamination of the crippled Three Mile Island nuclear reactor after two minor leaks of radioactive gas this week.

Members of the Nuclear Regulatory Commission said the pace of the cleanup at the reactor, Three Mile Island Unit No. 1, near Harrisburg, Pa., should be re-examined and a report issued within two weeks.

The Unit 1 reactor has been inaccessible nearly a year. It contains nearly 1 million gallons of radioactive water, radioactive krypton 85 gas and a core believed heavily damaged and in a fragile state because of the accident March 28, when the reactor allowed cooling water to escape from its system.

The Federal commission and the utility that operates the plant have estimated that workers will not be able to reach the damaged core until early 1983 and not complete the cleanup until 1984. So far only about one-tenth of the radioactive water has been decontaminated.

Victor Stello, director of the commission's office of inspection and enforcement, told his colleagues there was reason to believe that the cleanup could proceed faster. He indicated that the commission itself might be partly to blame because of inaction.

Two other commission members expressed concern that in its present, sealed state, the reactor might pose a greater risk than if some controversial cleanup procedures were begun now. Those procedures would lead to releases of radioactive material, but below dangerous levels.

The New York Times
March 13, 1980

Venting of Radioactive Gas Urged

WASHINGTON, March 12 (AP) — The Nuclear Regulatory Commission's staff proposed yesterday that radioactive gas be vented as soon as possible from the crippled Three Mile Island nuclear power plant in Pennsylvania.

The commission agreed to reach a decision on the proposal [redacted] after the [redacted] and the commission gives the matter further study.

Before any of the krypton-85 gas is released into the atmosphere, the commission's staff said, an effort would be made to reassure people living near the plant that the venting would pose no health threat.

Area residents have strongly opposed release of the potentially hazardous material that is now sealed in the nuclear plant's containment building, despite assurances by the commission that any releases would be well within Federal radiation safety limits.

The release of the gas would be the first major step toward gaining access to the containment building, which has been sealed since a nuclear accident occurred at the plant nearly a year ago. Members of the commission have indicated in recent weeks that they favor speeding the cleanup process at the reactor near Harrisburg, Pa. The staff warned that if the gas remained in the containment structure, "it is likely that future accidental releases" would occur.

The cleanup operation also must deal with 600,000 gallons of contaminated water in the containment building. Both the gas and water must be removed before anyone can enter the building to examine instruments, pipes and gauges that may be rapidly deteriorating.

The Philadelphia Inquirer
March 14, 1980

Associated Press

Two TMI technicians, the first to enter Unit 2 airlock since the accident, remove masks after finding area free of radiation

NRC staff wants gas at TMI released soon

By Mark Bowden
Inquirer Staff Writer

The Nuclear Regulatory Commission (NRC) staff has recommended to its five commissioners that 57,000 curies of radioactive krypton gas trapped inside the Unit 2 containment building at Three Mile Island be vented into the outside air soon.

If the commission approves the recommendation next month, the venting will be the largest release of radioactivity from the stricken nuclear power plant since an estimated 15 million to 20 million curies escaped during the accident there last year.

NRC officials stressed Wednesday that venting the Krypton-85, an inert gas that will remain radioactive for nearly 100 years, would not threaten the health of area residents.

Metropolitan Edison Co., co-owner and operator of the plant, asked the NRC for permission to release the gas as a first step toward decontaminating Unit 2, a process that will take at least four years and cost an estimated $400 million.

Although venting is strongly opposed by surrounding communities, it has now been endorsed by two separate NRC groups and by Gov. Thornburgh's TMI commission.

In approving the venting of the the radioactivity, the NRC staff rejected more time-consuming and expensive methods of cleaning the atmosphere inside Unit 2. Alternatives such as absorbing the krypton gas in special filters or liquefying and bottling it were vetoed because further delays in cleaning up Unit 2 could result in more dangerous, accidental releases, the staff report said.

"I regret to report that the technology for cleaning up a mass concentration of krypton gas is not as advanced as I had once hoped," said Harold Denton, the NRC's director of nuclear regulation.

Mayor Robert Reid of Middletown, Pa., which is close to the plant, said, "I knew it was going to happen, but I don't like it. There are a lot of people upset with it. Venting is just the cheapest and easiest way."

Reid predicted that many residents would leave the area when venting occurs, despite assurances from federal and state officials that it will be harmless.

Met Ed officials are anxious for permission to vent the gas. After that has been done, workers will be able to spend enough time inside the contaminated reactor building to begin devising a method of cleaning out the reactor core, which is thought to have partially melted during the accident. No one has entered the Unit 2 containment building since the accident occurred on March 28, 1979.

Yesterday morning, two teams of Met Ed workers entered the Unit 2 airlock for the first time since the accident. Workers are tentatively scheduled to enter the containment building next month to take photographs and test the level of radioactivity.

E-6

The New York Times
March 28, 1980
page 1 of 2

Officials Seem to Favor Venting Gas at 3 Mile Island

By RICHARD D. LYONS
Special to The New York Times

HARRISBURG, Pa., March 27 — The top Federal nuclear safety expert and Pennsylvania's Governor left little doubt today that they would support the controlled release of more radioactive gas from the Three Mile Island plant.

The venting, while small in amount, is likely to trigger the largest protest yet from people living nearby and serves to underscore the safety questions that remain one year after the nation's worst civilian nuclear accident.

Harold R. Denton, director of reactor safety for the Federal Government, said at a news conference here that he had recommended the venting of gases, mainly radioactive krypton 85, as the only logical means of speeding up efforts to decontaminate the plant of hazardous atomic waste.

General Public Utilites Corporation, owner of the Three Mile Island plant, is in severe financial trouble. Page D1.

"There would only be a very small, a tiny amount of radiation released," Mr. Denton said, "which would have inconsequential health effects."

'Has to Be Cleaned Up'

Mr. Denton, an official of the Nuclear Regulatory Commission, added that "we cannot walk away from the plant; it has to be cleaned up."

Gov. Dick Thornburg, who held the news session in his capital office, stopped short of endorsing the venting proposal, but he added that "the option to do nothing is simply not on the table; decontamination must go forward."

The news conference came on the eve of the one-year anniversary of the Three Mile Island accident. Equipment failure, human error and poor procedures have been cited as the primary causes of the accident, on March 28, 1979, in which a loss of coolant left the atomic fuel partly exposed.

Associated Press

Harold R. Denton speaking yesterday about Three Mile Island.

The venting issue has left many normally undemonstrative residents near the plant, on the Susquehanna River, in bitter, even violent, moods.

They contend that the renewed plan for venting highlights their fears that their health and safety are being placed behind the cost of the cleanup of Three Mile Island, perhaps as high as $1 billion.

Skepticism From Mayor

"I'm quite sure they'll never tell us the truth about the venting," Mayor Robert Reid of Middletown, the town closest to the plant, told a meeting of local residents two nights ago in summarizing the distrust felt by his constituents.

The Middletown Press and Journal made public today the results of a telephone spot check of area residents. It found that those questioned believed, by almost 2 to 1, that the Metropolitan Edison Company, the utility operating the plant, and the Nuclear Regulatory Commission had given them misleading information.

Earlier meetings, such as one at the Middletown fire house last week, have turned into heated exchanges and vandalism because of the depth of feeling on the venting issue, not only by people traditionally opposed to nuclear power but also by many apolitical residents who believe their safety is being subordinated to the cleanup cost.

It was Mr. Denton who bowed to what be termed "psychological stress" in banning the release of krypton gas into the atmosphere last summer.

Krypton Mixed With Air

Krypton 85 is a normal product of nuclear fission in an atomic power plant. It is highly radioactive and its half-life — the time it takes half the atoms to disintegrate or "cool off" — is almost 11 years.

As explained by Mr. Denton today, the Three Mile Island plant contains one to two cubic feet of krypton 85 mixed with 22 million cubic feet of air inside the containment vessel, which houses the reactor.

The krypton has about 57,000 curies of radioactivity, compared with the two million curies or so that were accidentally vented during the accident a year ago, mostly as xenon gas.

Although krypton 85 is a heavy, inert gas whose beta radiation normally cannot penetrate the skin, it can be inhaled.

Mr. Denton noted that the Nuclear Regulatory Commission and other groups had examined ways of disposing of the krypton and had come up with a few other possibilities.

Included was one to liquefy the air that holds the krypton. Yet Mr. Denton said this was extremely difficult to do, that there had been minor explosions in working with the necessary equipment and

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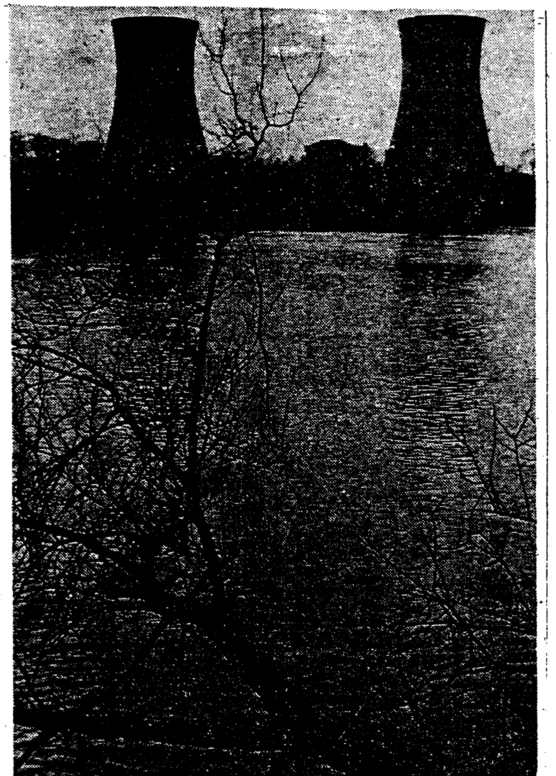
E-7



The New York Times/Teresa Zabala

The Three Mile Island nuclear plant one year after the accident

that such a project would take several years. Another possibility would be to absorb the krypton with activated charcoal, 34,000 tons of it. A third would be to store all the contaminted air in vacuum bottles.

After noting the options and calling attention to the drawbacks of each, Mr. Denton summed up by saying, "The technology is just not there to bring here and put into place."

The costs could range from about $4 million to more than $100 million.

Mr. Denton said that, although the health risks of venting were extremely small, there would be other risks if nothing were done, such as not knowing what was going on inside the reactor. He explained that the krypton gas must be disposed of to allow cleanup workers to enter the plant with greater safety.

After dealing with the radioactive gases, the workers then must clean up about 700,000 gallons of water inside the plant, contaminated mainly strontium 90 and cesium 137.

While far more toxic than krypton 85, these two materials can be handled more easily since they may be filtered out of the water and taken away in lead casks.

There still has been no decision about whether to restart the undamaged nuclear reactor at Three Mile Island. Known as T.M.I.-1, this was shut for refueling at the time of the accident to the second reactor, T.M.I.-2.

APPENDIX F

NECESSITY OF VENTING

The Philadelphia Inquirer
February 28, 1980

Somebody must decide the real TMI issue

Trapped inside the damaged reactor building at the Three Mile Island nuclear plant are gases containing 50,000 curies of radiation, along with many thousands of gallons of highly radioactive water. Whether that radioactive gas remains inside the plant or is intentionally vented into the atmosphere of central Pennsylvania is a question for which there is only one responsible answer: It must not be released.

A decision to spew the gas into the atmosphere and onto tens of thousands of people would represent the most indefensible form of expediency. It would be frightening, additional proof that the officials running the operations at TMI are like a bunch of boys playing mechanic in a back lot, trying to repair a derelict car by trying anything. When one thing doesn't work, they dream up another scheme.

In the TMI instance, mistakes can prove deadly for the people of Pennsylvania today and in the future.

Someone must decide whether the TMI plant is going to be returned to service or abandoned. The decision must not be made by the operating utility, which would profit from its reopening, or by the Nuclear Regulatory Commission, whose credibility to make such a decision is suspect. Perhaps that final decision must, by default, fall into the lap of Gov. Thornburgh who should have the best interests of the people uppermost in mind.

The decision will be difficult and controversial. But no one thus far has given any indication of considering it seriously. It would be an immense tragedy if sometime in the next year — after the residents near the plant have been exposed to radiation vented intentionally or unintentionally — the utility or the federal government decided simply to walk away from the plant because the clean-up process was not working or had grown too costly.

The gas trapped in the reactor building is radioactive krypton. Despite all sorts of benign assurances that exposure to the gas would be no more dangerous than taking a long airplane ride, any exposure to radiation poses a potential risk to health.

No one knows what the genetic legacy of TMI will be; only time will tell.

Officials at the crippled plant have warned repeatedly that unless they are permitted to vent the krypton under controlled circumstances the threat of uncontrolled releases increases. Considering the sloppy management and lax attitudes toward public safety already exhibited at the reactor, that possibility can't be ignored But it cannot — and must not — be legitimized.

The Governor's Commission on Three Mile Island has done precisely that by tentatively endorsing the plant owner's plan to vent the gas, pending approval by the NRC. Not surprisingly, commission member Robert Reid, mayor of Middletown, TMI's nearest neighbor, dissented.

Venting the gas is a cheap way out of the dilemma — cheap for the utility. Equipment to filter out the radioactive particles isn't immediately available — telling testimony that the nuclear industry plans only for the routine and not for the unexpected. Technology does exist in other fields, however, to remove radioactivity from gas and it could be adapted — at great cost — to the TMI reactor.

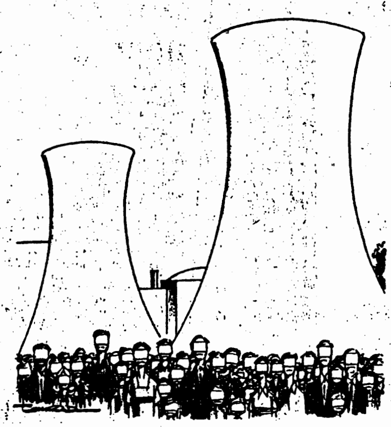
The NRC will decide this spring whether the krypton gas can be vented by the utility. It must not be. Safety, public welfare and the genetic future of millions of Americans have been neglected far too long in the scramble for easy answers to the problems of nuclear power.

The Philadelphia Inquirer
March 28, 1980

The Philadelphia Inquirer
Op-ed
Friday, Mar. 28, 1980 13-A

Public has reason for distrust . . .

By Rep. Peter H. Kostmayer



Two days after the accident at Three Mile Island, the chairman of the Nucear Regulatory Commission bemoaned the conflicting and incomplete information he was receiving from the accident site, the breakdown in communications, and the mounting public hysteria. "We are operating almost totally in the blind . . . staggering around making decisions," he said.

One year later, the situation is unchanged.

The owners of the crippled Three Mile Island reactor have embarked on a course fraught with danger and uncertainties, involving untested technologies and unpredictable consequences. It will involve the removal of radioactive krypton and almost one million gallons of contaminated water. Some 2,000 truckloads of radioactive material must be shipped 2,700 miles for disposal in Washington state. And the damaged core itself will be removed and stored in containers or shipped elsewhere.

The people of central Pennsylvania, facing the immediate prospect of venting of radioactive gas into the open atmosphere feel perhaps even less secure than they did a year ago.

A recent NRC staff report concludes that venting is preferable to any of the available alternatives which involve delay. How did we get into this current bind in which we must choose between dumping lethal gas into the atmosphere or risking unknown dangers by leaving it undisturbed?

In part, because we were all told by the industry and the regulators that the accident at Three Mile Island could never happen in the first place. Every investigation of the accident, from the President's special commission to the House Interior Committee task force on which I served, reached remarkably similar conclusions, namely, that an arrogant and dangerous complacency about nuclear safety issues and a near-religious faith in the virtues of nuclear power governed the activities of the industry and the government agency charged with regulating it.

This attitude still prevails today, and in many ways it is responsible for the situation in which we now find ourselves.

The NRC has simply reacted to industry proposals for the clean-up operation, rather than anticipating and confronting the problems that lie ahead.

What about alternative, and possibly safer methods of ridding the reactor of the lethal gas? Metropolitan Edison, the plant operator, originally estimated it would take 20 to 30 months to implement a cryogenic processing system in which the gasses would be contained rather than vented into the atmosphere.

The NRC staff said that 12 to 18 months for implementation of this system was more likely. Why the discrepancy? When I asked one of NRC's top technical staff, he replied that Met Ed was inclined to be pessimistic about alternatives because "Met Ed would really like to vent the containment." From Met Ed's point of view, venting is the quickest and cheapest solution.

But what about the public's point of view, which should be the primary concern of the NRC? The public's point of view could have been determined by an environmental impact statement which would allow for public review and comment, and for assessment of technical alternatives. But one was not begun until eight months after the accident.

Why? One reason given by the then NRC chairman for the failure to order an environmental impact statement earlier was that the plant's owner had not presented its clean-up plan until then.

Who's running the show here? The real reason we are faced with limits and possibly dangerous alternatives is NRC's inaction and its failure to respond to public health and safety concerns.

The President's Council on Environmental Quality, the agency responsible for overseeing the environmental impact statement process, insists that a comprehensive environmental impact statement *must* be completed before any of the clean-up options, including venting, can proceed. All citizens and their elected representatives should demand that this view prevail.

In the meantime, the NRC's continuing intransigence indicates that despite the calls of the Kemeny Commission for a fundamental shift in the government's and in the industry's attitudes, the public's distrust and skepticism are justified and should continue.

(Peter H. Kostmayer of New Hope, represents Pennsylvania's 8th district in the U.S. House of Representatives. He is a member of the Subcommittee on Energy and the Environment which has jurisdiction over the Nuclear Regulatory Commission.)

The Philadelphia Inquirer
March 30, 1980

Venting krypton at TMI: Convenience, not necessity

Responsible appraisal of the facts makes it imperative that the Nuclear Regulatory Commission reject the request of Metropolitan Edison Co., operators of the Three Mile Island nuclear plant, to vent radioactive krypton gas into the atmosphere.

Venting the gas not only would subject people in the vicinity to potential health and genetic damages which cannot be confidently determined, it would unnecessarily exacerbate a growing social problem of public distrust of the federal government officials charged with regulating the nuclear industry.

Venting is a choice of convenience — not legitimate need.

Once more, Met Ed officials — with the tacit support of NRC staff members — have deceived the public as they have done time and again since the crisis began a year and two days ago.

For months, Met Ed officials have stressed the urgency of venting, claiming that vital equipment inside the reactor building is in jeopardy due to lack of maintenance since the accident. Experts have asserted that unless the gas is vented and repairs are made, the reactor itself may malfunction again and spew potentially deadly radiation over the central Pennsylvania countryside.

The staff of the NRC officially has supported the company's position, claiming that the release would pose no hazard to public health and noting that clean-up in the reactor cannot occur unless the 57,000 curies of radioactive gas trapped inside is removed.

A careful review of the facts, however, produces a fundamentally different conclusion:

• Workers can enter the containment building to perform maintenance chores regardless of whether the krypton has been released. The krypton represents only one-fourth of the amount of radiation in the massive containment building housing the reactor vessel, which is separately sealed and which contains even much more intense radioactive material. The remaining 75 percent of the radioactivity in the containment area comes from contaminated water and radioactive particles clinging to the interior of the building.

• Without venting, workers can remain in the containment building for about one hour before exceeding the quarterly dose of annual radiation exposure set by the federal government. If the krypton *were* vented, that would extend the individual worker's time limit for maintenance by only 30 to 45 minutes, according to the company.

• Repair of a neutron detector which measures radioactivity inside the containment building would require "several hours of labor," according to an NRC staff report. (A company expert estimates that the time required would be much longer.) Although other repairs — of fans, pumps and valves — are believed necessary, the NRC report places the highest priority on repairing the neutron detector.

• Clean-up of the radioactive water lying deep in the containment building and the particles clinging like dust inside the building is a separate task. It will be a far more difficult and dangerous one because the level of radiation in those materials is much higher. But the removal of the krypton, significantly, would reduce only minimally that danger and difficulty. The larger containment clean-up will not be started for another year, according to Met Ed, and possibly two years, according to the NRC. The NRC estimates that equipment to remove the gas without venting could be installed at the plant within 18 months.

• In its special task force assessment of the clean-up operations at TMI, completed late last month, the NRC carefully analyzed the release of krypton. Although the staff ultimately recommended to the NRC commissioners that the release be approved, Norman M. Haller, who headed the task force, later admitted that the data on the necessity of such a release could be argued either way, and the decision to favor venting represented "a pretty close call."

The health effects of any release of radiation are unknown. Many scientists argue that any exposure to radiation poses a threat to the health and genetic structure of present and future generations.

A physicist employed by General Public Utilities, Inc., parent company of Met Ed, said that the utility selected venting in order to reduce exposure to workers entering the containment and to facilitate their work inside. The protective clothing the workers must wear is cumbersome and renders their efforts only "50 percent effective," he said. Met Ed has set its own strict exposure standards for the repair crews — far below those set by the federal government. As a result, Met Ed officials estimate that without venting, repair crews could only work inside the containment for about 20 minutes before getting their maximum allowable exposure.

"We just don't expose people to radiation," said the physicist, referring to the clean-up workers and clearly unaware of the irony of his statement. "It has to be for a really good reason."

On that basis, the company has elected to vent the radiation over the countryside of central Pennsylvania, and possibly over hundreds of thousands of *people* — for a reason of no greater persuasiveness than convenience.

Thus far the NRC has supported that dismaying decision. For the NRC commissioners to authorize such a plan, when they meet to consider the matter next month, would prove to the people of Pennsylvania, and the nation, beyond a shadow of a doubt that it is the convenience of the nuclear industry, and not the health and safety of the public, which is served by the agency.

F-3

Philadelphia Inquirer

December 5, 1979

GAO says curbs on radiation are inadequate

By Janet Staihar
Associated Press

WASHINGTON — Federal and state programs to protect the public against excess radiation are disjointed and frequently ineffective, the General Accounting Office (GAO) said yesterday.

"Despite widespread recognition of the hazards of radiation, there is no comprehensive program to protect the public from its hazards," said Elmer B. Staats, comptroller general of the GAO, the investigative arm of Congress.

Staats released a GAO study on radiation control during a hearing of a subcommittee of the Senate Governmental Affairs Committee. He said federal control programs failed to include many sources of radiation and often provided "limited protection" in the areas they did cover.

State programs are broader in scope but often lack depth, the GAO chief said. The states studied in the report were California, Colorado, Massachusetts, Missouri, North Carolina, Texas, Vermont and Virginia.

Staats was particularly critical of inspection programs to detect mistakes in the amount of radiation emitted from medical X-ray equipment.

All eight states in the study do have inspection programs for X-ray machines, but only one — North Carolina — met its goals for the frequency of checking out the equipment in use.

"Inspection frequency goals varied widely among the states," the GAO said. "For example, the number of years between inspections of X-ray machines in physicians' offices ranged from 2 to 10 years."

On the federal level, the Occupational Safety and Health Administation (OSHA) does not view radiation hazard as a high priority for inspection in the workplace, the GAO said. In fact, the agency said, OSHA did not even know how many of its inspections covered potential radiation dangers.

The GAO also said the Nuclear Regulatory Commission, which regulates certain users of radioactive material, actually appeared to have "little authority" over state activities.

The Food and Drug Administration, which has authority to regulate the manufacturing of medical devices containing radioactive materials, was criticized for not making certain that corrective measures for defective equipment were actually carried out.

Staats endorsed legislation proposed by the subcomittee chairman, Sen. John Glenn (D., Ohio), that would coordinate radiation programs under two new federal interagency groups.

G - 1

Cancer Society Reports It Finds Some Detection Tests Unneeded

New York Times

March 21, 1980

By JANE E. BRODY

The American Cancer Society announced a sweeping revision yesterday in the cancer detection tests that it has recommended to the general public, eliminating some commonly used tests and drastically reducing the frequency of others.

The society's new guidelines, intended only for people who have no symptoms of cancer, are designed to "deliver essentially the same health benefit as previous society recommendations to the public at a greatly reduced cost, risk and inconvenience to the patient," Dr. Saul B. Gusberg, president of the society and gynecologist at Mount Sinai Medical Center in New York, said at a press briefing.

Change in Lung-Test Policy

The society dropped its practice of advising an annual chest X-ray and sputum test for cigarette smokers and others who might incur lung cancer. Thus far, according to a technical report made public yesterday, on which the society's new recommendations are based, these tests have not been shown to increase a patient's chances of surviving lung cancer, even though the tests may detect the disease in its early stages.

The society also changed its recommendation of an annual Pap smear of the cervix to "at least once every three years" for all women 20 to 65 years old and for younger women who are sexually active.

According to the report, it takes the vast majority of patients many years to develop cervical cancer from precancerous lesions. Thus, an annual test to detect abnormalities of the cervix is not necessary for most women, the report said.

Dr. David M. Eddy, a medical economist at Stanford University, prepared the report on the basis of evaluations by medical consultants of the known benefits, risks and costs of the various tests for early cancer detection. The experts considered such factors as the ability of early detection tests to decrease mortality rates, the costs and hazards of the tests themselves and their accuracy.

The report emphasized that the final word on the value of the various tests was by no means in but that decisions had to be made now from the best available evidence.

Several changes have long been advocated by individual cancer specialists, but some, such as the advice on Pap smears, are expected to arouse considerable controversy.

Dr. Gusberg emphasized that the new recommendations were merely guidelines for the general public, not rules for specific individuals, who "should never" ignore the advice of their own doctors. "Personal histories, risk factors, objectives and budgets are different for each of us," he said, "and no single recommendation can therefore be fitted to all."

AMERICAN CANCER SOCIETY GUIDELINES

Type of Cancer	Test or Procedure	Sex	New Recommendation: Age	New Recommendation: Frequency	Previous Recommendation
LUNG	Chest x-ray		– not recommended –		high risk persons annually[1]
	Sputum cytology		– not recommended –		not recommended
COLON-RECTAL	Sigmoidoscopy	M, F	over 50	every 3-5 years[2]	persons over 40 annually
	Stool guaiac slide test	M, F	over 50	every year	persons over 40 annually
	Digital rectal examination	M, F	over 40	every year	same
UTERINE	Pap test	F	20-65[3]	at least every 3 years[4]	annual
	Pelvic examination	F	20-40 over 40	every 3 years every year	annual same
	Endometrial tissue sample	F	at menopause[5]	at menopause	same
BREAST	Breast self-examination	F	over 20	every month	same
	Breast physical examination	F	20-40 over 40	every 3 years every year	annual same
	Mammography	F	between 35-40 under 50 over 50	baseline consult personal physician every year	none
All	Health counseling and cancer checkup[6]	M, F M, F	over 20 over 40	every 3 years every year	"periodic"

1 persons over 40 who smoke or are exposed to other lung carcinogens.
2 after two initial negative examinations a year apart.
3 Pap test should also be done on women under 20 who are sexually active.
4 after two initial Pap tests done a year apart are negative. High risk women should have more frequent Pap tests.
5 if high risk because of history of infertility, obesity, failure of ovulation, abnormal uterine bleeding, or estrogen therapy.
6 to include examination for cancers of the thyroid, testicles, prostate, ovaries, lymph nodes, oral region, and skin.

The New York Times/March 21,1980

He added that anyone with symptoms should see a doctor. Possible cancer symptoms include a change in bowel or bladder habits, a sore that does not heal, unusual bleeding or discharge, a thickening or lump in the breast or elsewhere, indigestion or difficulty in swallowing, obvious changes in a wart or mole, and a nagging cough or hoarseness.

Revisions in Detail

Other extensive revisions in the cancer society's recommendations included these:

¶Previous advice that all men and women over 40 obtain an annual proctosigmoidoscopic examination for colon-rectal cancer has been changed: The society now advises an examination every three to five years for those over 50.

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¶For mammography, the highly controversial breast X-ray, an annual examination is recommended for women over 50; a single "baseline" X-ray is recommended for women between 35 and 40, and X-rays are recommended as often as advised by a personal physician for those under 50.

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According to the society, the examination should include checks for cancers of the thyroid, testicles, prostate, ovaries, lymph nodes, mouth and throat, and skin. These are usually done by a physician using hands and eyes, rather than with specific tests.

Philadelphia Inquirer

March 21, 1980

Smokers told X-rays of chest won't help

By Kevin McKean
Associated Press

NEW YORK — With evidence increasing that early detection does no good in treating lung cancer, the American Cancer Society said yesterday that it no longer recommended routine annual chest X-rays for heavy smokers.

The society also has revised recommendations for the Pap smear test for cervical cancer and for tests to determine the presence of cancer of the colon, rectum and breast. It did so on the basis of a study by Dr. David Eddy of Stanford University of the cost of such tests and their effectiveness.

A statement from Dr. Saul Gusberg, the society's national president, said that the revised methods "deliver essentially the same health benefit as the previous recommendations at a greatly reduced cost, risk and inconvenience."

He cautioned that the new recommendations apply only to those who do not have symptoms of cancer. People with symptoms should see a doctor immediately, he said.

For lung cancer, the society dropped a recommendation that people with a higher-than-normal risk have an annual chest X-ray. "High-risk" persons are defined as those 40 or older who are heavy smokers or who work with known carcinogens, such as asbestos.

Eddy's study concluded that tests for lung cancer, which include sputum cytology, a test based on mucus from the lungs, do indeed detect the disease at an early stage. But he said lung cancer was so hard to cure that "there actually is evidence from a half-dozen studies that such early detection does not reduce mortality."

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In other revisions, the society:

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- Dropped a recommendation for an annual Pap smear to detect cervical cancer, recommending instead a Pap smear every three years for women aged 20 to 65 and for those under 20 who are sexually active. Eddy said that checkups do not have to be so frequent because most cervical cancer is preceded for five years or more by a condition called carcinoma-in-situ, which the Pap smear can detect. (The Philadelphia division of the American Cancer Society disagrees with the recommendation on Pap smears. The division's Uterine Cancer Task Force has advised that every woman have an annual pap smear unless her doctor recommends otherwise.)
- Dropped a recommendation that men and women 40 or older undergo annual tests for blood in the stool and an annual examination with a proctosigmoidoscope, an instrument that looks for cancer of the colon and rectum. Annual stool tests can be delayed until age 50, the society said, and the uncomfortable sigmoidoscopic examination can be done every three to five years after age 50. Again, pre-cancerous conditions for these diseases often exist for years before cancer develops, according to the society.
- Stopped recommending only "periodic" physical checkups for cancer, recommending instead a general physical every three years for persons over 20 and every year for persons over 40.

Eddy said that, paradoxically, it is possible for cancer tests to appear to prolong the survival of patients when actually they don't.

This happens, he said, when early detection has no effect on whether a cancer can be cured, as appears to be the case for lung cancer.

Eddy's thesis is this: When a cancer is discovered early, the patient's survival seems longer — but only because of the early diagnosis. The early detection does not necessarily prolong life.

PUBLIC INTEREST LAW CENTER OF PHILADELPHIA
pilcop
1315 WALNUT ST., 16th FL., PHILA. 19107 215 · PE 5-7200
F. JOHN HAGELE
CHAIRMAN OF THE BOARD
EDWIN D. WOLF
EXECUTIVE DIRECTOR
1974-1976

16 April 1980

Dr. Richard H. Vollmer, Director
Three Mile Island Support
Office of Nuclear Regulatory Research
U.S. NUCLEAR REGULATORY COMMISSION
1717 H Street, N.W.
Washington, D.C. 20555

Re: Comments to Environmental Assessment for Venting of TMI-2 Containment Atmosphere.

Dear Dr. Vollmer,

Inadvertantly one section of the appendix, sub-section G, was omitted from our comments to the NRC Environmental Assessment for the decontamination of the Three Mile Island unit 2 reactor building atmosphere.

This is the last sub-section of our appendices and therefore these three pages should be attached to the back. For your convenience, I have also enclosed a cover page for the affidavits and appendices section which will make it easier to utilize.

I will be sending our comments regarding the second Addendum to the Environmental Assessment to you tomorrow.

Yours sincerely,

Bruce Molholt
Bruce Molholt, Ph.D.
for the TMI Legal Fund

Enclosures
2 copies Affidavit & Appendix cover page
2 copies of Appendix G.

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AFFIDAVITS AND APPENDICES

Comments to NRC Environmental Assessment on TMI-2 Venting

TMI Legal Fund

(215) 732 - 1928 x 50

APPENDIX G

DECREASING RECOMMENDED

RADIATION LIMITS

Philadelphia Inquirer

December 5, 1979

GAO says curbs on radiation are inadequate

By Janet Staihar
Associated Press

WASHINGTON — Federal and state programs to protect the public against excess radiation are disjointed and frequently ineffective, the General Accounting Office (GAO) said yesterday.

"Despite widespread recognition of the hazards of radiation, there is no comprehensive program to protect the public from its hazards," said Elmer B. Staats, comptroller general of the GAO, the investigative arm of Congress.

Staats released a GAO study on radiation control during a hearing of a subcommittee of the Senate Governmental Affairs Committee. He said federal control programs failed to include many sources of radiation and often provided "limited protection" in the areas they did cover.

State programs are broader in scope but often lack depth, the GAO chief said. The states studied in the report were California, Colorado, Massachusetts, Missouri, North Carolina, Texas, Vermont and Virginia.

Staats was particularly critical of inspection programs to detect mistakes in the amount of radiation emitted from medical X-ray equipment.

All eight states in the study do have inspection programs for X-ray machines, but only one — North Carolina — met its goals for the frequency of checking out the equipment in use.

"Inspection frequency goals varied widely among the states," the GAO said. "For example, the number of years between inspections of X-ray machines in physicians' offices ranged from 2 to 10 years."

On the federal level, the Occupational Safety and Health Administation (OSHA) does not view radiation hazard as a high priority for inspection in the workplace, the GAO said. In fact, the agency said, OSHA did not even know how many of its inspections covered potential radiation dangers.

The GAO also said the Nuclear Regulatory Commission, which regulates certain users of radioactive material, actually appeared to have "little authority" over state activities.

The Food and Drug Administration, which has authority to regulate the manufacturing of medical devices containing radioactive materials, was criticized for not making certain that corrective measures for defective equipment were actually carried out.

Staats endorsed legislation proposed by the subcomittee chairman, Sen. John Glenn (D., Ohio), that would coordinate radiation programs under two new federal interagency groups.

Cancer Society Reports It Finds Some Detection Tests Unneeded

New York Times

March 21, 1980

By JANE E. BRODY

The American Cancer Society announced a sweeping revision yesterday in the cancer detection tests that it has recommended to the general public, eliminating some commonly used tests and drastically reducing the frequency of others.

The society's new guidelines, intended only for people who have no symptoms of cancer, are designed to "deliver essentially the same health benefit as previous society recommendations to the public at a greatly reduced cost, risk and inconvenience to the patient," Dr. Saul B. Gusberg, president of the society and gynecologist at Mount Sinai Medical Center in New York, said at a press briefing.

Change in Lung-Test Policy

The society dropped its practice of advising an annual chest X-ray and sputum test for cigarette smokers and others who might incur lung cancer. Thus far, according to a technical report made public yesterday, on which the society's new recommendations are based, these tests have not been shown to increase a patient's chances of surviving lung cancer, even though the tests may detect the disease in its early stages.

The society also changed its recommendation of an annual Pap smear of the cervix to "at least once every three years" for all women 20 to 65 years old and for younger women who are sexually active.

According to the report, it takes the vast majority of patients many years to develop cervical cancer from precancerous lesions. Thus, an annual test to detect abnormalities of the cervix is not necessary for most women, the report said.

Dr. David M. Eddy, a medical economist at Stanford University, prepared the report on the basis of evaluations by medical consultants of the known benefits, risks and costs of the various tests for early cancer detection. The experts considered such factors as the ability of early detection tests to decrease mortality rates, the costs and hazards of the tests themselves and their accuracy.

The report emphasized that the final word on the value of the various tests was by no means in but that decisions had to be made now from the best available evidence.

Several changes have long been advocated by individual cancer specialists, but some, such as the advice on Pap smears, are expected to arouse considerable controversy.

Dr. Gusberg emphasized that the new recommendations were merely guidelines for the general public, not rules for specific individuals, who "should never" ignore the advice of their own doctors. "Personal histories, risk factors, objectives and budgets are different for each of us," he said, "and no single recommendation can therefore be fitted to all."

AMERICAN CANCER SOCIETY GUIDELINES

Type of Cancer	Test or Procedure	Sex	New Recommendation: Age	New Recommendation: Frequency	Previous Recommendation
LUNG	Chest x-ray		- not recommended -		high risk persons annually[1]
	Sputum cytology		- not recommended -		not recommended
COLON-RECTAL	Sigmoidoscopy	M, F	over 50	every 3-5 years[2]	persons over 40 annually
	Stool guaiac slide test	M, F	over 50	every year	persons over 40 annually
	Digital rectal examination	M, F	over 40	every year	same
UTERINE	Pap test	F	20-65[3]	at least every 3 years[4]	annual
	Pelvic examination	F	20-40 over 40	every 3 years every year	annual same
	Endometrial tissue sample	F	at menopause[5]	at menopause	same
BREAST	Breast self-examination	F	over 20	every month	same
	Breast physical examination	F	20-40 over 40	every 3 years every year	annual same
	Mammography	F	between 35-40 under 50 over 50	baseline consult personal physician every year	none
All	Health counseling and cancer checkup[6]	M, F M, F	over 20 over 40	every 3 years every year	"periodic"

1 persons over 40 who smoke or are exposed to other lung carcinogens.
2 after two initial negative examinations a year apart.
3 Pap test should also be done on women under 20 who are sexually active.
4 after two initial Pap tests done a year apart are negative. High risk women should have more frequent Pap tests.
5 if high risk because of history of infertility, obesity, failure of ovulation, abnormal uterine bleeding, or estrogen therapy.
6 to include examination for cancers of the thyroid, testicles, prostate, ovaries, lymph nodes, oral region, and skin.

The New York Times/March 21,1980

He added that anyone with symptoms should see a doctor. Possible cancer symptoms include a change in bowel or bladder habits, a sore that does not heal, unusual bleeding or discharge, a thickening or lump in the breast or elsewhere, indigestion or difficulty in swallowing, obvious changes in a wart or mole, and a nagging cough or hoarseness.

Revisions in Detail

Other extensive revisions in the cancer society's recommendations included these:

¶Previous advice that all men and women over 40 obtain an annual proctosigmoidoscopic examination for colon-rectal cancer has been changed: The society now advises an examination every three to five years for those over 50.

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G - 2

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G - 3

ROBERT S. WALKER
16TH DISTRICT, PENNSYLVANIA

COMMITTEES:
GOVERNMENT OPERATIONS
SCIENCE AND TECHNOLOGY

Congress of the United States
House of Representatives
Washington, D.C. 20515

April 22, 1980

Mr. James Ahearne, Chairman
Nuclear Regulatory Commission
1717 "H" Street, Northwest
Washington, D.C. 20555

Dear Chairman Ahearne:

Attached please find a statement from my constituent, Donald Griffith, who is the Mayor of Lebanon, Pennsylvania.

The statement concerns the venting of Krypton-85 gas from the Three Mile Island nuclear facility and I would hope your deliberations on this matter include Mayor Griffith's feelings.

Cordially,

Robert S. Walker

ts

Attachment

CC: Honorable Donald N. Griffith
Mayor of Lebanon
Municipal Building
400 South Eighth Street
Lebanon, Pennsylvania 17042

PRESS COPY

TO: All News Media

FROM: Mayor Donald N. Griffith, Lebanon, PA

FOR RELEASE: Immediate

DATE: April 4, 1980

STATEMENT ON THREE MILE ISLAND

Met-Ed, The Nuclear Regulatory Commission, and other related agencies and companies, have been the subject of unprecedented concern throughout our local area, indeed even throughout the world, for over a year now. The residents of this community and others nearby, have dealt with the possibility of unknown adverse physical consequences and very real mental stress during most of this year, following the worst accident ever to occur at a nuclear power plant--the near-catastrophy at Three Mile Island.

The situation now upon us is this: The Nuclear Regulatory Commission and Met-Ed have proposed that the radioactive Krypton 85 Gas be vented into our atmosphere in order to render the containment building of Reactor Number Two accessible for further clean-up. The Nuclear Regulatory Commission had imposed a fifteen day waiting period before initiating the venting, for the purpose of public reaction and input. That waiting period has been extended and will be over on April 17.

I am opposed to this proposed venting procedure. It's my firm conviction that the Krypton 85 Gas should not be vented. I urge that the Nuclear Regulatory Commission give careful consideration to this opposition, as it is a part of the larger voice of other public officials and many private citizens as well. I hope that before the April 17 deadline many other will add their voice to this opposition and call for a responsible solution to this most difficult situation. There are alternative clean-up methods which could be employed which would not put radioactive material into our atmosphere, and one of them should be employed without delay--to expedite a quick TMI 2 clean-up.

The effects of low level radiation of living things are not fully understood. Our community is not a test area and the people here have a moral, if not legal, right to be liberated from exposure to this radioactive gas.

Further, I strongly believe that the element of mental and emotional stress must be allowed as evidence, with respect to hearings concerning Three Mile Island, Met-Ed and The Nuclear Regulatory Commission. The mental and physical health of humanity in the shadow of Three Mile Island or any other nuclear installation is of primary importance. Matters of economics and convenience should be considered only after the primary consideration is preserved.

There are those who say that nuclear energy will save the public a tremendous amount of money--now and in the future. However, because of Three Mile Island, we in the Met-Ed area have seen the largest increase in rates ever to be imposed upon us. Many feel that we are paying for someone else's mistakes and bearing the economic brunt of the future of the entire nuclear energy industry. We should not have to bear that economic burden alone. The final resolution of the accident at the nuclear reactor at Three Mile Island in Middletown, Pennsylvania will affect the future of nuclear energy, indeed, the future of every human being, throughout the United States and even the world. We in this area surrounding Three Mile Island may never again be given the opportunity to create responsible

action regarding so serious a question. None of us should turn our backs on this responsibility.

We must tackle the question of nuclear energy in an orderly, organized manner--each of us using the avenues which we deem most effective.

Following a meeting three weeks ago of the National League of Cities in Washington, D.C., I expressed to Jessie Rattley, President of the National League of Cities, the need to establish a Nuclear Impact Committee, consisting of Mayors from every nuclear energy site in the country. The overall, general concern would ultimately be the future of the role of nuclear energy in the United States. I am awaiting Jessie Rattley's response to my proposal and keenly hope that such a Committee will be forthcoming. I repeat the plea to all those who can--to vocally oppose the venting of the Krypton 85 Gas from TMI 2 and I urge a public outcry against the approval of unjustified rate increases by Met-Ed, as well as the recommendation of the acceptance of emotional stress as a major factor to be considered in any future decisions involving any nuclear site, including Three Mile Island.

And finally, I strongly recommend that those who wish to express their feelings do so by writing to public officials at all levels of government, particularly the Governor of this State. Governor Thornburgh will possibly have the greatest influence on any decisions that any other figure at this time.

Responsible action can only be accomplished through responsible means.

-30-

JAMES B. COULTER
SECRETARY

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

STATE OF MARYLAND

DEPARTMENT OF NATURAL RESOURCES
ENERGY ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401
(301) 269-2261

April 22, 1980

Dr. Bernard J. Snyder
Program Director
TMI Program Office, NRR
USNRC
7920 Norfolk Avenue
Bethesda, MD 20014

Re: Addenda 1 and 2 to Draft Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere (NUREG-0662)

Dear Dr. Snyder:

These comments and recommendations are submitted on behalf of the State of Maryland. They reflect our review of the subject addenda, and should be considered supplemental to Maryland's comments on the base document (NUREG-0662), as transmitted by my letter of 31 March 1980 to Mr. Richard Vollmer. The Maryland Governor's Committee on Three Mile Island has reviewed the addenda and submitted to the Governor its own report, which is appended.

The subject addenda address the psychological impact of the current situation and describe a variation on the method for purging the containment building which the NRC staff recommends to reduce psychological impact. Although not stated explicitly in the Environmental Asessment addenda, it appears that the only benefits to a short (∿ 5 day) purge period would be 1) to "get it over with" as quickly as possible for the exposed individuals, and 2) to facilitate the desire of some individuals to leave the area during the actual purge. However, the addenda fail to adequately explore these advantages, and they neglect such disadvantageous factors as 1) the inherent delay of including this option in the decision making process is prolonging the

period of tension now being experienced by local residents, 2) families with school-age children would probably not be able to leave the area except during summer vacation or over weekends, 3) meteorological forecasting is not yet accurate enough to predict good dispersion conditions far enough in advance for orderly planning by those who would wish to leave, so tension may well be increased between the time of Commission approval and occurrence of suitable conditions, and 4) the proposal lends some feeling of validity to allegations that the expected dose levels are of a magnitude worthy of avoidance. While professing no special expertise in predicting quantitative psychological impact, we do not feel the proposed fast purge concept offers any net psychological advantage.

The methodology proposed for the fast purge is also treated in a sketchy manner by the assessment. The limiting criterion for the purge rate is expressed as 3 mrem/hour skin dose rate at the maximum point downwind. The model to be used for calculating the allowable purge rate from this criterion and current meteorological data has not been described, however. We note from our own experience that calculated hourly dispersion coefficients can be expected to fall within a factor of two of the predicted value about 50% of the time, and within a factor of five about 75% of the time. This means that, unless a rather conservative model is used, the fast purge could have a significant probability of overshooting the maximum intended total dose value, stated in the Environmental Assessment as 10 mrem skin dose, by deviation of a single hourly dispersion coefficient from its predicted value. It is not clear whether offsite dose rate monitoring would be sufficient to detect this event rapidly enough to prevent an actual overshoot of the total dose objective. Although such an event could not create a dose rate sufficiently high to be dangerous to exposed individuals, it would certainly increase psychological impact and create further credibility and public confidence difficulties for the remainder of the cleanup operation. The originally proposed purge program, by virtue of its much lower target hourly dose rates, poses no substantial risk of overshooting the total dose criterion during the purge.

In summary, we believe the Addenda 1 and 2 to NUREG 0662 fail to demonstrate either the feasibility or any net psychological advantage of the fast purge option. We recommend that the Commission reject this option in favor of the purge program which would use real-time meteorological data to minimize the highest off-site dose.

Sincerely,

Steven M. Long

Steven M. Long, Ph.D.
Director, Power Plant
Siting Program

SML:ps

THE JOHNS HOPKINS MEDICAL INSTITUTIONS

DIVISIONS OF NUCLEAR MEDICINE AND RADIATION HEALTH SCIENCES

615 NORTH WOLFE STREET
BALTIMORE, MARYLAND 21205

Telephone 301; 955-3350

April 18, 1980

The Honorable Harry R. Hughes
Governor, State of Maryland
Annapolis, Maryland 21404

Dear Governor Hughes:

On March 31, 1980, with your approval, we sent to the U.S. Nuclear Regulatory Commission our comments and recommendations on the Draft NRC Staff Report NUREG-0662 in which a proposal was made to vent krypton gas from the Unit 2 reactor building at Three Mile Island over a 60-day period when the meteorological conditions are suitable. Our report was appended to that of Maryland's Department of Health and Mental Hygiene and its Department of Natural Resources, in whose recommendations we concurred.

The NRC has now presented two addenda to NUREG-0662 for public comment. Addendum #1 describes in a general way studies designed to measure possible mental health effects resulting from the proposed action of releasing krypton gas from the reactor. We cannot comment on these studies because insufficient details are presented, but we will examine the results of such studies with great diligence when they are available. We agree that any consequences of the krypton release to the public health are likely to be psychological rather than any physical effects of radiation.

In addendum #2, a proposal is made to purge the reactor building in a period as short as approximately five days by using the purge system in conjunction with the hydrogen control subsystem which had been proposed as the sole mechanism for the release over the 60-day period. The reactor building purge system is an existing system originally installed for purging the reactor building atmosphere during normal operation or maintenance conditions.

Calculations made by the NRC indicate that the factor limiting the proposed 5-day release would be the beta radiation dose to the skin which would be limited to 3 mrem in any one hour and a maximum dose to any one person of 10 mrem. This is two-thirds of the annual maximum allowable dose of 15 mrem permitted for the general population under their existing license.

In our opinion, the disadvantages of changing from a 60- to a 5-day release program argue against support of the 5-day plan:

(1) As did some members of our Committee, some citizens may be led to wonder why the new 5-day proposal was not presented for public comment until this

stage of the review process. This change in the previously recommended plan may increase feelings of uncertainty about the safety of the venting process itself.

(2) While we can not be definite about psychological factors, the members of our Committee doubt that the 5-day plan "offers the best opportunity to minimize the degree of psychological stress to persons in the vicinity of the plant". The implication that some persons may wish to leave the area over the 5-day venting period seems to some of our Committee to encourage the view that the 60-day venting is hazardous, which we do not believe to be the case.

(3) The 5-day plan would in fact delay the decontamination process because it would require several more months to prepare for implementing this alternate plan.

Advantages of the 60-day program include:

(1) The possibility of better meteorological choices for release.

(2) Better feedback of monitoring data to optimize release control.

(3) Lower radiation levels during purging (although the total amount of radioactive gas released would be the same).

Thus, we have concluded that the 5-day venting program offers no psychological, economic, technical or public safety advantages over the 60-day program, and may indeed offer significant disadvantages.

As we have stated previously, we believe that the original 60-day program represents no radiation hazard to the public and therefore is the best choice.

Sincerely,

Henry N. Wagner, Jr., M.D.
Chairman,
Maryland Governor's Committee
on Three Mile Island

dmm

cc: Mr. Charles R. Buck, Jr.
Secretary,
Department of Health and Mental Hygiene
201 West Preston Street, Fifth Floor
Baltimore, Maryland 21201

Mr. James B. Coulter
Secretary,
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland 21401

Atmospheric Environment Vol. 13, pp. 819–831.
Pergamon Press Ltd. 1979. Printed in Great Britain.

APPLICABILITY OF STABILITY CLASSIFICATION SCHEMES AND ASSOCIATED PARAMETERS TO DISPERSION OF TALL STACK PLUMES IN MARYLAND

JEFFREY C. WEIL
Martin Marietta Corporation, Environmental Center, Baltimore, MD 21227, U.S.A.

(*First received* 8 *May* 1978 *and in final form* 2 *January* 1979)

Abstract – Stability classification schemes for predicting dispersion in the Gaussian plume model were evaluated with measurements of crosswind dispersion and ground-level SO_2 concentrations downwind of three Maryland power plants. The measurements were made during convective or near-neutral stability conditions. Satisfactory correlation between predictions and measurements was obtained with Brookhaven dispersion parameters selected by Weil's algorithm or Pasquill–Gifford sigma curves chosen by Turner's method, but shifted to the next more unstable class. The TVA and unmodified Turner approaches as well as use of σ_θ did not agree well with measurements. These results were explained by the criteria used to determine a "stability class" and by the similarities or differences between the Maryland experiments and those from which the empirical sigma curves were determined. Some anomalous measurements at the Chalk Point and Morgantown plants suggested that wide rivers bordering these plants increased stability during daytime and inhibited vertical dispersion.

Modeled ground-level concentrations were higher close to two adjacent stacks when their plume rises were calculated independently than when a single effective buoyancy flux was used. Most consistent agreement between measured and calculated concentrations was obtained with a single effective buoyancy flux and Brookhaven dispersion parameters.

1. INTRODUCTION

Ground-level concentrations due to tall stack releases are often assumed predictable to within a factor of two using the Gaussian plume model. Attainment of this accuracy depends strongly on the choice of sigmas (σ_y and σ_z) used in the model. Stability classification schemes for choosing these have received much attention recently because their applicability, especially to tall stack plumes, has been questioned. Pasquill (1975) pointed out that the Pasquill–Gifford (sigma) curves were intended for a ground-level source. However, these curves often have been applied to tall stacks and for this reason were considered for analysis in this paper. Pasquill also suggested that results from the elevated source releases at the Brookhaven National Laboratory (Singer and Smith, 1966) should be critically reviewed because of the similar dependence of σ_y and σ_z on downwind distance – a result at variance with some others. Later Pasquill (1976) gave some recommendations for changing the Turner workbook (Turner, 1971) approach for estimating sigmas. A workshop sponsored by the American Meteorological Society (Hanna *et al.*, 1977) also reviewed existing practical schemes and recommended areas for future work. All the above reviews emphasized the need for more and better field observations.

Recently, Weil and Jepsen (1977) evaluated several existing empirical methods for specifying sigmas in the Gaussian model, using measurements of crosswind dispersion and ground-level SO_2 concentrations downwind of the Dickerson, Maryland, power plant. The plume measurements were made from an instrumented mobile van and were collected during daytime under near-neutral or convective conditions. Good agreement between model calculations and measurements was found using both Brookhaven dispersion estimates selected by the algorithm given by Weil (1974) and Pasquill–Gifford curves selected by the Turner (1964) method but shifted to the next more unstable stability class. Other algorithms for choosing dispersion parameters, including the Tennessee Valley Authority approach (Thomas *et al.*, 1970) and the unmodified Turner method (no shift in stability class), were at significant variance with the measurements.

Weil and Jepsen's work has been extended to three Maryland power plants to test model transferability. An extensive description of the field measurements and data analysis has been given by Weil (1977a, b). This paper summarizes these data and discusses some of the reasons for differences found between the measurements and predictions.

2. POWER PLANTS AND FIELD DATA

The three power plants used in this study were chosen because they provided different terrain, stack height, and emission characteristics, for testing model transferability. The coal-fired Dickerson power plant has three 185-MWe generating units with two 122-m

stacks, 60 m apart, and is situated in the rolling terrain of Montgomery County. The Chalk Point generating station, also coal-fired, faces the Patuxent River in south-eastern Prince Georges County where surrounding terrain is comparatively level. At the time measurements were made at Chalk Point (1973–1974), the plant had two 355-MWe generating units, each with a 122-m stack, 40 m apart. (In 1975, a new oil-fired unit was added.) The Morgantown power plant is situated in flat terrain next to the Potomac River in southern Charles County. It has two 575-MWe generating units operating on either coal or oil or a mixture of the two. At Morgantown, boiler flue gases are exhausted through two 213-m stacks, 76 m apart.

At Chalk Point and Morgantown, air passage over large stretches (3–10 km) of water during daytime can produce low altitude atmospheric cooling, resulting in an increase in atmospheric stability and a reduction in plume dispersion during over-water transport (see Section 3). The Dickerson plant is also located on the Potomac River, but at that location the River is only about 300 m wide and river cooling effects are probably insignificant.

Measurements extended from October 1972 to April 1973 at Dickerson, from September 1973 to June 1974 at Chalk Point, and from February 1975 to June 1975 at Morgantown.

Crosswind profiles of ground-level SO_2 concentrations were measured from an instrumented mobile van. Repeated passes through the plume were made along roads transverse to the plume centerline; typically, six passes along the same road were made in about a 1-h time interval. The crosswind standard deviation (σ_y) and peak concentration were determined for each individual profile. The mean σ_y and peak concentration from the individual profiles in a set of repeated passes were used to approximate properties of a 10-min averaged plume. In addition, an average profile was found by computing the average concentration at 100 equally spaced angular intervals across the composite plume path. The σ_y and peak concentration from the average profile were used to approximate those of an hourly averaged plume. (See Weil and Jepsen, 1977, and Weil, 1977(b), for details of the analysis.)

Vertical profiles of wind and temperature were measured at each plant. Surface weather conditions (wind speed, cloud cover, ceiling height) were acquired from local airports, and solar insolation was available at one weather station. Measurements of σ_θ ($\frac{1}{2}$-h averages) also were recorded on a 100-m tower at the Chalk Point plant.

The range of power plant conditions, meteorological variables, and plume SO_2 concentrations for the three power plants are given in Table 1. A total of 126 "average" profiles comprising 688 individual profiles were analyzed. (See Weil, 1977a, for a listing of all the data; Weil, 1977a, b; Weil and Jepsen, 1977, for details of the measurements and analysis.)

3. EVALUATION OF STABILITY CLASSIFICATION SCHEMES

Approach

The applicability of the stability classification schemes and associated dispersion parameters in the Gaussian model was evaluated by comparing measured and predicted crosswind plume standard deviations and measured and predicted SO_2 ground-level concentrations along the plume centerline. The applicability of the vertical dispersion estimates (in combination with the plume rise formulas used) was inferred from comparisons between measured and

Table 1. Power plant emission characteristics, meteorological conditions, and plume measurements

	Dickerson	Chalk Point	Morgantown
Stack height* (m)	122	122	213
Distance between stacks (m)	60	40	76
Stack diameter at top (m)	5	5	6
SO_2 emission rate (kg s^{-1})			
Stack 1	0.22–1.02	0.45–1.48	1.37–2.03
Stack 2	0.35–0.55	0.73–1.29	1.45–2.03
Buoyancy flux† (m^4 s^{-3})			
Stack 1	130–452	163–526	518–772
Stack 2	125–237	239–408	531–738
Mean wind speed (m s^{-1})	0.7–15.7	1–11.8	1.6–11.3
Mixing depth (m)	300–2500	300–2300	520–2400
Maximum SO_2 concentration (ppb)			
From average crosswind profile	9–165	4–278	7–322
Average of peaks from repeated profiles	11–302	7–477	9–414
Distance downwind covered by measurements (km)	1.7–19	2.8–33	2.7–32
Total number of crosswind profiles	225	336	127

* Each power plant had two stacks.
† Briggs (1970) definition of buoyancy flux.

predicted SO_2 concentrations. Plume standard deviations were expressed as functions of distance x by

$$\sigma_y = a_1 x^{b_1}$$
$$\sigma_z = a_2 x^{b_2} \qquad (1)$$

where coefficients a_1, a_2 and exponents b_1, b_2 depend on the "stability class". Values used here were tabulated by Weil and Jepsen (1977) for sigma curves given by Turner (1971) and the Tennessee Valley Authority (Thomas *et al.*, 1970); parameters for Brookhaven curves were given in the ASME Guide (Smith, 1968).

For σ_y and σ_z given by Equation (1) and for an effective stack height h_e independent of distance, the maximum ground-level concentration c_m is

$$c_m = \frac{Q\alpha^{\alpha/2}}{\pi v a_1 a_2} \frac{\exp(-\alpha/2)}{(h_e/a_2)^\alpha} \qquad (2)$$

where Q is the SO_2 emission rate, v the mean wind speed, and $\alpha = 1 + b_1/b_2$. The downwind distance x_m to the maximum concentration is

$$x_m = \left[\frac{h_e}{\sqrt{\alpha}\, a_2}\right]^{1/b_2}. \qquad (3)$$

The expressions for c_m and x_m apply to a plume that is perfectly reflected at ground but is unrestricted in its spread above the plume centerline (i.e. no elevated inversion to limit vertical dispersion).

In the case of perfect plume reflection at an elevated stable layer, Scriven's (1967) modification of the standard Gaussian plume equation leads to the following equation for the normalized ground-level concentration c/c_m along the plume axis:

$$\frac{c}{c_m} = \frac{\exp(\alpha/2)}{(x/x_m)^{\alpha b_2}} \sum_{n=-\infty}^{\infty} \times \exp\left[-\frac{\alpha}{2}\left(1 - 2n\frac{H_m}{h_e}\right)^2 (x/x_m)^{-2b_2}\right] \qquad (4)$$

where H_m is the height of the stable air layer above ground ($H_m \geq h_e$).

Four methods for choosing stability classes were evaluated:

(1) Wind speed and temperature gradient algorithm for selecting Brookhaven stability classes (Weil, 1974; Weil and Jepsen, 1977) (see Table 2)
(2) Turner (1964) method of choosing Pasquill stability classes
(3) Tennessee Valley Authority approach (Thomas *et al.*, 1970)
(4) Standard deviation of horizontal wind direction (σ_θ) for selecting Brookhaven and Pasquill stability classes (Slade, 1968).

Measured crosswind standard deviations and ground-level SO_2 concentrations approximating 1-h averages were used to evaluate Brookhaven dispersion parameters, while measurements approximating 10-min averages were used to test the TVA and Pasquill parameters.

Plume rise was calculated from the formulae of Briggs (1970) and Fay *et al.* (1970) following the selection procedure used by Weil and Jepsen (1977). Because the potential temperature gradient, $d\theta/dz$, can be slightly positive (i.e. stable) in the upper regions of convective mixing layers (Deardorff, 1972); stable as well as neutral and unstable lapse rates were considered.

For neutral or unstable lapse rates

$$\left(\frac{d\theta}{dz} \leq 0\right),$$

Briggs' formula† for final rise Δh is:

$$\Delta h = 1.6 \frac{F^{1/3}}{v} (3.5x^*)^{2/3} \qquad (5)$$

where F is the buoyancy flux and x^* the downwind distance where atmospheric turbulence replaces buoyancy-induced turbulence in the entrainment assumption (see Briggs, 1970). The buoyancy flux is given by

$$F = \frac{V_1}{\pi} g \frac{(T_1 - T_1)}{T_1} \qquad (6)$$

where T_1 and V_1 are the temperature and volume flux of flue gas at stack exit, g the acceleration due to gravity, and T_1 the ambient air temperature at stack exit. The distance x^* (in meters) is given by Briggs as:

$$x^* = 14F^{5/8}; \quad F < 55\,\mathrm{m^4\,s^{-3}}$$
$$x^* = 34F^{2/5}; \quad F > 55\,\mathrm{m^4\,s^{-3}}. \qquad (7)$$

For unstable conditions, Weil and Jepsen (1977)

† It is recognized that the results of the present analysis depend on the accuracy of the plume rise expressions. However, this accuracy is difficult to assess because few definitive field observations of a "final rise" – a leveling off of the plume before the most distant observation – have been made in neutral or convective conditions. Recently, detailed measurements of plume rise as far as 6 km downwind of the Morgantown, Maryland power plant stacks were made by lidar. The measurements were obtained during neutral and convective conditions and included some observations of "final rise". The accuracy of the Briggs (1970) formula, as well as his more recent (Briggs, 1975) formulae and possibly others, will be tested with the lidar data and reported in a future paper.

Table 2. Weil's (1974) algorithm for selecting Brookhaven stability classes

Stability class	Mean wind speed ($\mathrm{m\,s^{-1}}$)
B_2	0–5
B_1	$v > 5$

Wind speed is averaged throughout the mixing layer. Average potential temperature gradient in the mixing layer must be less than or equal to 0.003°K $\mathrm{m^{-1}}$.

Table 3. Summary of comparisons between measured and predicted crosswind standard deviation (σ_y)

Stability class selection method	Stability class	Number of cases D*	CP	M	Geometric mean $\frac{\sigma_{y\,meas}}{\sigma_{y\,pred}}$ D	CP	M	Geometric standard deviation of $\frac{\sigma_{y\,meas}}{\sigma_{y\,pred}}$ D	CP	M
Brookhaven; Weil (1974) algorithm	B_2	18	33	12	1.16	0.85	0.91	1.53	1.56	1.40
	B_1	23	26	14	1.14	1.52	1.22	1.51	1.55	1.65
Pasquill, Gifford, Turner	A		3	3		0.81	1.08		1.31	1.13
	B	4	12	6	1.41	0.88	1.04	1.20	1.50	1.54
	C	14	15	6	1.34	1.10	1.24	1.53	1.60	1.38
	D	23	29	11	1.55	2.05	1.70	1.53	1.50	1.74
Pasquill, Gifford, Turner; drop one stability class	A	4	15	9	1.09	0.70	0.89	1.20	1.46	1.46
	B	14	15	6	0.92	0.75	0.85	1.53	1.60	1.38
	C	23	29	11	1.05	1.39	1.16	1.53	1.51	1.74
TVA	Neutral	41	59	26	2.34	2.55	2.86	1.56	1.51	1.63
Using σ_θ measurements for Brookhaven	B_2		14			0.90			1.52	
	B_1		16			1.51			1.52	
	C		9			3.45			1.44	
Using σ_θ measurements for Pasquill	A		9			0.77			1.56	
	B		3			0.81			1.18	
	C		13			1.25			1.65	
	D		11			1.74			1.19	

* D = Dickerson, CP = Chalk Point, M = Morgantown.

Table 4. Summary of comparisons between measured and predicted ground-level SO_2 concentrations (single effective buoyancy source)

Stability class selection method	Stability class	Geometric mean c_{pred}/c_{meas} D*	CP	M	Geometric standard deviation of c_{pred}/c_{meas} D	CP	M	Percent of predictions within a factor of 2 of measurements: By stability class D	CP	M	Over all cases
Brookhaven; Weil (1974) algorithm	B_2	1.24	1.21	0.92	1.90	1.60	1.64	72	76	75	71
	B_1	1.13	2.09	1.17	1.68	2.44	1.36	74	46	93	
Pasquill, Gifford, Turner	A		0.73	0.47		1.62	1.08		67	33	43
	B	0.04	1.15	0.51	202	1.71	2.43	25	83	67	
	C	0.28	1.70	1.30	68	1.94	1.39	50	67	100	
	D	0.00	0.00	0.41	6026	820	2.93	22	10	91	
Pasquill, Gifford, Turner; drop one stability class	A	0.84	0.74	0.61	1.90	1.71	1.74	75	73	44	58
	B	0.64	1.18	0.94	5.15	2.23	1.48	71	47	83	
	C	0.52	1.59	1.22	3.88	2.63	1.47	57	38	82	
TVA	Neutral	0.43	2.35	1.53	142	3.25	8.91	39	22	31	29
Using σ_θ measurements for Brookhaven	B_2		1.39			2.10			50		38
	B_1		2.15			2.03			38		
	C		1.36			10.48			22		
Using σ_θ measurements for Pasquill	A		0.86			1.84			78		47
	B		2.12			1.29			33		
	C		1.33			2.60			54		
	D		0.01			5014			18		

* D = Dickerson, CP = Chalk Point, M = Morgantown.
Note: See Table 3 for number of cases in each stability class.

proposed that x^* be given by:

$$x^* = 0.65\frac{F^{2/5}\tau^{3/5}}{(q/2)^{3/5}} \tag{8}$$

where

$$q = \frac{gQ_0}{\rho c_p T}. \tag{9}$$

Here Q_0 is the sensible heat flux at the surface (assumed to be 0.31 times the solar insolation; see Weil, 1974) c_p the specific heat of air at constant pressure, and ρ and T the density and temperature of air at ground level. The lower of the estimates of x^* given by Equations (7) and (8) was used here to compute plume rise for neutral or unstable lapse rates (see also Weil and Jepsen, 1977).

In the case of a stable lapse rate above the stack

$$\left(\frac{d\theta}{dz} > 0\right)$$

and a positive surface heat flux Q_0, the plume rise was chosen as the lowest rise given by 1. Equations (5) and (7), 2. Equations (5) and (8), and 3. the plume rise formula of Fay *et al.* for stable air:

$$\Delta h = 2.27\left(\frac{FT_1}{\upsilon g\frac{d\theta}{dz}}\right)^{1/3}, \tag{10}$$

where $d\theta/dz$ was assumed to be constant with altitude. (Only cases with a positive surface heat flux were treated in this paper.)

Each power plant had two adjacent stacks operating during some or all of the field measurements program. Since the procedure for computing plume rise for two nearby stacks was open to question, plume rise was calculated in two ways: (1) using the sum of the buoyancy fluxes from the two stacks (i.e. a single effective buoyancy source) which should set an upper limit on plume rise; and (2) assuming individual stack plumes to rise independently, which should give a lower limit on plume rise.

Results using a single effective buoyancy source

Consider first predictions based on Brookhaven dispersion parameters chosen by Weil's (1974) algorithm. Comparisons between measurements and predictions are summarized in Table 3 for crosswind standard deviations (σ_y) and in Table 4 for ground-level SO_2 concentrations. On the average, the correlations are quite good, except at Chalk Point for the B_1 stability class (discussed below). Over all 126 cases, 71% of the Brookhaven predictions were within a factor of 2 of the measured concentrations – a percentage higher than that attained using any other sets of dispersion parameters.

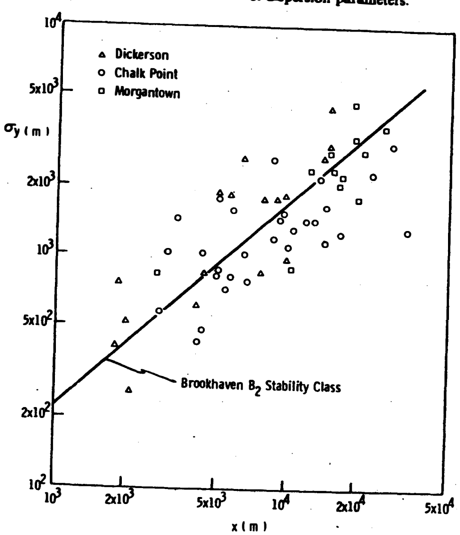

Fig. 1. Measured crosswind plume standard deviation as a function of distance compared to Brookhaven B_2 class prediction. Stability class selected by Weil's (1974) algorithm. (Measurements approximate σ_y of hourly averaged plume.)

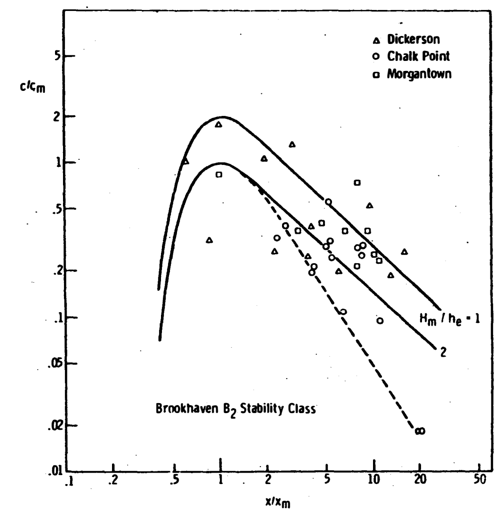

Fig. 2. Dimensionless ground-level SO_2 concentrations as a function of dimensionless downwind distance for measurements in Brookhaven B_2 stability class and $1 \le H_m/h_e \le 2$. Model predictions (Equation 4) corresponding to range of measurement conditions are indicated by solid lines. Stability class chosen by Weil's (1974) algorithm. (Measurements approximate 1-h averages.)

Graphical comparisons between measurements and predictions for the Brookhaven B_2 class are shown in Fig. 1 for σ_y and in Fig. 2 for ground-level concentrations. (Only data within the range $1 \le H_m/h_e \le 2$ are presented in Fig. 2). As was also shown by Weil and Jepsen (1977), predicted concentrations with trapping effects included (solid curves, Fig. 2) agree better with the measured concentrations than do those without plume trapping (dashed curve, Fig. 2). (Typical calculated values of the maximum concentration c_m ranged from 110 to 160 ppb SO_2; predicted x_m's usually ranged from 2 to 4 km.)

The failure of the B_1 class predictions at Chalk Point was further examined by dividing the data into two groups. For 16 cases obtained between September 1973 and February 1974, the geometric mean of c_{pred}/c_{meas} was 1.26, and 75% of the predictions were within a factor of 2 of the measurements. These results are consistent with others obtained using Brookhaven predictions. For the remaining 10 cases, obtained between March and June 1974, the predictions consistently overestimated the measurements. The geometric mean of c_{pred}/c_{meas} was 4.7, and none of the predictions were within a factor of 2 of the measurements.

One possible explanation for the 10 anomalous cases is differential heating of the lowest air layers by land and water (the Patuxent River). The river is cooler than the surrounding land mass during daytime, and the land/water temperature difference is probably highest during March–June (see Lyons, 1975). The cooler river water establishes a stable layer of air next to the surface and reduces the vertical heat flux which drives the convective mixing. These effects should diminish vertical dispersion of the plume and lower ground concentrations. Most of the anomalous cases occurred within 2 km of the Patuxent River shoreline, where the air trajectory crossed a 3- to 4-km stretch of the river upstream of the measurement site. (At Morgantown, several measurements suggested that plume fumigation occurred after the plume crossed a 10 km section of the Potomac River. These cases are discussed in Weil, 1977a.)

Comparisons with predictions based on the Turner (1964) method (Table 4, Pasquill, Gifford, Turner), show that predicted concentrations generally underestimate the measurements. The most unfavorable results occur for Pasquill class D. This presents a significant problem since class D is predicted to occur about 50% of the time. Figure 3 shows that predicted maximum concentrations are appreciably lower than measured, while the calculated distance to the maximum is too large by about an order of magnitude. (Typical calculated values of c_m and x_m were 25 ppb SO_2 and 25 km, respectively.) In addition, the crosswind dispersion is underestimated by Pasquill class D as shown in Fig. 4 and summarized in Table 3.

Others (Applied Physics Laboratory, 1973; Hino, 1968; Weil and Jepsen, 1977) report that shifting the Pasquill stability class by one towards the more unstable side results in much better agreement between calculated and measured ground-level concentrations. Calculations following this approach were made, and much improved results were indeed obtained (Fig. 5, Table 4, Pasquill, Gifford, Turner; drop one stability class).

Calculations using TVA sigma curves are summarized in Table 3 for σ_y's and in Table 4 for ground-level concentrations. Agreement with the measurements is poor. Both the vertical and crosswind dispersion seem to be underestimated by the neutral class curves which were selected in all cases. Figure 4 shows the discrepancy between TVA-predicted σ_y's and the measurements. The underestimated σ_z results in distances to the maximum concentration that are too large (predicted x_m's typically ranged from 6 to 12 km whereas the measurements suggested them to be only about 2–4 km).

Finally, we discuss results using σ_θ to select Brookhaven and Pasquill stability classes at the Chalk Point plant. The correlations between measurements and predictions (Tables 3 and 4) are not very favorable – a noteworthy result in view of reported success (Slade, 1968) in relating σ_θ to crosswind dispersion. The σ_θ approach may have failed here because the analysis did not consider initial plume growth due to buoyancy-generated turbulence, an effect not present in the experiments summarized by Slade. Other problems are the anomalies caused by land/water temperature differences and possibly unaccounted for time trends in the $\frac{1}{2}$-h averaged wind direction and σ_θ over the plume sampling period. Time trends in the wind direction would lead to a larger σ_θ and, hence, a more unstable stability class. (Fewer cases were analyzed with the σ_θ approach than with the other approaches because σ_θ was not always available.) A more thorough analysis of the σ_θ approach should be conducted in a future paper.

Results using individual stacks as buoyancy sources

Comparisons between measured and calculated concentrations using individual stack buoyancy fluxes are summarized in Table 5. In comparing Tables 4 and 5, we find significant differences only at Dickerson. This is due to a higher percentage of measurements obtained at close distances ($x < 4$ km) to the plant there (27%), than at Chalk Point (12%) or Morgantown (4%). When the two adjacent stacks were modeled as individual buoyancy sources rather than as a single effective source, higher predicted ground-level concentrations occurred primarily in the region of maximum concentration, say $x < 2x_m$. At distances

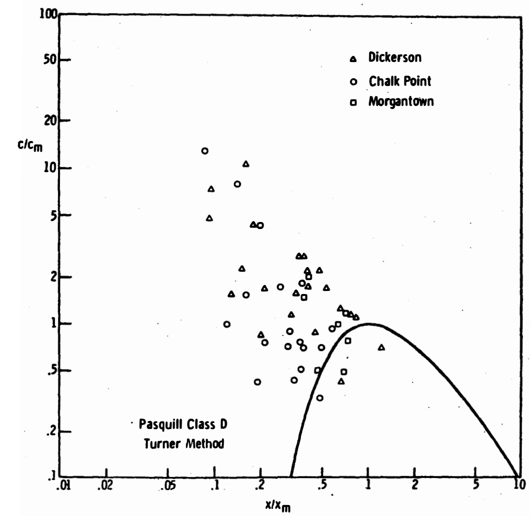

Fig. 3. Dimensionless ground-level SO_2 concentrations as a function of dimensionless distance for Pasquill D stability class, Turner method. Measurements compared to model predictions (solid line) for $H_m/h_e = \infty$ in Equation 4. (Measurements approximate 10-min averages.)

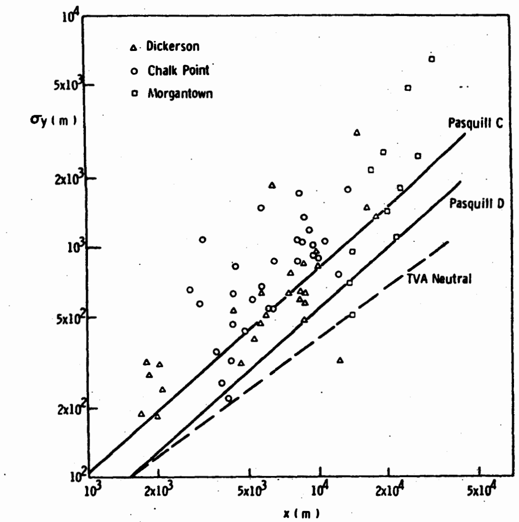

Fig. 4. Measured crosswind plume standard deviation as a function of downwind distance compared to predictions given by TVA neutral, Pasquill D, and Pasquill C (after dropping one class) stability classes. (Measurements approximate σ_y of 10-min averaged plume.)

beyond $2x_m$, the differences in the concentration predictions for individual or single effective buoyancy sources were small.

To determine more clearly the applicability of the two methods used to compute plume rise, we examined the distance dependence of the concentration ratio c_{pred}/c_{meas} at Dickerson. This was done using Brookhaven parameters selected by Weil's (1974) algorithm and Pasquill parameters chosen by Turner's (1964) method, but dropping one stability class. Based on a typical x_m of 2 km for Brookhaven parameters (single effective source), we divided measurements into two distance ranges: $x < 4$ km (11 cases) and $x > 4$ km (30 cases). The geometric mean of c_{pred}/c_{meas} was 1.79 for $x < 4$ km and 1.21 for $x > 4$ km, when Brookhaven dispersion estimates were used. With Pasquill parameters, the geometric means were 0.53 for $x < 4$ km and 1.16 for $x > 4$ km. In both cases, the differences between the near and far results were significant. The underestimated concentrations obtained using Pasquill parameters for $x < 4$ km were due to overestimated distances to maximum concentration. (This was especially true for Pasquill class C, where the typical predicted x_m was about 3.6 km.)

In contrast to the above findings, geometric means of c_{pred}/c_{meas} were 1.20 and 1.17 for $x < 4$ km and $x > 4$ km, respectively, when Brookhaven parameters and a single effective buoyancy source were used. The differences between the near and far results were insignificant. We therefore concluded that Brookhaven parameters, used in combination with a single effective buoyancy source, provided the most consistent results.

As a summary of the above analyses, frequency distributions of c_{pred}/c_{meas} were computed for three methods of calculating ground-level concentrations for all 126 cases. These distributions are shown in Fig. 6. The most narrow distribution (solid curve) was obtained using Brookhaven dispersion estimates and a single effective buoyancy source (geometric mean $c_{pred}/c_{meas} = 1.30$). A somewhat broader distribution (dashed curve) was found with the Pasquill, Turner (1964) approach, dropping one stability class, and using individual buoyancy sources (geometric mean $c_{pred}/c_{meas} = 1.07$). Note that these two distributions are essentially the same for $c_{pred}/c_{meas} > 1.3$. The higher percentage of low c_{pred}/c_{meas} values found with the second approach was due, in part, to overestimates of x_m. For reference, we also show the distribution obtained with the Pasquill, Turner (1964) approach (without dropping a stability class) and individual stack buoyancy fluxes (geometric mean c_{pred}/c_{meas} =

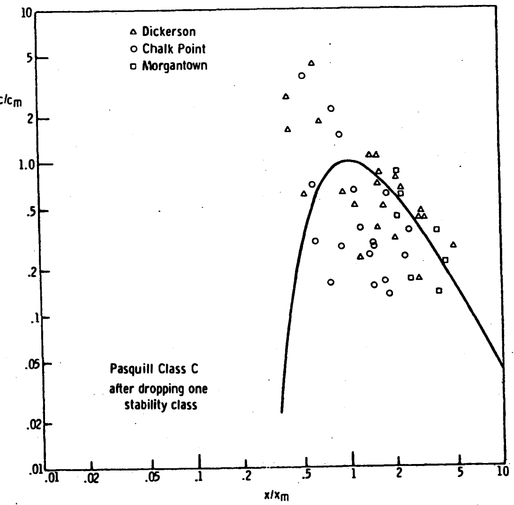

Fig. 5. Measurements shown in Fig. 3 compared to Gaussian model prediction (solid line) using Pasquill class C dispersion estimates. (Measurements approximate 10-min averages.)

Table 5. Summary of comparisons between measured and predicted ground-level SO_2 concentrations (individual stack buoyancy sources)

Stability class selection method	Stability class	Geometric mean c_{pred}/c_{meas}			Geometric standard deviation of c_{pred}/c_{meas}			Per cent of predictions within a factor of 2 of measurements: By stability class			Over all cases
		D*	CP	M	D	CP	M	D	CP	M	
Brookhaven; Weil (1974) algorithm	B_2	1.52	1.21	0.93	1.94	1.60	1.64	72	76	75	69
	B_2	1.22	2.18	1.19	1.75	2.45	1.39	70	42	93	
Pasquill, Gifford, Turner	A		0.73	0.47		1.62	1.08		67	33	50
	B	0.41	1.16	0.60	4.64	1.70	1.78	25	83	67	
	C	1.01	1.79	1.48	5.95	2.12	1.38	43	67	100	
	D	0.04	0.01	0.67	81.86	796	2.51	39	21	73	
Pasquill, Gifford, Turner; drop one stability class	A	0.85	0.74	0.61	1.92	1.71	1.74	75	73	44	59
	B	1.08	1.19	0.98	2.20	2.28	1.53	71	47	83	
	C	0.88	1.71	1.24	2.15	2.73	1.45	61	34	91	
TVA	Neutral	1.55	2.68	2.05	5.54	3.06	4.55	32	22	19	25
Using σ_θ measurements for Brookhaven	B_2		1.40			2.11			50		36
	B_1		2.25			1.99			31		
	C		2.26			2.83			22		
Using σ_θ measurements for Pasquill	A		0.86			1.84			78		44
	B		2.12			1.29			33		
	C		1.41			2.61			46		
	D		0.03			69			18		

* D = Dickerson, CP = Chalk Point, M = Morgantown.
Note: See Table 3 for number of cases in each stability class.

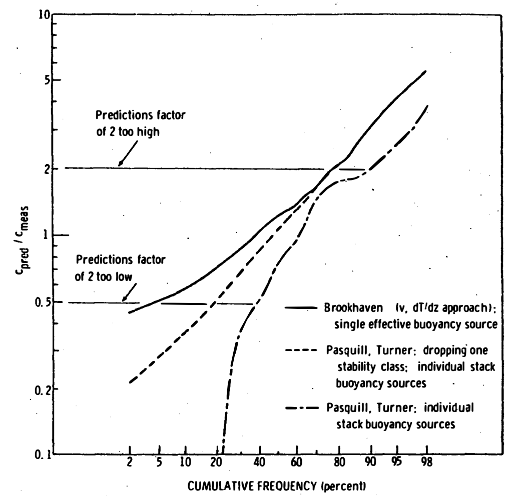

Fig. 6. Cumulative frequency distributions of the ratio of predicted-to-measured ground-level concentrations for three methods of calculating ground-level concentrations.

0.20). This last distribution is extremely broad, with about 38% of the predicted concentrations less than half of the measured values. Many of the underestimated concentrations were predicted for distances where maximum observed concentrations were found. The poor results found using this last approach support the warnings of Pasquill (1975) and Hanna *et al.* (1977) concerning application of the unmodified Pasquill curves to tall stack releases.

4. DISCUSSION

Comparison of field experiments

The poor correlation between the field data and some of the predictions can be explained, in part, by differences between the Maryland experiments and those from which the empirical sigma curves were determined. First consider the Pasquill curves. These were developed from neutrally buoyant tracer releases at ground level over a smooth surface (Prairie Grass Experiments, surface roughness height $\simeq$ 3 cm, Pasquill, 1976) and ground-level concentration measurements out to distances of 1 km from the source. The sigma curves for distances greater than 1 km were extrapolations based on "some experimental data" and noted by Pasquill (1961) as being more uncertain than the curves within 1 km.

The Maryland field experiments differ in all respects. First, the plumes are buoyant and initially grow due to self-generated turbulence during plume rise. Buoyancy-induced growth adds to the "passive" spread caused by ambient turbulence and contributes most significantly in cases of small passive growth – Pasquill Class D. (It would be even more important for the stable E and F classes not analyzed here.) Second, the sources are elevated so that plumes initially are subjected to a different turbulence spectrum than a plume with source at ground-level. Although we would expect more rapid dispersion with downwind distance for an elevated release, recent laboratory experiments simulating dispersion in convective conditions show that σ_y and σ_z are smaller for the elevated source than for a near-ground release (Willis and Deardorff, 1976a). This point requires further investigation. A third difference is that the Maryland power plant sites are characterized by a larger surface roughness ($\simeq$ 10 cm to $\simeq$ 1 m) than that of the Prairie Grass Experiments. This, of course, would lead to increased dispersion. Finally, the stack plume data were collected at distances where the Pasquill curves are essentially extrapolations.

The TVA curves are based on helicopter sampling of SO_2 in buoyant plumes from power plant stacks. Surface roughness at the plants is about the same as at the Maryland sites. Despite these similarities, TVA neutral sigma curves underestimate dispersion determined from the present experiments. Underpredictions of crosswind dispersion might be due to differences in the method of calculating σ_y (Weil, 1974). Values of σ_z measured in the TVA work are representative of the vertical spread about the nearly instantaneous plume centroid and do not take into account vertical plume meandering (Gartrell *et al.*, 1965) which must be considered in predicting ground concentrations. Furthermore, the TVA neutral curves are effectively extrapolations beyond about 3 km.

Brookhaven sigma curves were derived from neutrally buoyant tracer releases from a 108-m high stack in a forested area (roughness length about 1 m; Hanna *et al.*, 1977). Ground-level concentration measurements were made out to about 10 km from the stack. Vertical standard deviations (calculated from the ground-level concentrations, measured σ_y, and emission characteristics using the Gaussian plume equation) indirectly take into account vertical plume meandering. Although the Brookhaven experiments do not simulate buoyancy effects, this consideration should be less important during unstable conditions because ambient turbulence should become the dominant dispersing mechanism after 1 or 2 km.

Of all the diffusion trials, the Prairie Grass Experiments (Pasquill curves) are probably most dissimilar to the Maryland tall stack studies. The TVA experiments probably have the most comparable source and terrain conditions but are limited by plume sampling, especially in the case of σ_z. For unstable conditions, the Brookhaven experiments are probably most similar to the Maryland studies.

Correlation of stability classes with v/w_*

Theoretical work (Deardorff, 1972) and laboratory studies (Willis and Deardorff, 1976a; 1976b; 1978) have shown that a relevant stability parameter for characterizing diffusion in convective mixing layers is the ratio of mean wind speed v to the convective velocity scale w_* given by

$$w_* = (qH_m)^{1/3}. \tag{11}$$

Turbulent velocities within the mixing layer scale with w_* while the large convective eddies scale in size with H_m. Based on laboratory simulations of neutrally buoyant particle diffusion into a convective mixing layer, Willis and Deardorff derived estimates of v/w_* appropriate to the Pasquill and Brookhaven unstable stability classes. The magnitude of σ_y and σ_z at a given distance and the degree of instability increase as v/w_* decreases.

The consistency of the Weil (1974) and Turner (1964) methods of choosing stability was tested here by comparing values of v/w_* calculated from the field data to those given by Willis and Deardorff (1976a) and Deardorff and Willis (1974). Surface heat flux in Equation (11) was assumed proportional to solar insolation as noted earlier. Although this is a crude estimate of heat flux, the dependence of w_* on q is quite weak. A typical calculated value of w_* is $2\ \mathrm{m\,s^{-1}}$.

Field and laboratory values of v/w_* are compared in Table 6. First consider mean values using all of the data. (The number of cases falling within each stability class is given in Table 3.) The v/w_* ratios are separated distinctly for the Brookhaven stability classes as selected by Weil's algorithm. This was to be expected since Weil's algorithm distinguishes the B_2 and B_1 classes by mean wind speed in the mixing layer. Changes in v/w_* were caused more by variations in wind speed (factor of 10) than in w_* (factor of 3). The field values of v/w_* are consistent with the Willis and Deardorff value for class B_2 but not for class B_1 at Dickerson and Chalk Point. The v/w_* ratios are also well separated for the Pasquill stability classes, in most cases. However, a significant discrepancy exists for Pasquill class D – neutral stability. Willis and Deardorff gave no value here for v/w_* since presumably it would be quite large (small heat flux in Equation 11) while values from the field data range from about 4 to 6.

Table 6. Correlation of stability classes with v/w_*

Stability class selection method	Stability class	All data arithmetic mean v/w_* (Std. Dev. in v/w_*) D	CP	M	Only cases with $1.2 \le v/w_* \le 6.0$ arithmetic mean v/w_* (Std. Dev. in v/w_*) D	CP	M	v/w_* Willis and Deardorff
Brookhaven; Weil (1974) algorithm	B_2	2.15 (1.38)	2.02 (0.86)	2.13 (0.90)	2.63 (1.32)	2.26 (0.75)	2.27 (0.79)	1.82
	B_1	6.07 (2.74)	5.76 (2.86)	4.03 (0.79)	4.42 (0.79)	4.39 (1.10)	4.03 (0.79)	4.00
Pasquill, Gifford, Turner	A		1.98 (0.35)	1.81 (0.85)		1.98 (0.35)	2.23 (0.62)	1.54
	B	1.52 (1.37)	1.90 (1.06)	2.78 (1.21)	2.38 (1.61)	2.28 (1.13)	3.15 (0.88)	2.22
	C	3.10 (1.84)	3.01 (1.44)	2.78 (1.23)	3.65 (1.67)	2.78 (1.16)	2.78 (1.23)	4.00
	D	5.60 (3.11)	4.91 (3.22)	3.93 (1.02)	3.70 (1.14)	3.87 (1.39)	3.93 (1.02)	

Field and laboratory data for a restricted range of v/w_* are also compared in Table 6. The lower limit of the inequality ($1.2 \le v/w_* \le 6.0$) ensures that diffusion along the plume axis can be ignored while the upper limit is imposed to satisfy the condition that the bulk of the mixing layer be dominated by convective turbulence (Willis and Deardorff, 1976b). (About 20% of the cases were outside the range of the inequality.) For the Brookhaven parameters (Weil algorithm), the agreement between field v/w_*'s and Willis and Deardorff values improves considerably for class B_1 while it worsens slightly for class B_2. With the Turner approach, some changes in mean v/w_*'s occur, but the trends are about the same as those obtained using all the data.

The results found here show that the Turner (1964) stability criteria are strongly biased toward neutral conditions when unstable conditions actually exist. Recall that 50% of the data fell into Pasquill class D when choosing stability by the Turner approach. The improper designation of the neutral stability condition is one of the major causes for disparity between measurements and calculations when the unmodified Turner approach is used.

The success of the Weil algorithm in distinguishing the two Brookhaven unstable classes lies in the use of wind speed for choosing a stability class. (Use of v/w_* would be better, in principle.) By the same token, the lack of wind speed as a parameter for choosing stability classes in the TVA approach severely limits that approach. The TVA approach uses only vertical temperature gradients at plume altitude to distinguish stability. Because the temperature gradients at plume altitudes of several hundred meters are close to adiabatic in both neutral and unstable conditions, the TVA approach makes no distinction between these two stability conditions. This was also pointed out by Hanna *et al.* (1977).

5. CONCLUDING REMARKS

The applicability of several empirical methods for predicting dispersion in the Gaussian plume formula was evaluated with measurements of crosswind dispersion and ground-level SO_2 concentrations downwind of the Dickerson, Chalk Point, and Morgantown power plants. A total of 126 cases was analyzed under convective or near-neutral stability conditions.

Satisfactory results were found when using Brookhaven dispersion parameters selected by Weil's (1974) algorithm or Pasquill–Gifford sigma curves chosen by Turner's (1964) method, but shifted to the next more unstable stability class. The TVA and unmodified Turner approaches as well as use of σ_θ did not give good results. The success or failure of these approaches was explained in terms of the criteria used to determine a "stability class" and by the similarities or differences between the Maryland experiments and the diffusion trials upon which the approaches were based. Correlation of Brookhaven and Pasquill unstable stability classes with v/w_* gave empirical support to v/w_* as a more universal parameter for defining stability in unstable conditions. The v/w_* correlation also showed that the Turner (1964) criteria were biased toward neutral stability when unstable conditions actually existed.

Several anomalous measurements near the Chalk Point and Morgantown plants indicated that the wide rivers bordering these plants increased stability during daytime and inhibited vertical dispersion. Such anomalies were not found at Dickerson, which was in more uniform (and rolling) terrain. The empirical approaches for predicting dispersion did not address such problems, suggesting that a more general model is needed.

Concentration predictions near the stacks (within $\simeq 2x_m$) were higher when plume rise was calculated for individual buoyancy fluxes (from two adjacent stacks) than for a single effective buoyancy flux. The buoyancy flux that resulted in best agreement between measured and calculated ground-level concentrations varied with the dispersion parameters chosen. Most consistent concentration predictions were obtained with a single effective buoyancy source and Brookhaven dispersion parameters. However, the problem of plume merging and enhanced rise requires a more general analytical treatment than used here. Such a treatment should be tested with an extensive set of field observations of plume rise and wind tunnel or water channel simulations.

Acknowledgements – The author acknowledges Environmental Measurements, Incorporated, for supplying the field measurements used in this paper; T. J. Overcamp for providing data from the meteorological tower at the Chalk Point power plant; the Potomac Electric Power Company for furnishing power plant operating conditions; C. Y. Li and W. Furth for assistance in analyzing the data; and S. Maslen and J. Jensen for suggestions on the manuscript. This work was supported by the Maryland Power Plant Siting Program, Department of Natural Resources under Contract Number 1-72-02(78).

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15142 Sobey Road
Saratoga, California 95070
April 22, 1980

Jimmy Carter
President of the United States
The White House
1600 Pennsylvania Avenue
Washington, D.C. 20500

TMI-2 CLEANUP

Dear Mr. President:

As a veteran of 33 years in the nuclear business, I am very concerned about the lingering radioactive materials in TMI-2.

During my 10 year stint at the Hanford operation we dealt with massive quantities of radioactive materials in the various reactors and chemical separations plants.

Such operations were conducted long before the development of the present NRC regulations.

We developed one cardinal rule that was followed with religious fervor.

IF THROUGH SOME EQUIPMENT MALFUNCTION OR OPERATING ERROR, RADIOACTIVE MATERIALS MOVE TO AREAS WHERE THEY CANNOT BE MANAGED AND CONTROLLED IN A NORMAL MANNER, EXTRAORDINARY AND IMMEDIATE STEPS WILL BE TAKEN TO MOVE THE MATERIAL TO A STATE WHERE IT CAN EITHER BE CONTROLLED IN A NORMAL MANNER OR HARMLESSLY DISPERSED.

The reasoning behind this rule is fairly simple. When radioactive materials are in a location not normally intended for their routine handling, one can not be absolutely sure that such a non-standard environment will continue to prevail for long periods of time.

The TMI-2 plant was not designed to house large amounts of gaseous Kryton, radioactive water, or damaged nuclear fuel for long periods of time. The location of these materials in TMI-2 is not one where the materials can be managed and controlled in a normal routine manner using equipment and methods designed for that purpose.

Extraordinary steps should have been taken to remove these radioactive materials immediately after the TMI-2 accident.

Because so much time has passed, it is even more urgent that this action be accomplished immediately.

The interests of public safety are not being served by having the cleanup decisions open to public debate and political wheeling and dealing by special interest groups.

The TMI-2 situation must continue to be viewed as an emergency, and executive action is required to articulate this point to the public and formulate immediate plans to deal with it.

An organization exists today that has the experience and talent to carry out immediate cleanup actions at TMI-2. This is Admiral Rickover's Naval Reactors Branch of DOE.

It is urged that such an organization be assigned complete responsibility for the cleanup, with the assistance of other participating organizations only to the extent that they can contribute to this objective.

This assignment should come about by executive order and the cleanup decisions removed from public debate. The only restriction suggested is that any environmental dispersal programs meet existing discharge limits. This is no time to insist, for political reasons, that environmental discharges be 5X or 10X or 100X lower than normal limits. By prolonging these cleanup actions we are jeopardizing the health and safety of the public.

It is remarkable that the TMI-2 plant has been so well designed that it has, up to this point, contained these radioactive materials that are in the wrong places or in a damaged physical state.

I am confident that the public, particularly the residents living near TMI-2, will react well to the proposed action. To assign such a task to a professional organization that has an outstanding track record in nuclear safety will be recognized by the public as sound and timely action by your executive office.

I trust you will give these proposals your serious consideration.

Yours very truly,

R. B. Richards

Robert B. Richards

/da

cc: Mr. Charles W. Duncan - Secy. of Energy, DOE
Mr. John F. Ahearne - Chairman, NRC

P. O. Box 2063
Harrisburg, Pennsylvania 17120

(717)787-2480

April 24, 1980

Dr. James J. Fritz
Professor of Chemistry
The Pennsylvania State University
152 Davey Laboratory
University Park, Pennsylvania 16802

Dear Dr. Fritz:

Your proposal concerning the removal of Krypton-85 from the TMI-2 reactor building has been referred to this office.

Since we have no special expertise in this area, we have taken the liberty of forwarding your proposal to the Nuclear Regulatory Commission for their consideration. They have considered other proposals in their decision-making process and we feel confident that they will do likewise with yours.

We greatly appreciate your effort and concern in this matter and assure you that your proposal will be given every consideration.

Sincerely yours,

Thomas M. Gerusky, Director
Bureau of Radiation Protection

TMG/dmm

cc: Gerusky
[redacted]
P. Banzhoff, Governor's Office
✓NRC

THE PENNSYLVANIA STATE UNIVERSITY
152 DAVEY LABORATORY
UNIVERSITY PARK, PENNSYLVANIA 16802

College of Science
Department of Chemistry

March 31, 1980

Hon. Richard Thornburgh
Room 225
Main Capital Building
Harrisburg, Pennsylvania 17120

Dear Sir:

This concerns the problem of removing radioactive Krypton-85 from the air contained in the reactor building at Three Mile Island without further contamination of the environment. This problem is very similar to one I encountered many years ago, that of isolating traces (parts per billion) of acetylene in very large volumes of air. I believe that the same solution could be applied at Three Mile Island, as follows:

1. Pump the contaminated air to the inlet of a small (1 to 2 ton/day) oxygen liquefaction unit. A unit of any reasonable efficiency would concentrate more than 99% of the Krypton in the liquid oxygen product.

2. Pass the liquid oxygen through a bed of adsorbent such as silica gel, where the Krypton will be selectively adsorbed.

3. At periodic intervals, allow the adsorbent bed to warm up and pump the Krypton gas into storage cylinders for removal and disposal.

A sketch of the proposed scheme is attached. With reasonable process control, it should be possible to remove the Krypton without building up a large concentration of radioactivity at any stage and with no more than 1-2% escaping to the atmosphere. Details on individual steps follow:

1. The simplest way of removing the air from the containment building is to connect a vent to the inlet of the air compressor of the liquid oxygen unit, allowing pure air to replace it through a second vent as far from the first as possible. For the simplest reasonable flushing scheme, it would be necessary to process about 50 million cubic feet of air to flush out 90% of the Krypton, twice that amount to remove 99%. Any favorable features in the design of the building would reduce these amounts.

2. A liquefaction unit taking 200 cubic feet of air would remove the contaminated air at the rate of about 1% per day. Such a unit is quite small by industrial standards. If a portable unit of this size is not available, the need could be met with two or more smaller units. (Obviously, the process could be speeded up by use of a larger liquefaction unit.)

3. Removal of the Krypton from the liquid oxygen product could be carried out off-site if desired, since the quantity and level of radioactivity in the product would both be quite low.

4. The final separation of Krypton from the oxygen could be carried out by a number of other possible methods, particular if done at another location where other separation methods (distillation, gas chromatography) were feasible.

I shall be glad to discuss the Krypton removal further if desired. The possibility of removing it by air liquefaction was suggested to me by Warren W. Miller (retired) of our Department, and W. A. Steele contributed technical data and suggestions for improvement. I'm sure either of them would be prepared to contribute further, as well.

I'm sure that the necessary technical advice on liquefaction processes and equipment could be obtained from Air Products and Chemicals Co., in the Allentown area.

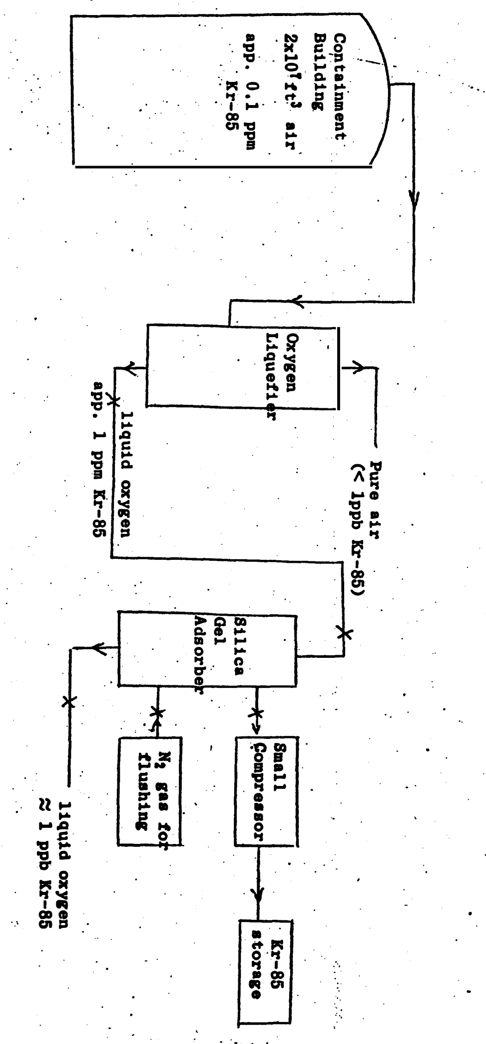
Sincerely yours,

J J Fritz

James J. Fritz
Professor of Chemistry

JJF/bhs

Encl.



Proposed Scheme for Removal of Kr-85 from Air

[Note - ppm = parts/million
ppb = parts/billion]

McNEES, WALLACE & NURICK
ATTORNEYS AT LAW
100 PINE STREET
P. O. BOX 1166
HARRISBURG, PA. 17108
TELEPHONE (717) 236-9341

April 25, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Snyder:

This is in response to your letter of April 21 to me along with certain booklets you supplied with respect to the decontamination of TMI Unit 2. I appreciate your soliciting my comments which I assume was done because of my position as Chairman of the Greater Harrisburg Area Task Force "Forward".

I have reviewed the materials you sent and speaking for myself primarily I do believe that the entire Task Force would, if it were put to them, join me in supporting a purging of the krypton gases in conjunction with a hydrogen control subsystem such as more fully explained on page 6-48 of Addendum No. 2 to Pamphlet NUREG-0662.

Thank you for your consideration in bringing these matters to our attention.

Very cordially yours,

Edward C. First, Jr.

/bev

Lebanon valley CHAMBER OF COMMERCE
P. O. BOX 899, LEBANON, PENNSYLVANIA 17042
TELEPHONE 717-273-3727
with offices in the Lebanon Treadway Inn
Quentin Road and Poplar Street

April 25, 1980

Mr. John F. Ahearne
Chairman
Nuclear Regulatory Commission
1717 H Street, N. W.
Washington, DC 20555

Dear Mr. Ahearne:

Enclosed you will find a resolution where we believe your Commission should proceed as quickly as possible with the cleanup of TMI. We believe the venting is the best alternative, and that the Commission should decide accordingly.

It is imperative that we protect the interest of our consumers and that your Commission has the expertise to make the best decision for all parties involved.

We sincerely appreciate your efforts to date, and we look forward to an expeditious cleanup of TMI.

Our Chamber believes it is time to trust your agency and that individuals should do the same.

Again, thank you, and we hope that a decision will be made in the near future.

Very truly yours,

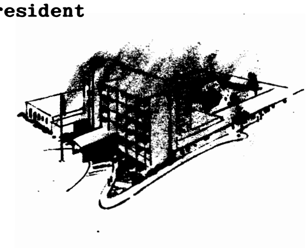
LEBANON VALLEY CHAMBER OF COMMERCE

David L. Wauls
Executive Vice President

DLW/cay

Enclosure

cc: Harold Denton



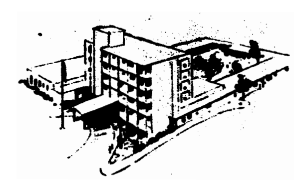
Lebanon valley CHAMBER OF COMMERCE
P. O. BOX 899, LEBANON, PENNSYLVANIA 17042
TELEPHONE 717-273-3727
with offices in the Lebanon Treadway Inn
Quentin Road and Poplar Street

LEBANON VALLEY CHAMBER OF COMMERCE

RESOLUTION ON CLEANUP OF TMI

The Lebanon Valley Chamber of Commerce would like to urge that the NRC and the Commonwealth of Pennsylvania assume the much needed leadership to resolve the problem at TMI. Our Chamber of Commerce believes that the emotions of our citizens are important, however, the individuals entrusted with the responsibilities of protecting the health and safety of the citizens should be permitted to carry out their functions.

It is also necessary, we believe, to take this problem out of the political arena and permit the knowledgeable individuals to proceed with clean up operations. People mention the psychological impact, but they must realize that the problem exists and it is time to resolve that problem. Consumers realize what it is costing them, but do they realize that the commercial and industrial businesses are paying the same increases? Total additional costs for replacement power for the residential, commercial, and industrial users amounted to over $1,000,000 for the month of January in our Lebanon area.



Page 2 Continued

Our Lebanon Valley Chamber of Commerce urges the following:

a. The NRC and the Commonwealth of Pennsylvania start making decisions necessary to resolve the problem at TMI.

b. The politicians start trusting the knowledgeable individuals on this subject and curtail rhetoric that incites people rather than leading to a rational decision.

c. The clean up process should proceed with the governmental agencies responsible for the process being given the authority to proceed and to ensure the health and safety regulations are met.

Our Lebanon Valley Chamber of Commerce believes the clean up process should proceed as quickly as possible and that the citizens should have respect and confidence in those individuals making those decisions.

Our Chamber will continue to support nuclear power and to urge the expeditious clean up of TMI for everyone's benefit.

Irwin D.J. Bross, Ph.D.
Director of Biostatistics
Roswell Park Memorial Institute
666 Elm Street
Buffalo, N.Y. 14263

No opinions here expressed should be construed as reflecting official positions of the administration of Roswell Park Memorial Institute or of the N.Y. State Health Department.

April 25, 1980

Harold R. Denton, Director
Office of Nuclear Reactor
Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Denton:

Thank you for your letter of April 18, 1980. The stress on going full speed ahead with the purging of TMI-2 does nothing to put to rest my concerns. To say in response to the proposal for entombment that this is "not a viable alternative to its disposal since some uncontrolled release is likely to occur in the future" is really baffling. If the radioactivity is immobilized in concrete where will the uncontrolled releases be coming from?

Clearly the NRC is dealing with symbols, not reality, in a situation where mistakes are going to kill people. The purging is a symbolic reaction to show the "damn the torpedos, full speed ahead" spirit. Your own data make it clear that exposures to workers in the containment will quickly exceed NRC limits whether the Kr-85 is purged or not. It shows that most of the radiation is not coming from the gas phase.

The data of the Pennsylvania State Health Department, properly analyzed (as in my letter to Nature) shows almost a doubling of the infant mortality rate after the accident. If NRC had any interest in protecting the public health and safety in a real (as opposed to a symbolic) sense, this would be a deterrent against additional Kr-85 exposures to the general population. While we may not be certain that the additional 14 dead babies in the 1979 period of the study are due to the low-level radiation, we also cannot be certain that they are not.

"Full speed ahead" is not a sign of courage or determination, it is a sign that NRC is far more concerned about obeying signals from the White House than in what happens to the people living around TMI-2.

Very sincerely yours,

Irwin D.J. Bross, Ph.D.
Director of Biostatistics

IDJB/mak

Herman Dieckamp
President

GENERAL PUBLIC UTILITIES CORPORATION

100 Interpace Parkway
Parsippany, New Jersey 07054
201 263-6500
TELEX 136-482
Writer's Direct Dial Number:
201-263-6030

April 25, 1980

The Honorable Allen E. Ertel
1030 Longworth House Office Building
Washington, D. C. 20515

Subject: Three Mile Island Krypton-85 Venting

Reference: Congressman Ertel letter to Chairman Ahearne dated April 21, 1980

Dear Congressman Ertel:

Thank you for sending us a copy of your April 21 letter to Chairman Ahearne. Thank you also for your interest in the TMI clean-up program.

We note that your letter does not identify any criteria or judgment concerning the appropriate standard for clean-up activity impact on the public. Under the company's venting proposal the public will receive between 1/100 (at the site boundary) and 1/20,000 (average within 50 miles) of the expected exposure from natural environmental sources during the 30 day venting period.

Venting the Krypton-85, under predetermined meteorological conditions, results in a dose to the surrounding population within 50 miles that is calculated to be about 1 person-rem; i.e., the summation of the dose to all individuals or the average dose times the number of individuals affected. The concept of person-rem is not one of general public knowledge but is a meaningful parameter for indicating health impact under the assumption of linear dose effect. It is possible to place the health impact of venting in perspective by comparing the resulting exposure to that imposed by the natural environment. That exposure is, for central Pennsylvania, about 0.120 rem/year. In this comparison, we have used the whole body gamma exposure which is, for this case, the exposure of controlling significance.

Independent of venting or TMI the 2 million people in the 50 mile radius around TMI will receive on the average 0.01 rem each from natural environmental sources for an integrated person-rem dose of 20,000; i.e., (.01) x (2,000,000) during the 30 day venting period. Thus the venting dose to the public is, on average, 1/20,000 of the environmental exposure.

For an individual at the site boundary, as contrasted with the average within 50 miles, the calculated venting exposure is 0.0001 rem and results, for that individual, in a person-rem dose of 0.0001 (.0001 x 1) compared with his expected environmental dose of .01 (.01 x 1), during the same time period. Thus, the venting dose at the site boundary is 1/100 of the environmental exposure. In other terms the total site boundary dose to an individual from venting is equal to the natural background exposure one receives in each 8 hour period or about 1/200 of that received from one chest x-ray.

Since we are unaware of any demonstrable health effects from the average environmental exposure in the central Pennsylvania area and since the venting will contribute an almost undetectable addition to that exposure, we have concluded that the public interest is best served by not delaying the clean-up process and not incurring even the slightest possibility of an uncontrolled release in the interest of further reductions to an already undemonstrable effect. Every step forward we take to remove the radioactive material lowers the threat to public health and safety. Any step available to be taken which is ignored or unnecessarily delayed only prolongs the exposure of the public to potential hazard. The problem we all struggle with is the impossibility of describing exactly the magnitude and extent of the hazards. But the judgments of all concerned are near-unanimous that the public's best interests are served by rapid clean-up of the island.

We recognize that there is a clear difference between the scientific and the public perception of the impact of the proposed venting. I am sure that we can all agree that the clean-up must be safely and expeditiously completed. I sense a great need for responsible public officials to support the efforts of those conducting and regulating the clean-up effort. The public sorely needs reassurance from their chosen leaders that their interests and their health are being properly protected by the use of technically sound and safe methods. We stand ready to cooperate with you and other responsible individuals or organizations to provide the basis for such support.

Sincerely,

H. Dieckamp

lda

To: Science Editor
WASHINGTON POST
WASH. DC

RE: THREE MILE ISLAND
DISPOSAL OF KRYPTON GAS

A. THE PROBLEM: - DEGREE OF CONCENTRATION
- ABSORPTION BY ALL LIVING THINGS

B. SUGGESTED SOLUTION:

1. USE OF BALLOONS; HOT AIR & CLIMATOLOGY from: NASA - NOAA OR WHATEVER APPLICABLE.

2. MODIFY EXHAUST VENT CONTAINMENT BLDG. TO SAFELY VENT GAS INTO DEFLATED BALLOONS.

3. MODIFY BALLOON INTAKE TO SAFELY INFLATE WITH KRYPTON GAS WITH ABSOLUTE SEAL.

4. EMPLOY BLIMP TO TOW BALLOONS A DISTANCE OUT TO SEA AND EXPLODE OR DEFLATE SAME.

5. OR: EMPLOY HIGH ALTITUDE HELIUM BALLOONS WITH MESH UNDER SLINGS TO HOLD KRYPTON GAS BALLOONS. EXPLODE WITH REMOTE DETONATORS OR ALTITUDE SENSITIVE DETONATORS ~~AT~~ DISIGNATED ALTITUDE AND VERTICLE LOCATION.

6. THE ABOVE TO BE IMPLEMENTED AND EXECUTED BY THE COMBINED EXPERTISE OF MET ED; NRC, EPA, OR ANY FEDERAL AGENCIES REQUIRED PLUS THE USE OF TECHNOLOGY OR EQUIPMENT FROM THE PRIVATE SECTOR (ACADEMIC OR CORPORATE)

ORIGINATED & SUBMITTED by: GEORGE E PLIMPTON
1610 EUCLID AVE
MIAMI BEACH, FLA 33139
(NO PHONE)

[MULTIPLE COPIES DISPERSED TO PARTIES OF INTEREST]

George E Plimpton

Pamila J. Spear
RFD # 8, Box 319
Loudon, NH 03301

April 29, 1980

Director
Three Mile Island, N.R.R.
Nuclear Regulatory Commission
Washington, DC 20555

Dear Sir:

I am writing in reference to the NRC Staff's Second Addendum to the Environmental Assessment for Decontamination of Three Mile Island Unit 2 Reactor Building Atmosphere. (Addendum 2 to NUREG - 0662) Having received this information nearly two weeks after it was released.

I am strongly in opposition to the decontamination of the containment building (although it is already to late), only to contaminate the atmosphere? I would like to know how it can be considered that any meterological conditions can be considered favorable, to disperse radioactive gases into the atmosphere? No matter which way the wind blows, that radioactive gas is going to go somewhere! I can not believe that any amount of radiation can be harmless, no matter how small.

It is very disappointing that people who are supposed to be regulating Nuclear Plants in my behalf, that are supposed to be safe and harmless, are proceeding to poisen the American citizen. If this is what we have to depend on for the future, I don't expect we will have much of a future. What would happen if some country (like Iran) decided to bomb a couple of these plants? It would have as much a devastating effect as a nuclear bomb.

I really think the time has come to consider our future (mine and your's). I don't deny the energy is needed for us to live as we are accustomed to. But isn't there other cleaner, safer ways? Water, Wind, and Solar Power are as inexhaustible as we could ask for. We have the ability and knowledge it's time we used it. Haven't we been civilized long enough to live that way?

In closing, I would like to thank you for taking the time to read this, though I'm sure it has little or no effect. I am not a clamsheller, but just an ordinary person that thinks it is time to save the human race, before we too become extinct, we're already an endangered species.

Thank you,

P J Spear

P. J. Spear

HOUSE OF REPRESENTATIVES
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

THE MAJORITY CAUCUS CHAIRMAN

April 29, 1980

Dr. Bernard J. Snyder, Program Director
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Vent it!

Kindest personal regards.

Sincerely,

FRED C. NOYE

FCN/bjs

LAW OFFICES
GOLDBERG, EVANS & KATZMAN
319 MARKET STREET
P. O. BOX 966
HARRISBURG, PENNSYLVANIA 17108

ARTHUR L. GOLDBERG
JAMES W. EVANS
RONALD M. KATZMAN
HARRY B. GOLDBERG
F. LEE SHIPMAN
CRAIG A. STONE
PAUL L. ZEIGLER
JAMES E. REID, JR.
PAUL J. ESPOSITO
TIMOTHY I. MARK

TELEPHONE
(717) 234-4161

April 30, 1980

Dr. Bernard J. Snyder
Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

In re: NUREG-0662

Dear Sir:

Pardon my delay in responding to your letter of April 21, 1980. I have now had an opportunity to study the Draft N.R.C. Staff Report for Public Comment with Addenda 1 and 2 and recommend that the proposal contained in Addendum 2, ¶6.6 be adopted and implemented as soon as possible.

This proposal, as I understand it, will use the in-house purging system in conjunction with the hydrogen control subsystem to decontaminate the atmosphere of the building of Kr-85 so that access to the building can be had to remove damaged fuel.

It is my opinion that this method has the greatest advantages and the least disadvantages and a good worst case accident potential.

In addition, all other things being equal, I firmly believe that the process of decontamination and removal of the damaged fuel must proceed and delay is only increasing the psychological stress on the members of this community. The five (5) day period is, therefore, appealing.

Dr. Bernard J. Snyder
In re: NUREG-0662
April 30, 1980
Page 2

Fully realizing that no alternative will be acceptable to some, I would urge prompt and, I am sure, carefully considered action.

Very truly yours,

JAMES W. EVANS

JWE:jpm

P. O. Box 2063
Harrisburg, Pennsylvania 17120

(717)787-2814

April 30, 1980

Mr. Thomas L. Berry
BEL Manufacturing Company
P. O. Box 6255
Linglestown, Pennsylvania 17112

Dear Mr. Berry:

Your proposal for decontamination of the TMI-2 reactor building atmosphere has been reviewed by my staff and we have the following comments.

Your proposal tends to somewhat oversimplify the problems that exist. Using your proposed method the maximum volume that could effectively be displaced by an inflatable bladder would be about two-thirds of the building atmosphere. This is due to the fact the reactor building consists of many different compartments, some of which are currently inaccessible or contain complex piping system and equipment which would interfere with an expanding bladder system. These physical limitations imply that after the approximate two-thirds of the building volume is removed, the remaining one-third would still have to be purged. This decontamination alternative would therefore only result in a public dose reduction of about two-thirds. It is very possible that this same reduction could be achieved by variations in the purging alternative as evaluated by the NRC staff.

Your proposal also suggests compressing the gases to a liquid because this would be a more stable state for storage. This change of phase cannot be accomplished without the addition of a sophisticated cryogenic refrigeration system and indefinite storage in this form would imply continuing cryogenic processing. This in fact would be a very unstable storage mode over the long term and therefore could be subject to higher accidental risk than the other storage mode which was evaluated by the NRC. Even compressed storage without liquification would be subject to similar accidental risks and occupational exposure as the evaluated sotrage alternative.

We have taken the liberty of forwarding your proposal to the NRC for their consideration. I would like to personally thank you for your concern and effort in this matter. If you have any questions, please feel free to contact this office.

Sincerely yours,

CLIFFORD L. JONES

TMG/dmm

cc: Middendorf
Sec. Jones
~~Gerusky~~
NRC - John Collins

BEL Manufacturing Co.
P.O. Box 6255 Linglestown, PA 17112

Presented to
Governor
4/8/80

Proposed Alternative for
Decontamination of the
Three Mile Island Unit 2
Reactor Building Atmosphere

Due to the separation of the building into 3 levels ~~[illegible]~~ and the many isolated cubicals especially in the basement and the difficulties of getting to the basement, the largest volume that could effectively occupied by a inflatable bladder would be about 2/3 of the building.
Purging would still be necessary with ~~[illegible]~~ only a 2/3 reduction in public exposure. Accident risk would still be relatively large compared to complete purging ~~[illegible]~~ as well as occupational exposure would ~~[illegible]~~ be larger.

WPO.

Displacement System

1. Introduction

The displacement system involves drawing off the reactor building atmosphere into suitable pressurized storage containers so that the entire building atmosphere, including Kr-85, remains in pressurized storage for approximately 100 years. The total volume to be stored would be 2 million cubic feet, as opposed to the 23 million cubic foot figure for the Nureg 0662 reports gas compression system. This would lower the Kr-85 concentration in the reactor building to well below the 1 x 10^{-5} μCi/cc maximum permissible concentration.

2. System Description and Operation

In this system the gaseous contents of the reactor building would be removed and piped to pressure tanks for long term storage. These pressure tanks or "bottles" would then be stored in a pressure pod. The reduced overall volume of this system would render storage of the compressed building atmospere extremely simple.

The biggest advantage of this system is the low quantity of gases to be stored, which would be approximately 1 building volume, as opposed to the proposed 11.5 building volumes of the Nureg 0662 gas compression system. The systems equipment would consist of one dual-stage gas compressor, pressure tanks and related pods, and all pertinent piping, valves and monitoring devices. The required number of containers would be approximately 1,600. (It should be noted that the 1.54 cubic foot containers recommended in the Nureg 0662 report are almost the smallest size that is commercially available: i.e. the size used for propane for a backyard barbecue grill.)

The pipe storage complex mentioned as a storage mode in the Nureg 0662 would be impractical (i.e. 28 miles of 36-inch diameter pipe) and unsafe (i.e. a few large volume containers of gas).

Note: the Nureg report gives virtually no information on the actual handling and transfer of the containment building gases. It deals almost solely with a highly questionable storage system.

The displacement system would pump out the contaminated air from the building at the same time that fresh air is introduced into a series of air bags or "balloons" (which are commercially available) which have been previously introduced, in a deflated condition, into the interior of the containment building. This totally and effectively eliminates the need for a feed-and-bleed type operation. (which is dilutory in principle) The extracted gases are then compressed to a liquid

state (being more stable than a gaseous state and less susceptible to volumetric changes due to temperature fluctuations), and introduced into pressure tanks of approximately 5.0 cubic feet volume. These tanks, when filled, would then be transferred to a pressure "pod", which would house 20 or more tanks. This pod would be able to withstand the pressure of several tanks should some of them leak during the storage period. The pods would also suffice as an outdoor storage unit until such time as a structure could be built to house them.

All of the individual components of the displacement system are commercially available.

3. Occupational Exposure

No significant amount of additional radiation exposure should be incurred by plant personnel during the proposed displacement system operation. All system components are simple in operation and, therefore, would present very minimal chance of operator error.

Surveillance of the pod-type storage system, during storage, would be minimal and could be easily and inexpensively left to an automated, electronic monitoring system. Maintenance would be considerably less than for any of the four proposed Nureg 0662 systems.

4. Environmental Impact

The entire contaminated building atmosphere, including Kr-85, could be removed from the Unit 2 reactor containment building, and transferred to storage, with little or no release to the environment.

5. Summary

A release of gas from the displacemtn systems storage mode, for whatever reason, would be significantly lower in volume and radioactive intensity than any of the four Nureg 0662 storage systems.

The time required to make the gas displacement system operational would be from 4 to 6 weeks, depending on logistical factors. Total time span for the actual atmosphere evacuation procedure would be 1 to 2 weeks.

Any further details, etc. can be obtained by contacting:

Thomas L. Berry
BEL Manufacturing Company
P.O. Box 6255
Linglestown, PA 17112
or call (717) 652-5076 evenings

HRA

April 30, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder

I have, as requested, reviewed NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere." Based on this information, and on remarks by Dr. Denton at a recent meeting here in Harrisburg, the following comments:

1. Early access to the reactor building in order to maintain instrumentation and equipment is critical.
2. Purging of the reactor building atmosphere to the environment (venting) represents the fastest method of gaining access to the reactor building.
3. Given 1 and 2, the fastest system of venting consistent with safety standards should be undertaken.

Thank you for the opportunity to review the material and to comment.

Cordially

Louis G. Milan

Louis G. Milan
Executive Director

LGM/bjh

cc: Ed First

HARRISBURG REDEVELOPMENT AUTHORITY
121 NORTH FRONT STREET / P. O. BOX 2157 HARRISBURG, PENNSYLVANIA 17105 TELEPHONE 717-238-9601

April 30, 1980*

Daniel W. Book
H.A.C.C.
3300 Cameron St. Rd.
Harrisburg, Pa. 17110

Hon. John F. Ahearne
Chairman
Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20555

Dear Chairman Ahearne:

I am writing on behalf of the proposal stated in a letter sent to you by Congressman Allen Ertel dated April 21, 1980. His endorsement of the use of the Selective Absorbtion System should be seriously considered as an alternative to venting of KR-85 into our atmosphere.

As a resident of the Harrisburg area, I have, since the accident at TMI, observed many negative results and influences being manifested in the attitudes of people I work and live with. There has been an increase in the level of anxiety, insecurity and mistrust of authority in general. These feelings are difficult to define and impossible to measure in a reliable way, but to a casual observer, are readily apparent. The residents of this area feel they have been lied to, conned and cheated out of their fundamental rights as democratic citizens. These negative feelings, serving to aggravate doubts and anxieties already present throughout American culture, have pervaded the every-day thoughts, actions and attitudes of those here in the Central Pennsylvania area.

A decision to use the Selective Absorbtion System instead of atmospheric venting to deal with the KR-85 problem at TMI would certainly help to reinstate confidence and faith in the NRC and in governmental authority in general. Thank you for your consideration.

Sincerely,
Daniel W. Book

David S. Messner
2719 North Second Street
Harrisburg, Pennsylvania 17110

April 30, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Thank you for the opportunity to comment on NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere," which arrived on Monday, April 28, 1980.

Over the past two evenings, I read every detail of the report and addenda. Especially in view of the verbal abuse and threats of violence to which your staff has been subjected by cynical agitators and emotionally unstable people, the report is a model of objective and satisfactorily detailed analysis.

I am in complete agreement with your recommendation that the venting/purging be undertaken before arrival of summer meteorological conditions to facilitate optimal diffusion. Although I regret the all too obvious importance of accomodating the recent bellicose expression of what I assume to be the long-term anxiety or hysteria neuroses of a small group in this area, I must also agree with your recommendation that the building purge system be used in conjunction with the hydrogen control system.

However, if the latter is the option selected, I hope for the good of the Commission and for the industry as a whole, that a paid public relations campaign will be undertaken to detail the steps which you have taken to facilitate public expression and respond to public concern. I suspect that there are legitimately disinterested business groups which would consider assisting in the organization and funding of such a campaign. Unless I am advised of a likelihood of a seriously counterproductive outcome from such an effort by disinterested individuals, I may discuss the idea with acquaintances in Pennsylvania.

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By way of certification of my own disinterested status, I am a regional economic development planner employed by the Commonwealth of Pennsylvania, and I have no financial investments in any utility or manufacturer of utility equipment.

Why am I concerned? As a regional development planner, I know all too well that Pennsylvania (and West Virginia) are the heart of the Mid-Atlantic region which is victimized worse than any other region in the country by declining business investment and chronically cyclical unemployment. Grossly inadequate rail freight service is an identifiable problem in retaining current business investment and attracting new investment. Complicating the matter is the fact that EPA has declared almost all of our metropolitan air basins as "non-attainment" air quality regions. In this situation, rail electrification powered by environmentally clean nuclear power is an impressively specific solution to several of our problems. That option becomes the more attractive when the lead-time for financially and environmentally viable coal syn-fuel development is considered on the one hand, with a projected growth in the use of personal and light commercial electric vehicles recharging and eroding present off-peak load capacity margins by the end of the decade on the other hand.

Given the increasing economic disincentives for oil-fired boilers, limited supplies of natural gas, vastly increased radioactive emissions from coal combustion (compared to nuclear), the CO_2 and acid rain problems from coal, early (but not yet conclusive) indications of heavy metal stormwater run-off and radon 222 emissions from costly and inefficient solar panels, nuclear generation of electricity looks better to me every day.

However, in view of limited uranium supplies and the costs in terms of human health and environmental damage from uranium mining, I would very much like to see an active program of breeder reactor development which would roughly synchronize their plutonium output with fuel needs of light-water reactors. Obviously, if such a program could be developed, our present logistical problems with waste disposal would be minimized significantly.

By this point, I'm sure you have realized that I favor a prompt reactivation of TMI Unit 1 and, pending the discovery of any feasibility contra-indications during clean-up, the restoration of Unit 2 to service at the earliest possible date.

In my view, the regulatory fate and consequent financial future of GPU and Med Ed are critically important issues for Pennsylvania's future. What we plainly cannot sustain without unconscionable economic damage is a regulatory climate at either state or federal levels which discourages utility capital investment and modernization, thereby raising serious questions about our near and moderate term capability to provide adequate electric power for industry's needs at reasonably competitive rates.

I know all too well that vociferous members of single-issue groups will understand none of this unless or until their own employment is affected. Simple-mindedness nourished by determined rage is a formidable incapacity to overcome. Yet, in view of the far-reaching consequences of decisions on TMI, the opinions of *les enfants terrible*, in my opinion, should be the last factors to be considered except where political considerations must be taken into account.

The opinions expressed in this letter are altogether my own in the sense that they do not constitute any policy or opinion of any agency in Pennsylvania State Government. At the May meeting of the Harrisburg Redevelopment Authority, however, I will urge the Board to support the krypton venting of Unit 2 through enactment of a resolution.

Very truly yours,

David S. Messner

David S. Messner, Chairman
Harrisburg Redevelopment Authority

THE WHITAKER FOUNDATION
875 POPLAR CHURCH ROAD
CAMP HILL, PENNSYLVANIA 17011

Mary 1, 1980

Dr. Bernard J. Snyder
Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

This is in response to your letter of April 21, 1980 with which you sent me copies of the NRC Staff Report entitled "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" and its two addenda. I have attended two meetings in the Harrisburg area in which the subject was thoroughly reviewed for two groups having business interests. As to my own qualifications to comment on the purging of the krypton-85, I should point out that prior to my retirement, and until quite recently, I was a licensed professional mechanical engineer in the Commonwealth of Pennsylvania. My business career spanned almost 43 years in the gas utility business. I am thoroughly conversant with safe purging procedures, though, of course, have little knowledge of the special problems involved with radioactive substances.

My point in writing is to urge prompt action to implement the reactor building purge alternative described in paragraph 6.1 on page 6-1 of your Draft NRC Staff Report. It appears to me far and away to be the safest and most expeditious method of gaining access to the building so that Unit 2 can be cleaned up as quickly as possible. I am convinced the long time delays, risks, and complexities attendant on the other alternatives present far more hazard to the public and workers than are involved with the recommended procedure. From your addendum No. 2 it would appear that it is too late in the spring to do the purging in a short time by taking advantage of atmospheric conditions in the high-volume purge described. It is obvious, however, that in instituting the first alternative, estimated to require 60 days at the proposed venting rates, advantage can be taken of favorable wind velocities to reduce the overall time required to vent the krypton-85 and make the containment building safe for worker entry.

Dr. Bernard J. Snyder - 2 - May 1, 1980

The very complete set-up for monitoring by the several agencies involved, one of which includes local citizenry, should certainly give very prompt indications if, during such periods of more rapid venting, radiation appears to be approaching the safe limits established for the first alternative procedure.

Thank you for the opportunity to review the staff report and to give you my comments.

Sincerely,

Leonard B. Richards
Executive Director

LBR/w

Robert C. Robert R.
SIDMAN & SIDMAN
Consultants
3115 Susquehanna St., Harrisburg, PA 17110
(717) 232-5556

May 1, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S, Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Snyder,

Thank you for asking me to comment on the NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere." I have read your staff's draft report and addenda with great interest.

Unfortunately, I do not feel qualified to comment on the technical aspects of the report.

However, I am disturbed by one of its non-technical aspects; this is the staff's evident determination to avoid preparing "a separate Environmental Impact Statement" on purging the reactor Building atmosphere through the hydrogen control system. (1-4)

Having participated in both the preparation and consideration of many EISs over the past twenty years, I am well aware of the great effort, and the cost in both time and money, that such a statement would require. Your staff has both my understanding and sympathy in this matter. Nevertheless, an EIS is essential, particularly in view of the great unease that a large segment of the population feels in this matter. There have been too many empirical decisions taken regarding TMI.

If the staff proposals are appropriate, the public should be informed as to their merit. What better way than through submitting an EIS, and letting public hearings develop the support you need?

Sincerely,

Robert C. Sidman

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SE
1/1

HARRISBURG HOSPITAL
SOUTH FRONT STREET
HARRISBURG, PA. 17101

SECTION OF NUCLEAR MEDICINE
DEPARTMENT OF RADIOLOGY
Phone (717) 782-5390

George L. Jackson, M.D., Director — 782-5394
Fred W. Flickinger, M.D.

H.F. Bronfman, M.D.
J.S. Burkle, M.D.
D.R. Buxton, M.D.
J.H. Croteau, M.D.
H.E. Fink, Jr., M.D.
F.J. Gallia, M.D.
B.B. Giulian, M.D.
R.P. Stewart, M.D.
G.J. Triano, M.D.

May 1, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Snyder:

Thank you sincerely for forwarding NUREG-0662 and the two addenda for my comment. I am most appreciative of your thoughtfulness.

On the basis of my review of these documents, my interest in the subject of radioactivity and the peaceful applications of atomic energy and attendance at several meetings pertaining to the subject, I personally endorse the proposal to decontaminate TMI Unit 2 Reactor Building Atmosphere by the venting of krypton-85. I would also favor the shorter total elapsed purged time of five days as compared with sixty days.

As you may or may not know, I have written to numerous government officials citing my observations of patients' reactions and expressing my personal concern for the increasing level of anxiety which is evident among the patients I am privileged to serve. If this is a fair representation of the general population response (and I believe it is), then every effort to reduce this anxiety is appropriate. As I have written on other occasions, I am convinced that physicians generally and particularly those knowledgable about radioactivity (Nuclear Medicine or Radiologists) can be a useful resource (if wisely used) to assist in defusing the anxiety referenced above. Forwarding this useful document could be one step in that process. I would hope that wide distribution of this document (NUREG-0662 and addenda) was accomplished.

Finally, and possibly you would have no direct concern with this problem, I believe that a second positive step in relieving the anxiety in our populous (and also a prudent preventive medicine and public health consideration) is the prompt development of a responsible evacuation plan for hospitals. In considering this, we must recognize that the most recent hospital evacuation (in Toronto, Canada) was required by virtue of a railroad accident with the release of toxic chemicals. There is an enormous problem in the evacuation

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of patients on life-support systems. This was dramatically called to our attention from March 28 to April 7, 1979. On April 2, 1979, there were several hundred patients on life-support systems in the hospitals in the immediate vicinity of Three Mile Island. The problems of addressing the appropriate evacuation and disposition of these patients has NOT been addressed. I am confident that one of the contributing factors to the anxiety in the Central Pennsylvania population is the recognition by many of the intelligent people in this area of the inadequacies of this evacuation plan. If we were able to tell them that a method to evacuate people with special requirements in the event that krypton purging did not proceed as we anticipate (a most unlikely possibility), I believe we would have taken a positive step in relieving anxiety.

In any event, I have spoken too much. Thank you for sharing this information with me. If any of my comments strike harmonious cord, I would be happy to develop them further in discussions with you.

Sincerely,

George L. Jackson, M.D.

GLJ:caw

8005080397

Capital Blue Cross

Richard D. Rife
President

100 Pine Street
Harrisburg, Pa. 17101
(717) 255-6001

May 1, 1980

Mr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Snyder:

While I in no way purport to have any knowledge of nuclear power plants and in particular the problems related to returning TMI Unit 2 to a safe condition, I do believe it is important that task be accomplished as expeditiously as is safely possible.

There are few, if any, subjects or activities in which people become involved where there is not divergence of opinion even among so called experts. In this instance, from my limited knowlege, I believe sufficient study has been made and expert judgment expressed that the recommendations set forth in the report, NUREG-0662, you recently forwarded should be carried out as soon as possible. I am assuming the passage of time as the report indicates does increase the potential hazard and certainly the psychological effect on the population of the area will not be substantially lessened until it can be said TMI is back in a safe condition.

My personal view is that the krypton gas should be vented into the atmosphere and further decontamination moved forward expeditiously.

Sincerely,

Richard D. Rife

Richard D. Rife

vh

Agent for Pennsylvania Blue Shield

RITE AID Corporation

ALEX GRASS,
CHAIRMAN OF THE BOARD
PRESIDENT

• MAILING ADDRESS:
P.O. BOX 3165
HARRISBURG, PA 17105
• GENERAL OFFICE:
RAILROAD AVE. & TRINDLE RD.
SHIREMANSTOWN PA 17011
• (717) 761-2633

May 1, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Recently you requested my comments in regard to removal of Krypton-85 from the Unit 2 Reactor at Three Mile Island. I favor purge of the Krypton at the earliest possible date and lowest cost, consistent with a reasonable degree of saftety.

Judging from information contained in your publication NUREG-0662 and addenda, decontamination through use of the reactor building purge system in conjunction with the hydrogen control subsystem offers the best alternative.

Not only does this method have the advantages of the lowest cost and fastest decontamination, using known technology, but it appears to be the only alternative that eliminates the possibility of future uncontrolled releases of Kr-85.

I believe that the purge period should be initiated as soon as possible. Thank you for the opportunity to comment about this most important matter.

Cordially yours,

RITE AID CORPORATION

Alex Grass

AG:lc

8005070530
H

CENTRAL

CENTRAL STORAGE AND TRANSFER COMPANY OF HARRISBURG
POST OFFICE BOX 2821
HARRISBURG, PA. 17105

JOHN F. VOYSTOCK, JR.
EXECUTIVE VICE PRESIDENT

May 2, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

I have reviewed the NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662), and the two addenda. It is my recommendation that Unit 2 at Three Mile Island be purged of the krypton with the least practicable delay, utilizing the built-in reactor building purging system.

It is realized that this will cause a certain amount of psychological stress. However, it is my opinion that by using one of the other systems, all of which represent considerable delay, we will only be prolonging the agony -- so to speak.

My recommendation is based on the NRC staff supervising the purging and every consideration be given to maximum safety, atmospheric conditions at the time, etc.

Thank you for the opportunity to comment.

Sincerely,

John F. Voystock, Jr.
John F. Voystock, Jr.
Executive Vice President

JFV/kir

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SE
1/0

PITTSBURGH BRANCH
P.O. Box 87, Route 8
Bakerstown, Pa. 15007
Phone (412) 486-0510
(412) 443-7271

SHAULL'S

PHILIPSBURG BRANCH
Route 53
Chester Hill, Pa. 16866
Phone (814) 342-3242

SHAULL EQUIPMENT & SUPPLY COMPANY
P.O. BOX 95, LEMOYNE, PENNSYLVANIA 17043 PHONE HARRISBURG (717) 737-6731

May 5, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Snyder:

After reading your material concerning the Environmental Assessment for Decontamination of Unit 2, at Three Mile Island, I feel that the reactor building purge system in conjunction with the Hydrogen Control Subsystem would be the best method.

The other systems mentioned take entirely too long, are too expensive and offer a greater danger for radiation than the building purge system.

We have already wasted too much time in talking about this problem. In my opinion, the people who are working with the nuclear system from day to day should know better than anyone else the best method for removing Krypton 85.

I personnally feel there is a greater danger in doing nothing than there would be in purging the system with the Hydrogen Control subsystem. I feel the entire community will feel much better about the situation at Three Mile Island after Unit 2 has been decontaminated.

Best wishes for success in getting Three Mile Island decontaminated.

Sincerely,

SHAULL EQUIPMENT AND SUPPLY COMPANY

Les Ginanni
Les Ginanni

LG/ms

HARRISBURG & HERSHEY P.O. BOX 969 • HARRISBURG, PA. 17108 • (717) 232-4121

May 5, 1980

Mr. Harold Denton
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

On Tuesday, April 29, 1980, the Board of Directors of the Harrisburg-Hershey Area Tourist Promotion Agency adopted a resolution concerning the cleanup of Three Mile Island's Unit Number 2. Enclosed is a copy of this resolution.

With this resolution we encourage the immediate, safe cleanup of Unit 2. This will allow the tourism industry to operate at full efficiency and come out from under the "cloud" of TMI. The economic health of the Greater Harrisburg Area is dependent upon this.

Your friend in Harrisburg and Hershey,

Nancy Thayer Hoch
Manager

NTH:dll

Enclosure

HARRISBURG • HERSHEY TOURIST PROMOTION AGENCY

RESOLUTION

WHEREAS, South Central Pennsylvania experienced a traumatic nuclear accident beginning on March 28, 1979 at Three Mile Island; and

WHEREAS, the people of the area by their tenacity, strong will and hard work have avoided most of the usual upheavals and economic turmoil that follows in the aftermath of a disaster; and

WHEREAS, there could be a threat to the health of our people and the orderly growth of our area from the damaged Unit Number 2 at Three Mile Island if it is not promptly cleaned up;

NOW, THEREFORE BE IT RESOLVED, that the Harrisburg-Hershey Area Tourist Promotion Agency strongly recommends to the Governor of the Commonwealth of Pennsylvania, the Secretary of the Department of Environmental Resources, the Environmental Protection Agency, the Nuclear Regulatory Commission and all other interested parties, that Unit Number 2 and all of Three Mile Island be cleaned up without further delay; that venting of Krypton 85 be undertaken in a manner which will take the least amount of time without creating any additional danger to the health and welfare of our citizenry.

Approved by the Board of Directors of the Harrisburg-Hershey Area Tourist Promotion Agency,

Date April 29, 1980

Signature ______ President

Signature ______ Manager

May 5, 1980

The Hon. Joseph Hendrie
Commissioner
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Hendrie:

I am in favor of the venting of Krypton 85 gas from Three Mile Island Unit II. It is extremely important that this plant be cleaned up and maintained. The experts who have studied the alternatives have all said "vent it." It is only a few radical groups and individuals who seem to be causing the delays and the rest of us must suffer for it.

Except for a few radical groups, all leading scientists and nuclear experts have said that the accident at Three Mile Island did no harm to the public. Yet the undamaged reactor at the island has not been producing electricity since March 28, 1979 and we are buying all the high priced electric from other utilities. This is bankrupting Met-Ed's customers and the company cannot do anything about it and still supply us with the electric we need.

I am asking you to listen to the experts who have the knowledge and rational thoughts to know what is best for cleaning up Three Mile Island and getting it operating again. We must have electric and coal can't do it alone. Oil and gas are out of the question. Let's get TMI running so that Pennsylvania will have the electricity we need and show everyone that TMI was not a catastrophe but an industrial incident. Our country needs all the power we can get.

Why don't we have Three Mile Island operating. Unit I is ready to go but government delays keep it shut down. I want my children to have the same opportunity that I have had here in Central Pennsylvania and the only way this can happen is for them to have a good low-cost supply of electricity. The only way they can have this is to use nuclear power.

You are in the position to take a positive step and get Central Pennsylvania back to the progressive role it deserves. Let's clean up Three Mile Island and get it operating again.

Thank you for listening to my opinion.

Sincerely yours,

Cathy Fuhrman
544 Canal St.
Lebanon, Pa. 17042

Bethlehem Steel Corporation
STEELTON PLANT
STEELTON, PA 17113

R. L. SUMMERS
GENERAL MANAGER
R. F. URBAN
T. J. ROBERTSON
ASSISTANT GENERAL MANAGERS

May 6, 1980

Mr. Bernard J. Snyder
Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Snyder:

I have great concern about TMI because of the fact that our plant and my residence are both within a five mile radius.

I have attended several meetings concerning the problems discussed in your assessment and even tho I am not an expert on radiation, I have very strong feelings that the krypton gas should be vented to the atmosphere as quickly as possible. My understanding of the procedure to be followed would permit radiation limits way below those that are found in many areas of work or residence around our countryside.

I am also very anxious to see Unit I put back into service to give our area the best power situation available.

Sincerely,

R. L. Summers

R. L. Summers
General Manager

May 6, 1980

Nuclear Regulatory Commission

Washington, D. C.

Attention: Chairman

Reference: Three Mile Island Nuclear Plant

Sir,

Noting press accounts of disputed release or projected release of krypton gas from the reference plant, prompts speculation why the following scenario could perhaps be employed to solve this vexatious problem.

a) Krypton gas would be vented into a containment balloon.

b) Above (a) would be a lifting hydrogen balloon attached to (a).

c) After combined (a) and (b) had been released into the stratosphere, they could be left to drift or vented or exploded by an attached, timed device, or radio controlled device, thus causing wide and hopefully harmless dispersion of the contained gases. Dispersion could be perhaps be accomplished out over the Atlantic ocean.

Sincerely yours,

Joseph A. Schaut

Joseph A. Schaut

COPY TO: Governor Richard Thornburgh

252 St. Michael St. N.

St. Marys, Pa. 15857

APPLETON PAPERS INC.

GENERAL OFFICES: P.O. BOX 359, APPLETON, WI 54912 / 414-734-9841

Reply to:
Harrisburg Plant
2850 Appleton Street
Camp Hill, PA 17011
717-761-6250

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HARRISBURG, PA
PORTAGE, WI
ROARING SPRING, PA

May 6, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Snyder:

This letter is in response to your request for comments regarding NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662), and two addenda.

It is my opinion (which agrees with the recommendations of the Nuclear Regulatory Commission staff) that the reactor building purge method of venting the K-85 gas is the best method for accomplishing the decontamination objective.

I could not find anything in these reports which indicated at what radiation level it would be possible for work to be performed around the reactor. Apparently, a total purging of the containment building is not necessary for entry to be made into this area. The fact that work could be safely carried out before complete decontamination would likely alter the completion dates on some of the other methods being considered. You might like to comment on this point in your final report.

I hope these comments are of some value to you.

Sincerely,

Floyd L. Strelow

Floyd L. Strelow
Plant Manager
Harrisburg Plant

pac

8005090442

H

May 6, 1980

4327 Alconbury Lane #3
Houston, Tex. 77021
(713) 741-4437

TMI Support Staff (or Responsible Officials)
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington D. C. 20555

Re: COMMENT ON NUREG-0662, "ENVIRONMENTAL ASSESSMENT FOR DECONTAMINATION OF THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING ATMOSPHERE.

To whom it may concern:

This "Draft Report" does not consider the feasibility of using plans #2 through #5 with plan #1 (Reactor Building Purge) as a standby.

In regard to such plans, it appears the Staff does not weigh heavily the importance of the fact many members of the public simply do not accept the idea that the releases are harmless. With that in mind, it is important that <u>any</u> of the alternatives except "Reactor Building Purge" be <u>started</u>. One has the feeling the public is asserting it does not want any more burden regardless of the dose of radioactivity.

In that situation for a government agency to make the choice and have General Public Utilities proceed with the "Reactor Building Purge" makes it in opposition to the people it "serves". It makes no difference if you can prove there will be no "harm" to the public by doing the building purge. The result can only be further animosity for the NRC and the utility.

Therefore, the "Reactor Building Purge" shouldn't be a plan, but rather the back-up to any other plan among the four listed from page 6-9 to 6-38 of the document.

I believe NUREG-0662 might expand on the options and problems involved if the last monitoring is lost between the TMI-2 reactor and the control room. Would it mean an effort would have to be made <u>at once</u> to enter the building?

But, going back to my original point. Since no preparation is needed to perform the "Reactor Buidling Purge" it is superior to make a try at another arrangement in order to avoid doing some action the public is clearly opposed to.

Sincerely,
John F. Doherty
John F. Doherty

DO19
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Pennsylvania's Capital City • The Heart of Distribution

Chamber of Commerce - Greater Harrisburg Area 114 WALNUT STREET, HARRISBURG, PA. 17101
232-4121

May 7, 1980

Mr. Harold Denton
Director
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Denton,

The Board of Directors of the Chamber of Commerce of the Greater Harrisburg Area has adopted the following resolution concerning Three Mile Island.

RESOLUTION

"WHEREAS, South Central Pennsylvania experienced a traumatic nuclear accident beginning on March 28, 1979 at Three Mile Island; and

WHEREAS, the people of the area by their tenacity, strong will and hard work have avoided most of the usual upheavals and economic turmoil that follows in the aftermath of a disaster; and

WHEREAS, there is a continuing threat to the health of our people and the orderly growth of our area from the damaged Unit Number 2 at Three Mile Island;

NOW, THEREFORE BE IT RESOLVED, that the Chamber of Commerce of the Greater Harrisburg Area strongly recommends to the Governor of the Commonwealth of Pennsylvania, the Secretary of the Department of Environmental Resources, the Environmental Protection Agency, the Nuclear Regulatory Commission and all other interested parties, that Unit Number 2 and all of Three Mile Island be cleaned up without further delay; that venting of Krypton 85 be undertaken in a manner which will take the least amount of time without creating any additional danger to the health and welfare of our citizenry."

We strongly urge your consideration of this position in your deliberations of the clean up. Needless to say, our concern is real and represents a very large segment of the Greater Harrisburg Area.

Sincerely,
Matthew M. Douglas, Jr.
Matthew M. Douglas, Jr.
President

MMD/kbk

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOTE TO: Files

FROM: William Travers, Technical Assistant
TMI Program Office, NRR

SUBJECT: STATEMENT OF (TOM COCHRAN) NRDC RE: TMI-2 CONTAINMENT ATMOSPHERIC CLEANUP - MADE VIA PHONE AT 3:00 P.M. May 7, 1980

"Provided that the amount of radioactive materials to be vented are what they are reported to be (for example in NUREG-0662) and provided that the venting procedures are appropriately conducted then the public health risks (somatic and genetic consequences), associated with venting the TMI-2 containment, are not significant, that is sufficient to warrant exclusion of this option."

Mr. Cochran has given his oral permission to use this statement of NRDC position as appropriate.

William Travers, Technical Assistant
TMI Program Office, NRR

cc: W. Oliu
B. Snyder

THE PENNSYLVANIA STATE UNIVERSITY
THE CAPITOL CAMPUS
MIDDLETOWN, PENNSYLVANIA 17057
May 7, 1980

Office of the Provost (717) 783-6100

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Dr. Snyder:

Thank you for your letter of April 21 regarding the Commission's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" and addenda. The documents clearly present the need for action and the various alternatives for decontamination. The report also makes a compelling case for the Reactor Building Purge Method.

Nevertheless, I hope that serious consideration will be given to the more complex and costly options, including the novel selective absorption system. Although I recognize the risks of long-term storage and surveillance of Kr-85, I believe the risks of release, both perceived and real, are serious. I further believe the resources of the federal government should be applied to this problem so that the final decision is not influenced by the licensee's financial considerations.

I appreciate this opportunity to comment on the staff report and would be happy to discuss my response if you wish.

Sincerely,

Theodore L. Gross
Theodore L. Gross
Provost and Dean

TLG:ame

8005150402

HARRISBURG AND CENTRAL PENNSYLVANIA BUILDING AND CONSTRUCTION TRADES COUNCIL

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DR. BERNARD J. SNYDER, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

May 8, 1980

Dear Dr. Snyder:

I have given a considerable amount of time for a possible solution as to the removing of Krypton 85 from Unit #2, Three Mile Island. I find that most of the discussed processes will (1) take an extensive period of time for preparation, (2) create a storage problem and (3) only move the K-85 from one location to another. This latter consideration is one that causes me most concern.

Removal of Kr-85 from the containment building to be placed in any of the other containment areas merely moves the problem from one space to another but does not eliminate the problem. To me, this appears to be completely incongruous.

I feel that the process making the most sense is to combine the Reactor Building Purge System and the Hydrogen Control System in a slow, monitored, venting process. This procedure would eliminate the immediate problem without creating a new problem.

I believe a lot of attention has been paid to public concern, etc., but not much concern has been expressed relative to the men and women who face the inevitable -- that is, to enter Unit #2 and assess the damage in order to determine (1) is Unit #2 Reactor in a repairable condition and (2) should decommission be started.

(Continued)

In either situation someone MUST go inside Unit #2, T.M.I., to make one of the aforementioned decisions. Many of these workers are on TMI today, preparing for this most difficult task that has been delayed for far too long.

The problem is not going to disappear of itself but it must be dealt with in a calm and rational manner. The work force are also under considerable strain because of the many delays that have already taken place.

At present, we have the skilled personnel to perform these necessary tasks but I wonder how long their patience will hold out before they move to other employment, thus taking with them their valued skill and knowledge of Unit #2.

I think it is time for us to stand up and be counted and take decisive action on a problem that begs a solution

I hope my brief statement will will add to the many voices already calling for the venting of Krypton 85 in Unit #2, T.M.I. and that we will get on with the rest of the energy program so this country will become less dependent on foreign oil.

Sincerely yours,

Henry T. Doherty

HENRY T. DOHERTY, JR.
Business Manager

AREA CODE 717
944-4831

BOROUGH OF ROYALTON

Burd and Dock Streets
Royalton - Middletown, Pennsylvania 17057

May 8, 1980

Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen,

We are enclosing a copy of a Resolution, adopted by the Royalton Borough Council at their May 6, 1980 meeting.

Sincerely,

ROYALTON BOROUGH COUNCIL

ENC:

AREA CODE 717
944-4831

BOROUGH OF ROYALTON

Burd and Dock Streets
Royalton - Middletown, Pennsylvania 17057

RESOLUTION OF MAY 6, 1980

BE IT RESOLVED:

It is in the public interest to provide for the Health and Welfare of the people of the Borough of Royalton by cleaning up TMI as soon as possible. The Nuclear Regulatory Commission and the Environmental Protection Agency Staffs have determined that it is safe and proper to vent the Krypton 85 gas to expedite the clean-up process and restore some sense of tranquility to this community; and

BE IT FURTHER RESOLVED that the Government should exert the necessary leadership to accomplish venting of the Krypton 85 gas.

RESOLVED this 6th day of May, 1980.

CERTIFICATE

I, the undersigned, secretary of the Borough of Royalton, certify that the foregoing is a copy of a Resolution duly adopted by the majority vote of the entire Borough Council at its meeting duly convened and held on May 6, 1980; that the Resolution has been duly recorded in the minutes of the Borough Council; and that the Resolution remains in full force and effect, unaltered and unamended, as of the date of this certification.

In witness whereof, I affix my hand and the official seal of the Borough of Royalton this 7th day of May, 1980

(SEAL)

Bonita J. Young

Bonita J. Young, Secretary

Treadway Resort Inn

Executive Offices

May 9, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Snyder:

Thank you for the opportunity to review the NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere".

Admittedly, the information makes the removal of the KR-85 gas via the reactor building purge system in conjunction with the hydrogen control system an attractive alternative based on the sheer time lapse as being immediate.

However, I am totally concerned over the release of this gas into our environment, and am quite opposed to it.

Information released by Metropolitan Edison Co. during the Three Mile Island incident, and following, has not always been accurate, and with reservation as to the honesty.

The selective absorbtion process appears to me the most acceptable alternative. Although an estimated two years involvement for design, perfection, and implimentation of the process, it appears to possess less exposure for the local communities, no transportation difficulty, and some storage problem. But for the overall effect of safety on a day to day basis, I would select this process.

Sincerely,

Michael J. Sabatello, Jr.
General Manager

MJS:grw

222 Eden Road, Lancaster, Pennsylvania 17601 Phone (717) 569-6444

BERGER ASSOCIATES, INC.
101 ERFORD ROAD
CAMP HILL, PENNSYLVANIA 17011
TELEPHONE 717-763-7391

RALPH E. PETERS
PRESIDENT

May 12, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Please forgive the delay in responding to your urgent letter of April 21, 1980 but I have been in Central America on business and returned yesterday.

I have carefully read with extreme interest NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662), and two addenda.

I wholeheartedly concur with the final recommendation of the NRC staff that we should proceed immediately to remove the krypton from the reactor building. I volunteer my services, as a local civic leader, to work with you to help educate and inform the public that because of atmospheric conditions, etc., we should proceed to remove the krypton from the reactor building as soon as possible.

Thank you for your thoughtfulness in forwarding a copy of the report and for soliciting my opinion on this controversial and complicated subject.

Sincerely,

Ralph Peters

AIR and WATER
Pollution Patrol
BROAD AXE, PA.

May 12, 1980

REPLY TO:

61 Forest Avenue
Ambler, Pa. 19002

Harold K. Denton
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington D.C. 20555

Attn: Dr. Harold K. Denton

Gentlemen:

On April 23, 1980, radioactive krypton 85 gas was scheduled for venting from the crippled Unit 2 nuclear reactor at Three Mile Island, Middletown, eight miles from Harrisburg, Pennsylvania.

The release, over the strong objections of the people of the area, together with all who oppose the threat from nuclear reactors, was to enable workmen to enter a compartment from which they might see the damage inside the containment building.

Irrespective of the small amount of krypton that the NRC claims would be involved, the lethal krypton was to be released within one mile of the Middletown Airport and approximately five miles from the Harrisburg International Airport. Both airports are served by passenger jets daily.

As a licensed pilot, on April 23, 1980, I filed a flight plan leaving Turner Airport near Philadelphia at 1:00 p.m. (1300) flying to Harrisburg via Lancaster, passing over Middletown to Harrisburg International Airport. Middletown was filed as the alternate airport.

The evening before; the morning of, and at 1:00 p.m. on April 23, at take-off, I asked the Philadelphia Flight Service Station for weather information, and specifically whether or not there were any notams connected with my filed flight plan. At each time, I was told there were no notams for the Lancaster, Middletown, Harrisburg flight route filed.

At approximately 1:30 p.m., in flight, I contacted Philadelphia Flight Service to modify my flight plan because resultant airspeed, due to winds coming from the general Middletown direction, made progress less than anticipated, thus necessitating request to close my flight plan one hour later than filed. It was approved.

I flew south of Lancaster, in contact with Lancaster Approach Control, and then up the Susquehanna, at which time Lancaster Tower gave me, at my request, the Middletown Airport Tower frequency. I decided to land at Middletown instead of Harrisburg because of delay caused by the wind. Middletown cleared me to land on runway 31...with no instructions involving the Three Mile Island reactor.

AIR and WATER
Pollution Patrol
BROAD AXE, PA.

On the base leg for runway 31, I had to practically fly over the Three Mile Island cooling towers at approximately 1400 feet, since runway 31 is almost lined up with the cooling towers, not much more than a mile or so away. After landing (approximately 1:45 to 2:00 p.m.), passenger jets (U.S. Airways) came in and took off. After some time, I purchased a New York Sectional map at the Minute Man Flight Office on the Middletown field. I contacted ground control, then the tower, and was cleared for take-off.

After stopping at Hershey airport, I returned to Turner at approximately 4:30 p.m. and contacted Flight Service to close my flight plan as required.

I had made the flight specifically to determine whether or not flyers and passengers would be advised prior to entering the Three Mile Island area, to notify them of the danger of lethal krypton, irrespective of amount, which would be present at the glide slope for airplanes landing on runway 31 that day. After all, dilution of the krypton requires time and dispersal, so that the gas would be lethal because less diluted in the airspace over the reactor area, and areas surrounding the Middletown Airport.

The fact that there were no notams is irresponsible and such negligence suggests a pattern of withholding danger aspects of radioactivity from nuclear reactors by government agencies, in particular the NRC.

It must be determined also if the Federal Aviation Authority, which has permitted reactors to be built close to VOR's is also involved in not alerting Flight Service Stations to protect those whose filed flight plans place them in the air space where lethal radioactive concentrations are being released.

All pilots, and in particular, pilot organizations like AOPA, should protest this open disregard for safety of pilots and passengers. I ask the NRC, and the FAA to investigate this breach of their stated prime responsibility to protect the public and, in particular, I ask a prompt answer indicating proper action to correct this dangerous situation is taken immediately. Proper action would require total prevention of release of lethal radiation into the airspace. Other action would require cessation of flights in upward of 250 to 25,000 cubic miles of air, depending on wind and amount of radioactive gas released. This, of course, would be an unacceptable denial of the freedom of movement and infringement of rights of pilots and the aviation industry.

The notice of release for that day, irrespective of amount, should have been made to all immediate areas of Three Mile Island including the Middletown and the Harrisburg airport. If and when other releases, large or small, are to be made, notification by NRC and FAA must be mandatory.

Very truly yours,
AIR & WATER POLLUTION PATROL

Frank R. Romano, Chairman

FRR/cap

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
ENGINEERS AND PLANNERS

P. O. BOX 1963
HARRISBURG, PENNSYLVANIA 17105
PHONE 717 763-7211
—
CABLE ADDRESS: GANFLEC
TELEX 84-2375

May 13, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Thank you for forwarding me a copy of NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662) and two addenda. I have read this report and the addenda with concerned interest and find that the report only confirms the opinion I have held for some time, and that is that we should proceed with venting the krypton in the damaged unit at Three Mile Island at the earliest possible date. It is incredible to me that such an enlightened society as we have today continues to let that crippled unit lie as it is without proceeding with a clean-up. In the interest of safety for all of us, we should proceed with the first step, that is the venting of the krypton, just as quickly as meteorological conditions permit.

You may be interested to know that at a meeting of the Board of Directors of Gannett Fleming Corddry and Carpenter, Inc., held on May 9, 1980, I asked the other six members of the Board for their opinion on the venting at Three Mile Island. These men are all registered professional engineers but not nuclear engineers. They have, of course, followed the problems at Three Mile Island since the accident. They were unanimous in their opinion that the venting should proceed immediately.

Very truly yours,

John R. Dietz

JOHN R. DIETZ
Chairman of the Board

JRD:bs

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1/0

Continuous Service Since 1915

HARRISBURG HOSPITAL
SOUTH FRONT STREET
HARRISBURG, PA. 17101

May 13, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

This is in response to your letter of April 21 asking for my comments on NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere".

While we have a concern about the potential long-term adverse effects on the health of the population surrounding Three Mile Island, we believe that the krypton gas should be vented into the atmosphere on a controlled basis and that decontamination of the Unit 2 Reactor proceed in an expeditious manner. We also believe that because of the anxiety of a portion of the population about the release of the krypton gas into the atmosphere, there should be sufficient advance public notice so as to allow those individuals who wish to leave the Three Mile Island area to do so.

Sincerely yours,

Milton H. Appleyard

Milton H. Appleyard
President

MHA/mah

May 13, 1980

to The Nuclear Regulatory Commission

I Am writing in response to your recommendations to allow Met Ed to vent krypton-85 gas this summer.

I Am a resident of Annville, PA, not more than 12 miles from the plant. I strongly feel that the release of any more radiation, krypton, tritium, whatever would indeed be a health risk, for the people of the surrounding communities. I strongly feel that the NRC is not taking into consideration the health, as well as, the psychological affects venting will have on the residents here. Personally, i feel terrified at the prospect of knowing that some day in June when i go outside and the winds are blowing that krypton gas will be released and scattered over the fields of newly planted crops and over, in and around me. I realize you are telling people that this will have little health affects and that krypton is a Noble gas, but i do not believe the environmental assessment reports you have been releasing to the public.

I feel that you have choosen to release the krypton -

1. To clean up the plant as quickly as possible, using the least amount of Monies possible, without taking into consideration the People and our Health, Safety & Welfare.
2. I feel that you have given permission to Release the krypton to clean up the plant as quickly as possible for the Promotion of Nuclear Power - so as to show people that yes, this can be Controlled, Cleaned up without any ill affects. But wait 20 to 30 years to see the affects on all the children, the children of my Friends and Family.

two

3. I feel that the Nuclear Industry is Buying Time with the Residents of South Central Pennsylvania. Buying it as cheaply as possible, using us as a testing ground for the Nuclear Industry.

4. I feel that if Harrisburg would have been New York, Phila or San Francisco (just more labs), that the NRC would be handling this "Crippled Plant" in a far different manner. That fact that this is a rural area, the Response is far different, and you, as trusted, supposedly competent officials are taking advantage of this.

5. I feel that the absorption Method could have been - should have been Implemented many months ago - at least giving this process a chance, instead of Buying time and saying it's too late and not saying its too Expensive in your eyes.

6. I strongly feel that my Health and the Health of the Residents here will be greatly affected in years to come.

Women are affected by Radiation 50% more than men. Child bearing women and children will be subject to the affects of your Testing. I feel scared, terrified at the prospect of this Reality. Yet you continue to say, it will have no affect whatsoever.

I have been writing letters to our Senators and Congress people - and Am glad there has been some Response. Senator John Heinz wrote a letter to **Carter** inquiring about his Administration's failure to implement the Kemeny Commission recommendations and particularly concerning means for strengthening the Nuclear Regulatory Commission, as well as, ensuring the protection of the Health & Safety of the public.

Why haven't you taken more action along the lines of public safety? Instead you go along with Metropolitan Edison.

Please consider the people of Pennsylvania and the future of the children, the farmlands, and our Water. Please do not allow the Venting of Krypton -

Sincerely, Maggie McDonald

PHONE: (717) 843-3891

ESTABLISHED 1906

MANUFACTURERS' ASSOCIATION

TWENTY-FIVE NORTH DUKE STREET P. O. BOX 1668, YORK, PA. 17405

GERALD F. SNYDER, EXECUTIVE SECRETARY AND TREASURER

E. B. FROCK, PRESIDENT
A. R. MARX, VICE PRESIDENT

LEE G. LICHLITER, INDUSTRIAL RELATIONS CONSULTANT
WALTER R. HENRY, INDUSTRIAL RELATIONS DIRECTOR

May 14, 1980

Mr. Harold Denton
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Denton:

Having attended the public meeting at the Host Inn in Harrisburg, April 24, with Messrs. Clifford Jones, secretary of DER, Harold Denton, NRC and others relative to relieving the mass hysteria surrounding TMI, we want to emphasize the need to set a positive program in motion at TMI.

We are greatly concerned with the lack of progress on clean up of Unit #2.

Our Board of Directors approved the attached Resolution at our regular meeting, Monday, May 12, 1980.

Very truly yours,

G. F. Snyder
Executive Secretary

GFS/jw
Attachment

RESOLUTION RE: TMI

WHEREAS, South Central Pennsylvania (including York County) experienced a nuclear accident beginning March 28, 1979, and

WHEREAS, the area's people by their strong will and hard work have avoided the usual upheavals and economic difficulties which usually follow such disruptions, and

WHEREAS, the clean up of TMI Unit #2 is a requisite if we are to maintain the orderly growth of the area and protect the health of our people, and

WHEREAS, current delays in the clean up process have resulted from controversy over the proposed release of krypton gas in small amounts, and

WHEREAS, the NRC, DER, and the Governor's Commission Report of February 26, 1980, have all indicated that the release of such gas can be accomplished in a safe, controlled, fully monitored manner producing radiation well below normal levels experienced in everyday life,

NOW, THEREFORE BE IT RESOLVED, that the Board of Directors of the Manufacturers' Association of York, Pa., urges the Governor, the Secretary of DER, the NRC, and the EPA and other interested parties to proceed expeditiously with venting the krypton gas and proceed with the clean up so that we can avoid added threats to the health and welfare of our citizenry, which may result from extended delays in resolving a recognized problem.

Approved by the Board of Directors of the Manufacturers' Association of York, Pa., on May 12, 1980.

80 06260 494

PP&L

TWO NORTH NINTH STREET, ALLENTOWN, PA. 18101 PHONE: (215) 821-5151

May 15, 1980

Dr. Bernard J. Snyder
Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

This is in response to your letter of April 21, 1980 requesting comments on the NRC's "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662). Due to other demands on our limited resources, we are unable to perform a comprehensive evaluation of the various alternatives discussed in NUREG-0662. We are, however, of the opinion that decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere should be completed as expeditiously as possible giving due consideration to any potential risks to the public health and safety from the various alternatives available. We have no reason to believe that the Staff's recommendation to purge the reactor building atmosphere into the environment is not technically sound or environmentally acceptable.

Very truly yours,

NW Curtis

Norman W. Curtis
Vice President
Engineering & Construction

PENNSYLVANIA POWER & LIGHT COMPANY

United States Department of the Interior 8005200

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-80/229

MAY 15 1980

TMI Support Staff
Office of Nuclear Reactor
Regulation
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

The Department of the Interior has completed its review of the environmental assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere, Dauphin County, Pennsylvania. We have the following comments.

The environmental assessment does not discuss what effects the proposed release of reactor gases would have on fish and wildlife resources and their habitats. The document should determine whether or not fish and wildlife impacts are to be expected and, if expected, discuss and analyze them.

Sincerely,

James [signature]

Special Assistant to
Assistant SECRETARY

the Harrisburg Area
YOUNG MEN'S CHRISTIAN ASSOCIATION

GENERAL OFFICES
Front & North Streets
Harrisburg, Pennsylvania 17101
Telephone (717) 234-6221

May 15, 1980

Mr. Bernard J. Snyder
Program Director
Three Mile Island Program Office
Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C.20555

Dear Mr. Snyder:

I thank you for your letter of April 21st and the accompanying documentation regarding the Three Mile Island Unit II reactor situation. I appreciate also the opportunity of commenting to you as to my feelings in regard to the situation.

I have reviewed the materials that you supplied to me and as a layman, I certainly am no expert in nuclear power or, in fact, this current situation. I do, however, feel qualified to comment the feelings of people as they have been expressed to me regarding this situation. I think the general feeling is that nothing should be done to further expose the people of central Pennsylvania to this type of venting which would only add to the anxiety that peoplehave and the mistrust that our people experienced due to the rather unreliable information that we have received about this entire catastrophe. Until such time as someone can restore confidence in the minds of people in this area of Pennsylvania, I believe the entire operation should be sealed and monitored to insure no further leaks of any kind occur until a reasonable period has passed and the fears of residents who have suffered greatly during this whole event have passed. I am sure no one has an accurate reading as to the exposure people have experienced and because of that limited information and data, my recommendation is as stated. I feel confident that these remarks will mean little or nothing and that those interests who are pushing for eventual use of Three Mile Island again, will be the action that will be followed.

I do hope you or someone connected with our government will be able to restore confidence in those managing these types of nuclear projects in the years to come.

With warmest regards,

Dick Shelly

RICHARD P. SHELLY
President

RPS/bjs

May 15, 1980

The Honorable Richard L. Thornburgh
Governor of Pennsylvania
Main Capitol Building
Harrisburg, PA 17120

Dear Governor:

As you know, the Lancaster Association of Commerce & Industry has strongly endorsed an immediate cleanup of Reactor #2 at Three Mile Island.

We have encouraged the quick release of the krypton gas as a means to accomplish this task. From the announcement on Wednesday, there does not appear to be any significant new information in the Union of Concerned Scientists' report to cause LACI to alter our position.

Therefore, we encourage you to make the decision to release the gas as soon as possible in the manner suggested by the NRC staff. I know that the majority of our city and county officials have already endorsed this position.

Considering stress, the possible failure of equipment and an uncontrolled release of gas, LACI cannot see the benefit of any further delay in making a decision to vent the gas.

We are anxiously awaiting your position on this announcement.

Very sincerely,

Richard E. Blouse, Jr.
President

REB/tth

Harrisburg Dairies

20TH & HERR STREETS • HARRISBURG, PENNA., 17105
PHONE: 233-8701

May 16, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

Your communication dated April 21, 1980, reached my desk on May 12, and I am responding promptly since any action taken to decontaminate TMI Unit #2 Reactor Building will adversely affect our firm's operations.

In regard to the alternative proposals for the decontamination process, we have carefully reviewed the information provided and have reached the conclusion that the preferred method would be the "Reactor Building Purge System" used in conjunction with the hydrogen control subsystem. Our reasons for the conclusion are as follows:

1. Immediate availability. Our concern is that the longer the KR85 is contained in a building dependent on equipment that cannot be entered for service, the more we are exposed to future problems within the building.

2. No further uncontrolled releases. Any release, controlled or uncontrolled affects our business seriously and adversely. We are therefore anxious to take any steps that will permanently end future potential danger to our product and public questions as to its safety.

3. No storage requirements. We do not believe that we should add to our already weighty problems of contaminated storage of radioactive substances in our county.

Having stated our opinion on the alternative methods presented, we hasten to add that we have already been seriously affected by the releases from the TMI accident. We have calculated sizeable economic losses as well as erosion of public confidence in our product. Since any further releases, controlled or uncontrolled, will further affect us in an adverse manner, we feel it is encumbent on the NRC to carefully control and monitor the releases and to provide the public with assurance before, during and after the releases that no increase in radioactive levels are present in our products. This will require close cooperation between NCR, FDA and ourselves to test and report the sampling and acceptability of finished dairy products.

We wish that there were some way that no further releases of any kind were necessary. We are unalterably opposed in theory to any releases. However, as a practical matter, in order to solve this problem and its inherent potential dangers, we base our decision on its being the least undesirable of all alternatives available.

Please keep us advised of your decisions and actions in this matter.

Sincerely,

HARRISBURG DAIRIES, INC.

Fred B. Dewey
President

FBD/ad

The Chamber

YORK AREA CHAMBER OF COMMERCE

May 16, 1980

Mr. Harold Denton
UNITED STATES NUCLEAR
REGULATORY COMMISSION
Washington, D. C. 20555

Dear Mr. Denton:

The attached resolutions, plus similar ones on behalf of the York County Industrial Development Corporation and Hanover Area Chamber of Commerce, are being forwarded to you at the direction of the Boards of Directors of all five organizations.

Sincerely,

CARL F. NEU
President

Attachments

13 East Market Street • P.O. Box 1229 • York, Pennsylvania 17405 • 717 • 854 • 3814

The Chamber

YORK AREA CHAMBER OF COMMERCE

PROPOSED RESOLUTION RE: TMI

Whereas, South Central Pennsylvania (including York County) experienced a nuclear accident beginning March 28, 1979, and

Whereas, the area's people by their strong will and hard work have avoided the usual upheavals and economic difficulties which usually follow such disruptions, and

Whereas, the clean up of TMI Unit #2 is a requisite if we are to maintain the orderly growth of the area and protect the health of our people, and

Whereas, current delays in the clean up process have resulted from controversy over the proposed release of krypton gas in small amounts, and

Whereas, the NRC, DER, and the Governor's Commission Report of February 26, 1980 have all indicated that the release of such gas can be accomplished in a safe, controlled, fully monitored manner producing radiation well below normal levels experienced in everyday life,

Now, therefore be it resolved that the Board of Directors of the York Area Chamber of Commerce urges the Governor, the Secretary of DER, the NRC, and the EPA and other interested parties to proceed expeditiously with venting the krypton gas and proceed with the clean up so that we can avoid added threats to the health and welfare of our citizenry, which may result from extended delays in resolving a recognized problem.

Approved by Executive Committee on May 8, 1980

ACCREDITED

13 East Market Street • P.O. Box 1229 • York, Pennsylvania 17405 • 717 • 854 • 3814

PROPOSED RESOLUTION RE: TMI

Whereas, South Central Pennsylvania (including York County) experienced a nuclear accident beginning March 28, 1979, and

Whereas, the area's people by their strong will and hard work have avoided the usual upheavals and economic difficulties which usually follow such disruptions, and

Whereas, the clean up of TMI Unit #2 is a requisite if we are to maintain the orderly growth of the area and protect the health of our people, and

Whereas, current delays in the clean up process have resulted from controversy over the proposed release of krypton gas in small amounts, and

Whereas, the NRC, DER, and the Governor's Commission Report of February 26, 1980 have all indicated that the release of such gas can be accomplished in a safe, controlled, fully monitored manner producing radiation well below normal levels experienced in everyday life,

Now, therefore be it resolved that the Board of Directors of The Colonial York County Visitors and Tourist Bureau, Inc. urges the Governor, the Secretary of DER, the NRC, and the EPA and other interested parties to proceed expeditiously with venting the krypton gas and proceed with the clean up so that we can avoid added threats to the health and welfare of our citizenry, which may result from extended delays in resolving a recognized problem.

Approved by the Board of Directors on May 12, 1980.

MAY 15

John J. Tucker

RESOLUTION RE: TMI

WHEREAS, South Central Pennsylvania (including York County) experienced a nuclear accident beginning March 28, 1979, and

WHEREAS, the area's people by their strong will and hard work have avoided the usual upheavals and economic difficulties which usually follow such disruptions, and

WHEREAS, the clean up of TMI Unit #2 is a requisite if we are to maintain the orderly growth of the area and protect the health of our people, and

WHEREAS, current delays in the clean up process have resulted from controversy over the proposed release of krypton gas in small amounts, and

WHEREAS, the NRC, DER, and the Governor's Commission Report of February 26, 1980, have all indicated that the release of such gas can be accomplished in a safe, controlled, fully monitored manner producing radiation well below normal levels experienced in everyday life,

NOW, THEREFORE BE IT RESOLVED, that the Board of Directors of the Manufacturers' Association of York, Pa., urges the Governor, the Secretary of DER, the NRC, and the EPA and other interested parties to proceed expeditiously with venting the krypton gas and proceed with the clean up so that we can avoid added threats to the health and welfare of our citizenry, which may result from extended delays in resolving a recognized problem.

Approved by the Board of Directors of the Manufacturers' Association of York, Pa., on May 12, 1980.

May 16, 1980
Harrisburg, Pennsylvania

Dr.Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Apreciado señor Snyder:

Por obvias razones, las siguientes, he decidido hacer este pequeño reporte en español.

Primero, La seguridad y tranquilidad de nuestra comunidad seguirá siempre dependiendo de la habilidad de un limitado numero de individuos. Sinembargo, intereses ajenos, turban a veces el ambiente del que esperamos surjan siempre las mejores y más nobles opiniones e ideas.

Humilde, pero a la vez determinadamente es que he decidido escribir lo que a continuación:

Estoy en favor de que usando las medidas preventivas en sus reportes mencionadas como salvaguardas de la seguridad de los intereses de nuestra area, se de comienzo a la ventilación controlada del Kriptón-85 retenido en el edificio conteniente de Three Mile Island.

Noto que en las conclusiónes y recomendaciónes que he leido luego de habérmelas Uds. enviado, se da el suficiente énfasis a la cuestion de mayores posibilidades de accidente si usando las otras alternativas al metodo de ventilación controlada.

Por consiguiente deseo recomendar que terminantemente se prohíba el tráfico de materiales críticos que en caso de accidente puedan poner en riesgo vidas y propiedad en la vecindad de Three Mile Island. El riesgo de una posible concentración de gases táles como el Clorhídrico en el vecindario inmediato de Three Mile Island, merita en mi opinión el que las siguientes restricciónes sean puestas en vigor.

Restricción de la transportación de los anteriormente mencionados materiales críticos por carretera y por vias ferroviarias hacia:

A. El Sur desde Middletown.

B. El Oeste desde Newville.

C. El Norte desde Bainbridge.

Que tomándose en cuenta la dirección de los vientos prevalecientes al otro lado del rio, así como otros factores metereológicos y ambientales, se tomen también allí medidas preventivas.

Además creo también oportuno y apropiado, el que el cruce ferroviario que está aproximadamente a un cuarto de milla al Sur de Royalton sea eliminado cuanto antes.

Sinceramente,

Luis A. Vázquez Sr.

Luis A. Vazquez Sr. Presidente
Puertorrican Community Planning
Civic Association
1447 Vernon Street,
Harrisburg, Pennsylvania. 17104

Translation of May 16, 1980, letter

Dear Mr. Snyder:

For obvious reasons, the following, I have decided to make this report in Spanish.

First, the security and tranquility of our community will always depend on the capability of a limited number of individuals. Nevertheless, outside interests sometimes disturb the ambient from which we hope will come always the best and most logical opinions and ideas.

With humility, but at the same time with determination, I have decided to write what continues:

I am in favor that while using the preventive measures mentioned in your reports as safeguards of the security of the interests of our area, that we start the controlled release of Krypton 85 which is retained in the containment building on Three Mile Island.

I note after reading the conclusions and recommendations that you sent me that there is sufficient emphasis on the question of larger possibilities of accident if other alternatives to the method of controlled release are used.

I, therefore, wish to recommend that as soon as possible the transit of critical materials be prohibited which in case of accident could put lives and property in danger in the vicinity of Three Mile Island. The danger of of a possible concentration of gases such as the hydrochloric in the immediate vicinity of Three Mile Island merits in my opinion that the following restriction be vigorously imposed. Restriction of the transportation of the above mentioned critical materials by highway and by railroad to:

A. the South from Middletown

B. The West from Newville

C. The North from Bainbridge

Preventive measures be imposed taking into account the direction of the prevailing winds from the other side of the river as well as other meteorological factors.

Also I believe it is opportune and appropriate that the railroad crossing that is approximately one-fourth of a mile south of Royalton be eliminated as soon as possible.

Sincerely,

/S/

Luis A. Vasquez, Sr. Presidente
Puertorrican Community Planning
Civic Association
1447 Vernon Street
Harrisburg, Pennsylvania 17104

NCRP

National Council on Radiation Protection and Measurements

7910 WOODMONT AVENUE, SUITE 1016, WASHINGTON, D. C. 20014 AREA CODE (301) 657-2652

WARREN K. SINCLAIR, *President*
HYMER L. FRIEDELL, M.D., *Vice President*
W. ROGER NEY, *Executive Director*

May 16, 1980

The Honorable Richard Thornburgh
Governor of Pennsylvania
Harrisburg, Pennsylvania 17108

Dear Governor Thornburgh:

The National Council on Radiation Protection and Measurements (NCRP), in response to your request of April 30th, has examined the health and safety aspects of the venting proposals and prepared a statement, "Krypton-85 in the Atmosphere - With Specific Reference to the Public Health Significance of the Proposed Controlled Release at Three Mile Island". I am pleased to present this statement.

The statement, like most reports from the NCRP, is a scientific appraisal of the venting situation which is somewhat detailed. We draw your attention especially to the summary which highlights the principal findings of our study. In our opinion this clearly makes evident that the public health impact of venting under either of the proposed procedures is not a valid basis for concern, either to individuals who might be located close to the plant boundary or to the population throughout the entire area.

The NCRP is pleased to make this information available to you as a public service.

Yours sincerely,

Warren K. Sinclair
President

Office of the President: Argonne National Laboratory, Argonne, Illinois 60439

NCRP news

THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS

for additional information:
W. R. NEY, Executive Director
NATIONAL COUNCIL ON RADIATION PROTECTION and MEASUREMENTS
7910 WOODMONT AVENUE, SUITE 1016
WASHINGTON, D.C. 20014
AREA CODE (301) 657-2652

FOR IMMEDIATE RELEASE
May 16, 1980

KRYPTON-85 IN THE ATMOSPHERE
With Specific Reference to the Public Health
Significance of the Proposed Controlled
Release at Three Mile Island

At the request of Governor Thornburgh of Pennsylvania, the National Council on Radiation Protection and Measurements (NCRP) has examined scientific material relating to the health effects of krypton-85, updated its Report No. 44 on krypton-85 published in 1975, and estimated the doses to the public and the risks associated with them for the amounts of krypton-85 expected to be released as a result of the proposed venting at the Three Mile Island nuclear power plant. The findings are that the maximum doses likely to be received by any person are very small.

Superficial beta radiation to the skin is the primary potential health concern; however, in the total population within 50 miles no cases of skin cancer would be expected from the doses likely to be received. The risk to the maximally exposed individual member of the population at the plant boundary is estimated to be equivalent to the risk of skin cancer resulting from exposure to a few hours of sunlight, which is known to be the principal cause of skin cancer in the general population.

The dose expected from the penetrating radiation is about 100 times less than that from the superficial radiation and the risk of inducing cancer is correspondingly smaller.

The NCRP concludes that the exposures likely to be received as a result of venting are not a valid basis for concern with respect to health effects.

National Council on Radiation Protection and Measurements

KRYPTON-85 IN THE ATMOSPHERE - With Specific Reference to the Public Health Significance of the Proposed Controlled Release at Three Mile Island

SUMMARY

This report is concerned with the potential health consequences that may arise from the proposed release of 57,000 curies of Krypton-85 via the two venting proposals made by the Nuclear Regulatory Commission (NRC) during 5 day and 60 day periods (NRC, 1980a, 1980b).

1. It has been concluded that methods of estimating the atmospheric dispersion and biological effects used in an earlier report by the NCRP (Report No. 44, "Krypton-85 in the Atmosphere — Accumulation, Biological Significance, and Control Technology," NCRP 1975) continue to be valid.
2. Concentrations of krypton-85 from the plant boundary to a distance of fifty miles were estimated using accepted techniques of meteorological analysis. Calculated values of the expected concentrations and doses are given in Table 1.
3. Risk estimates and expected health effects associated with these doses have been derived from the best available source, a report prepared by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1977) and are as given in Table 2.
4. The basic question is whether the krypton-85 concentrations in the atmosphere will be sufficient to justify concern about skin or other types of cancer. The estimated effects of the 5-day scenario are as follows: for the maximally exposed individual at the site boundary, the risk of skin cancer would be 0.000038 and the risk of other cancers would be 6 per billion. For the population within 50 miles 2.2 million, less than 0.07 skin tumors and no

Table 1 - Estimated concentrations of ^{85}Kr and expected doses for the 5-day and 60-day venting scenarios

	^{85}Kr Concentrations	Doses: Skin	Doses: Whole Body
5-day scenario			
maximum offsite concentration	0.3 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		7.4 mrem[b]	0.06 mrem
average concentration (within 50 mi)	4.5×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.011 mrem	8×10^{-5} mrem
collective dose (within 50 mi)[c]		25 person rem	0.19 person rem
60-day scenario			
maximum offsite concentration	0.06 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		18. mrem	0.14 mrem
average concentration (within 50 mi)	1.8×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.054 mrem	4×10^{-4} mrem
collective dose (within 50 mi)[c]		118 person rem	0.92 person rem

[a] This is a hypothetical person who remains at one point on the fenceline for the duration of the release.

[b] mrem is one-thousandth of a rem which is the unit of dose equivalent. For the purposes of this report, the number of rems may be considered equal to the number of rads (the unit of absorbed dose).

[c] The population within 50 miles is assumed to be 2.2 million persons (NRC, 1979).

more than 0.00002 other tumors would be expected.

5. The effects for the 60 day scenario are 3 to 5 times higher than the 5 day scenario.

6. Cancer of the skin occurs normally in the general population primarily as a result of exposure to sunlight. The risk of skin cancer to the maximally exposed individual (5-day scenario) is estimated to be equivalent to about 20 hours of exposure to sunlight. For the average person within 50 miles, the risk would be equivalent to less than 2 minutes of exposure to sunlight.

7. The risk of cancers other than skin cancer to the average person within 50 miles is equivalent to 25 seconds of exposure to the ionizing radiation from nature. The dose to the maximally exposed individual can be similarly shown to be equivalent to about 5 hours of exposure to natural ionizing radiation.

8. It is concluded that the exposures likely to be received as a result of venting are not a valid basis for concern with respect to health effects.

May 16, 1980

Table 2 - Risk estimates[a] of radiation induced cancers for the proposed 5-day and 60-day ^{85}Kr venting scenarios

	5-day scenario	60-day scenario
SKIN		
risk of skin cancer from beta radiation to the maximally exposed individual		
absolute risk model[b]	3.8×10^{-5}	9.2×10^{-5}
relative risk model[b]	2.5×10^{-5}	9×10^{-5}
risk of skin cancer to the average individual within 50 miles (absolute model)	5.1×10^{-8}	4×10^{-7}
number of skin cancers expected in a population of 2.2×10^6 over their lifetime (relative risk model)	less than 0.07	less than 0.4
WHOLE BODY		
maximum number of other expected cancers in population from whole body gamma irradiation	2×10^{-5}	9×10^{-5}
number of cancers in average person at the site boundary exposed to whole body gamma radiation	6×10^{-9}	1.4×10^{-8}

[a]Skin cancer risk estimates are based on the tinea capitis and thymus studies (NAS, 1979).

[b]For an explanation of the absolute and relative risk models see text page 14.

KRYPTON-85 IN THE ATMOSPHERE - WITH SPECIFIC REFERENCE TO THE PUBLIC HEALTH SIGNIFICANCE OF THE PROPOSED CONTROLLED RELEASE AT THREE MILE ISLAND

May 16, 1980

NCRP

National Council on Radiation Protection and Measurements

Washington, D. C.

CONTENTS

PREFACE

The National Council on Radiation Protection and Measurements (NCRP) on July 1, 1975 published NCRP Report No. 44, Krypton-85 in the Atmosphere — Accumulation, Biological Significance, and Control Technology (NCRP, 1975), which was prepared by the Task Group on ^{85}Kr of the Council's Scientific Committee 38. That report dealt with the sources of ^{85}Kr, its behavior in the atmosphere, the dose to exposed persons, and the biological significance of exposure.

This review supplements the 1975 report and brings it up to date with respect to the latest scientific information available on ^{85}Kr, with the exception that the present review does not consider methods of removing ^{85}Kr from waste streams. The application of this information to the venting proposals developed for the Three Mile Island (TMI) nuclear power station has been prepared at the request of The Honorable Richard Thornburgh, Governor of the Commonwealth of Pennsylvania. A copy of his letter to the President of NCRP dated April 30, 1980 is included as Appendix A.

The National Council on Radiation Protection and Measurements (NCRP) is a non-profit Corporation chartered by Congress in 1964 to, among other things, "collect, analyze, develop, and disseminate in the public interest information and recommendations about ... protection against radiation ...." The NCRP consists of 75 members and its committees include more than an additional 400 scientists. The normal procedures require that the full membership be consulted and a consensus be reached before a report is issued as a formal NCRP report. In view of the urgency of the request made by Governor Thornburgh and the tight timetable imposed, the President of the NCRP acted under a provision in the NCRP bylaws that permits the Board of Directors to issue statements on its own authority. To accomplish the review, the President of the NCRP reactivated the Task Group on ^{85}Kr, with certain modifications in membership. The membership of both the original Task Group and the present group are set out in Appendix B, together with a list of the membership of the NCRP.

This is a report of the NCRP prepared by the Task Group, as approved for release by the NCRP Board of Directors. The report supplements the 1975 report and addresses current knowledge of the biological effects of ^{85}Kr, with particular reference to the proposals made to vent 57,000 Ci of this nuclide now confined within the containment building of TMI unit two. In its evaluation, the NCRP was in no position to judge the validity of the NRC estimate of the quantity of ^{85}Kr. Using this figure as a starting point, the dose to persons residing within 50 miles of the plant has been estimated and the potential public health significance addressed.

Warren K. Sinclair
President, NCRP

Washington, D.C.
May 14, 1980

SUMMARY

This report is concerned with the potential health consequences that may arise from the proposed release of 57,000 curies of Krypton-85 via the two venting proposals made by the Nuclear Regulatory Commission (NRC) during 5 day and 60 day periods (NRC, 1980a, 1980b).

1. It has been concluded that methods of estimating the atmospheric dispersion and biological effects used in an earlier report by the NCRP (Report No. 44, "Krypton-85 in the Atmosphere — Accumulation, Biological Significance, and Control Technology," NCRP 1975) continue to be valid.
2. Concentrations of krypton-85 from the plant boundary to a distance of fifty miles were estimated using accepted techniques of meteorological analysis. Calculated values of the expected concentrations and doses are given in Table 1.
3. Risk estimates and expected health effects associated with these doses have been derived from the best available source, a report prepared by the United Nationa Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1977) and are as given in Table 2.
4. The basic question is whether the krypton-85 concentrations in the atmosphere will be sufficient to justify concern about skin or other types of cancer. The estimated effects of the 5-day scenario are as follows: for the maximally exposed individual at the site boundary, the risk of skin cancer would be 0.000038 and the risk of other cancers would be 6 per billion. For the population within 50 miles 2.2 million, less than 0.07 skin tumors and no

more than 0.00002 other tumors would be expected.

5. The effects for the 60 day scenario are 3 to 5 times higher than the 5 day scenario.
6. Cancer of the skin occurs normally in the general population primarily as a result of exposure to sunlight. The risk of skin cancer to the maximally exposed individual (5-day scenario) is estimated to be equivalent to about 20 hours of exposure to sunlight. For the average person within 50 miles, the risk would be equivalent to less than 2 minutes of exposure to sunlight.
7. The risk of cancers other than skin cancer to the average person within 50 miles is equivalent to 25 seconds of exposure to the ionizing radiation from nature. The dose to the maximally exposed individual can be similarly shown to be equivalent to about 5 hours. of exposure to natural ionizing radiation.
8. It is concluded that the exposures likely to be received as a result of venting are not a valid basis for concern with respect to health effects.

Table 2 – Risk estimates[a] of radiation induced cancers for the proposed 5-day and 60-day ^{85}Kr venting scenarios

	5-day scenario	60-day scenario
SKIN		
risk of skin cancer from beta radiation to the maximally exposed individual		
absolute risk model[b]	3.8×10^{-5}	9.2×10^{-5}
relative risk model[b]	2.5×10^{-5}	9×10^{-5}
risk of skin cancer to the average individual within 50 miles (absolute model)	5.1×10^{-8}	4×10^{-7}
number of skin cancers expected in a population of 2.2×10^{6} over their lifetime (relative risk model)	less than 0.07	less than 0.4
WHOLE BODY		
maximum number of other expected cancers in population from whole body gamma irradiation	2×10^{-5}	9×10^{-5}
number of cancers in average person at the site boundary exposed to whole body gamma radiation	6×10^{-9}	1.4×10^{-8}

[a]Skin cancer risk estimates are based on the tinea capitis and thymus studies (NAS, 1979).

[b]For an explanation of the absolute and relative risk models see text page 14.

Table 1 – Estimated concentrations of ^{85}Kr and expected doses for the 5-day and 60-day venting scenarios

	^{85}Kr Concentrations	Doses: Skin	Doses: Whole Body
5-day scenario			
maximum offsite concentration	0.3 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		7.4 mrem[b]	0.06 mrem
average concentration (within 50 mi)	4.5×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.011 mrem	8×10^{-5} mrem
collective dose (within 50 mi)[c]		25 person rem	0.19 person rem
60-day scenario			
maximum offsite concentration	0.06 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		18. mrem	0.14 mrem
average concentration (within 50 mi)	1.8×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.054 mrem	4×10^{-4} mrem
collective dose (within 50 mi)[c]		118 person rem	0.92 person rem

[a]This is a hypothetical person who remains at one point on the fenceline for the duration of the release.

[b]mrem is one-thousandth of a rem which is the unit of dose equivalent. For the purposes of this report, the number of rems may be considered equal to the number of rads (the unit of absorbed dose).

[c]The population within 50 miles is assumed to be 2.2 million persons (NRC, 1979).

1. DEVELOPMENTS SINCE PUBLICATION OF NCRP REPORT NO. 44

Physical Properties and Production Rates

Krypton is an inert gas with a natural abundance in the atmosphere of 1.14 ± 0.01 parts per million by volume (Weast, 1977). Nuclear fission produces sizable quantities of ^{85}Kr which, with a 10.76-year half-life, accumulate in the atmosphere. ^{85}Kr decays, 99.6 percent of the time, to stable ^{85}Rb by emitting a beta particle with maximum energy of 0.672 MeV; 0.4 percent of the decays consist of a beta particle with a maximum energy of 0.15 MeV, followed by a 0.514 MeV gamma ray (Lederer et al., 1967).

Sources of ^{85}Kr besides the nuclear power industry include nuclear weapons tests, nuclear reactors used to produce plutonium for weapons, cosmic ray induced atmospheric reactions with atmospheric ^{84}Kr, and spontaneous fission of naturally occurring uranium. Between 1945 and 1962, approximately 3 megacuries of ^{85}Kr were introduced into the atmosphere by weapons tests (UNSCEAR, 1977). Plutonium production in the United States through 1966 introduced another 15 MCi. Additional ^{85}Kr was produced after 1966 in the United States, but at much reduced rates and was produced before and after 1966 by weapons production programs in other countries.

Emissions of ^{85}Kr from the nuclear fuel cycle will increasingly become the dominant source of ^{85}Kr. During normal operations, ^{85}Kr generated in a nuclear reactor is contained in the fuel rods and is released only during reprocessing when the fuel rods are disassembled. Reprocessing plants do not at present control releases of ^{85}Kr and depend instead on dilution of the gas after discharge

to the atmosphere. ^{85}Kr can also be released to the reactor containment building and the general atmosphere in the event of a severe accident associated with core damage. Effective January 1, 1983, government regulations in the United States will limit releases of ^{85}Kr from the uranium fuel cycle to a maximum of 50,000 Ci per thousand megawatts of electricity (GW_e) produced (CFR, 1979). This will require retention of about 80 percent of the total production of ^{85}Kr. Nevertheless, the total amount of ^{85}Kr to be released in the future will continue to depend primarily on the amount of electric power generated by nuclear reactors. In NCRP Report No. 44 (NCRP, 1975), Nichols and Binford's (1971) projections of nuclear power generated through the year 2000 were used to predict ^{85}Kr generation and release. These authors projected 353 GW_e of installed nuclear power in the world in 1980, 1,660 GW_e in 1990, and 4,500 GW_e in 2000. In 1975, the National Radiological Protection Board of the United Kingdom predicted approximately 1,200 GW_e in 1990 and 3,100 GW_e in 2000 (Fig. 1 of Kelly et al., 1975). The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1977) more recently predicted 2,000 GW_e in the year 2000, a figure substantially less than the 4,500 GW_e predicted by Nichols and Binford (1971) which was used in NCRP Report No. 44. A recent report by the U.S. Department of Energy (1979) predicted 400 GW_e in the United States in the year 2000 which was similarly much below the 1,000 GW_e prediction for U.S. nuclear generating capacity in the year 2000 contained in NCRP Report No. 44. These reductions in estimated future nuclear power generation result in corresponding reductions of estimated accumulation of ^{85}Kr in the atmosphere.

Diffusion in the Atmosphere

Measurement of ^{85}Kr in the atmosphere since publication of NCRP Report No. 44 indicated a concentration of 19.5 pCi/m^3 in 1977 (Rozanski, 1979). This value is substantially below the predicted value of about 55 pCi/m^3 shown in Fig. 6 of NCRP Report No. 44, which may be due to the lack of reprocessing in recent years, or to the slowed growth rate of nuclear power in the United States and elsewhere. NCRP Report No. 44 assumed release of ^{85}Kr in the year generated, an assumption which has not been realized due to the moratorium on reprocessing in the United States. The exact reason for the discrepancy is not understood at this time and further consideration of the matter is warranted.

The mechanisms of diffusion of ^{85}Kr from point sources, like diffusion of other gaseous contaminants, was well understood at the time of publication of NCRP Report No. 44. More recently, the Air Resources Laboratory of the National Oceanic and Atmospheric Administration has published a study of the diffusion of ^{85}Kr being released from the Savannah River plant (Telegadas et al., 1980). By making concurrent measurements of meteorological parameters, ^{85}Kr concentrations downwind, and ^{85}Kr release rates, an unusual opportunity was provided to verify the models used in forecasts of the environmental consequences of ^{85}Kr releases at distances of 20 to 90 miles. The models yielded predictions that proved to be 2 to 4 times greater than the observed values, which indicates a conservatism in the models erring, however, on the safe side.

Dosimetry

Dose calculations in NCRP Report No. 44 are in good agreement with values reported in 1975 by the National Radiological Protection Board of the United Kingdom (Kelly et al., 1975). Kelly et al. (1975) quoted an annual dose of 2.5 mrad/y to the skin surface due to exposure to a cloud of ^{85}Kr of 1 pCi/g air. This is equivalent to a dose of 1.93 rad/y due to a cloud of ^{85}Kr at a concentration of 1 $\mu Ci/m^3$ at standard temperature and pressure, in very good agreement with the value of 1.8 rad/y reported in NCRP Report No. 44 (Table 13, p. 30). Kelly et al. reported a dose of 1.6×10^{-2} rads/y to the shallow tissue and gonads due to external ^{85}Kr exposure at a concentration of 1 $\mu Ci/m^3$, also in good agreement with values reported in NCRP Report No. 44. In calculating population doses, however, Kelly et al. reduced the skin dose by a factor of 0.6 to convert the surface dose to that at a depth of 7 mg/m^2 and they reduced the shallow tissue and gonad dose by a factor of 0.4 to account for time spent indoors. This correction factor is of questionable applicability in the Three Mile Island situation and is not used in this report. Nor were these factors used in NCRP Report No. 44. Kelly et al. also took no account of the dose due to inhaled krypton, referring to a report showing that the internal dose is small in comparison with the skin and whole body dose (Whitton, 1968). This observation is in agreement with calculations in NCRP Report No. 44.

Harley and Pasternack (1977) calculated doses due to internal ^{85}Kr to cells of particular importance in human carcinogenesis; namely, hematopoietic stem cells, osteoprogenitor cells on bone surfaces, and basal cells in bronchial epithelium. Their calculated doses are in good agreement with the internal whole body dose (7.4×10^{-4} rad $m^3/\mu Ci$ y) shown in Table 13 (p. 30) of NCRP Report No. 44. Work on behavior of ^{85}Kr within the body following inhalation was not discussed in NCRP Report No. 44. Recent inhalation experiments using adult beagles have shown that the highest partition coefficients were for lungs, bone marrow, and fat (Willard et al., 1978). Earlier experiments by the same group using rats showed that doses from ^{85}Kr tended to be highest in the adrenals and body fat (Willard and Ballou, 1977). The large intestines were found to have prolonged desaturation times which were related to the presence of air or gas pockets in this organ.

Cohn et al. (1979) have studied the internal dose from inhaled traces of ^{85}Kr in human volunteers. The longest retention times were found to be in the abdomen and thigh fat deposits. Cohn et al. (1979) note that the high retention in this area necessitates a small adjustment of the gonadal dose. However, their results are in good agreement with earlier studies using volunteers and showing greatest uptake and longest retention in heavier, fatter people (Turkin and Moskalev, 1975).

The possibility that inhaled ^{85}Kr may concentrate in fetal tissues has been studied using pregnant ewes (Andrew et al., 1978). ^{85}Kr concentrations in the fetal tissues were found to be similar to or lower than concentrations in ewe tissues, indicating no special exposures of the fetus.

Willard et al. (1980) have been studying groups of rats exposed continuously to ^{85}Kr atmospheres at measured surface dose rates to the skin of 2750, 370, 38 rad/y. After 15 months of exposure, no effects on survival had been observed. There also had been no effect on weight gain, and after one year of exposure, no indications of leukemia. DeFord and Ballou (1980) have also reported studies of newborn rats in ^{85}Kr atmospheres receiving total body radiation of 1,000-4,800 rads. While radiation dermatitis, stunted growth, and abnormal development were seen at higher doses, whole body doses of 1,000 rads caused no observable effects.

The United States Environmental Protection Agency has been studying the effects of exposures to ^{85}Kr since 1971, using various animal models (Kirk, 1980). Exposures of guinea pigs to very high concentrations of ^{85}Kr in cylindrical chambers approximating infinite beta cloud exposures have yielded excess cases of lymphocytic leukemia in female, but not male, animals. A total of 25 cases out of 176 animals (14 percent) have been observed to date in animals exposed at doses of 15,172 rads to the skin or less, with no cases observed in 45 animals exposed at higher doses (25,542 rads to the skin or more), and five cases observed in 53 control animals (9 percent). Substantial life shortening has been seen in the higher dose animals (life table analyses of the data have not yet been conducted). The experiment was originally designed to study lethality of ^{85}Kr at very high doses and thus was not of optimal design to investigate long-term sequelae such as leukemia. Kirk is currently replicating the experiment, but results will not be available for several years.

Kirk (1980) also has been studying skin tumor incidence in Sprague-Dawley caesarean derived (CD) rats immersed in a ^{85}Kr atmosphere. Preliminary analysis indicates a lifetime risk of an individual animal developing at least one tumor of 7×10^{-5} per rad. Most of the animals had several tumors and, counting each tumor separately, the risk was 1.5×10^{-4} tumors per rad. Data analysis is continuing, but the results seem to be in agreement with tumor incidence in male (CD) rats found by Albert et al. (1967) on exposure of (CD) rats to electrons with an 0.35 mm maximum penetration.

NCRP Report No. 44 noted the possibility that the carcinogenic effects of ^{85}Kr beta radiation on skin might be enhanced by ultraviolet (UV) radiation and recommended that experimental studies be initiated. Laboratory studies that have since been undertaken have demonstrated that the two kinds of radiation do interact, but in complex ways that are not yet understood (Burns et al., 1976; Burns, 1980). The findings of these studies are taken into consideration in discussion of the health implications of the Three Mile Island ^{85}Kr release later in this report.

Methods of Control

The method of removing ^{85}Kr from gases prior to venting to the atmosphere were also reviewed in NCRP Report No. 44. There have been recent developments in the field, but these were not reviewed for the purposes of this report.

2. DOSE ESTIMATES FROM THE PROPOSED ^{85}KR RELEASE

In the course of its review, the NCRP examined the reports of the Nuclear Regulatory Commission and Metropolitan Edison, in which the radiological consequences of the release of the krypton-85 are assessed (Met. Ed., 1979; NRC, 1980a, 1980b; Denton, 1980). In addition, the Council initiated an independent estimate utilizing the facilities of the Air Resources Laboratories of the National Oceanic and Atmospheric Administration (NOAA). The dose calculations were based on the Nuclear Regulatory Commission estimate that there are 57,000 Ci of krypton-85 now confined within the containment building and that this would be the quantity of radioactive material discharged to the atmosphere.

Two scenarios were analyzed. In the first, the 57,000 Ci would be released at a uniform rate of 0.13 Ci/s when atmospheric conditions met certain predetermined criteria (Type D stability or better and a wind velocity of at least 5 m/s (11 mph)). The total time for the release would be 120 h (5 days), but this would be spread over a longer period, depending on meteorological conditions.

In the second scenario, the krypton-85 was assumed to be released at a uniform rate of 0.011 Ci/s over a sixty-day period, in which the wind rose was typical of that for June and July and atmospheric stability was Class D 50 percent of the time and Class E 50 percent. The mean wind velocity for Class D conditions was assumed to be 4 m/s (9 mph) and the Class E mean wind velocity was assumed to be 2 m/s (4.5 mph).

The ground level concentration of krypton-85 was calculated at various distances from the point of ground level release, using well-verified techniques in use for many years at NOAA and elsewhere. It is relevant that the members of the NOAA staff who assisted the NCRP in the work on this report have recently published a report of the krypton-85 surface air concentrations within 150 km (94 mi) of the Savannah River plant during the period March 1975 through September 1977, in which the calculated krypton-85 concentrations were verified by a network of cryogenic krypton-85 sampling stations (Telegadas et al., 1980). During the 31-month sampling period, the average krypton emission from normal operations at the Savannah River plant varied from a monthly low value of 2300 Ci to a maximum of 98.000 Ci. In only five months were the emissions less than 30,000 Ci/mo, and for twenty months the emissions exceeded 50,000 Ci/mo. The required meteorological data were recorded continuously during this period, providing an opportunity to verify existing dispersion models such as the one used to prepare the dose estimates presented in this report. Generally, these models were found to be conservative, i.e., they tended to overestimate the concentrations.

The mean concentration during each of the scenarios was then calculated at the fenceline (600 m) and at distances of 1 mile (1,600 m), 10 mi (16,000 m), and 50 mi (80,000 m) from the plant, and some of these are quoted in Table 1. To facilitate computations, the actual concentrations were calculated at appropriate intermediate distances within the annuli surrounding the plant. Thus, the concentration to which people would be exposed in a given sector to a distance of

Table 1 - Estimated concentrations of ^{85}Kr and expected doses for the 5-day and 60-day venting scenarios

	^{85}Kr Concentrations	Doses: Skin	Doses: Whole Body
5-day scenario			
maximum offsite concentration	0.3 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		7.4 mrem[b]	0.06 mrem
average concentration (within 50 mi)	4.5×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.011 mrem	8×10^{-5} mrem
collective dose (within 50 mi)[c]		25 person rem	0.19 person rem
60-day scenario			
maximum offsite concentration	0.06 $\mu Ci\ m^{-3}$		
maximum individual dose[a]		18. mrem	0.14 mrem
average concentration (within 50 mi)	1.8×10^{-4} $\mu Ci\ m^{-3}$		
average dose (within 50 mi)		0.054 mrem	4×10^{-4} mrem
collective dose (within 50 mi)[c]		118 person rem	0.92 person rem

[a] This is a hypothetical person who remains at one point on the fenceline for the duration of the release.

[b] mrem is one-thousandth of a rem which is the unit of dose equivalent. For the purposes of this report, the number of rems may be considered equal to the number of rads (the unit of absorbed dose).

[c] The population within 50 miles is assumed to be 2.2 million persons (NRC, 1979).

1 mi were made using the average concentration at a distance of 1/2 mi. The average concentration was then computed within each of sixteen sectors within several annuli around the point of release to a distance of 50 mi.

The estimated concentration was then converted to a dose rate for the skin and total body. The conversion factor used to compute the dose rate to the skin from a given concentration of krypton-85 is 4.9 mrad m^3/μCi d (page 30 of NCRP Report No. 44). The conversion rate for estimating whole body dose is 0.038 mrad m^3/μCi d.

The per capita dose for the duration of the release was then computed from the per capita dose rate. The population dose was calculated as the product of the per capita dose within each sector times the number of people within that sector.

The estimated dose rates and collective doses from the fenceline to 50 mi are summarized in Table 1. The maximum dose would be at the fenceline (600 m). For the 5-day case, an individual located at a point on the fenceline would receive a dose of 7.4 mrem to the skin and 0.06 mrem to the whole body. For the 60-day case, the skin dose at the fenceline would be 18 mrem and the whole body dose 0.14 mrem. This calculation applies to the average person on the fenceline. If the person remained at the point of maximum wind direction, the values would be higher by a factor of 3 or 4.

For the 5-day scenario, the 2.2 million living within 50 mi would receive a skin dose of 25 person-rem and a whole body dose of 0.19 person-rem. This would be increased to 118 person-rem to the skin and 0.92 person-rem whole body for the 60-day scenario. The per capita skin and whole body doses are 0.054 mrem and 0.0004 mrem, respectively. The 5-day scenario gives lower doses because it is assumed that the periods of discharge would be selected so as to provide somewhat more favorable meteorological circumstances than would be true during the 60-day period.

3. ESTIMATED HEALTH EFFECTS

For total body irradiation from gamma rays, the risk of cancer is 1×10^{-4} per rem, obtained from the 1977 report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR, 1977), a value similar to that derived by other national and international groups. Using this risk coefficient, and the estimated collective gamma dose of 0.19 person-rem for the 5-day scenario, it is estimated that the dose from penetrating (gamma) radiation would yield no more than 2×10^{-5} cancers in the lifetime of the population, i.e., there is only a 2 in 100,000 chance that any cancer would be produced. By the same calculation, the estimated number of cancers for the 60-day scenario would be 9.6×10^{-5}.

The risk of skin cancer from the beta radiation was then considered. Although an increase in skin cancer following high doses of gamma and x-radiation has been observed in some groups of human beings receiving high localized doses of radiation, other large series, including those in Hiroshima and Nagasaki and the British study of patients treated for ankylosing spondylitis, have shown no excess cancers of the skin (UNSCEAR, 1977; NAS, 1972; Albert and Omran, 1968; and NAS, 1979). The human data are inadequate to establish a dose-response curve, particularly in the region below about 400 rem of x- or gamma-ray radiation. Animal studies indicate that the dose-response curve is curvilinear upwards, and that decreasing dose rate does decrease the incidence from a given dose (Albert _et al._, 1961).

In the recent National Academy of Sciences report (NAS, 1979) of the various available human studies, only two studies, both involving x radiation, were deemed to be suitable for making risk estimates for partial body irradiation. These involved treatment for ringworm of the scalp (tinea capitis) (Shore et al., 1976) and enlarged thymus (Hempelmann et al., 1975). Linear interpolation from high doses (mean doses of 700 and 300 rem, respectively) was used, and a number of caveats were given (see below and NAS, 1979). Risk estimates of 1.02 and 0.44 skin cancers per 10^6 person-year-rem (PYR) were thus obtained.[1]

If a risk coefficient of 1×10^{-6} per PYR is used, and a 50-year period of tumor formation is assumed, the 118 person-rem from ^{85}Kr beta radiation (for the 60-day case) would yield $50 \times 25 \times 10^{-6} = 1.25 \times 10^{-3}$ cancer in the 2.2×10^6 persons from which the value of 25 person-rems was derived. The corresponding risk to the highest-dose individual of 7 mrem would be $1 \times 10^{-6} \times 50 \times 0.007 = 3.5 \times 10^{-7}$ (i.e., less than one in a million).

The above risk estimates for skin cancer are re-estimated below, using recent data derived from the tinea capitis series of cases (Albert, 1980). For the purposes of this report, all factors will be selected to maximize the risk. The net effect of this procedure will almost certainly overestimate the true situation. Both the absolute and the relative risk models are used to calculate the incidence, as follows.

[1] All of the cancers were basal cell carcinomas, which are amenable to therapy and are associated with low mortality. No melanomas have occurred following irradiation for either tinea capitis or enlarged thymus.

The incidence of skin cancer (basal cell carcinoma) among patients in the tinea capitis series has been 8.9 percent, 35 years post irradiation at a scalp dose of 500 rem. This compares to an incidence of 0.5 percent in the unexposed control groups, giving a net increased incidence of 8.4 percent. Assuming linearity of dose response, the resulting risk estimate is 1.7×10^{-4} cases of scalp cancer per rem. If one assumes the risk to the total skin surface is proportional to the area irradiated, and that the skin of the scalp is 3.3 percent of the whole body, the cancer risk per rem of skin irradiation will be 51×10^{-4}. Since the average beta dose for the 5-day release has been estimated to be 0.01 mrem, the risk to the average individual within 50 miles of the release would be (51×10^{-4}) $(0.01 \times 10^{-3}) = 5.1 \times 10^{-8}$ or about five in 100 million. The risk to the maximally exposed person (7.4 mrem) would be about 3.8×10^{-5}, or about 4 per 100,000. The number of skin cancers that might result from this exposure among the 2.2 million people living within 50 mi would be less than one during their lifetime. Because the period of tumor formation in the studies used for these calculations includes only the first 15 years post exposure, the appearance of additional tumors may increase these absolute risk estimates by a factor of perhaps 2 or 3.

In applying the relative risk model, it is assumed that the risk of cancer in the exposed group remains a constant multiple of the normal incidence during the entire life span of the exposed population. The tumor data collected to date are not inconsistent with that assumption. From the data, the relative risk at 500 rem would be 8.9 percent/0.5 percent = 17.8, compared to a risk (by definition) of 1.0 at zero exposure. On this assumption, at an average dose of 1×10^{-2} mrem, the relative risk interpolated between zero and 500 rem would be $1 + 3.4 \times 10^{-7}$. The number of cancers attributable to the ^{85}Kr release (the 5-day scenario) would be 3.4×10^{-7} times the lifetime incidence in an unexposed population (10 percent) (Scotto _et al_., 1974) times the number of people exposed (2.2 million). This equals 0.07 cases during the lifetima of the exposed population. The maximally exposed person would be subject to a risk of skin cancer of about 2.5×10^{-5} or 2.5 in 100,000.

These estimates, derived from the tinea capitis and thymus studies, involve relatively high dose rates and little or no fractionation. It is to be expected that the relatively protracted low dose rate radiation associated with ^{85}Kr irradiation would have a smaller effect of perhaps 3 to 5 than estimated in the above calculations.

The risk estimates for both skin and whole body exposure for both scenarios for persons at the site boundary as well as for persons within a fifty-mile radius are set out in Table 2.

Table 2 - Risk estimates[a] of radiation induced cancers for the proposed 5-day and 60-day ^{85}Kr venting scenarios

	5-day scenario	60-day scenario
SKIN		
risk of skin cancer from beta radiation to the maximally exposed individual		
absolute risk model[b]	3.8×10^{-5}	9.2×10^{-5}
relative risk model[b]	2.5×10^{-5}	9×10^{-5}
risk of skin cancer to the average individual within 50 miles (absolute model)	5.1×10^{-8}	4×10^{-7}
number of skin cancers expected in a population of 2.2×10^{6} over their lifetime (relative risk model)	less than 0.07	less than 0.4
WHOLE BODY		
maximum number of other expected cancers in population from whole body gamma irradiation	2×10^{-5}	9×10^{-5}
number of cancers in average person at the site boundary exposed to whole body gamma radiation	6×10^{-9}	1.4×10^{-8}

[a]Skin cancer risk estimates are based on the tinea capitis and thymus studies (NAS, 1979).

[b]For an explanation of the absolute and relative risk models see text page 14.

4. COMPARISON OF HEALTH EFFECTS WITH EFFECTS OF SUNLIGHT AND NATURAL IONIZING RADIATION

Sunlight

It helps to put these risk estimates into perspective to compare them with the skin cancer risk associated with exposure to sunlight and the risk of other cancers due to exposure to gamma radiation from natural sources.

If we take the normal skin cancer risk to be 0.1 per lifetime, and assume that the average person spends 10 percent of the time out of doors in the sunlight (875 h/y), and make the further assumption that all skin cancers are due to sunlight, the probability of developing a skin cancer is:

$$= \frac{0.1}{(875) \times (70\ y)} = 1.6 \times 10^{-6} \text{ per hour of exposure to sunlight.}$$

By the absolute risk model, we have seen that the probability that the average person within 50 mi of the point of discharge during the 5-day release will develop skin cancer is about 5×10^{-8}. The equivalent "carcinogenic sunshine dose" would in this case be approximately

$$\frac{5 \times 10^{-8}}{1.6 \times 10^{-6}} = 3 \times 10^{-2} \text{ h (1.8 min).}$$

In short, the carcinogenic potential of the krypton-85, so far as the average person is concerned, will be equivalent to about 2 minutes of exposure to sunlight.

Natural Ionizing Radiation

The significance of the gamma component of exposure can best be put into perspective by comparison with exposure to natural background, which can be taken to be 100 mrem/y on average in the United States.

At this annual dose rate, the per capita dose within 50 miles from penetrating radiation (8×10^{-5} mrem) for the 5-day scenario is equivalent to 25 s of exposure to the radiation from nature. The dose to the maximally exposed individual (0.06 mrem) can be similarly shown to be equivalent to 5.5 h of exposure to natural ionizing radiation.

5. CONCLUSION

It is concluded that the exposures likely to be received as a result of venting are not a valid basis for concern with respect to health effects.

APPENDIX A

April 30, 1980

Dear Dr. Sinclair:

Your interest in assisting the Commonwealth of Pennsylvania in evaluating any safety and health consequences of the proposals to vent krypton-85 radioactive gas at the Three Mile Island Nuclear Power Station has been conveyed to me by Paul Critchlow of my staff.

As you know, I have been seeking technical advice on this important issue from as wide a range of responsible and respected authorities as possible. I certainly would welcome the involvement of the NCRP in this crucial fact finding and evaulation process.

Toward that end I am formally asking the Council to undertake an independent study of any safety and health consequences of the various venting proposals. It is my understanding that you wish to limit such a study to that question and that is suitable to me.

In order to comply with a May 16 deadline for my public comment on this matter to the Nuclear Regulatory Commission I would ask that you complete your analysis and report no later than that date if possible.

It is also my understanding that the Commonwealth will be willing to reimburse reasonable expenses incurred during the course of your effort. Please feel free to draw upon the resources of any relevant Department or Agency in the State Government.

Again, let me thank you on behalf of Pennsylvania citizens for your interest in helping us to resolve this fairly complex and troublesome issue.

I hope you will contact me or Paul Critchlow with any further questions.

Sincerely yours,

Dick Thornburgh, Governor

APPENDIX B

Membership of the Task Group on Krypton-85 Responsible for the Preparation of NCRP Report No. 44, Krypton-85 in the Atmosphere — Accumulation, Biological Significance, and Control Technology

Merril Eisenbud, Chairman
Institute of Environmental Medicine
New York University Medical Center
P.O. Box 817
Tuxedo, New York 10987

Roy E. Albert
New York University Medical Center
Institute for Environmental Medicine
550 First Avenue
New York, New York

Kenneth Cowser
Health Physics Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee

Edward D. Goldberg
Scripps Oceanographic Institute
University of California
LaJolla, California

Joseph A. Lieberman
Nuclear Safety Associates, Inc.
5101 River Road
Bethesda, Maryland

Lester Machta
National Oceananic and Atmospheric Administration
8060 13th Street
Silver Spring, Maryland

Arthur C. Upton
Institute of Environmental Medicine
New York University Medical Center
Tuxedo, New York

Consultants

Jere P. Nichols
Chemical Technology Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee

William P. Kirk
Health Effects Research Laboratory
EPA Environmental Research Center
Research Triangle Park,
North Carolina

Michael Marmor
Department of Preventive Medicine
Ithaca, New York

Walter S. Snyder+
Health Physics Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee

Added to the Task Group in preparation for the formulation of this statement were:

Members

Victor P. Bond
Associate Director
Brookhaven National Laboratory
Upton, Long Island, New York

Michael Marmor
Department of Preventive Medicine
Ithaca, New York

Consultants

Roland Draxler
National Oceanic and Atmospheric Administration
8060 13th Street
Silver Spring, Maryland

Gilbert Ferber
National Oceanic and Atmospheric Administration
8060 13th Street
Silver Spring, Maryland

Jerome Heffter
National Oceanic and Atmospheric Administration
8060 13th Street
Silver Spring, Maryland

+ Deceased

Members of the Council

Seymour Abrahamson
S. James Adelstein
Roy Albert
Edward L. Alpen
John A. Auxier
William J. Bair
John Boice
Victor P. Bond
Harold S. Boyne
Robert L. Brent
Antone Brooks
Reynold F. Brown
Melvin W. Carter
George W. Casarett
Randall S. Caswell
Arthur B. Chilton
Stephen Cleary
Gerald Dodd
Patricia Durbin
Merril Eisenbud
Thomas S. Ely
Benjamin G. Ferris
Donald E. Fleckenstein
Richard F. Foster
Hymer L. Friedell
Arthur B. Gladstein
Robert A. Goepp
Barry D. Goldberg
Robert O. Gorson
Douglas Grahn
Arthur W. Guy
John H. Harley
John W. Healy
Louis H. Hempelmann
John M. Heslep
George B. Hutchison
Seymour Jablon
A. Everett James
Bernd Kahn
Jacob Kastner
James G. Kereiakes
Edward B. Lewis
Thomas A. Lincoln
Ray Lloyd
Charles W. Mays
Roger O. McClellan
James E. McLaughlin
Charles Meinhold
Mortimer Mendelsohn
Dade W. Moeller
A. Alan Moghissi
Paul E. Morrow
Robert D. Moseley, Jr.
James V. Neel
Robert J. Nelsen
Frank Parker
Andrew K. Poznanski
Norman Rasmussen
William C. Reinig
Chester Richmond
Harald H. Rossi
Robert E. Rowland
Eugene L. Saenger
Leonard A. Sagan
Warren K. Sinclair
John B. Storer
Roy C. Thompson
James E. Turner
Arthur C. Upton
John C. Villforth
George L. Voelz
Niel Wald
Edward W. Webster
George M. Wilkening
McDonald E. Wrenn

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EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

May 19, 1980

Samuel J. Chilk, Secretary
U.S. Nuclear Regulatory Commissioı
Washington, D.C. 20555

Dear Secretary Chilk:

The Council has reviewed the environmental assessment for the decontamination of the Three Mile Island Unit 2 reactor building atmosphere (NUREG-0662) and Addenda. We have considered the assessment's discussion of alternatives and staff's conclusion that all of the alternatives for removing the contaminated atmosphere from the reactor building at TMI can be implemented with little risk to the health and safety of the public from resulting effluents and can be carried out in full compliance with the Commission's regulations and applicable requirements. According to staff's calculations, this decontamination activity will have no significant environmental impacts. The Council also notes that staff has determined that the proposed action will not limit the choice of reasonable alternatives for the future steps in the TMI cleanup program. 40 C.F.R. 1506.1 (1979).

Staff has stated that purging of the containment at TMI will allow greater personnel access to the reactor building which in turn would permit needed maintenance of instrumentation and equipment required to keep the reactor in a safe shutdown condition. It is also staff's conclusion that prompt purging is in the best interest of public health and safety (SECY-80-132). As the Council has stated before in its communications with the Nuclear Regulatory Commission regarding TMI, public health and safety is of paramount concern to the Council.

At a meeting with representatives of NRC staff and General Counsel's office on March 31, 1980, our staff explained their substantive comments on the Environmental Assessment. We strongly urge NRC staff to make the revisions and additions suggested by the Council at that meeting.

The Council has made no technical review of NUREG-0662 and Addenda. For this proposal, the Council defers to the Commission's judgment on such issues. However, based on the assumption that the Council's comments on the environmental documents will be tended to and relying on the NRC staff's technical analysis and representations referred to above, the Council is of the view that as a matter of procedure, staff's proposal does not violate 40 C.F.R. § 1506.1 (1979) (Limitations on actions during NEPA process) of the Council's regulations implementing the National Environmental Policy Act.

Sincerely,

NICHOLAS C. YOST
General Counsel

York County Industrial Development Corporation

13 EAST MARKET STREET • YORK, PENNSYLVANIA 17401

John J. Bell
EXECUTIVE DIRECTOR

phone
(717) 8

May 19, 1980

Mr. Harold Denton
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

The attached Resolution was adopted unanimously by the York County Industrial Development Corporation Board of Directors on May 13, 1980.

We urge you to do whatever you can to expedite the cleanup at Three Mile Island and return of units to productive use.

Very truly yours,

John Bell

John J. Bell
Executive Director

JJB/jd
Enclosure

York County Industrial Development Corporation

13 EAST MARKET STREET • YORK, PENNSYLVANIA 17401

John J. Bell
EXECUTIVE DIRECTOR

phone
(717) 846-8879

Whereas South Central Pennsylvania (including York County) experienced a nuclear accident beginning March 28, 1979, and

Whereas the area's economy has suffered through the need to buy high cost replacement power and

Whereas the Nation's negative Balance of Payments has widened by increasing oil imports for power generation and

Whereas the controlled clean up of TMI Unit #2 is a requisite if we are to maintain the orderly growth of the area and protect the health of our people, and

Whereas, current delays in the clean-up process have resulted from controversy over the orderly release of krypton gas in small amounts, and

Whereas, the NRC, DER, and the Governor's Commission Report of February 26, 1980, have all indicated that the release of such gas can be accomplished in a safe manner well below normal radiation levels experienced in everyday life,

Now, therefore be it resolved that the Board of Directors of the York County Industrial Development Corporation urge the Governor, the Secretary of DER, the NRC, the EPA and other interested parties to proceed expeditiously with controlled venting of the krypton gas and proceed with the clean up so that we can avoid added threats to the health and welfare of our citizenry.

Department of Energy
Washington, D.C. 20585

MAY 19 1980

Mr. William J. Dircks
Acting Executive Director
for Operations
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Dircks:

The Department of Energy (DOE) has reviewed the "Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere" (NUREG-0662, March 1980) and Addendum 2 (April 1980). The document represents a comprehensive effort by your staff to accurately assess the environmental effects of the proposal. Our review has, however, identified several areas where additional information or clarification would enable a more complete assessment of potential effects of the removal of krypton gas (Kr-85) from the reactor building. The following comments are offered for your consideration:

- The accident analysis for each alternative, including the proposed action, should include estimates of the probability of occurrence of the worst case scenarios. This would permit a more complete evaluation of the potential for adverse health and safety impacts.

- A more precise estimate of the time necessary to implement the various alternatives should be provided because of the importance of this factor in the overall decision-making process. Estimates should be based on realistic projections of an accelerated construction/testing program for each alternative.

- The potential hazards associated with the storage of Kr-85 should be quantified to the extent possible in order to better reflect the seriousness of problems associated with the storage.

- A more detailed description of the monitoring program for the proposed action would be helpful. Advanced monitoring to calibrate and verify analytical methods for predicting the incremental dose at the site boundary should be discussed. The ability to promptly and accurately determine off-site concentrations also should be discussed in more detail.

- The description of DOE's radiological monitoring program (Section 7.6) does not represent an accurate summary of our current efforts. An updated version of this section is enclosed for your information.

- The nature and extent of the controversy surrounding the proposed venting should be presented. The basis for the technical questions being raised by various segments of the public and scientific community along with a critical evaluation of their concerns would provide a more meaningful assessment of the significance of the impacts of the proposal.

We trust that the above comments will be useful in the preparation of the final version of the environmental assessment. We would welcome the opportunity to review the completed document and those changes made as a result of your public involvement efforts. Should you have any questions, do not hesitate to contact us.

Sincerely,

Ruth C. Clusen

Ruth C. Clusen
Assistant Secretary
for Environment

Enclosure

7.6 U.S. Department of Energy Radiological Monitoring Program

The Department of Energy and Commonwealth of Pennsylvania are sponsoring a Community Radiation Monitoring Program. This program has as its purpose to (a) provide independent verification of radiation levels in the TMI area by trained local community people, and (b) to increase public understanding of radiation and its effects. The approach to achieve this purpose has involved the selection of individuals by local officials from the following 12 communities within approximately five miles around TMI.

East Manchester Twp.
Londonderry Twp.
York Haven
Lower Swatara Twp.
Conoy Twp.
Goldsboro
Fairview Twp.
Royalton
East Donegal Twp.
Middletown
Newberry Twp.
Elizabethtown

Approximately 50 individuals are participating in training classes conducted by members of the Nuclear Engineering Department of the Pennsylvania State University. Eleven training sessions are to be conducted and will involve classroom instructions, laboratory training, and actual radiation monitoring in the field. The teams will utilize EPA gamma rate recording devices which are currently in place around TMI and will be supplemented by gamma/beta sensitive devices which are being furnished by DOE through EG&G Idaho, Inc. This training will be structured to cover the following areas:

1. Classroom instruction

   o Introduction to radioactivity
   o Interaction of radiation with matter
   o Methods of radiation detection
   o Radiation counting variables
   o Radiation protection units
   o Health physics procedures
   o Radiation interaction with biological systems
   o Administrative procedures for Community Radiation Monitoring Program
   o TMI-2 accident and cleanup
   o Meteorological conditions

2. Laboratory instruction

   o G.M. (Geiger Mueller) counting experiments
   o Radiation counting statistics
   o Monitoring equipment familiarization
   o Argonne-41 and Krypton-85 monitoring
   o Supervised area monitoring with actual procedures and equipment

At the completion of the instructional phase, a final examination will be given. This will be followed by field monitoring training of approximately one week.

The training sessions will provide basic information on radiation, its effects, detection techniques, and will include hands-on experience with monitoring equipment in the field. Citizens will be expected to demonstrate competence in both the theoretical and practical aspects of the course before actual monitoring efforts begin. Following the completion of training, in the third week of April, team representatives in each of the 12 selected areas will begin data acquisition from the gamma and gamma/beta sensitive instruments on a routine basis. Detailed procedures are being developed to consolidate the information being obtained into a central point of contact in the Commonwealth of Pennsylvania for dissemination to the press, local officials, and other interested parties on a routine basis. Maintenance and calibration procedures are also being developed and will be in place prior to the initiation of routine field monitoring, anticipated to begin during the last week of April.

PROPOSAL FOR THREE MILE ISLAND.

ELEMENTS IN THE EVACUATION AND DISPERSAL OF KRYPTON IN UNIT TWO

CONTAINMENT UNIT....Holding 2 million cubic feet of air and contaminating 5 thousand units of Krypton.

ESCAPEMENT: ......Heavy duty Neoprene tube hermetically sealed into airlock area.Tube is fitted with closure valves.

VENTING :...........High velocity vacuum pump receives escapement tube air and Krypton gas exiting into four large diametered Neoprene tubes.Each tube enters collapsed Neoprene baloon six feet in diameter.All connections doubly sealed .

PROCEDURE:......... Vacuum pump completes inflation of four balloons.They are sealed effectively.A transmitter is attached to each balloon. The balloons are then harnessed to form an integrated unit.The unit is securely fastened to a Helium filled balloon ten feet in diameter.Combined balloons are released .The Helium balloon with its captive Krypton gas will ascend to approximately 60,000 feet,caught in the prevalent Westerly wind the balloons will be driven over the Atlantic and burst due to variance

in atmosperic pressure.A Radar equipped plane is used for surveillance as well reception of transmitted radio frequency from the floating units.

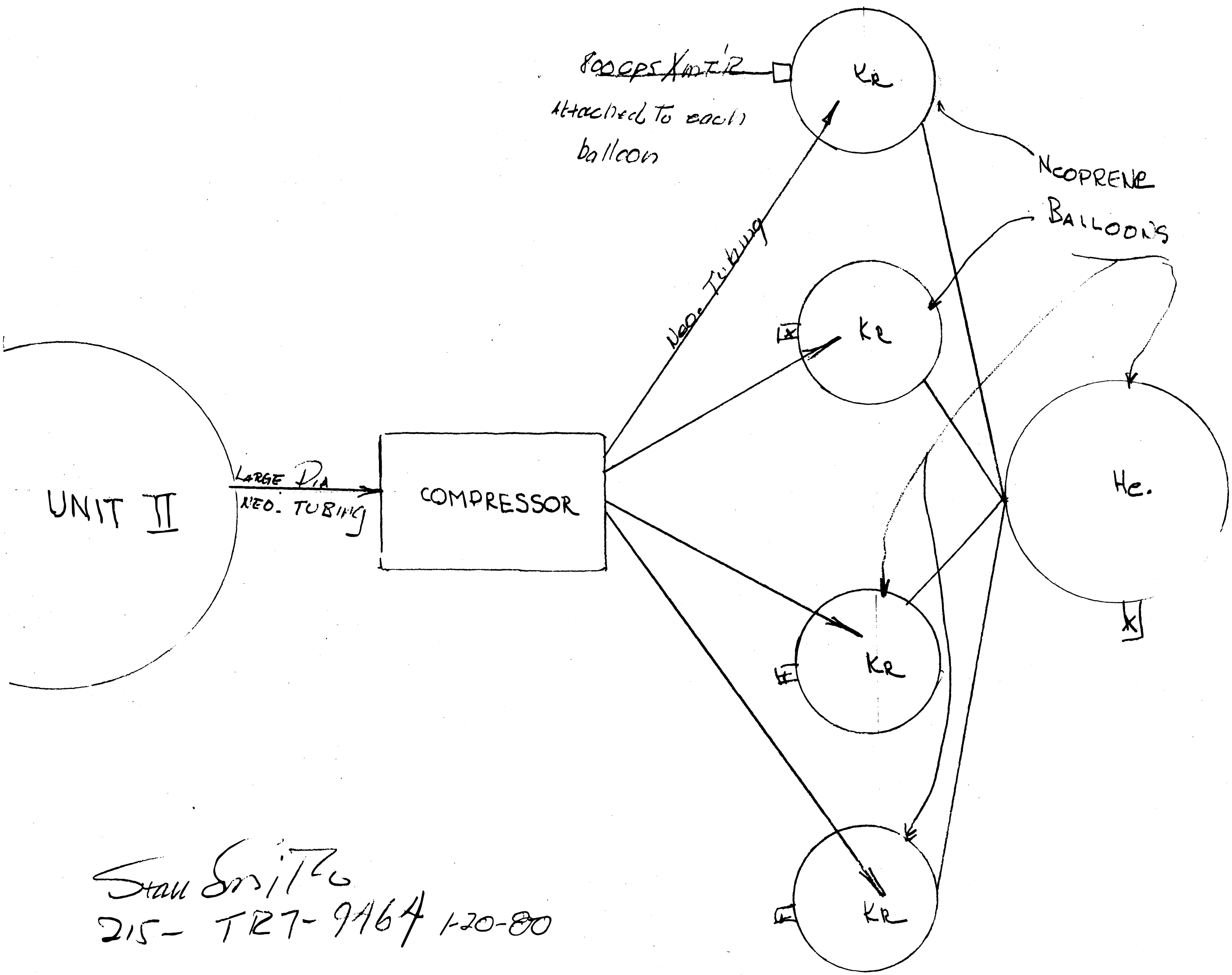
CONCLUSION :...This procedure as outlined above will be performed at a pre-dawn time where the public will not be alarmed by "U F O" sitings or psychological projections .Naturally, cubic content of the combined four balloons will not evacuate content of Unit 2 Successive repetition will be exercised until venting and dispersal is complete.

Stanley Smith

Designed and submitted by:
Stanley Smith.
Apt.612 Overmont Apts.
4001 Monument Rd.
Phila;Pa. 19131.

215-TR-7-9464

Reviewed
5/20/80
W. P. D[illegible]



Stan Smith
215- TR7-9464 1-20-80

DEPARTMENT OF TRANSPORTATION
REGIONAL REPRESENTATIVE OF THE SECRETARY
434 WALNUT STREET
PHILADELPHIA, PENNSYLVANIA 19106

REGION III

May 21, 1980

TMI Support Staff
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: Environmental Assessment - Decontamination of Three Mile Island Unit 2 Reactor Bldg. - PA, NUREG-0662

We have reviewed the subject document, recognizing that our area of expertise and interest is transportation, and offer the following comments:

1. The recommended action to purge the building's contaminated atmosphere through the hydrogen control system has no apparent effect on the highway system. However, in the event that another action is selected which will require the highway transport of contaminated materials, further coordination with the Federal Highway Administration and the Pennsylvania Department of Transportation should occur.

2. The TMI plant is close to both Capital City and Harrisburg International Airports. The venting of KR-85 into the atmosphere might pose a potential hazard to aircraft flying through the KR-85 plume. Coordination between the TMI operator, Pennsylvania Bureau of Aviation and the Federal Aviation Administration's Air Traffic Control facilities at both airports may be necessary to insure that aircraft are directed away from the plume. To assist in this coordination process, the subject DEIS should be made available to the Pennsylvania Bureau of Aviation for their review.

3. As described, the proposed action has no direct impact on the Susquehanna River. However, if the recommended action involves the use of the Susquehanna, the U.S. Coast Guard, Third District Office, Governors Island, NY, should be consulted.

We appreciate the opportunity to review and comment on this DEIS. If we can be of any further assistance, please contact us.

Sally H. Cooper for
Regional Representative
of the Secretary

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MAY 22 1980

MEMORANDUM FOR: Dr. Bernard J. Snyder
TMI Program Office

FROM: John F. Suermann
Office of Congressional Affairs

SUBJECT: CONSTITUENT COMMENT FROM SENATOR PACKWOOD ON TMI

The attached letter from Ray McDuffee was referred to this office by Senator Bob Packwood. I responded to the letter and indicated I would have the comments inserted in the public comment file on the gas venting at TMI. I request that this be done.

Ray W. McDuffee
P.O. Box 178
Seal Rock, Oregon 97376

1980 APR 15 AM 9:45

April 9, 1980

Senator Robert Packwood
Senate Office Building
Washington, D.C. 20510

Dear Senator:

The idea I set forth here may have no valid application to the problem of radioactive gases in Nuclear Piles. It seems rather simple but I note that the authorities responsible of such gases are considering releasing them.

For about 4 years I was a member of Air Force Materiel Special Weapons - I. We dealt with the long range detection by scientific means of world wide atomic activities. I sat on and helped produce the CIA Atomic Energy Committee's national estimates on world wide atomic activities. There is much more to that but I merely wish to tell you I have some knowledge & credibility.

We employed several teams and large diesel powered compressors in both hemispheres to determine the quantities of radioactive rare gases in the atmosphere. We compressed large quantities of atmospheric gases and then in due process separated out and quantified the radioactive gases.

Now, the gases as they exist in the nuclear plants can be compressed into small, manageable quantities and so be handleable. They can probably be separated into active & non-active. For what it may be worth.

Sincerely,

Ray W. McDuffee, Col, USAF (Ret)

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa. 17057

Dear N.R.C.

After reading an issue of the Inquirer which discussed alternatives to venting radiactive krupton, I am convinced that Metropolitan Edison company is only interested in disposing of the gas in the cheapest and easiest method, not the safest.

There fore, this letter represents my strong opposition to cleaning up the crippled TMI reactor by venting the gas. I believe the cyrogenic equipment should be used so that the solid form of krypton can be properly contained + safely stored.

Oxana Riley
2730 S. Hutchinson St.
Phila. Pa. 19148

Gentlemen:

I live approximately 40 miles from T.M.I., but am very opposed to the release of Krypton from T.M.I-2. I oppose the release for a number of reasons but most of all because my father and other family members live close to the incomplete Limerick Station. If something would ever happen to the Limerick plant which would result in a release of radioactive gases I know my family would strongly oppose such a proposal. Another reason for opposing a release is the cryogenic process which is available to Met-Ed.

The people at the N.R.C. are constently assuring us that the release will present no threat to the public. Statements such as this confuse me, as I am a student with textbooks which all seem to say there is no dose of radiation so low that it produces no mutations at all. Many Pennsylvanians feel that the permissive radiation policy supported by our government in effect turns us into guinea pigs in an experiment to determine how much radioactive material can be released into the environment before major epidemics of cancer, leukemia, and genetic abnormalities take their toll. I urge you to reject the venting proposal.

Respectfully yours,
Dennis J Wilson

Nuclear Regulartory Commission
P. O. Box 311
Middletown, Pa. 17057

To whom it may concern;

The prospect of venting radioactive gas from the Three Mile Island facility is one which leads me to believe that Metropolitan Edison company is not overly concerned with the health hazards this poses to both human life and the environment.

Alternative methods of freezing the gas should be utilized. At least, through proper storage of the solidified gas, the people would not have to breathe in the gas and run the risk of ~~de~~ developing cancer or giving birth to defective offspring.

Marie Nocille
2439 S. 9 ~~street~~
Phila Pa 19148

To the Nuclear Regulatory Commission
Box 311
Middletown, Pa. 17057

To the NRC,

I am <u>outraged</u> that you are considering releasing Krypton gas from TMI. The residents of Harrisburg and Middletown are not the only ones who are angry. I live 60 miles away and I <u>Know</u> the effect of releasing this gas are poisonous for us and our future generations as well as the physical earth.

It isn't good enough to think you can evacuate the area with ~~ours~~ your children. The cows eat the grass and it goes ~~it~~ in the milk and into much of the food cycle that will still affect one after one returns. There is only one alternative - one option:

Use the cryogenic process and seal up the whole unit. The expense is less important than the health of citizens in Pa.

CLOSE TMI.

We <u>all</u> live in Harrisburg.

We are not fooled by so-called low-level radiation. We don't want any of it.

Very Sincerely,
(Mrs.) Julie Morrow
Camphill Village
Kimberton, Pa 19442
Registered voter

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa. 17057

Dear N.R.C.

After reading ~~an~~ issue of the Inquirer which discussed alternatives to venting radioactive Krypton, I am convinced that Metropolitan Edison Company is only interested in disposing of the gas in the cheapest ~~and~~ easiest method, not the safest.

Therefore, This letter represents my <u>strong opposition to cleaning up the crippled T.M.I. reactor by venting</u> the gas. I believe the cyrogenic equipment should be used so that the solid form of Krypton can be properly contained & safely stored.

Hedy Nawalany
2710 So Hutchinson St.
Phila Pa. 19148

Dear Mr. Carter,

I am ten years and I have been thinking about Three Mile Island and the fact that because of an accident some krypton gas has to be released into the atmosphere. So, why not release it into big tanks or ballons for future use or ~~proper disposal~~. If you decide to dispose of the gas, I suggest a blast furnace or something like that. Also I suggest that the stat buys all the threatened houses.

Sinserely,
Christopher Harris

USNRC
Re: Venting of radioactive gas at TMI
Sirs:

We must take strong exception to your notion of releasing the accumulated containment gases without
1. environmental impact statement
2. public hearings

We, the people of the U.S. need to be informed - it is not enough to say "There has been no harmful (or detectable) release of radiation"

Therefore we demand an EIS and public hearings on the cleanup of TMI

yrs sincerely
John S Hepler
1210 Cedar Lane
(Catfish Alliance)
Nashville, Tenn 37212

D TIRPAK
4 Box 15
Island City, Tenn.

P.S. Please include us in your mailing list of press releases to keep us informed of your antics

The Hon. John Ahearne
Chairman
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Ahearne:

I am in favor of the venting of Krypton 85 gas from Three Mile Island Unit II. It is extremely important that this plant be cleaned up and maintained. The experts who have studied the alternatives have all said "vent it." It is only a few radical groups and individuals who seem to be causing the delays and the rest of us must suffer for it.

Except for a few radical groups, all leading scientists and nuclear experts have said that the accident at Three Mile Island did no harm to the public. Yet the undamaged reactor at the island has not been producing electricity since March 28, 1979 and we are buying all the high priced electric from other utilities. This is bankrupting Met-Ed's customers and the company cannot do anything about it and still supply us with the electric we need.

I am asking you to listen to the experts who have the knowledge and rational thoughts to know what is best for cleaning up Three Mile Island and getting it operating again. We must have electric and coal can't do it alone. Oil and gas are out of the question. Let's get TMI running so that Pennsylvania will have the electricity we need and show everyone that TMI was not a catastrophe but an industrial incident. Our country needs all the power we can get.

Why don't we have Three Mile Island operating. Unit I is ready to go but government delays keep it shut down. I want my children to have the same opportunity that I have had here in Central Pennsylvania and the only way this can happen is for them to have a good low-cost supply of electricity. The only way they can have this is to use nuclear power.

You are in the position to take a positive step and get Central Pennsylvania back to the progressive role it deserves. Let's clean up Three Mile Island and get it operating again.

Thank you for listening to my opinion.

Sincerely yours,

Mrs. Kathy Buchter
RD #4, Box 210-F
Elizabethtown, Pa.
17022

Pamela Shore
519 Cambridge Rd.
Bala Cynwyd, Pa. 19004

Nuclear Regulatory Commission
Washington D.C., 20555

Dear NRC,

It has been brought to my attention that you are considering venting the krypton gas in the Three Mile Island nuclear power plant in five days instead of sixty. This distresses me and I would like to let you know of my thoughts on the matter.

It seems to me that the more slowly the gas is released, the less harm will be done. The gas could be absorbed into the environment in small quantities if it was vented over sixty days, and thus more easily assimilated into the environment. Also, weather patterns would vary more over the sixty days, distributing the gas over a wider area. If the gas was vented in five days, more damage would be done to the environment and it would be too late to stop venting the gas if visible harm was being done.

In general, I think that cleaning up TMI is best done as slowly as is feasible. In this way the damage can be minimalized and recorded, and no more mistakes can be made. It is important to place the health of people and the environment before the amount of money that each operation will cost. I'd appreciate any response you could give me on this matter.

Sincerely,

Pamela Shore
Pamela Shore

DEAR NRC,

IN ORDER TO KEEP YOUR POSITIONS I WOULD THINK IT NECESSARY TO MAINTAIN CREDIBILITY & HONESTY. THE PUBLIC IS NOT IGNORANT AND IS BECOMING INCREAS-INGLY AWARE OF THE DECISIONS YOU HAVE MADE AND ARE MAKING.

FOR INSTANCE, THERE ARE OTHER ALTERNATIVES TO CLEAN THE TOWER, RATHER THAN SPILLING ALL THIS DANGEROUS WASTE INTO THE RIVER. THE CRYOGENIC PROCESS IS AVAILABLE AND WE KNOW ABOUT IT. WE KNOW THAT MET-ED HAS THE EQUIPMENT. WHY NOT BE HEROES RATHER THAN SNAKES.

Gregg [illegible]

The Hon. Joseph Hendrie
Commissioner
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Hendrie:

I am in favor of the venting of Krypton 85 gas from Three Mile Island Unit II. It is extremely important that this plant be cleaned up and maintained. The experts who have studied the alternatives have all said "vent it." It is only a few radical groups and individuals who seem to be causing the delays and the rest of us must suffer for it.

Except for a few radical groups, all leading scientists and nuclear experts have said that the accident at Three Mile Island did no harm to the public. Yet the undamaged reactor at the island has not been producing electricity since March 28, 1979 and we are buying all the high priced electric from other utilities. This is bankrupting Met-Ed's customers and the company cannot do anything about it and still supply us with the electric we need.

I am asking you to listen to the experts who have the knowledge and rational thoughts to know what is best for cleaning up Three Mile Island and getting it operating again. We must have electric and coal can't do it alone. Oil and gas are out of the question. Let's get TMI running so that Pennsylvania will have the electricity we need and show everyone that TMI was not a catastrophe but an industrial incident. Our country needs all the power we can get.

Why don't we have Three Mile Island operating. Unit I is ready to go but government delays keep it shut down. I want my children to have the same opportunity that I have had here in Central Pennsylvania and the only way this can happen is for them to have a good low-cost supply of electricity. The only way they can have this is to use nuclear power.

You are in the position to take a positive step and get Central Pennsylvania back to the progressive role it deserves. Let's clean up Three Mile Island and get it operating again.

Thank you for listening to my opinion.

Sincerely yours,

Carol A. Smith

The Hon. Joseph Hendrie
Commissioner
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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Thank you for listening to my opinion.

Sincerely yours,

Linda S. Cooper
Box 210-E R.D #4
Elizabethtown, Pa
17022

The Hon. Richard Kennedy
Commissioner
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Kennedy:

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Thank you for listening to my opinion.

Sincerely yours,

Margaret A Ditzler
319 Elm St.
Lebanon, Pa 17042

The Hon. Joseph Hendrie
Commissioner
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Hendrie:

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Thank you for listening to my opinion.

Sincerely yours,

Dennis A. Bent[illegible]
RD #4 Box 210F
Elizabethtown Pa 17022

Dear Sir:

I live two miles from the Three Mile Island nuclear power plant and am the mother of a pre-school child.

I am writing to express my support for the idea to vent the krypton gas over a five day period instead of sixty days.

I lend my support, however, only if this could be done on five successive days and if we could be told enough in advance to permit us to leave the area if we so desired.

As you are aware, the psychological impact the accident and clean-up has had on this area has been very great. It would ease my mind if I could get my family far away during the release of the krypton gas.

Sincerely,
Kim G. O'Lnick

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa. 17057

Dear Sir.

This letter represents my strong opposition to the cleaning up of the crippled Three Mile Island reactor by venting the krypton gas into the atmosphere. There is an alternative to exposing the public to gas.

Through cyrogenic equipment, the gas can be made into a solid form, then placed in proper containers and stored. Although neither method is foolproof, at least by solidifying the krypton we will be eliminating it out from our breathing air!

Mrs A. Heyman
3422 Midvale Ave.
Phila Pa. 19129

296

Mr President:

Any radioactive gases inside the containment building at three mile island can be removed by liquidfication. The device that can do it are called nitrogen generators. They take nitrogen from the air, and cool it until it liquidfies. Ideally as the generator pulls the radioactive air out of the building new air should be let in to the building.

The gases could be put into a large L.P. or propane tank sealed with plastic and buried.

sincerely
Charles W Lonson

(1)

x

Metropolitan Edison's decision to vent 57,000 curies of radioactive Krypton 85, along with particulants of cesium 137, strontium 90, and Iodine 131, is an unacceptable health risk to the people of Central Pennsylvania.

A normal functioning Nuclear plant releases an average of 1,000 curies per month of such Noble gasses such as Krypton. It would take an normal Nuclear plant 5 years to release as many curies as Met Ed wants to spill in 40 days.

Krypton 85 has a half life of 10.4 years. It emits beta radiation which CAN penetrate skin and tissue. KR 85 can be absorbed in the blood when inhaled or digested. In 10.4 years how many humans will inhale, exhale, inhale these 57,000 curies of KR 85?

The NRC argument that time is the greatest factor involved, for

(2)

we may face more catastrophic releases than a mere 57,000 curies if we do not get to certain vital equipment, is insulting to the intelligence of the public.

We know that MET Ed sat and frittered away one year, confident that the NRC would approve venting, rather than immediately take steps to protect the public. All alternatives listed in your Environmental Assessment are preferable to venting which causes "the greatest environmental impact in terms of public dose." If MET Ed had not betrayed public health concerns for financial calculations then we could be within months of an alternative removal of KR 85.

Certainly, the threat of further and more damaging releases of fission poisons is chilling. The evidence of control rod damage and the unknown properties of the core itself sends

(3)

shudders through Central Pennsylvania. The NRC is hanging a monster over the public's head. Still, I must protest the first step in what is sure to be a future of public health compromises from the NRC. You should have issued an Environmental Assessment within weeks not one year later and then to tell us only time stands between anoth nuclear nightmare in the Harrisburgh area.

57,000 curies of KR 85 is not safe. You don't want Met Ed's workers expososed to such dangerous radiation so dump it slowly into the environnment so the dose at any one time is measured as "low" but with a half life of 10.4 years we are worried about not only rad but the total number of curies released into our life cycle. To call your "purge system" a clean up operation is like taking garbage from a can, dumping it all over, and

(4)

proudly pronouncing that everything is now clean!

You have stated in your report that you recognize public anger at the venting option is strong but you have to overstep those concerns for long term safety outlook. Once again you treat us like school children. We know after the gas is vented that Met Ed will want to dump the water. Some "clean up".

Take notice, my friends, that a movement is growing to shut down TMI forever. That is your best long range safety bet. Keep your krypton.

Terry Rumsey
109 E. 23 Street
Ship Bottom, N.J.
08008

Box 160
So. Casco, Me 04077

Nuclear Regulatory Commission
1717 H St. NW
Washington, D.C.

To NRR

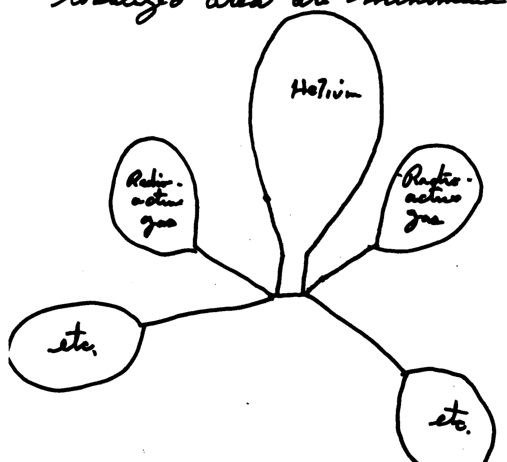
Gentlemen:

I have been following the various problems that have appeared at the various reactor sites, specifically 3 Mile Island.

I have a theory, or a plan if it better describes my point of view; a way to get rid of the radio-active gases that are causing so much public reaction to the possibility of them being vented into the atmosphere.

Here is my plan, please excuse my ignorance should it be too obvious.

I have no knowledge of the volume of gases to be released but - should these gases be pumped into balloon like sacks, sealed, and hoisted by a helium filled balloon, allowed to rise into the stratosphere and the gaseous cargo detonated over an area where the likelyhood of contaminating any particular localized area are minimum.



Actually, if properly filled the expanded volume of gases in the sacks could be predicted to explode these sacks at high stratospheric altitudes. The helium filled balloon would move away from this area and eventually meet with the same conclusive end. The gases in the sacks could be controled to be dispersed at different levels depending on the volume to which the sacks were filled at normal earth surface atmospheric pressure.

I may be very wrong in my theory but I'm interested in nuclear power and its hazzards and any possible safety procedures.

Yours truly
Richard H. McKinney Sr.

Dear Sirs,

Please do not vent the gasses at Three Mile Island. If you do you are committing murder. No amount of radiation is harmless. Every amount that is released increases the risk of cancer.

You can use cryogenics, freezing the gas, then encase it in concrete. This should have been started a year ago, but it can still be done now.

I went around my neighborhood with a very strongly worded letter against releasing the gasses at Three Mile Island. Out of 30 houses only one person refused to sign the letter. People are becoming angry at authorities for not considering ~~their~~ well being of the public when making decisions about nuclear Power.

Please think of the human beings involved in your decision.

Sincerely,

Linda Schneider
RD #1 Box 33
Douglassville, Pa. 19518

(1) FROM: Annette Alwine
R.D. #2 Box 1499
Mt. Joy, Pa. 17552
(I live 5 mi. away from TMI)

Director, Three Mile Island Support:

I'm writting in reply to your new plan of venting the krypton gas by venting the large amounts of it over a five day period instead of venting it over a period of sixty days. Public comments were to be sent to this address. In my opinion the Krypton gas should NOT be vented into the air AT ALL. I would think, by now, that you would use another alternative to venting the gas, since you know how much the residents living in the surrounding vicinity are opposed to this plan of venting. I know you say that the other alternatives would take alot of time, but why haven't you started on another, SAFER plan to rid the plant of this krypton gas? Why not start on ANOTHER plan, NOW? WE NEED A NEW "SAFE" PLAN! NOW! DON'T WAIT ANY longer get into action! We don't need that krypton gas in our community, OUR bodies, OUR water and OUR land. Why don't some of YOU sophisticated guys sitting on your backside in Washington come down to Pa. and live at my house when they release that gas-- bring YOUR family and

PLEASE SAVE our community & Homes is OUT CRY!

PLEASE Save our Community and OUR Homes!

Save our living quarters!

PLEASE

PLEASE DON'T KILL US OFF.

You won't have any customers to buy from you anymore!

PLEASE!

(2)

We like our community-- save it! We have OUR right TOO! Please start on another, safer plan. Don't Always Think of YOUR $, think of "US"-our, health, community, kids, ETC! Your friends, too. Come on you chickens--

That is, IF you think it really is as safe as you say it is. And that's another area you have failed us in -- LYING. How in the world can we believe you, or any T.M.I or N.R.C. worker again? We have heard, and still ARE hearing many conflicting reports on the situation at T.M.I. GET YOUR ACT TOGETHER! You wonder why the people had an effigy, spit in your face, cried out to you in fear & bitter anger, swore at you & wouldn't let you present your plan of venting to us at the meetings in Middletown and Elizabethtown School. Because we can't trust you & we've sat back & listened (to many many conflicting ideas and stories) to you long enough. So, Listen To Us for Once!

At the initial accident in March of 1979, on that Friday when we learned of the real danger and heard that buzzer on the radio go off telling us there was an emergency-- WE WERE SCARED TO DEATH! I'll NEVER forget that day as long as I live, (if I live much longer after all the radiation). It was THE MOST horrible sound -- when that

Please don't turn our (3) Community into a long, lost Ghost town of horrible, "Preventable" Disaster!

buzzer came on the radio I figured it was just a test as it always is. NO! This time something had REALLY happened. My reaction was -- Are we going to war? NO -- it's T.M.I. that feared monster in OUR community. After they told us not to panic they said we were to stay in our homes because T.M.I. had radiation escaping from it. Men were outside working on our road, my sister & brother were at school, my father at work! What are we going to do? There is this danger around us that we can't see or feel and it's so frightening cause we don't know what it's doing to us and how much is there. Hurry! Get on the phone call dad -- We are LEAVING! We'll stop at the school and pick up the kids and tell Dad where to meet us -- you go pack a while, my mother instructed me. She couldn't get on the phone because all the circuits were jammed with other phone calls. What are we going to do now?? -- PACK! We couldn't get through to my father so, while we waited for him to return from work we listened intently to the radio all day long. AND PACKED!

SAVE OUR RIGHT (4) TO CLEAN AIR, WATER + BODIES

About three o'clock in the afternoon someone came to the door. It was, our neighbor, Mr. Kondras, who works at T.M.I. Oh! He came to reassure us that everything at the plant was O.K. And he said that the levels of radiation weren't high enough to hurt us. So, we don't have to worry, that's what he told us -- my mother, sister and I. After we argued with him for about 45 minutes that the radiation was safe. We finally told him we didn't believe him & we KNOW that there is NO "safe" level of radiation exposure - his face looked VERY ashen and worried and worn out. We told him we were leaving cause we didn't believe him. He promptly told us, again, that there was no reason to leave. We asked him where HIS wife and ten year old son were and you know where they were? He told us flat out that he SENT them to New Jersey to stay for a couple of days until this with T.M.I. blows over. ISN'T THAT A DIRECT CONTRADITION TO WHAT HE JUST TOLD US? He decided to leave then.

SAVE OUR(S) RIGHT TO HEALTH SAVE OUR COMMUNITY

THAT IS ONLY ONE EXAMPLE OF CONTRADITION after contradition that you as officials have been feeding us. And you wonder why, we the people of the surrounding community, are all shoke up.

DON'T WE have a RIGHT to clear air, water & land & BODIES? I don't see You getting too close to that plant for any length of time (and MOST of you officials), NOT AT ALL! YOU are poluting OUR RIGHTS WITH RADIATION and if you didn't have money to pay off some people to keep their mouth shut you wouldn't be allowed to do it. That's all these big bussinesses do: pay off one person & rip off & infringe on another persons' rights. And it's all because of the BIG "I" and "$" (money). But, I won't see any of you "BIG GUYS" down here when they release that gas, with all that money you can afford a nice, memorable funeral. We'll come & look at you lying in your casket & remeber you can at the time they realeased the gas --- If we are still around by then. It COULD take a couple of years of painful suffering until you REALLY and FINALLY die off!

Please don't pollute OUR RIGHT to a clean and healthy living enviroment. What did we EVER do to yours? (Except make yours a little richer by the $ you get from us)

You told us there ARE other ways to rid TMI of that Krypton gas. Why don't you use one of those other ways? Krypton gas DOES have a half-life of about "eight" years that makes it even WORSE. It WON'T go away after the day you release it OR after eight years -- it'll take many many years! OF COURSE YOU ALREADY KNOW THAT. And you ALREADY know what it'll do to our DNA genetic cells. It won't only harm US it'll harm generations to come! Retarded, malformed kids, born without libs, without legs & it can go on and on, they'll pass the deformed DNA cells to THEIR kids and on it goes. It'll collect in our bone marrow, thyroid glands, cause leukemia, cancer, etc.; not to mention all the stress, mentally in which it has already caused to an innumerable amount of people. And you call US crazy for being bitter, hateful & mean to YOUR NRC + TMI representatives when they come here. SHOULD WE BE NICE? HAVE THEY DONE ANYTHING NICE TO US? AND WILL THEY? Please! Get working on another alternative clean-up plan NOW! Save the surrounding community PLEASE

FROM:
Annette Alwine
R.D.#2
Mt. Joy, Pa.
17552

[I live 5 miles from TMI + I want to always have this be MY home and COMMUNITY. Please DON'T turn it into a ghost town.

Nuclear Regulatory Commission
P.O. Box 311
Middletown, Pa 17057

As a resident of the Philadelphia area, I am quite aware of the fact that within the next 5 yrs., we will undoubtedly be subjected to the hazards of receiving electricity via the Limerick Nuclear Power Plant.

The thought of a potential accident similar to the one which occurred at Three Mile Island, is one which causes me to worry.

I have attempted to put myself in the position of a resident of the Middletown area, in terms of how I would deal with the venting of radioactive gas. If this were to happen at Limerick, my first inclination would be to leave the area and wonder if I could ever return to a safe environment.

I believe the Metropolitan Edison company should use the alternative method of liquidizing the gas and then freezing it so that it can be stored properly, not venting the gas. The health of the people is far too important to let krypton gas go into the breathing air.

Catherine McGonigal
3124 S 13th St
Phila Pa 19148

AFSCME, AFL-CIO COUNCIL 13

AMERICAN FEDERATION OF STATE, COUNTY, AND MUNICIPAL EMPLOYEES • AFL-CIO
5th FLOOR, CITY TOWERS BUILDING, 301 CHESTNUT STREET, HARRISBURG, PENNSYLVANIA 17101
(717) 236-4051

Gerald W. McEntee
Executive Director

May 16, 1980

Dr. Bernard J. Snyder, Program Director
Three Mile Island Program Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Dr. Snyder:

The attached reflects our response to the Nuclear Regulatory Commission's Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere as per your cover letter of April 21, 1980.

Very truly yours,

Gerald W. McEntee
Executive Director

In our attempt to react to the report, a number of statements and questions must be posed and responded to.

1. Clearly the most basic premise is that the Krypton-85 must be removed from the reactor building. The report states that the licensee estimated there are 44,000 curies of Krypton-85 while the Nuclear Regulatory Commission states there are 57,000 curies. This difference is not insignificant when one considers that a plant operating under "normal" conditions, "gives off" 1,000 curies per month. Immediately there exists a discrepancy of over one years' worth of Krypton-85 exposure. Nevertheless it is agreed that the Krypton-85 must be removed from the reactor building.

2. Our opinion is that the method chosen for the removal of the Krypton-85 must be the one that is the least harmful to the general public. Given the data in your report, the venting proposal gives, by far, the greatest exposure to the general population. Greater by factors in the thousands and tens of thousands.

3. Our opinion is, given #2, that the costs involved should be a very minor consideration if it is considered at all. Your report relies heavily on the licensee's cost estimates while that licensee's credibility has been and is being gravely questioned. Their estimates range between $10 to $160 million with the exception of venting which is only $75,000. The only other estimate, supplied by the Nuclear Regulatory Commission staff is between $4 to $10 million.

4. What causes the urgency to remove the Krypton-85 from the reactor building? Your report briefly mentions a cooling fan system and door seals while giving virtually no substantive documentation of your concerns. Although the Krypton-85 has been in there for over one year, no system for its removal is even in the embryo stage. Again raising the question, what is causing the urgent need for the removal of the Krypton-85. Several weeks ago your spokesmen in this area were claiming there was a dire urgency for its removal while very recently these same spokesmen are saying several months delay would be no cause for alarm. All of the other alternatives (other than venting) are at least partially dismissed because of the length of time needed to make them operable. If lack of accessability for maintenance purposes is the concern, how is it that the licensee will soon be sending two engineers into the reactor building? Finally if an urgent situation develops during the time period an alternate removal system is being developed, isn't venting still a very real possibility?

Dr. Bernard J. Snyder
Page Two
May 16, 1980

5. Along with the time-lag problems with the alternate removal systems, the other primary objection to them is the danger of storing the radioactive waste generated. Your report indicates that it is difficult to store under controlled conditions and it would threaten occupational exposures for one hundred years. That statement and premise is sound for after all it is a radioactive material that has a half-life of 10.7 years. That concern is real, even though your report defines Krypton-85 as "A radioactive noble gas, with a half-life of 10.7 years, that is not absorbed by body tissues and is soon eliminated by the body if inhaled or ingested."

While we are told of all the dangers of long term storage of Krypton-85 with its 10.7 years half-life, we are assured by the licensee, the entire nuclear industry, the Nuclear Regulatory Commission and by the White House that nuclear wastes pose no real threat to society. We are told this even though one of the by-products of a nuclear power plant is plutonium with a half-life of over 24,000 years and poses a very real danger for 250,000 years.

In conclusion I feel that venting isn't the safest method given the radiation exposure it gives the general population, nor is there any great urgency in removing the Krypton-85 from the reactor building. Therefore I would suggest you seriously consider one of the other alternatives, most likely the selective absorption process system which would result in very little radioactivity exposure to the general population in addition to which it can be put into operation in a relatively short period of time.

Lacking your selection of the selective absorption process system, I would like you to very seriously consider the just released report by the Union of Concerned Scientists.

And finally should you not decide to err even that much on the side of safety, vent it over the five day period discussed in your NUREG-0662 addendum #2. Do it after the current school year terminates which would allow more people who are so inclined to evacuate the area with their children. Those choosing to then evacuate should be compensated for all expenses incurred by either the licensee and/or the Federal Government.

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE
HARRISBURG

THE GOVERNOR

May 21, 1980

Honorable John F. Ahearne
Acting Chairman
Nuclear Regulatory Commission
Washington, DC 20005

Dear Mr. Chairman:

Enclosed are the various reports and assessments to which I referred in my letter to you of May 16, 1980 regarding the proposal to remove radioactive krypton 85 from the Three Mile Island Unit 2 containment building by the process of venting it into the atmosphere.

They include:

*The report to me of the Union of Concerned Scientists (UCS).

*A joint press release I developed with the UCS, the seventh paragraph of which contains a clarification regarding the first recommendation on page 57 of that organization's report.

*The report to me of the National Council on Radiation Protection and Measurements (NCRP). (See page 259)

*A copy of a letter addressed to your staff, and forwarded to me, from the Director of the U.S. Bureau of Radiological Health.

*The report of The Governor's Commission on Three Mile Island.

*A copy of a memorandum to me from the Secretary of the Pennsylvania Department of Environmental Resources (DER), Clifford L. Jones.

*A copy of a letter, addressed to me from the Secretary of the Pennsylvania Department of Health, Dr. H. Arnold Muller, M.D.

*A copy of a letter, addressed to me, from the Secretary of the Pennsylvania Department of Public Welfare, Helen B. O'Bannon.

5/29..To EDO for Appropriate Action..Cpys to: Chm,Cmrs,PE,GC,Records,Snyder
80-1119

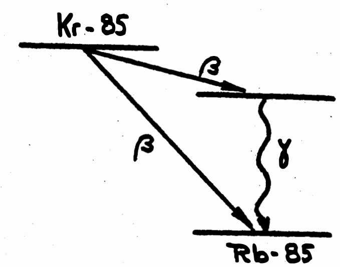
I understand that the views of your own staff, as well as those of the electric utility and nuclear industries, have been made available to you directly. I trust you will give all of these materials due consideration in reaching a decision on how best to remove krypton 85 from the containment building.

Again, thank you for the opportunity to express my views on this important matter, and to submit to you those made available to me by other institutions and organizations.

Sincerely,

Dick Thornburgh
Governor

DECONTAMINATION OF KRYPTON-85 FROM THREE MILE ISLAND NUCLEAR PLANT



A REPORT OF
THE UNION OF CONCERNED SCIENTISTS
TO
THE GOVERNOR OF PENNSYLVANIA

MAY 15, 1980

DECONTAMINATION OF KRYPTON-85
FROM
THREE MILE ISLAND
NUCLEAR PLANT

Study Director

Henry W. Kendall

Study Members

Jan Beyea
Dale G. Bridenbaugh
Gregory C. Minor
Robert Pollard
Edward Radford
Frank von Hippel (Reviewer)

A REPORT OF
THE UNION OF CONCERNED SCIENTISTS
TO
THE GOVERNOR OF PENNSYLVANIA

MAY 15, 1980

THE UNION OF CONCERNED SCIENTISTS

1384 Massachusetts Avenue

Cambridge, Massachusetts 02238

617-547-5552

The Union of Concerned Scientists is a non-profit tax exempt coalition of scientists, engineers and other professionals concerned about the impact of advanced technology on society. UCS has conducted a series of independent technical studies on a wide range of questions relating to nuclear power plant safety, radioactive waste disposal options, nuclear arms race issues, energy policy alternatives and Liquefied Natural Gas transport and storage hazards.

TABLE OF CONTENTS

Members of The UCS Study Group

Jan Beyea, Ph.D, Nuclear Physicist and Senior Energy Scientist with the National Audubon Society. Specialist in airborne dispersion and radiation effects from airborne releases of radioactivity.

Dale G. Bridenbaugh, BSME, PE Mechanical Engineer. Partner MHB Technical Associates. Former manager of (Nuclear Plant) Performance and Improvement, General Electric Nuclear Energy Division.

Henry W. Kendall, Ph.D, Experimental Physicist in elementary particle physics. Professor of Physics at Massachusetts Institute of Technology and Chairman, Union of Concerned Sicientists.

Gregory C. Minor, MSEE Electrical Engineer. Partner MHB Technical Associates. Former manager Advanced Control and Instrumentation Engineering, General Electric Nuclear Energy Division.

Robert D. Pollard, BSEE Nuclear Safety Engineer, Union of Concerned Scientists. Formerly Licensing Project Manager, Nuclear Regulatory Commission.

Edward Radford, M.D. Professor of Environmental Epidemiology, Graduate School of Public Health, University of Pittsburgh. Chair National Academy of Sciences Advisory Committee on Biological Effects of Ionizing Radiation (BEIR).

Frank von Hippel, Ph.D (Reviewer of the UCS Study.) Theoretical Physicist. Senior Research Physicist, Center for Enviromental and Energy Studies, Princeton University. American Physical Society Reactor Safety Study and NRC Risk Assessment Review Group specializing in reactor accident consequence and strategies for their mitigation.

Acknowledgements

The Union of Concerned Scientists (UCS) wishes to express its appreciation to Governor Richard Thornburgh of Pennsylvania and his staff, especially Mssrs. Roland Page and Paul Critchlow for their help and support throughout the course of the study.

Tom Overcamp, Associate Professor in Clemson University's Department of Environmental Systems Engineering, provided much valuable advice and carried out useful calculations in support of our proposed hot plume venting scheme.

UCS is grateful to the Office of the Secretary of the Air Force, Hans Mark and to the Office of the Under Secretary of Defense, William Perry, for help they provided. Tom Kelly and his associates of the U.S. Air Force Geophysical Laboratory made numerous suggestions and calculations bearing on tethered balloon technology. We thank them.

We extend thanks to Walter Martin of the Office of Naval Research, Jean Nelson of Winzen International, Inc., George Rathjens of M.I.T., Bruce Preston of Public Service Electric and Gas, Arthur Winters of Air Products and Chemicals, Inc., Milton Lytton of Mitre Corporation, Ward Diethorn of Pennsylvania State University, and Evelyn Bromet, Ph.D. of the University of Pittsburgh.

We benefited greatly from discussions with representatives of the citizens groups which comprise the TMI Legal Fund.

We wish to thank Robert Arnold and his associates of Metropolitan Edison, and Harold Denton, Bernard Snyder, and John Collins of the Nuclear Regulatory Commission for their cooperation in supplying the quantity of information we requested.

The National Audubon Society (Russell Peterson, President) very kindly allowed Dr. Beyea to join our study.

Jim Leas, a physicist on the UCS staff, provided important information on Krypton recovery and storage techniques.

Finally, we acknowledge the support and aid provided by the UCS staff in Cambridge and Washington, especially Janice Candelora, Andrea Fishman, and Bette Pounders.

(The cover page illustration represents the radioactive decay scheme of krypton-85.)

I. INTRODUCTION

During the accident at the Three Mile Island (TMI) nuclear plant which started March 28, 1979, extensive melting of the reactor fuel released substantial quantities of the accumulated radioactive fission products into the reactor coolant system and reactor building. Among these was much of the radioactive krypton-85. The physical quantity of krypton is very small, no more than a few ounces it would occupy about 1.3 cubic feet if isolated. Unfortunately, it is uniformly mixed with the roughly 2 million cubic feet of air in the sealed Three Mile Island Unit 2 reactor containment building.

Krypton is the 36th element in the periodic table. At room temperature it is a gas with a density three times that of air. From its position in the periodic table a chemist would at once know that it has little chemical activity; indeed, it is classified as inert. The nuclear physics of krypton is far more varied.

There are twenty-one isotopes of krypton. Chemically they are identical, but their nuclear masses differ. Six of these isotopes are stable, but the remaining fifteen are all radioactive to some degree. In the fission chain reactions that split the uranium nuclei, about 0.3% of the fissions yield Kr-85, with a radioactive half-life of 10.7 years.

The krypton-85 is biologically hazardous because of its radioactivity. Short-range beta particles emitted by the krypton-85 can irradiate skin or other tissue and its more penetrating gamma radiation can cause whole body irradiation. As we discuss below in more detail, worker entry into the TMI reactor building in order to carry out maintenance, inspection, and work associated with decontamination of the plant is substantially hindered by the presence of the krypton. In the upper levels of the reactor building, the krypton appears to be the source of most of the damaging radiation and thus poses the most important restriction to free worker access.

The Union of Concerned Scientists (UCS) Study Group believes that ultimate decontamination of the plant is an absolute necessity. Decontamination must include complete removal of the damaged fuel rods and of the contaminated water in the containment sump and elsewhere. The plant cannot be sealed and walked away from. This would constitute a negligent disposal means for a very large quantity of radioactivity. Important quantities of these toxic materials would ultimately find their way into the environment during the tens or hundreds of thousands of years that some of them will remain hazardous.

Accordingly, UCS has concluded that the krypton must be removed from the TMI reactor building so that an orderly

program of decontamination can be undertaken. The problem is how to do this in a manner which protects the safety of the workers who may be exposed to the krypton and also safeguards the physical and mental health of members of the public who may also be exposed.

Based on arguments emphasizing the need for prompt entry into the reactor building and calculations that claim to show small or negligible consequences to the public, Metropolitan Edison (Met Ed) has proposed to vent and flush the reactor building through a 160 foot vent pipe located near the building over a period of from 5 to 50 days. The Nuclear Regulatory Commission (NRC) staff indicated its initial approval of this scheme. The radioactive plume from this release would mix in the turbulent wind-induced wake downwind of this building and, in some wind directions, in the wakes of the cooling towers. Some of the radioactive gas would therefore hug the ground. This would result in beta and gamma radiation doses to persons exposed to the contaminated wind. For this reason we refer to this venting scheme as a "ground-level" release.

This Met Ed and NRC proposal to conduct ground level venting has resulted in immense anxiety and considerable resistance in a significant portion of the population near the plant. This population was subject to the lengthy trauma of the accident itself and to the subsequent efforts, not entirely successful, to prevent unexpected leaks of radioactivity.

On March 28, 1980, Pennsylvania Governor Richard Thornburgh asked UCS to make an independent evaluation of the krypton problem.

The UCS Study Group evaluated the need for containment entry, the urgency of that need, the impact of the ground level venting of the krypton, and the advantages and disadvantages of the four alternative krypton recovery schemes rejected by Met Ed and the NRC in making their choice to vent. We also searched for solutions to the krypton problem not previously proposed. Because the NRC staff and Met Ed had announced their decision to vent before the UCS meeting with Governor Thornburgh and because the NRC has the legal authority to allow the venting to proceed and wishes to do this promptly, UCS was under great pressure to complete its study in a most rapid manner. We have done so. Barely a month could be devoted to the task, from its inception to the delivery of our conculsions to Governor Thornburgh and to the public. This is our report.

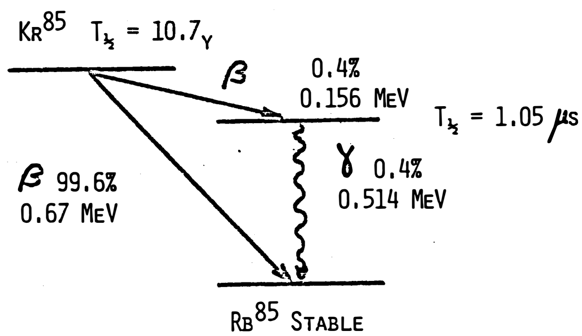
II. THE KRYPTON PROBLEM

A. Radiation Levels

The difficulties posed by the krypton-85 in the containment arise from its radioactivity. As shown in Figure 1, krypton-85 decays dominantly by emission of beta particles of maximum energy 0.67 MeV. However, 0.4% of the krypton atoms decay with a lower energy beta spectrum accompanied by a gamma ray of 0.514 MeV.

The amount of krypton-85, expressed as radioactivity, is about 57,000 curies. Because of the biological hazard posed by the radiation, this is by no means a small quantity. Beta particles travel only a short distance in human tissue, so the principal injury from exposure outside the body is to the skin or, if the gas is inhaled, to the lungs and to other tissues of the body to which krypton-85 may be carried if dissolved in the blood. Conventional radiation protective clothing does not provide sufficient protection to workers against the beta particles. A heavy diving suit with breathing apparatus is required for adequate protection for workers who would encounter the gas but work in such gear is awkward and the suit is subject to leaks or other failure. The gamma rays are more penetrating and cannot be effectively stopped by any practical protective clothing of any sort. They produce whole body radiation exposure.

Removal of the krypton-85 will not significantly reduce the gamma radiation to workers in the lower part of the containment. The radioactive materials concentrated in the 600,000 gallons of water in the building sump are a far more intense source of gamma radiation. Some surface deposition, or



The radioactive decay scheme of the fission product krypton-85. The branching ratios, lifetimes and gamma energy and beta spectrum end point are shown. The stable daughter nuclide is rubidium-85.

FIGURE 1.

plate out, of gamma emitters, primarily Cs-137, has occurred throughout the containment. However, in the upper portions of the containment where successive concrete floors provide significant shielding from gamma radiation originating in the sump, the beta exposure from the krypton appears to be the principal hazard to entering workers.

The estimated radiation levels in the containment building with the krypton present are shown in the following tables. The estimates were provided by Met Ed personnel. UCS has no way to verify these numbers or estimate the uncertainfies in them, but they appear to be reasonable.

Gamma Radiation Levels

(REM/hour)

Sump, just above water surface		125
15 ft. above water, at 305 ft. building elevation:		
	Radioactive plate out	0.26
	Kr-85	0.66
	Sump water	1.08
	All sources	2.0
57 ft. above water, at 347 ft. building elevation:		
	Radioactive plate out	0.4
	Kr-85	1.1
	All sources (total)	1.5

Beta Radiation Levels

(REM/hour)

All locations, dominated by kr-85	
No protective clothing	200-300
Special protective clothing (with minor leaks) and with self-contained breathing equipment	9

To put the gamma levels in perspective, one should note that less than one hour occupancy at the sump level would induce acute radiation sickness and would increase the exposed individual's risk of eventually developing cancer by several percent. Three hours occupancy would result in a nearly even chance of death within weeks.

A one hour exposure to beta levels exceeding 200 REM/hr would lead to increased risk of skin and lung cancer. While the precise relationship between dose and outcome is not known, there is no question that such a dose is exceedingly unwise. Indeed, even individual beta skin exposures at the 10 REM level should be avoided if at all possible.

In summary, there is no question, in our view, that removal of the krypton is necessary before decontamination work in the containment can proceed. The central consideration for worker protection is the need to minimize their exposure to the krypton beta radiation.

B. Need For Reactor Building Entry

1. Introduction

There appears to be no significant disagreement about the ultimate need for worker access to the TMI-2 reactor building. Relatively free personnel access will eventually be necessary to remove the damaged fuel and to decontaminate the reactor coolant system and reactor building. No one knowledgeable of the type and quantity of radioactive material present in the damaged plant would ever suggest that the plant could be abandoned without a major clean-up to guard against eventual release of some of that material to the environment. There is, however, disagreement about the urgency of the need for reactor building entry.

The reasons advanced by Met Ed and the NRC (in NUREG-0662) for promptly regaining access to the reactor building fall into three categories: 1) Maintaining reactor building integrity, 2) assuring continued integrity of the reactor coolant system, and 3) safeguarding against accidental criticality (restart) of the reactor. As long as these conditions are maintained, there is no urgent short-term need for personnel access to the reactor building. However, the ability to maintain these conditions depends partly on components located within the reactor building. Access to the reactor building could be required by the actual failure, or concern for the failure, of these components. There are only a few such important components and these are addressed in the following discussion.

2. Reactor Building Integrity

Reactor building integrity is provided by the reinforced concrete building and its extensions. The extensions include piping penetrations and isolation valves, electrical penetrations and personnel and equipment hatches. However, the reactor building is not leaktight. The pressure test of building integrity conducted prior to the accident showed that at 56 psig, the building leaked at a rate of less than 0.1% by weight per day. (The design leak rate is 0.2% by weight per day at 60 psig.) The leakage rate has apparently remained very low. We have identified no likely failure that would increase the present low leakage rate.

As long as the reactor building pressure continues to remain slightly negative, no direct leakage of the krypton is possible. In fact, air is probably leaking into the building. The negative pressure is being maintained by the combination of the low leakage rate, the release of a small portion of the building atmosphere through the steam generator cooling mode, and operation of four fan coolers.

The reactor is being cooled by natural circulation which transfers heat to the steam generator. The secondary side of the steam generator is being maintained at a vacuum to permit boiling at a temperature below 212°F. Some small portion of the reactor building atmosphere is leaking into the steam system and is being discharged through the condenser

air ejectors. This discharge of a small portion of the reactor building atmosphere may be compensating for the air leaking into the reactor building.

The heat sources being controlled by the fan coolers are about 50% of the decay heat being generated in the reactor and the solar energy input to the reactor building. About half the decay heat is being transferred to the reactor building atmosphere because some of the reactor coolant piping is submerged in the 600,000 gallon pool of water in the bottom of the building. The heat is transferred from the reactor coolant to the pool and then to the building atmosphere.

Met Ed and NRC have estimated that, if all fan coolers failed during the peak summer solar heat load, reactor building pressure could increase to 4 psig in the worst case. With positive pressure in the building, some leakage of the krypton could occur. Therefore, Met Ed and NRC argue that prompt reactor building access is needed for maintenance of the fan coolers.

The UCS study group concludes that the desire for access to the fan coolers does not justify immediate venting of the krypton. The reasons for this conclusions are threefold: there are several mitigating actions available, the hazards posed by fan cooler failure have been exaggerated, and venting could take place later if in fact the fan coolers did fail.

The heat load now being carried by the fan coolers can be reduced. Met Ed plans to place a low flow decay heat removal system in operation soon. Operation of this system will make it possible to reduce reactor coolant temperature and thereby reduce the heat being transferred to the building pool and atmosphere. The total decay heat load is currently about 540,000 BTU/hour and the fan coolers are removing only about half of that -- about 270,000 BTU/hour. Met Ed estimated that the peak solar energy load would contribute about half the total heat load to be removed by the fan coolers -- another 270,000 BTU/hour. Spraying water on the outside of the building could help reduce the solar energy contribution. Nevertheless, since the heat removal capacity of each fan cooler is 1.4 million BTU/hour, it appears that operation of just one of the five coolers is probably adequate to maintain reactor building temperature at its present level. However, there is no way of being certain that at least one fan cooler will continue to be operable. Four of the five units have been in operation since the accident began. They were qualified to operate for only 3 to 4 hours of accident conditions and are supposed to receive maintainance once a year. Nevertheless, the one fan cooler not now in operation is believed to be operable and the dual speed motors could conceivably function on high speed should the windings now in service fail.

Even assuming that all fan coolers failed completely, the hazard to the public would be slight. NRC exaggerated the hazard by calculating a radiation dose to the public far in excess of the expected dose by assuming an unrealistic leak rate. (See page 4-5 of NUREG-0662.) Although building pressure was estimated by NRC to be 1-2 psig, the leak rate used by NRC was the leak rate that would occur only if pressure increased to 60 psig or if the leakage paths increased in size. The NRC further assumed that this high leak rate would be constant over a 30-day period. We believe that, if the situation arises where all methods of reactor building heat removal fail, the partial venting of the containment could take place then, if needed, to reduce the radiation dose to the public from the uncontrolled ground level release of the krypton. Furthermore, if such venting were used, it would not be necessary to release the entire contents of the building but only the fraction needed to reduce building pressure to 0 psig. The bulk of the krypton would not be released.

In summary, the UCS study group concludes that immediate venting of the TMI-2 reactor building is not necessary to maintain building integrity, there is no immediate need for fan cooler maintenence, and the public can be protected even if all fan coolers fail.

3. Reactor Coolant System Integrity

Met Ed and NRC have also advanced concerns about the integrity of the reactor coolant system as a reason for promptly venting the krypton in the reactor building. They speculate that the submergence of some of the reactor piping in the 600,000 gallons of contaminated water and the exposure of piping, the reactor, and steam generators to contaminants in the building atmosphere could cause accelerated corrosion which could lead to a failure of these pressure boundary components. Such a failure could lead to a loss-of-coolant accident and severely complicate the clean-up process and the status of the damaged plant.

Based on our review of the alternatives to venting and the need for access to the reactor building, we conclude that failure by accelerated corrosion is not significant to the particular issue of immediate krypton removal. We agree that removal of the krypton is ultimately necessary to achieve relatively free access to the reactor building. However, no gases have been reported present that are a severe threat to the integrity of the piping and components exposed to the building atmosphere. In addition, venting would have little or no effect on the integrity of or access to piping submerged in the contaminated water.

We therefore conclude that treatment of the contaminated sump water, rather than venting of reactor building, is the action needed to alleviate concern about the loss of reactor

coolant system integrity. Until a plan for treatment of the water is approved, speculation about failure of components submerged in the sump water cannot be used as justification for venting. If the treatment is accomplished remotely and externally, the need for building access is even less urgent. If the method of water treatment approved requires access, venting (or an alternative developed by the time access for water treatment is needed) could be used.

In summary, the UCS study group concludes that immediate venting is not needed to assure continued reactor coolant system integrity.

4. Safeguarding Against Accidental Criticality

The possibility of the reactor accidentally starting up again (achieving criticality) has also been advanced as a basis for immediate venting of the krypton. The particular concerns related to personnel access are the need to ensure adequate boron concentration in the reactor coolant and the availability of neutron detectors.

The only method available for keeping the reactor subcritical is to maintain the boron concentration in the reactor cooling water sufficiently high. Met Ed has calculated that in the worst case (i.e., all control rods and burnable poison rods removed and the core slumped on the lower grid in the reactor vessel), the reactor will remain subcritical by a large margin _if_ boron concentration is 3500 ppm or greater.

Presently, boron concentration is being maintained at 3700 ppm. When the low flow decay heat removal system is placed into operation, which is scheduled for May 1980, there will be thorough mixing of the reactor coolant. This will eliminate the expressed concern about the boron concentration in the coolant sample being representative of the boron concentration in the reactor vessel. In any event, personnel access to the reactor building will not materially aid in determining or in maintaining the boron concentration.

The only direct way to determine whether the reactor is subcritical is to measure the neutron level. Only one of the plants' two source range neutron detectors (the most sensitive of three ranges of neutron detectors) is presently operable. Failure of the last instrument would make future, direct verification of shutdown difficult if not impossible. However, two factors relate to whether immediate access to the reactor building is needed to repair the other source range detector. First, it is not known whether removal of the krypton would make the location of the source range detector (the 327 foot level near the top of the reactor) accessible. In all likelihood, venting will have little impact on the radiation dose rate at this location, but the mobility of personnel would be improved by elimination of the need for bulky protective clothing. Entry into the reactor building in the near future, in special heavy protective suits, could give some indication of the radiation levels in this area. Second, failure of the source range detector would, of course, not

cause the reactor to go critical. An additional failure or personnel error leading to dilution of the boron would be required. Thus, increasing the sampling frequency to determine boron concentration could compensate for failure of the remaining source range neutron detector. If the reactor did become critical, it would be detected by temperature increases of the reactor water (although not as quickly as if the source range detector remains operable). In addition, special instruments are now being connected to the power range detectors which may also indicate criticality.

In summary, the UCS study group concludes that it is highly unlikely that the reactor will become critical and that immediate access to the reactor building will not significantly affect either the ability to keep the reactor subcritical or the ability to reachieve shutdown if criticality occurred.

5. Conclusion on Need for Entry

Relatively free worker access to the reactor building is eventually necessary in order to decontaminate the plant. The radiation dose to workers from the krypton in the building atmosphere effectively precludes the necessary access. Therefore, the krypton must eventually be removed from the building.

On the basis of concerns about reactor building integrity, reactor coolant system integrity, and accidental criticality, Met Ed and the NRC concluded that building entry was urgently needed -- within a few weeks or months. The UCS study group concludes that none of the concerns expressed by Met Ed and NRC have sufficient merit to justify their proposed schedule. Furthermore, we have identified no other concerns that would support a conclusion that prompt entry in the short time they propose is needed.

The UCS study group concludes that taking additional time to develop an alternative course of action to the Met Ed/NRC venting proposal is justifiable for reasons discussed later. Such a course would not pose an undue risk to the health and safety of the public. However, because of the uncertainty about future problems developing that are not now foreseen, the delay should be no longer than necessary. It must not be much longer than a year and certainly no longer than a year and a half. Furthermore, if an emergency situation developed that required prompt building entry, the krypton could be vented in a few days in the manner proposed by Met Ed and NRC. We believe this possibility to be remote.

C. Reference, Section II

NUREG-0662

"Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere," U.S. Nuclear Regulatory Commission, March 1980.

III. VENTING

A. General Considerations in Venting

Venting of the contaminated containment gases as proposed by NRC and Met Ed would employ a 160 foot stack located near the containment building. This stack is sufficiently short so that the released gases would mix with the turbulent wake downwind of the containment building, and for some wind directions the wakes of the cooling towers. The resultant plume of radioactive air would initially be roughly as wide and as high as the building and would quickly come into and remain in contact with the ground. Maximum radiation levels occur very near the release site. Because the beta emissions from krypton travel only a relatively short range in air, and are the dominant emission, a ground level cloud gives rise to the greatest radiation exposure to people. A cloud more than a few meters distant irradiates only by its gamma ray emissions.

If the release point is elevated so that no building wake entrainment occurs, then the plume initially will not contact the ground. As the wind carries the material along, mixing and diffusing of the plume will cause lateral and vertical dispersion of the material and at some distance downwind (depending on the release height and weather conditions) the now more dilute material will contact the ground. The maximum radiation levels may occur at some distance from the release point. The maximum radiation exposures in such cases

may be dramatically lower than for ground level releases. For this to occur the release point must be effectively far above the structure tops so that no structures intercept the plume.

In our search for means to reduce the radiation exposures to persons on the ground we examined the possibility of venting from the top of one of the 370 foot TMI cooling towers. Mixing in the tower wake occurs so quickly downwind, however, that no appreciable reduction in the ground dose off-site is achievable.

Consequently, we turned to other alternatives discussed later in our report.

B. Radiation Exposure and Direct Health Effects

Our calculations for the total beta skin dose and separately for the total gamma dose are given in Tables 1 and 2 for a variety of release heights and entrainment. They are based on a standard gaussian plume model described in another publication. (Beyea, 1979). They are expressed in millirem (0.001 Rem) and are totals following complete containment purge.* They are also based on the assumption that venting is completed in 24 hours. For longer venting periods the variability of the wind direction will cause the plume to wander significantly and the doses to decrease perhaps by a factor of two or three. Because venting as proposed by Met Ed/NRC would require 5-50 days our calculations with respect to this effect are conservative overestimates.

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*-We assume that any significant quantities of airborne particles in the containment carrying radioactive cesium will be removed from the release stream through filtering as proposed by Met Ed.

There are three distinct doses to note:

A. Beta skin dose -- dependent on the ground-level concentrations of Kr-35.

B. Beta and gamma doses following inhalation -- also dependent on ground-level concentration.

C. Cloud gamma doses.

The results for cases A and B are probably unreliable for very high plumes because the plume model has not been adequately tested for such circumstances. In general the exposures are very small in such cases for it is known that the doses drop off very quickly with increased release height.

There is an additional uncertainty for case B owing to the difficulty of determining how much radiation will be distributed within the body. However, it is known that skin is the tissue exposed to the highest dose from the betas of airborne Kr-35. The low solubility of krypton gas in water makes internal doses quite small, especially for developing embryos. Fat solubility plays a minor role for short exposures because absorption levels are determined by solubility in blood. The small volume of gas in the respiratory tract air passages reduces the direct beta dose to values below the skin dose. Table 2 includes in an approximate way the small contribution to the whole body dose from inhalation of material. The dominant contributor to this dose, case C, is "cloud shine" (direct radiation from

the radioactive cloud). The information in the tables is appropriate to release under restricted meteorological conditions known as D-stability, corresponding to nighttime or overcast day release, and for a wind of 11 mph (5 m/sec). Doses vary as the inverse of the wind speed. We assume that releases are only allowed during periods when meteorological conditions are such that doses would not be significantly greater than those shown.

The largest gamma dose occurs close to the plant for the "ground-release" case, proposed by the NRC/Met Ed. It is 0.03 millirem. This should be compared with the radiation background to which we are all exposed, from naturally occurring terrestrial and cosmic sources, of about 100 millirem per year. The dose at this worst case location from a ground release corresponds to 3 hours of normal background exposure. In contrast, a release at a 300 meter height yields a maximum dose of 0.001 millirem.

From current evidence of effects of whole body radiation on human populations, the above considerations indicate that at the doses postulated, no health effects would be anticipated as a result of the "ground release" venting.* The amount of exposure is so low that it falls in the range of background variability naturally occurring for the citizens living around the plant. This variability arises from differences in body characteristics (e.g., potassium-40 content), the amount of certain nuclides naturally present in soil (uranium and radium) and the type of materials in one's home (e.g. brick and stone vs. frame). While

* The total population dose received while the plume is recognizable as a plume would be less than one person-rem.

we believe that any additional whole body radiation exposure will increase cancer risk, exposures well below the natural lifetime variation of background sources will lead to effects so minimal that they cannot be detected by any method.

Doses to the body from beta radiation, while larger than the gamma dose by factors of about 100, are not whole body exposure. Beta radiation from Kr-85 involves only a limited portion of the body tissue, principally the skin, and doses anticipated are far below the levels required to induce beta burns (radiation erythema) of the skin. It is possible that the larger beta doses from Table 1 would increase the chances of developing skin cancer. However, the best present evidence suggests, but does not prove, that doses substantially in excess of 10,000 to 50,000 millirem are required in order to increase the incidence of such cancer. The present margin of safety appears to us to be comfortably large.

One matter of importance in all predictions of the kind we are discussing is uncertainty, and therefore possible error, in the results. We estimate the uncertainty in the dose predictions of Tables 1 and 2 to be a factor of 10. That is to say the expected radiation doses under the stated conditions could be as much as ten times greater, or ten times less, than our numbers. Consideration of the worst case exposure, unlikely but possible within our estimated uncertainties, does not change our view that direct health effects will be absent from venting the Kr-85 even from the "ground-level" release. Our conclusions in this regard are similar to those reached by the NRC and Met Ed.

TABLE 1 - Beta Skin Dose

(Millirem) Plume Centerline

'ease Height (meters)	50	125	125	200	300	500	700
DISTANCE (Miles)	"Ground Level" NRC-Met Ed proposal	In wake of cooling tower	Not in Wake	660 ft.	990 ft.	1650 ft.	2300 ft.
1	5.7	3.3	0.31	0.0009	*	*	*
2	2.9	1.8	0.90	0.007	0.0007	*	*
3	1.8	1.2	0.90	0.19	0.009	*	*
4	1.2	0.90	0.77	0.25	0.028	2.3×10^{-5}	*
5	0.87	0.70	0.63	0.28	0.048	1.9×10^{-4}	*
6	0.67	0.53	0.53	0.27	0.067	0.0007	*
7	0.53	0.47	0.47	0.26	0.076	0.0017	*
8	0.43	0.37	0.40	0.24	0.087	0.0032	2.2×10^{-5}
9	0.37	0.32	0.33	0.22	0.09	0.005	6×10^{-5}
10	0.32	0.28	0.29	0.21	0.093	0.007	0.00013
15					0.087	0.017	0.0013
20					0.07	0.022	0.0035
30						0.024	0.007
40						0.021	0.009
50							0.0093
100							0.007

* - Less than 10^{-5}

This table gives the plume centerline doses for complete purge of the TMI containment building. The underlined entries are the downwind positions of the maximum radiation exposures. The doses have been calculated for a 24-hour release, D atmospheric stability class, flat terrain, and an 11 mph wind. Beta doses (in millirem) are calculated as 60 times the "exposure" (in curie-seconds per cubic meter). Doses could be greater at locations with elevations higher than the elevation at the release point. See the text for further discussion of the table.

TABLE 2 - Total Gamma Dose

(Millirem) Plume Centerline

ease Height (meters)	50	125	125	200	300	500	700
DISTANCE (Miles)	"Ground Level" NRC-Met Ed proposal	In wake of cooling tower	Not in Wake	660 ft.	990 ft.	1650 ft.	2300 ft.
1	0.03	0.021	0.0067	0.002	0.0005	5×10^{-5}	*
2	0.017	0.012	0.007	0.002	0.0005	5×10^{-5}	*
3	0.011	0.009	0.006	0.0023	0.00057	6×10^{-5}	*
4	0.008	0.006	0.005	0.0025	0.0006	6×10^{-5}	*
5	0.006	0.005	0.005	0.0023	0.0007	7×10^{-5}	*
6	0.005	0.004	0.004	0.0022	0.0008	8×10^{-5}	*
7	0.004	0.004	0.003	0.002	0.0008	9×10^{-5}	1.0×10^{-5}
8	0.004	0.003	0.003	0.0019	0.0009	9.6×10^{-5}	1.4×10^{-5}
9	0.0031	0.003	0.003	0.0018	0.0008	1.1×10^{-4}	1.5×10^{-5}
10	0.0027	0.002	0.002	0.0017	0.0008	1.2×10^{-4}	1.7×10^{-5}
15						1.8×10^{-4}	2.8×10^{-5}
20						2.2×10^{-4}	4.3×10^{-5}
30						2.1×10^{-4}	7.3×10^{-5}
40							8.7×10^{-5}
50							8.3×10^{-5}
100							6.7×10^{-5}

* - Less than 10^{-5}

This table gives the plume centerline doses for complete purge of the TMI containment building. The underlined entries are the downwind positions of the maximum radiation exposures. Doses were calculated as the sum of the whole body cloud dose and the inhalation dose (600 millirem per curie inhaled). The cloud dose value was obtained by using an approximate geometrical correction factor (Slade, 1968) to adjust the easily calculated dose from an infinite cloud (0.48 millirem per curie-second per cubic meter). See the text and Table 1 notes for further discussion of the table.

C. Stress-Related Public Health Effects

There are public health effects of venting, aside from possible but imperceptible direct effects of radiation, which cannot be dismissed lightly. We refer here to the *perceptions* of hazard by the people living near TMI, and the health significance of these perceptions. These psychosocial problems have been investigated by the group at Hershey Medical Center, and in addition are currently under study by a team from the Western Psychiatric Institute of the University of Pittsburgh. The latter study is not yet analyzed sufficiently for conclusions to be drawn. The problems have also been manifest in angry confrontations between citizens of the Harrisburg area and NRC/Met Ed officials, especially over the proposal of these officials to carry out the "ground-level" release of the krypton-85 gas.

The Pennsylvania State University Medical Center at Hershey, supported by a grant from the Electric Power Research Institute, issued a report in April, 1980 entitled "Health-Related Behavioral Impact of the Three Mile Island Nuclear Incident." This report included results of a series of telephone interviews conducted in April, 1979, July, 1979, and January, 1980. The first involved nearly 700 people living within 5 miles of TMI, the second involved over 1500 people living within 55 miles of TMI, and the third series, including reinterviews, involved over 950 persons. It is clear from this report that a number of physical and behavioral symptoms can be related to an individual's proximity to the TMI plant. Contrary to expectation, the prevalence of these symptoms has not declined in the nine months between April, 1979 and January, 1980. Indeed some may have increased. The "physical stress" symptoms included headaches, diarrhea, constipation, abdominal pain, sweating spells, stomach trouble, frequent urination, and rash. "Behavioral stress" symptoms included irritability, fits of anger, sleeplessness, loss of appetite, feeling trembly, interrupted thought processes, and overeating.

These symptoms and behavioral effects evidently have arisen from anxiety engendered by proximity to the plant, fear of exposure to radioactivity, and apprehensions concerning loss of trust of official reassurances about potential radioactive releases.

It is significant that between 10% and 20% of the population sampled within 10 miles of the plant was affected, as the Penn State Study concluded. Because some 200,000 persons live in this area, the number of affected persons may be inferred to be in the range of 20-40,000. This is a surprisingly large number.

It is in stark contrast to claims that only a few, perhaps only one person, were "victims" of the Three Mile Island accident. While the methodology poses some difficulty to interpretation of these results, the findings are striking.

If this conclusion is valid, it indicates a medical problem of major public health importance. There is therefore good reason to conclude that the deliberate venting of krypton-85, already opposed by many citizens, may seriously exacerbate the problems of the mental and physical health of the public that the stress of the planned exposure would engender.

D. Elevated Release

1. Introduction

Because of the significant and unacceptable public health consequences described above, which we believe would stem from the ground-level venting planned by Met Ed and the NRC, the UCS Study Group devised two alternative venting methods each of which we believe to be superior. Use of either one would result in very large reductions in the radiation dose affecting any segment of the public as compared with the "ground-level" release. All doses would be significantly lower, and the peak dose would be moved further from the plant as well as diminished. This substantial dilution and transfer of impact would be achieved by elevating substantially the effective point at which the containment building gas would be released into the atmosphere.

2. Heated Plume

The first UCS alternative employs the buoyancy imparted to gas by heating it. This is a familiar effect frequently summarized in the aphorism -- heat rises. We find that a heated plume can be produced with readily available equipment and at moderate cost, that flushing of the containment can be carried out in a few days, and that significant reductions in ground level beta skin doses can be achieved. The heating could be carried out using a modified commercially available incinerator fueled by oil or natural gas.

Buoyant Plumes*

If an incenerator with very buoyant emissions can be installed, the containment gases, including the krypton, will rise with the plume. The effective height of emission of the gases can be much greater than the stack height and more than enough to clear all building and cooling tower turbulent

*The material set forth in this section was prepared by Dr. Thomas Overcamp, Associate Professor in Clemson University's Department of Environmental Systems Engineering.

wakes by a considerable margin. The effective height of emission, h_e, is given by the expression

$$h_e = h_s + \Delta h$$

where h_s is the height of the incinerator stack and Δh is the final plume rise. If Δh is large, the gases will diffuse as if they were emitted from a very tall chimney. This is the mechanism that leads to the reduction of ground radiation levels as compared with a cold release at height h_s.

The theory of the rise of buoyant plumes was developed by Briggs (1969), Hoult, Fay, and Forney (1969) and others. The rise is a function of the initial momentum of the plume and its buoyancy. For highly buoyant plumes as from the proposed incinerator, the final rise can be predicted from considering just the plume's buoyancy.

The final rise is a function of the buoyancy, the wind speed, and the stability of the atmosphere.

The buoyancy of the plume is measured by its buoyancy flux, F:

$$F = \frac{gD_s^2 w_o}{4} \; \frac{T_s - T_a}{T_s}$$

where g is the gravitational acceleration, D_s is the stack diameter, w_o is the exit velocity of the gases, and T_s and T_a are the exit and ambient temperatures respectively.

Atmospheric conditions can be classified as unstable, neutral or stable. Unstable conditions occur on sunny days with light winds. Neutral conditions occur under overcast conditions during the day or night and also for very windy conditions. Stable atmospheres occur under clear skies at night with light winds.

For neutral to unstable conditions, the most widely used plume rise formula is one proposed by Briggs (1970).

$$\Delta h = \frac{1.6\ F^{1/3}\ (3.5x)^{2/3}}{u}$$

in which u is the wind speed and x is given by the empirical formula

$$x = 34\ F^{2/5}\ (m)$$

where $F > 55\ m^4/s^3$

This formula is the one used by the U.S. Environmental Protection Agency for modeling buoyant plumes from power plants and industries. It is recommended by many others (A.S.M.E., 1979) as the state of the art formula.

For stable conditions, the recommended formula is

$$\Delta h = 2.4 \left(\frac{F}{uS}\right)^{1/3}$$

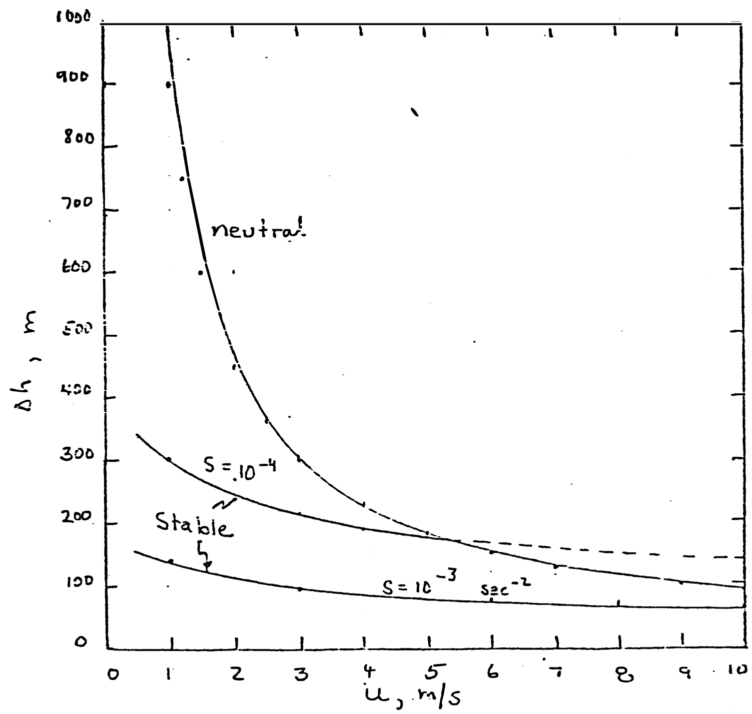
in which S is a stability parameter given by

$$S = \frac{g}{T_a}\left(\frac{dT_a}{dz} + 0.01\right) \quad \text{where } \frac{dT_a}{dz} \text{ is in } ^\circ C/m$$

For stable conditions, the stability parameter will typically have a value between 10^{-4} and 10^{-3} sec $^{-2}$.

The incinerator we propose would have a height of 250 ft. (76m), an exit diameter of 6ft. (1.83m), an exit velocity of 100 ft/s (30.5m/s), and an exit temperature of 1800°F (1256 To avoid any possibility of the plume from the incinerator being trapped in the wake of a cooling tower, the incinerator should be sited two or three cooling tower heights away from any tower. This corresponds to 750-1000 ft. If this is not possible, the incinerator should be taller or a more detailed study should be undertaken to determine the potential for interference. For this incinerator, the buoyancy flux is 193 m^4/s^3. For any given atmospheric conditions, the plume rise and effective height of emission can be estimated using the above formulas. For example, if the wind speed is 6.7 mph (3 m/s), the plume rise for neutral conditions will be 1000 ft. (300 m). If the atmosphere is stable and the stability parameter is 10^{-3} sec $^{-2}$, the plume rise is 315 ft. (96 m). These correspond to effective heights of emission of 1240 ft. (376 m) and 570 ft. (172 m) respectively. These heights are sufficient to clear any terrain obstacles within 6 miles (10 km) of the plant.

Figure 2 gives the calculated plume rise of this incinerator for various wind speeds and stabilities. The predictions show that the plume rise is higher for lower wind speeds. The neutral stability is generally higher than the stable plume rise. These predictions will have to be modified if there is an elevated inversion that limits the rise of the plume. The average height of such an elevated inversion over that area is 1000 to 1800 m depending on the season of the year and the daily weather conditions (Holzworth, 1972).



Plume Rise Versus Wind Speed for Neutral Conditions and Various Stable Conditions.

Figure 2

From the information in Figure 2 and an assumed stack height of 250 ft. (75 m) it can be seen that effective heights of emission in excess of 900 ft. are achievable in many circumstances, especially with low to moderate light wind conditions.

Radiation Exposure

The reduction in the beta skin dose (the radiation effect of most concern) in the heated plume case, as compared to the "ground level" release, is extremely large within a few miles of the release point for a 1000 ft. emission height -- a factor of 4000 reduction at 2 miles, and a factor of nearly 15 at 5 miles. See Table 1. At greater distances, the fraction decreases owing to vertical diffusion of the plume. The maximum dose occurs at a considerable distance from the release point, as discussed earlier, at least 8 to 10 miles distant, and in some weather circumstances at 20 miles or more. The magnitudes of the skin doses, for appropriately chosen weather conditions, are very small by any reasonable measure.

The Facility

We have carried out a preliminary investigation of the size and configuration, cost, and availability of the incinerator necessary to implement the hot plume release. The details are included in Appendix I and are summarized here.

The incinerator would employ a 6 ft. diameter refractory-lined stack perhaps 250 ft. (75 m) high. With a discharge temperature of 1800°F and an exit velocity of 100 feet per second, it would run with natural draft and a negative furnace pressure, minimizing ground level leakage. Fuel requirements would be in the range of 250 gallons per hour of liquified petroleum gas. If containment gas were vented into the furnace at 100 cubic feet per second, only a few days of release time, perhaps spread over several weeks, would be required for reduction of the containment krypton concentration to below Maximum Permissible Concentration of 10 CFR 20. Total fuel cost would be below $20,000.

Rough estimates of the construction time for the facility are in the acceptable range of 7-9 months, at a cost, exclusive of those special features required for the delivery and special handling of the contaminated gas to the incinerator furnace, of $250,000. The time estimate does not include the possibility that top-priority expediting, aided by support from the US Government, or the immediate availability of a used incinerator could appreciably speed things up.

Evaluation

UCS regards the hot buoyant plume proposal as promising. It is based on well known phenomena that may be predicted with adequately small uncertainty. The venting can be monitored and halted as required. The technology of producing the plume is

mundane and the equipment easy to manufacture or possibly, obtain second hand.

The risk of an accident of unacceptable scale during the venting seems to be very low because the amount of krypton in the system at any given time is small. For the same reason worker doses may be kept low as well. Coping with unexpected changes in the weather during venting is accomplished by system shutdown.

Elevated releases have the advantage that even the skin dose can be kept well below the skin dose any individual receives in one year from natural background.

Finally, there are large reductions in beta skin dose compared to the ground level release scheme. The levels are likely (although by no means certainly) to be acceptable to people living in the vicinity of the release point. At the very least, reductions of this magnitude would be perceived by the public as an attempt to reduce the radiation exposures and, thereby, the possible stress-related public health impact that venting might have.

3. Tethered Balloon Release

Introduction

The second alternative devised by UCS to implement an elevated release point makes use of a tethered unmanned balloon to support a light-weight impermeable fabric-reinforced tube. By this means it is possible to achieve a release height in the range of 1000 to 2000 ft. (300-600 m). The reduction in ground-level beta skin dose within a few miles of the release point, as compared with the "ground-level" release, is very great.

Because the technique is new, and innovative, we have taken special pains to establish its practicality as well as we could in the time available. In this effort personnel of the U.S. Air Force Geophysical Laboratory have been of particular help.

Balloon Technology

Tethered balloons, manned and unmanned, have long been used in military and non-military affairs. Both the U.S. Air Force and the U.S. Navy have active programs that involve such lifting devices. These, and free flight balloons, levitated by helium, may typically be filled through a 1 ft. diameter hose made of 0.003 inch polyethylene. Hoses some 600 ft. long have accommodated gas flow rates in the vicinity of 30 cubic feet per second.

What we propose is a hose or tube of coated nylon able to withstand perhaps three times the pressure of unreinforced polyethylene. It would contain an integral supporting cable of Kevlar, an exceptionally strong lightweight material, to reduce the tendency of the tube to kink and to provide support. Kevlar tether cable weighs 50 lbs/1000 ft. and has a 16,000 lb. breaking strength. The tube would be supported nearly vertical by an unmanned non-spherical aerodynamically-shaped balloon. The balloon would be tethered by two or perhaps three Kevlar cables arranged so the balloon remained over the ground end of the fabric tube. A diffuser at the balloon, or exit, end of the tube would produce adequate back pressure to ensure the tube remained well inflated. 2000 feet of fabric tube of the sort required would weigh less than 500 lbs., perhaps as little as half that. Inflatable fabric balloons employing 45,000 cu. ft. of helium are now available as are portable winches for handling them. They have a payload of about 1500 lbs. and are simple to handle. On an ordinary single tether, with no tube, they can fly in winds up to 20 Kts and can be recovered from an altitude of 2000 ft. in 10 minutes. It is estimated that a double tether arrangement and a tube payload should not significantly increase recovery time. Figure 3 illustrates a double tether arrangement, launch ready and in operation, which is based on a preliminary Air Force concept.

SCHEMATIC

VENTING BY TETHERED BALLOON

Launch Ready

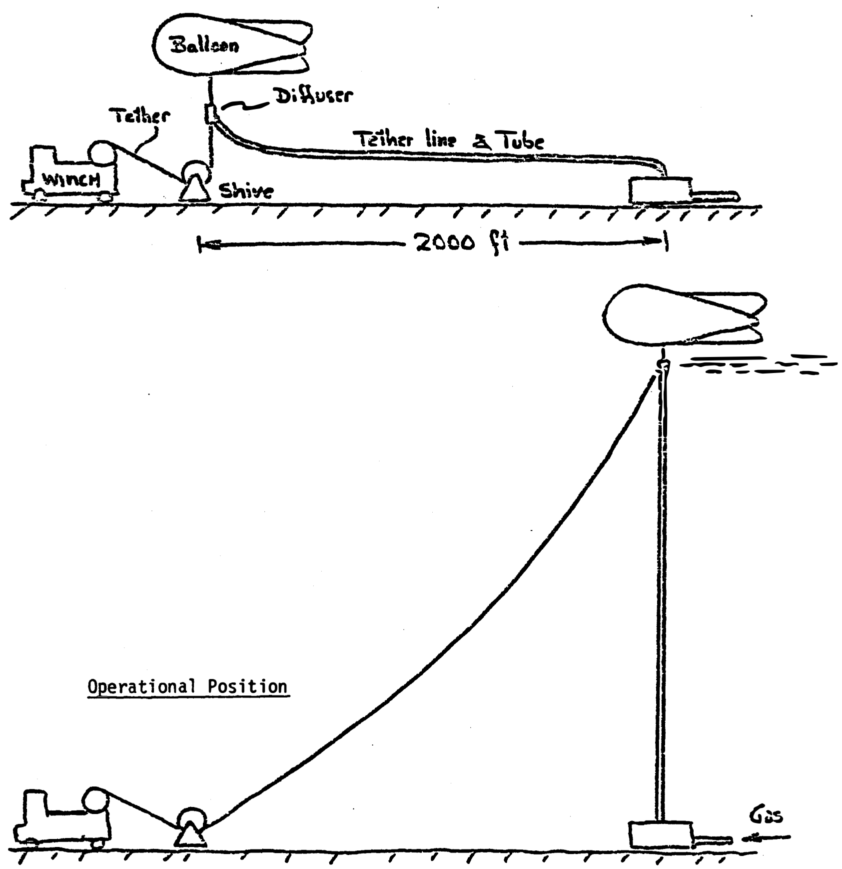


FIGURE 3

About six people are needed to inflate and fly such a balloon, and that number of people must be on call if recovery is required. Two persons are all that are required for "babysitting" while the device is tethered aloft.

At a balloon height of 2000 feet wind drag limits the tube diameter to about 1 foot. For this altitude achievable flow rates, according to the Geophysical Laboratory experts, would exceed 60 cubic feet per second and may exceed 100. For a 1000 ft. tube, the flow rate could conservatively exceed 100 cubic feet per second because a larger diameter tube can be used. At this latter rate, as with the heated plume, a total release time of a few days is all that is required to bring the containment krypton concentration below the maximum permissible concentration for workers. Night time periods of stable air minimize the ground level radiation exposure, but this exposure is already so small for release heights above 1000 feet that venting could probably proceed in all wind strengths in which the balloon was flyable.

Radiation Exposure

With a release height in the range of 1000-2000 feet, a plume remains largely overhead for ten or several tens of miles. As it is borne by the wind, the plume diffuses vertically and laterally and its concentration dwindles. The ground level radiation exposure at all distances is dramatically reduced over "ground level" release. Table 1 tells the story. For the highest release, out to 6 miles from the release point, the beta skin dose (again, the radiation of most importance) is reduced by factors from a million, at worst, to very much larger numbers when compared with the "ground level" release case. In the range 20 to 100 miles from the release point, where a very small portion of the plume has diffused to the ground, the exposure is at worst no more than a few percent of the "ground level" case's exposure at 10 miles. It is fair to say that the maximum exposure is wholly negligible. Indeed the ground level radiation probably could not be detected anywhere under the plume of such an elevated release over the background of naturally occurring terrestrial and cosmic radiations.

Safety

The tethered balloon shares with the heated plume the feature that the amount of krypton in the system at any given time is small. Thus a total release of krypton from the tube stemming from a rupture or from a loss of support is not a major concern. Nor should worker exposure be large. Before routine recovery of the balloon, the tube could be purged with fresh air. In some tether arrangements proposed by the Air Force experts, recovery does not require approach to or handling of the tube. Should the balloon break free

it will simply deflate slowly and come to earth.

The balloon while tethered would represent a considerable hazard to aircraft, especially if, as expected, it were flown primarily at night. Identification of the balloon by appropriate lights, and notification to pilots through the FAA's NOTAMS (Notice to Airmen), radio, TV, and newspapers of flight schedules and wind directions would be required.

Costs and Timetable

Costs and timetable for a tethered balloon system are somewhat difficult to estimate. The fabric tube of the required length would require a few weeks of engineering and perhaps a month to fabricate at a cost probably less than $20,000. A new balloon costs in the vicinity of $100,000. Helium need not be purchased because, barring an accident, it can be recovered after the project terminates.

If the tests described below are successful, it should be possible to have equipment ready in about 4 to 7 months from the time of commitment. It is possible that Air Force balloons, handling equipment, and ground crews could be made available for the venting. This might appreciably shorten the krypton release schedule and decrease the costs.

Evaluation

This venting technique we propose is untried. Tests of the concept are therefore a necessary precursor to a commitment to deploy. Such tests can, fortunately, be carried out with Air Force balloons, at the facility at Hollomon Air Force Base in New Mexico. Such tests would include air flow rate measurements on balloon supported tubes of the required size and of the required length. These tests could be carried out in a few weeks and, most fortunately, the Air Force has agreed that they will do them if requested.

The Air Force has already reviewed and commented on our proposal. Their comments are included here in Appendix II. They regard the technique as workable. The tests would, hopefully, confirm this judgement or, nearly as good, lead to the prompt solution of new difficulties the tests unearthed.

A Three Mile Island site visit is necessary to establish whether or not an adequate area exists in which to establish the needed tether and the ground-based gas system. The site is hardly ideal for balloon flights with its cooling towers and power lines. It is not, however, an impossible location.

The tethered balloon venting appears to be the most attractive of the venting schemes in terms of costs, schedules, and, especially, radiation exposure. While there are some significant unknows remaining, these can be illuminated promptly and with seemingly modest effort.

This venting scheme will lead to very great reductions in radiation exposure. However, we do not know whether even this very low exposure will be acceptable to citizens in the area.

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IV. KRYPTON RECOVERY

A. Introduction

Met Ed and NRC identified four major alternatives to ground-level venting of the krypton, all of which involve recovery of the krypton rather than venting: These are selective absorption, cryogenic processing, gas compression, and charcoal adsorption. The UCS study group identified no additional alternatives other than the tethered balloon and heated plume modifications to the venting proposal.

Our evaluation of the four alternative recovery methods is presented below. We conclude that the selective absorption and cryogenic processing alternatives are preferable to Met Ed's venting proposal if they could be accomplished in less than a year. The gas compression and charcoal adsorption alternatives are not realistic alternatives because of the long time needed for their implementation and the hazard presented by the nature of the long-term gas storage facilities required with these methods.

B. Selective Absorption

The selective absorption process exploits the different solubilities of different gases in fluorocarbon solvents. In the particular system under consideration for use at TMI, the krypton is dissolved in a common refrigerant, Freon. The absorbed gas is carried by the refrigerant to a different section of the system where the refrigerant is heated to release the krypton. The krypton is recovered and stored in standard-sized gas cylinders.

The principal advantage of the selective absorption is that the krypton can be removed from the reactor building and stored with negligible release to the environment. There is also a high degree of assurance that the system would be effective because of the extensive experience with pilot plants at Oak Ridge National Laboratory since 1967. A third generation pilot plant with a capacity of 15 scfm has been successfully operated for the last 18 months. The principal disadvantage of this alternative is the time required to implement it. The NRC's estimated time to construct a selective absorption system at TMI was 1 1/2 to 2 years or longer depending on regulatory requirements. The Oak Ridge National Laboratory's estimates range from 1 1/2 to 4 years, but individual engineers at Oak Ridge estimate only three months assuming the availability of components and regulatory approval. Recently, the staff of the Science and Technology Committee of the U.S. House of Representatives estimated six months.

Another possibility discussed was moving the pilot plant from Oak Ridge to TMI. We believe this is not a reasonable plan because the capacity of the pilot plant is only 15 scfm. It would therefore require a processing time of about two years to remove 99.9% of the krypton. This is an unacceptable delay in our judgment.

Since the principles of operation of the selective absorption process are well-understood and the components are either standard items or easily fabricated, we foresee no difficulty in scaling up to a system with a capacity of 150 to 250 scfm. This would reduce the processing time to two or three months.

With regard to the hazard presented by long-term storage of the krypton as an undiluted compressed gas, we conclude that NRC has exaggerated the problem. In NUREG-0662, it was assumed that all 57,000 curies of krypton would be stored onsite in a single container that might rupture. This is unrealistic. Storage of the krypton at 500 psi in five or six standard gas cylinders rated for more than 3000 psi would significantly reduce the probability and magnitude of an accidental release. Furthermore, we believe that it is feasible to ship the krypton offsite or store it inside the TMI-1 containment or in a specially constructed facility to ensure against accidental release

In summary, the UCS study group recommends that the selective absorption alternative be reassessed. The first step needed is a determination of the availability of components. If the components are all readily available for a system capacity on the order of 200 scfm and the projected time for construction is not excessive, we see no obstacles to using selective absorption as the method of krypton recovery.

C. Cryogenic Processing

The cryogenic processing system operates on the principle of condensing the krypton from the building atmosphere by direct contact with liquid nitrogen. The liquid krypton is then vaporized and stored in standard gas cylinders or other suitable containers.

The principal advantages and disadvantages of the cryogenic processing system are similar to those of the selective absorption system. The krypton can be recovered and stored with negligible release to the environment. The storage of the gas presents no more difficulty than discussed above for selective absorption. However, the time required to implement a cryogenic processing system at TMI was estimated by NRC and Met Ed to be 20-30 months.

There has been extensive experience with cryogenic processing on a commercial scale to recover Kr-85 at nuclear fuel reprocessing plants. While the system is more complex than selective absorption, three major U.S. companies and several foreign companies manufacture cryogenic equipment for production and commerical nuclear applications. A cryogenic system has been in operation at the Idaho Falls Rare Gas Recovery Facility since 1959. This system recovers Kr-85 from contaminated air resulting from the reprocessing of fuel rods.

The cryogenic system design evaluated by Met Ed and NRC was the system available for purchase from the Limerick plant. This system was designed by the Linde Division of Union Carbide. A particular hazard associated with this system is the proposal to add catalytic recombiners to the front end to remove oxygen. The hydrogen supply for the recombiners would constitute a fire or explosion hazard.

Another cryogenic processing system that may be useful at TMI is owned by the Public Service Electric and Gas Company of New Jersey. This system is presently in storage at the two Hope Creek nuclear plants which are under construction but are not scheduled to begin operation until 1987. The system components are assembled and mounted on skids. Therefore, the system can be easily transported to TMI and quickly installed. There are actually three systems, one for each plant and a spare, with a capacity of 75 scfm. These systems were designed and built by Air Products, Inc. Hope Creek and Air Products engineers each estimated that the three systems could be moved to TMI and erected in two or three months after a suitable building to house them was available. We are informed that, in an effort to assist, Public Service Electric and Gas is willing to sell the systems to Met Ed and this would not adversely affect the Hope Creek construction schedule.

The Hope Creek cryogenic systems are designed to process air with as high or higher radioactive contamination than found in the TMI containment building atmosphere. The systems use an insignificant amount of hydrogen to remove the small amount of oxygen mixed with the krypton at the end of the process and thus would not have the same risk of fire or explosion as the system evaluated by Met Ed and the NRC. The total cost of the three Hope Creek cryogenic systems is about $5 million.

We recommend that the feasibility of using the Hope Creek systems at TMI be examined further before a decision on the method of krypton removal is made.

D. Gas Compression and Charcoal Adsorption

The UCS study group concludes that, in view of the other potential alternatives to the venting proposal evaluated by Met Ed and the NRC, the gas compression and charcoal adsorption alternatives do not merit further consideration.

We have reviewed the evaluations performed by Met Ed and NRC of these two alternatives and conclude that their evaluations are unduly pessimistic. The construction time of the storage facility for the gas compression system can be reduced in several ways. Larger diameter piping and/or gas storage at a higher pressure could reduce the proposed 28 miles of piping significantly. For the charcoal adsorption alternative, the amount of charcoal needed could be reduced significantly by regenerative use of a much smaller amount of charcoal. For both charcoal adsorption and gas compression, removing only 90% of the krypton and venting the rest would shorten the construction time and reduce the radiation dose to the public by a factor of ten compared to venting the entire building atmosphere. The method of storing the krypton can be designed so that it would be unrealistic to postulate the ground level release of all 57,000 curies of the krypton which was NRC's assumption in NUREG-0662.

Even if the gas compression and charcoal adsorption alternatives were re-examined in detail to determine a more realistic construction schedule and assessment of the storage hazards, we conclude that other alternatives are preferable. Considering the very low public and worker radiation doses resulting from an elevated venting scheme (whether heated plume or tethered balloon), selective absorption or cryogenic processing, it is unlikely that either gas compression or charcoal adsorption could achieve lower doses. Furthermore, we believe that the construction time for either a gas compression or charcoal adsorption system could not be as short as the time needed to implement elevated venting, selective absorption or cryogenic processing. We therefore conclude that no further consideration of the gas compression or charcoal adsorption alternatives is warranted.

V. FINDINGS AND RECOMMENDATIONS

A. Findings

KRYPTON PROBLEM

* Sealing and abandoning the TMI plant is not an alternative to clean-up. The plant must be decontaminated whether it is to be restarted or decommissioned.

* Relatively free access to the reactor building is necessary to accomplish the decontamination work. The beta and gamma radiation from the krypton-85 in the building atmosphere effectively precludes the necessary personnel access. Therefore, the krypton eventually must be removed.

* Met Ed and the NRC advanced concerns about reactor building integrity, reactor coolant system integrity, and accidental criticality as bases for recommending prompt removal of the krypton. None of these concerns have sufficient merit to justify a conclusion that personnel entry is necessary within a few weeks or months.

* A delay of a year in removal of the krypton would not pose an undue risk to the health and safety of the public. However, because of the possibility of unforseen problems, the delay should not be more than a year and a half. If an unforseen emergency developed, the krypton could be removed in a few days using the venting scheme recommended by Met Ed and the NRC staff.

RADIATION EXPOSURE

We carried out independent calculations of the beta skin dose exposures and gamma whole body exposures expected downwind under the plume from a complete purge of the TMI containment building by venting under varied conditions and at a range of vent altitudes.

* The greatest radiation exposures result from the venting proposal advanced by Met Ed and NRC. Release heights well above the largest structures at TMI reduce the doses markedly, and in some cases by enormous factors.

* The largest gamma dose a person could receive under the Met Ed/NRC proposal is 0.03 millirem and occurs close to the plant. It corresponds to 3 hours of exposure to the naturally-occurring radioactive background of approximately 100 millirem per year.

* The beta skin doses are typically 100 or so times greater than the gamma doses, but involve only a limited portion of body tissue. Evidence suggests that beta doses in excess of 10,000 to 50,000 millirem are required to increase the incidence of skin cancer.

* UCS concluded that direct radiation-induced health effects from exposure to Kr-85 even from the Met Ed/NRC proposed venting would be absent. These conclusions are similar to those reached by the NRC and Met Ed.

STRESS-INDUCED PUBLIC HEALTH EFFECTS

There has been marked stress-induced illness in persons living within ten miles of TMI. This has surfaced in angry confrontations between citizens and NRC and Met Ed officials. A recent medical study has shown that between 10% and 20% of the some 200,000 people living within 10 miles of TMI show evidence of "physical stress" including headaches, diarrhea, and stomach trouble, and "behavioral stress," including irritability, sleeplessness, and loss of appetite.

* UCS concludes that this indicates a stress-induced medical problem of major public health importance. There is good reason to believe that at least the Met Ed/NRC venting, already opposed by many citizens, may seriously exacerbate this problem.

VENTING PROPOSALS

UCS has devised two venting schemes in which radiation exposures are much lower than the already small exposure expected from the Met Ed/NRC proposal:

The first makes use of a gas or oil-fired small incinerator feeding a 6 foot diameter 250 foot stack. The contaminated containment air is fed into the furnace, buoyed by the heat, and elevated far above the stack and all TMI structures.

* This scheme can yield an effective release height approaching 1000 ft. and in some cases more.

* The reduction in radiation exposure at 2 miles from TMI, for example, is by a factor of 4000 over the Met Ed/NRC case, and a factor of 15 at 5 miles.

* This scheme uses conventional technology, is practical, reasonably rapid to implement, and of modest projected cost.

The second UCS proposal would vent from a reinforced fabric tube, supported by a tethered balloon at 2000 ft. altitude. U.S. Air Force balloon experts made a preliminary review of the proposal and found it workable. The ground-level radiation is so low with this scheme (very much lower than even the hot plume), that in all probability it could not be detected at all.

* Tethered balloon venting appears to be a practical proposal in terms of costs, schedules and especially, radiation exposure. Some residual questions can be rapidly resolved by tests at Hollomon Air Force Base and by a TMI site visit.

* Air Force balloons and handling gear might possibly be available for the TMI venting if appropriate.

* It is not certain, however, that either of these schemes would be perceived as acceptable by the citizens of the area. The same psychosocial problems as we anticipate would occur with the proposed Met Ed/NRC venting could occur with <u>any</u> deliberate release of Kr-85, even if dose reductions of the magnitude expected by the two methods suggested were achieved.

KRYPTON RECOVERY PROPOSALS

* Use of a selective absorption system to recover the krypton for storage avoids a deliberate release to the environment, but there is a question whether it can be implemented in less than a year. There has been extensive experience with pilot plants at Oak Ridge National Laboratory. Therefore, there is a high degree of assurance that construction of a selective absorption system ten times larger than the pilot plant would be an effective means of krypton recovery. A determination of the availability of the necessary components can be done in a few days to help determine whether the system could be implemented in less than a year.

* A cryogenic processing system to recover the krypton for storage would also avoid any deliberate release to the environment. Three cryogenic systems now in storage at the construction site of the Hope Creek nuclear plant have a total capacity sufficient to recover the krypton from the TMI containment in a few months. Construction at the TMI site would take two or three months after a suitable building is available. The owners of the cryogenic systems are willing to sell them to Met Ed and that would not delay construction of the Hope Creek plants.

* The gas compression and charcoal adsorption methods of krypton recovery do not merit further consideration. Considering the very low public and worker radiation doses resulting from an elevated venting scheme, selective absorption or cryogenic processing, it is unlikely that either gas compression or charcoal adsorption could achieve lower doses. Furthermore, the construction time for either a gas compression or charcoal adsorption system could not be as short as the time needed to implement elevated venting, selective absorption, or cryogenic processing.

* The tethered balloon scheme might prove valuable as an emergency backup system if one of the krypton recovery schemes were selected.

B. Recommendations

* UCS recommends against any procedure that would result in citizens in the area around TMI being deliberately exposed to radiation from the plant at levels comparable to those expected from the Met Ed/NRC venting proposal.

* We recommend evaluation and public discussion of the two UCS venting proposals, each of which would yield a markedly decreased ground-level radiation exposure. Each appears potentially attractive, but there remains an open question of citizen acceptability of deliberate releases of Kr-85. Evaluations can be carried out promptly.

* We recommend reevaluation and public discussion of the two krypton recovery proposals previously rejected by the NRC and Met Ed: cryogenic processing and selective absorption. Because each recovery method has the potential for implementation within one year, either one might prove the technique of choice in ridding the containment building of Kr-85.

* We recommend that the final choice among the alternatives give significant weight to the need we identify of having the krypton removed within one year. This must be in addition to the absolute need to ensure the health and safety of the much-stressed population around TMI.

Appendix I

Incinerator Information

The following information was obtained on the high temperature, high velocity, high stack incinerator. Dr. Thomas Overcamp made the original suggestion of the use of a 6-foot diameter incinerator stack, approximately 200 feet high.

Such incinerators are made by the John Zink Company, located in Tulsa, Oklahoma. John Young, one of their engineers in their Process Systems Division, was very helpful. Conversation with him produced the following details:

He believes that the incinerator concept is a very workable idea. He is of British background and spoke of having significant experience in the UK in dealing with the release of various pollutants through similar means. He said that they were very successful but won the disfavor of the Norwegians due to their ability to loft it out of the UK and into Scandinavia.

He recommended the use of a 6-foot diameter refractory-line stack. He felt that 200 to 250 feet would be ideal and further recommended a discharge temperature of 1800°F and a velocity of approximately 100 feet per second. Such conditions would permit the incinerator to be operated only with a natural draft from the stack, giving a negative furnace pressure which would be highly desirable in minimizing ground-level leakage.

He calculates it would require approximately 10 to 40 x 10^6 BTU's per hour to maintain these stack conditions. He recommends firing with gas rather than fuel oil and indicated that either natural gas or liquified petroleum would be fine. UCS has checked with Met Ed on the availability of natural gas on site and does not have a firm answer yet. The preliminary response was that the quantity was not available. UCS checked locally in California on availability of LP gas. LP gas has a heating value of approximately 90,000 BTU's/gallon. Based on this heating value and the 20 million BTU's per hour, operation would require approximately 200 to 250 gallons per hour or, assuming 10 hours operation per day, roughly 2,000 gallons per day. LP gas is available in California at a cost of about $.75 per gallon, so the fuel cost would be something less than $2,000 per day.

Young recommended using an incinerator with a self-supporting stack. Stack sections are normally fabricated in 50-foot lengths and his estimate of time to erect the system was about one month. This time, of course, follows manufacture of the equipment and assumes an appropriately designed foundation.

Ballpark estimates for time to design and manufacture and cost of procurement are:

Fourteen weeks from date of order for production of drawings for approval.

Fourteen to eighteen weeks from date of drawing approval for manufacturing.

Cost of the system would be approximately $200,000 to $250,000 complete with stack, burners, and controls. This would not, of course, include the fuel supply piping or necessary auxiliary power but if fuel is supplied by tank truck, this should not be an expensive system. UCS has not done any checking on availability or complexity of piping systems for the expansion of LP gas at the necessary flow rates, but it is likely that freeze-up problems might be predicted.

Total weight of the incinerator is estimated at 130,000 lbs. The combustion chamber is a part of the lower stack section and would probably be about 10 feet in diameter.

Appendix II

This appendix, relating to the tethered balloon venting scheme, includes:

1) Letter to H.W. Kendall from Thomas W. Kelly, Director, Aerospace Instrumentation Division, U.S. Air Force Geophysics Laboratory.

2) Air Force Feasibility Evaluations.

Further attachments referenced in the latter document are omitted from the UCS Report. A version of the referenced figures is included in the body of the report as Figure 2.

DEPARTMENT OF THE AIR FORCE
AIR FORCE GEOPHYSICS LABORATORY (AFSC)
HANSCOM AIR FORCE BASE, MASSACHUSETTS 01731

REPLY TO ATTN OF: LC (Mr. Kelly, 3004)

8 May 1980

SUBJECT: Feasibility Evaluation

TO: Professor Kendall
Union of Concerned Scientists
1384 Massachusetts Ave.
Cambridge, MA 02138

Dear Professor Kendall,

The enclosed memorandum summarizes a rather hurried assessment of the feasibility of using a tethered balloon for Krypton disposed at Three Mile Island. Although the assessment is hardly definitive, all balloon related aspects of the undertaking are well within the range of existing balloon technology.

The problem, of pumping air through a long flexible tube at comparatively high rates is outside our experience, however, the enclosed calculations indicate that the desired flow rates can be achieved. This result can easily be verified by a simple, inexpensive experiment to put that uncertainty at rest. The remaining question concerning the suitability of Three Mile Island for tethered balloon flight operations can best be resolved by a brief site survey -- a matter of one day.

Please call if the Air Force Geophysics Laboratory can be of further assistance in this matter.

Sincerely,

T Kelly
THOMAS W. KELLY
Director
Aerospace Instrumentation Division

1 Atch
a/s

FEASIBILITY EVALUATION

The Aerospace Instrumentation Division of the Air Force Geophysics Laboratory has reviewed the feasibility of raising a 1 ft. diameter flexible tube, to an altitude of, two thousand feet above the Three Mile Island Nuclear Power Plant using a tethered balloon. Our conclusion is that the proposed balloon operation is indeed feasible. The suggested configuration is that of using a single 45,000 cu. ft. tethered balloon with two tether lines. The first line would be positioned over ground zero and serve to support the flexible tube while the second line would be used to raise and lower the system and to prevent twisting of the flexible tube.

A candidate tube material is ILC Advanced Balloon Material which weighs 8 oz/yd^2 and has an allowable stress of 117 pounds/inch. Calculations have indicated that a flow rate of 60 to 100 ft^3/sec can be maintained with a 10.0 psi differential pressure. This would result in a maximum stress level of only 60.0 pounds/inch, well below the 117 allowable.

The balloon itself, when filled with helium, would have a gross lift of 2800 pounds. The net lift is then calculated by subtracting the balloon weight (1000#), the tube weight (350#) and the weight of the two tether lines (140#). This results in a net lift of 1300#, more than enough to insure stability under 20 knot wind conditions.

The proposed concept is based upon the availability of an unobstructed space on the order of 2000 feet long by 200 feet wide. If open spaces of this magnitude are not available, other concepts, although less desirable, may be feasible.

Attachment #1 to this document gives the flow characteristics of the gas venting tube, while figure #1 and 2 define the balloon system configuration.

Questions relating to the operation of such a balloon system including limitations imposed by air safety, flight control instrumentation, costs and schedules have not been addressed.

Union of Concerned Scientists
Dr. Henry W. Kendall
(617) 547-5552
Robert D. Pollard
(202) 296-5600
FOR IMMEDIATE RELEASE
508-R80

GOVERNOR'S PRESS OFFICE
COMMONWEALTH OF PENNSYLVANIA
CONTACT: Roland Page
Deputy Press Secretary
(717) 783-1116
OR
Paul Critchlow
Press Secretary
(717) 783-1116

HARRISBURG (May 14) -- The Union of Concerned Scientists (UCS) told Gov. Dick Thornburgh today that proposals to vent Krypton gas into the atmosphere around Three Mile Island would have "no direct radiation-induced health effects" on area residents.

The organization said its only health concerns over a venting plan advanced by Metropolitan Edison Company (MetEd) and the staff of the Nuclear Regulatory Commission (NRC) are focused on the "psychological stress" that might accompany it.

A 63-page UCS report was released at a joint press conference with the governor, UCS Chairman Henry W. Kendall, and UCS nuclear safety engineer Robert D. Pollard. The report said: "UCS has concluded that direct radiation induced health effects from exposure to Kr-85 (Krypton), even from the Met Ed/NRC proposed venting, would be absent."

The group said its calculations on estimated radiation exposure from the proposal are "essentially the same" as those of the utility and the NRC.

Thornburgh said the report, coming from the nation's foremost critics of existing nuclear power safety, "may well amount to an emancipation from fear for the people of this area."

He said the report puts UCS in agreement with various government and industry experts "on the key question of direct radiation health effects" from venting, and he praised the scientists for "the professional integrity and organizational courage they have displayed in addressing that question."

Dr. Henry W. Kendall, UCS chairman, said the organization ultimately decided to recommend against implementation of the existing Met Ed/NRC venting plan, but he emphasized that this was primarily because of the stress problem.

Kendall said UCS concluded the gas should not be removed in a manner that would "exacerbate tensions," given the "documented magnitude of present levels of stress in the population living around the plant."

- more -

Because of that, UCS said: "even modified venting may not be acceptable."

Thornburgh and Kendall agreed that a growing consensus on the radiation safety of the venting should, in itself, substantially reduce the stress factor.

The report advanced two modified venting proposals, which UCS feels the Nuclear Regulatory Commission snould consider with a view to further reductions in psychological stress.

The modified venting plans suggested by UCS include:

*Installing an incinerator to heat the krypton prior to release, thereby causing it to rise to 1,000 feet or more, dispersing it over a wider area. UCS said this would cut the radiation exposure to residents within two miles of the plant by 4,000 times.

*Channelling the gas more than one-third of a mile into the air before release, by using a coated, nylon tube held aloft by a tethered, unmanned balloon -- the technical "workability" of which, UCS said, has been "confirmed in a preliminary analysis by the U.S. Air Force."

Dr. Kendall said the balloon technique could reduce radiation exposures to residents within six miles of the plant by more than a million times. He said it might be in place within "a few months, in the absence of delays." The incinerator, he said, could be installed within seven to nine months.

The UCS also suggested that NRC take another look at two methods of recovering the Krypton for permanent storage offsite, "provided that either could be implemented in one year or less." They include the so-called "cryogenic" and "selective absorption" techniques previously rejected by NRC.

The study group reiterated its earlier concurrence that the TMI facility "must" be decontaminated in the interest of public safety. In its report to the governor, the organization said it is important that the Krypton phase of decontamination be completed within a year. Chairman

- more -

Kendall told the governor his group would be "uncomfortable" with any delays beyond that time.

Thornburgh said he is forwarding the UCS report to appropriate state health, radiation and engineering specialists for review.

The governor expects to deliver an "appropriate statement" on the Krypton cleanup for insertion in NRC records by Friday, May 16.

The NRC has ultimate jurisdiction over the entire TMI cleanup operation, including the final decision on venting.

Thornburgh had asked the UCS on March 28 to undertake an independent study of the venting proposal. He also asked the NRC to extend its official period for receipt of comments on the plan to May 16, in order to allow time for UCS to complete its work.

Thornburgh said the UCS report, along with other studies and documents gathered by the state, will accompany whatever personal statement he chooses to make for the commission's records.

In addition to his request to UCS, the governor asked the National Council on Radiation Protection and Measurements (NCRP) to study the "safety and health consequences" of Krypton venting. That study is still underway.

\# \# \#

4-16-80

Richard H. Vollmer
Director
Three Mile Island Support, NRR
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Vollmer:

Staff of the Bureau of Radiological Health have reviewed NUREG-0662 (and Addenda 1 and 2) which were announced in 45 FR 20265 and 45 FR 21760.

It is our conclusion that the venting of the Kr-85 in the TMI-2 containment building to the atmosphere under controlled release is the prudent and proper course of action which provides minimal, if not zero, health impact. It is recognized that members of the public in the vicinity of TMI may call for alternatives that do not release the Kr-85 to the environment. It should be noted, however, that the occupational workers are also members of the public and the health impact (if any) best relates to the total population dose in person-rem (both occupational and general public). In this regard, it would be appropriate for NRC to provide estimates of the total population dose (both offsite and occupational). Based on the population dose estimates for the TMI-2 accident, it appears that the cumulative dose (person-rem) to the offsite population from the venting will be less than that due to occupational exposure for the alternatives in Table 1.1.

It is further concluded that the accelerated venting procedure proposed in Addendum 2 provides equal, if not greater, control and protection of the public. Since this procedure will require a smaller resource commitment (particularly for offsite monitoring), the Addendum 2 procedure is preferred.

In addition to the above general conclusions and comments, we would like to provide these specific comments:

1) p. 6-44, middle para. Provide a more specific reference to the limit of 15 mrem per year as it is not evident in those referenced.

2) p. 6-44, middle para. It appears that the value 5.7 x 10^{-6} sec/m^3 should have been 6.7 x 10^{-5} sec/m^3, as on the top of page 6-5, the occupancy factor of 0.7 accounting for the reduction from 16 mrem to 10 mrem.

3) p. 6-46, footnote d A reference should be provided for the beta and whole body dose factors, which apparently come from Regulatory Guide 1.109.

4) <u>p. 6-45 to 6-47 and Table 6.6-1</u> This material on the maximum allowable X/Q for a one hour period does not place such a maximum limit in proper perspective. If the Kr-85 venting were to continue for only 3-1/3 hours, at these maximum X/Q's out of the 120-hour period, then all of the 10 mrem limit would be exhausted. Thus, it is obvious that the venting must, on the average, be controlled to periods when the meteorology is equal to or better than 6.7×10^{-6} sec/m^3. While some deviation about the average can be accepted, to allow the maximum to go to 3 mrem/hr would not appear to be good practice. Further, no basis for the 3 mrem/hr value has been provided (10 CFR 20, 20.105(b)(1) provides a limit of 2 mrem/hr).

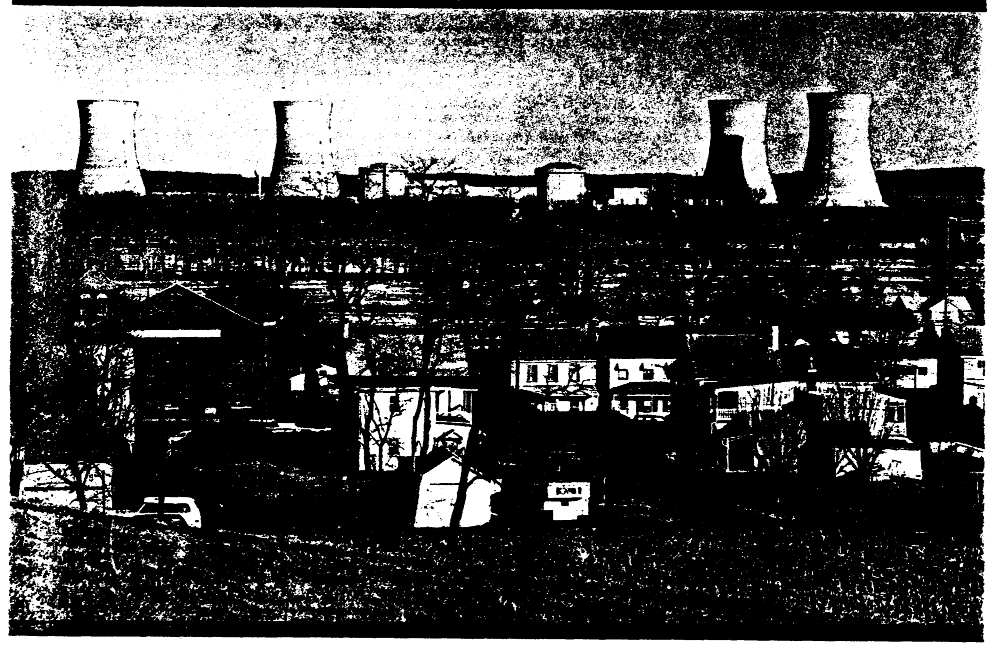
We concur in the proposal to vent the Kr-85 gas from the TMI-2 containment building to the atmosphere within the constraints of existing regulations and guidance, but recommend that NRC provide definitive controls to assure venting only during periods of high meteorological dispersion.

Sincerely yours,

/S/

John C. Villforth
Director
Bureau of Radiological Health
HEW

REPORT OF THE
GOVERNOR'S COMMISSION
ON THREE MILE ISLAND



Presented To:

Honorable Dick Thornburgh, Governor
Commonwealth of Pennsylvania

FEBRUARY 26, 1980

"Nuclear opponents, who would shut down every reactor in the country tonight, simply are not in touch with our needs for tomorrow. But nuclear advocates, who would pretend that nothing was changed by our vigil at Three Mile Island, simply are not in touch with reality."

DICK THORNBURGH
GOVERNOR

COMMONWEALTH OF PENNSYLVANIA
LIEUTENANT GOVERNOR'S OFFICE
HARRISBURG
717-787-3300

WILLIAM W. SCRANTON III
LIEUTENANT GOVERNOR

The report of this Commission is the result of a seven-month investigation into the consequences of the accident at Three Mile Island. The Commission did not attempt to discern the causes of the accident nor to criticize the response of federal, state, local or company officials. The Governor's Executive Order did not call for such an investigation, nor could one have been conducted credibly by a Commission composed of so many who played a part in the drama which unfolded on March 28, 1979.

Instead we have attempted to assess fairly the environmental, economic, health, legal, and social effects of the accident and to make recommendations for action or further study as we believe necessary. We have also undertaken a broad review of emergency response from the viewpoint of state government with an eye toward correcting errors and improving procedures.

It is the assumption of this Commission that nuclear power will be around for some time to come, although opinions as to the desirability of nuclear energy in general and re-opening of Three Mile Island, Unit 2 in particular, vary among Commission members. We have attempted in our recommendations to make intelligent choices from realistic alternatives, avoiding the temptation to espouse ideal solutions which are plainly implausible.

I would like to thank the Commission members for their hard work, patience, and dedication to the task of putting this report together. It is our hope that this report wll contribute to the health and security of all Pennsylvanians.

WILLIAM W. SCRANTON, III

ACKNOWLEDGEMENTS

This Commission report could not have been written without the help of many people who work for the Commonwealth of Pennsylvania. The research tasks alone demanded time and careful thought from over twenty-five members of the Commission technical staff.

Special thanks must go to Dr. Walter Plosila, Director of the Governor's Office of Policy and Planning; Thomas Gerusky, Director of the Bureau of Radiation Protection; Karin Carter, Deputy Attorney General, Department of Environmental Resources; Robert Kelly, Deputy Attorney General, Department of Justice; and the administrative staff of the Pennsylvania Emergency Management Agency.

We were grateful for the help provided by Joyce Freeman, Executive Director; Donald Lowry, Barbara Snyder and Amy Kelchner, staff to the Commission; and Jean Woodruff, who assisted in the final preparation of this report.

We also benefitted from the comments, opinions, and in the case of Mrs. Cynthia Diute, the volunteer time of citizens from the Three Mile Island vicinity.

MEMBERSHIP
PENNSYLVANIA COMMISSION ON THREE MILE ISLAND

William W. Scranton, III, Chairman
Lieutenant Governor of Pennsylvania

Nunzio J. Palladino, Ph.D., Dean
College of Engineering, The Pennsylvania State University

Thomas W. Pomeroy, Jr., LL.B., retired Justice
Supreme Court of Pennsylvania
Counsel to Kirkpatrick, Lockhart, Johnson & Hutchison
Pittsburgh, Pennsylvania

Robert G. Reid, Mayor
Middletown, Pennsylvania

Anita A. Summers, Associate Chairperson
Public Management Unit, Wharton School of Business
The University of Pennsylvania
Formerly, Research Officer and Economist
Federal Reserve Bank of Philadelphia

Frank Townend, LL.B., Major General,
Pennsylvania Army National Guard, retired
Partner, Silverblatt & Townend
Director, Luzerne County Emergency Management Agency
Wilkes-Barre, Pennsylvania

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Department of Radiation Health
The University of Pittsburgh

James F. Bodine, Secretary
Pennsylvania Department of Commerce

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Pennsylvania Department of Revenue

William R. Davis, former Secretary (until November 1979)
Pennsylvania Department of Community Affairs

Shirley M. Dennis, Acting Secretary
Pennsylvania Department of Community Affairs

Penrose Hallowell, Secretary
Pennsylvania Department of Agriculture

Clifford L. Jones, Secretary
Pennsylvania Department of Environmental Resources

Gordon K. MacLeod, M.D., former Secretary (until November 1979)
Pennsylvania Department of Health

H. Arnold Muller, M.D., Secretary
Pennsylvania Department of Health

Helen B. O'Bannon, Secretary
Pennsylvania Department of Public Welfare

CONTENTS

I. CHARGE OF THE COMMISSION

Beginning on March 28, 1979, Pennsylvania experienced what was probably the worst accident in the history of commercial nuclear energy. At 4:00 a.m. on that day near Middletown, Pennsylvania, at the Three Mile Island Nuclear Power Plant, a pump supplying water to TMI Unit 2's steam generator failed. Control rods stopped the fission process,* but a series of equipment malfunctions and human errors caused the core* to overheat, resulting in the release of radioactive gases into the atmosphere. In subsequent days, there were further radioactive releases resulting in a precautionary evacuation advisory for pregnant women and pre-school age children within a five-mile radius, and fear caused by the presence of an unexplained hydrogen bubble* in the reactor vessel.* From March 28 through April 3, 1979, world attention was focused on the Harrisburg area.

After the immediate crisis had passed, the Commonwealth began to study the consequences of the accident. Initially, a cabinet-level task force held a series of meetings to assess the impact of TMI on the public health, environment, agriculture, business, local governments and Commonweath agencies. Various studies were proposed by the task force to monitor the accident's effects, and in areas such as public health, to provide a basis for future long-term research. The task force

*This symbol denotes a word defined in the Glossary located in the back of this report.

worked with special representatives from the federal executive branch, as President Carter pledged full support from Washington for the Commonwealth's effort to mitigate the effects of the accident.

Acting on the findings of this task force, on May 14, 1979, Governor Dick Thornburgh issued an Executive Order establishing the Commission to Study and Evaluate the Consequences of the Incident at Three Mile Island. A copy of this Executive Order is included as Appendix A. The Executive Order stated that the purpose of the Commission was to assess the Commonwealth's performance during the emergency, assess the consequences of the accident, and determine what state government can do to alleviate the impact of the accident on Pennsylvania's citizens. The Order specified that the Commission have 14 members; eight government officials and six citizens of the Commonwealth who were knowledgeable in pertinent areas.

The Chairman of the Commission was Lt. Governor William W. Scranton, III, whose duties already included overseeing the different Commonwealth agencies working with energy programs and with emergency management. Commission members from the private sector included General Frank Townend, Director of the Luzerne County Emergency Management Agency; Anita Summers, Associate Chairperson of the Public Management Unit of the University of Pennsylvania, Wharton School of Business; Justice Thomas W. Pomeroy, Jr., retired Supreme Court Justice; Robert Reid, Mayor of Middletown; Dr. Niel Wald, Professor and Chairman of the Department of Radiation Health, University of Pittsburgh, and Nunzio J. Palladino, Dean of the College of Engineering, The Pennsylvania State University. Commission members from the state government were Secretary Clifford Jones, Department of Environmental Resources; Secretary Penrose

Hallowell, Department of Agriculture; Secretary Helen O'Bannon, Department of Public Welfare; Secretary James Bodine, Department of Commerce; Secretary Howard Cohen, Department of Revenue; former Secretary Gordon MacLeod, Department of Health, who left office in November 1979, and Health Secretary, H. Arnold Muller; former Secretary William Davis, Department of Community Affairs participated until he assumed other duties in November 1979 and Acting Community Affairs Secretary, Shirley Dennis.

At the first Commission meeting on June 5, the Lt. Governor charged the group with assisting the Commonwealth in determining the consequences of the accident, and advising the executive branch by making recommendations for improved response should a similar incident occur in the future. To accomplish these goals, the Commission established six subcommittees: Emergency Management, Legal Implications, Environmental Impacts, Health Impacts, Economic Impacts, and Programs and Recovery. The subcommittees were chaired by the citizen members of the Commission. A complete list of subcommittee assignments is included in Appendix B. The entire Commission was briefed on the work of each subcommittee during meetings held on June 5, July 6, October 4 and December 17.

The subcommittees met numerous times in the six-month period to study information and prepare their final reports. Although they did not hold formal hearings, subcommittees conducted many interviews and conferences with officials and citizens. A four member Commission staff and a large technical staff drawn from participating Commonwealth agencies assisted the subcommittees in their work. Subcommittee members reviewed procedures and policies and researched large amounts of related material. This final report is the product of that study.

II. SUMMARY OF FINDINGS

A. ENVIRONMENTAL CONSEQUENCES

1. Accident

The conclusions on the estimated maximum radiation dose to the nearby population between March 28, 1979 and April 7, 1979, drawn by an ad hoc group of technical staff members from the Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), and the Department of Health, Education and Welfare (HEW), can be accepted as reliable by this Commission.

Dose estimates are based primarily on ground-level radiation measurements from 20 utility thermoluminescent dosimeters* (TLD's), ten Radiation Management Corporation* TLD's, and after March 31, 37 NRC TLD's placed at specific locations both on the island and within a 15-mile radius. The collective dose to the total population (approximately 2,000,000 off-site residents within a 50-mile radius) has been estimated to be 3300 person-rem.* Using this value, the average dose to an individual in this population was 1.5 millirem.* (2,000,000 divided by 3300 = .0015 rem or 1.5 millirem). Members of the ad hoc group agree that the collective dose projections overestimated actual doses because of the following caveats:

- No reduction was made to account for shielding by buildings when people remained indoors.

- No reduction was made to account for the population known to have relocated from areas close to the TMI site as recommended by the Governor or who otherwise left the area. According to a study conducted by Mountain West Research Inc. for the NRC, 21,000 persons living within a five-mile radius of TMI evacuated. For the 15-mile radius, 144,000 evacuated.

- No reduction was made to account for the fact that the actual dose absorbed by the internal body organs is less than the dose assumed using the net dosimeter exposure.

Although the average dose for an individual was 1.5 millirem, it was of course possible for specific persons to receive larger doses. The highest dose actually attributed to a specific off-site individual during the TMI episode is 37 millirem. This individual had been on an island located 1.1 miles north-northwest of the plant site during a part of this period. According to the NRC ad hoc group, the maximum estimated dose that an individual located off-site could have received was less than 100 millirem. This estimate is based on the cumulative dose of 83 millirem which was recorded by an off-site dosimeter at 0.5 miles east-northeast of the site, and assumes that an individual remained outdoors at that location for the entire period from March 28 through April 7.

These doses were considerably below normal annual background radiation* levels for the TMI area, which average 100 millirem per year. Doses after April 7, 1979 were less than 1% of those recorded before that date. Refer to Appendix C for specific dosimeter locations and tables of readings.

The Pennsylvania Department of Environmental Resources' Bureau of Radiation Protection verified the readings in the ad hoc report by evaluating exposures at area facilities maintaining radiation monitoring stations. The Federal Bureau of Radiological Health also verified the low readings in an independent study. In that effort, the Eastman Kodak Company collected and analyzed high speed photographic film located in the area during the TMI releases. None of the film showed any unusual fogging. Since the minimum exposure level at which fogging occurs is five millirem, no film received an exposure in excess of that amount.

The Commission has determined that despite apparent confusion concerning the initial concentrations of radioactivity released from the plant stack, there was both adequate aerial monitoring of the plume* and adequate ground-level monitoring to accurately assess the off-site radiation doses. The Commission further affirms that the assessment of radiation releases was done in an acceptable way.

2. Clean-Up

Radioactive material exists in three major areas of the plant. These are:

- The tanks in the auxiliary* and fuel-handling buildings.*
- The reactor containment building.*
- The primary system.*

Each of these areas presents a different set of problems because of variety in the form and intensity of the radioactive sources. The clean-up will involve a three-stage process, starting with the tanks in the auxiliary and fuel-handling

buildings, then the reactor containment building, and finally the primary system. In each stage, the method to be employed for disposal of wastes is a crucial consideration.

2.1 The Tanks in the Auxiliary and Fuel-Handling Buildings

NRC and General Public Utilities (GPU) representatives independently reported that as of October 16, 1979, there were approximately 280,000 gallons of contaminated water in the fuel- handling building tanks of TMI-2. To decontaminate this water, the utility installed a system called EPICORE-II to remove the fission products* by filtration and ion exchange.*

The Commission affirms that decontamination of the water stored in these tanks is essential for several reasons: it continues to be a source of releases of gaseous radioactivity to the building resulting in small releases to the environment; it is a direct source of radiation exposure to workers who need access to the building; the continued safe shutdown of Unit 2 depends on the operability of original plant equipment in the building and the use of additional equipment being installed; and the auxiliary building tanks could be needed to store water removed from the reactor building to protect equipment necessary for continued safe shutdown.

Decontamination of the water in these tanks began October 23, 1979, and by the beginning of 1980, 94,177 gallons of the water had been processed. The entire processing of contaminated waste by EPICORE-II is expected to result in off-site exposures of less than one millirem, which is well within NRC and EPA guidelines. DER's Bureau of Radiation Protection reviewed the EPICORE-II Environmental Assessment Report* in NuReg 0591 and concurred with the off-site exposure estimates.

The EPICORE-II system was designed and manufactured on the assumption that the resins,* once contaminated and temporarily stored in the on-site storage facility, would eventually be transferred to commercial low-level radioactive material burial sites in a dewatered condition. It has been estimated that 250 truck shipments would be required over four years to effect clean-up of the auxiliary building. After the release of the EPICORE-II Environmental Assessment, the NRC decided that all radioactive resin wastes must be solidified prior to off-site shipments. This requirement to solidify all spent resins could result in additional occupational radiation exposure to on-site personnel and up to 20% more radioactive truck shipments to the final storage site. The requirement to solidify the spent resins, however, decreases some risks of transporting the wastes.

To provide additional assurance about operation of the EPICORE-II system, NRC conducted an in-depth review of the procedures, health physics* and training of Met Ed personnel before granting approval to begin this phase of the clean-up.

At the beginning of 1980, the utility had not proposed a final plan for disposition of the water once it had undergone decontamination by the EPICORE-II system. The NRC has stated that disposal of the decontaminated water would be treated in a separate assessment similar to NuReg 0591. The utility has reported intentions to clean up the water from Unit 2 to meet EPA drinking water standards and NRC water discharge requirements. If these standards are met, the water could be discharged safely into the Susquehanna River. However, utility representatives reported that this decontaminated water could be stored so that it is available for later use within the closed Unit 2 system.

2.2 Reactor Containment Building

Clean-up of the reactor containment building will involve three separate phases: decontamination of radioactive water in the basement, removal of radioactive gases from the atmosphere and the decontamination of internal surfaces. Radiation levels and principle radioactive isotopes within the containment building have been determined (both water and atmosphere). Radiation levels are high enough to prevent manned entry for any extended length of time.

Containment Building Water - Both NRC and GPU representatives reported that as of January 1980, there was between 600,000 and 700,000 gallons of contaminated water at approximately a 7½ ft. depth in the basement of the reactor containment building. The utility had estimated, based on data accumulated during June - October 1979, that the water level in the building was rising at the rate of one to two inches per month, because of leaks from the primary system such as those which occur around valves and pipe seals. More recent data indicate that the leakage rate may not be as high now. The following findings relate to decontamination of the containment building water:

- The rising water level has covered a number of important instrumentation leads and electrical cables, but the utility has been able to compensate for the loss of these items. However, the electric motors on two valves which must remain operable for continued safe cooling of the reactor are only one and one-half to two feet above the present water level. This situation is potentially dangerous, and requires careful monitoring.

- The predominant radioactive isotopes in the water are cesium-137,* cesium-134* and strontium-90.* As of October 16, 1979, indirect readings indicated a dose rate of about 200 rem*/hour just above the surface of the water.

- Proposed clean-up of the water in the containment building may be done with a system similar in design to EPICORE-II. Once the design is completed, it will be submitted to the NRC for an environmental impact assessment. Projected off-site releases from the operation of the containment building clean-up system are not expected to be higher than those of EPICORE-II.

Containment Building Atmosphere - Krypton-85* is the predominant radioactive isotope in the containment building atmosphere. The containment building has been maintained at negative pressure* since the accident, thereby "holding in" the radioactive material. However, this does not eliminate all potential risks to the public. Equipment used to maintain negative pressure is likely to fail at some point over an extended period of time. This is due to the unusual factors making up the containment environment, including high humidity and equipment not designed to function for indefinite periods without maintenance. If any equipment failure occurs, there is an increased likelihood of ground-level releases of radiation in sufficient quantity to impose a public health risk.

Four different techniques for decontamination of the air in the containment building and their estimated off-site radiation doses have been studied by Bechtel Corporation, Metropolitan Edison and the NRC. These are:

- Charcoal absorption and storage, which involves absorption of radioactive gases as they are passed through a charcoal bed at very low temperatures. Estimated completion time for installation and processing is 30-40 months, and the estimated population dose is zero.

- Gas compression and storage in tanks at high pressure. Estimated completion time for installation and processing is 25-35 months, and the estimated population dose is zero.

- Cryogenic distillaton and storage, which involves cooling of the containment atmosphere to very low temperatures at which the radioactive gases liquify and can be separated from the air. Estimated completion time for installation and processing is 20-30 months, and the estimated whole body gamma doses* of .05 millirem to the population are well within current federal specifications.

- Controlled atmospheric venting to the environment over a period of about 51 days. Estimated whole body gamma doses over the entire controlled venting period are .5 millirem. This amount would be less than one-half the amount of radiation usually absorbed by a person flying by airplane from New York to San Francisco. Further, the controlled releases would be permitted only under favorable weather conditions and would be made from stacks at an altitude which would impose less risk to public health than the possible ground-level releases mentioned earlier.

The major advantage of the controlled venting option is that it can be accomplished in a relatively short period of time and it is a permanent disposal solution. The alternative disposal systems create large volumes of intensely concentrated waste material which must be stored on-site or transported to a permanent disposal facility. These are not permanent solutions, and would continue to impose a potential public health hazard. The extended period of time necessary to implement any of the alternative systems must also be a major consideration. As detailed earlier, there is much uncertainty about the ability to maintain the containment building at negative pressure for any extended time period. The utility recently reported that minute quantities of the krypton-85 gas are escaping from the containment building into the auxiliary building through the reactor cooling system. This underscores the necessity for a timely, controlled disposal process. Prolonged delays add greater risk of accidental releases with significant public health consequences.

Reactor Building Internal Surfaces - The details for clean-up of these surfaces have not yet been developed, but it is clear that the process will produce a considerable amount of contaminated water and chemical solutions which will have to be decontaminated. Means similar to those for clean-up of the water now in the containment building may be used. No assessment has yet been made of the potential doses associated with clean-up of these surfaces.

2.3 Primary System

Procedures for clean-up of the primary reactor coolant system and for removal of the reactor head* and damaged core are highly speculative at this time. Accurate dose assessments of these clean-up operations are currently impossible to make.

These operations may impose a larger potential for releases to the local population and the environment than any of the other clean-up activities.

2.4 Disposal of Low-Level Radioactive Wastes from Clean-up Operations

Permanent storage for the large amounts of low-level radioactive wastes generated by clean-up activities is a critical aspect of that operation. The EPICORE-II system is producing concentrated wastes that are stored in temporary facilities on-site. Each successive phase of the clean-up will increase both the volume and the concentration of wastes, which must be stored on-site or transported to commercial disposal sites.

The permanent storage of commercial low-level radioactive wastes in the United States is an acute problem. As of November 1979, only one facility in the United States, located in South Carolina, was receiving shipments of commercial low-level radioactive wastes for permanent storage. The only other facilities, located in Nevada and in Washington State, were closed in October 1979. The Washington site has since reopened and has begun to receive shipments of TMI wastes. However, the continued availability of this site is in doubt. The Governor of the State of Washington announced recently that she would support legislation to limit the site to receive only Washington's radioactive wastes. This may evolve into a severe problem for Pennsylvania.

II. SUMMARY OF FINDINGS

B. HEALTH CONSEQUENCES

1. Physical

Certainty about physical health effects from the accident at Three Mile Island could not be established during the time in which this Commission made its evaluation, but present knowledge provides no reason to disagree with the finding of the President's Commission on the Accident at Three Mile Island that "most of the radiation was contained and the actual release will have a negligible effect on the physical health of individuals". Long-term studies in this area are underway and should continue. One difficulty due to the scarcity of scientific observation is uncertainty existing among health professionals about the effects of very low-level radiation on humans. Most of the available scientific data stem from studies on the effects of high level exposure on humans. Extensive studies at high and low levels have been done only on animals.

2. Psychological

The Commission also agrees with a related finding by the President's Commission that "the major health effect of the accident appears to have been on the mental health of the people living in the region..." The Behavioral Effects Task Force of the President's Commission was given responsibility for examining mental health effects on the public and workers

directly involved in the accident. The Task Force technical staff report concluded that "the TMI accident had a pronounced demoralizing effect on the general population of the TMI area... However, this effect proved transient in all groups studied except the workers, who continue to show relatively high levels of demoralization. Moreover, the groups in the general population and the workers, in their different ways, have continuing problems of trust that stem directly from the accident."

Results of the Three Mile Island area telephone survey, conducted by Mountain West Research, Inc. for the Nuclear Regulatory Commission (NRC), also indicated there were psychological consequences from the accident. This survey found that one indicator of "the degree of psychological stress experienced by families near TMI is the extent of disagreement regarding the decision to evacuate. Nearly 20% of households over the entire area said there was disagreement over the decision." The Mountain West survey also found that for some, continued stress is evident -- 22% of respondents perceive TMI to be a continuing threat to their families. However, 28% feel TMI is not a continuing threat.

Generally, the health effects of psychological stress have had insufficient study in field situations as opposed to laboratory experiments.

3. Future Studies

Insufficient information on the effects of low-level radiation and psychological stress on population groups led government and private agencies to begin a thorough field analysis of these aspects of the accident. This analysis is described in Section IV of this report. The results of these studies, when made known, will be useful in checking the validity of the judgments made by the various groups reviewing the health impact of TMI. Data from these studies are expected to be available starting in June 1980.

C. ECONOMIC IMPACT

In exploring the economic effects of the TMI accident, the Commission tried to answer two questions:

- What costs have been imposed by the accident?
- On whom have they been imposed?

Answers to the first question are partially complete. For example, estimates on TMI Unit 2 clean-up costs and an analysis of the accident's impact on housing are available. The answer to the second question will be determined largely by the Pennsylvania and New Jersey Public Utility Commissions, the courts, the Commonwealth and the federal government. These bodies will decide how the burden will be shared among GPU (Metropolitan Edison) customers and shareholders, and all United States energy users and taxpayers. The decisions will be critical to the future development of nuclear energy in this country, and to the pace of economic development in the South-central Pennsylvania region and the Commonwealth.

1. Immediate and Short-Term Effects

The accident produced some immediate effects on industry in the region, and on Metropolitan Edison and its parent company, General Public Utilities (GPU).

The event caused disruptions to area business during the first few weeks, but evidence suggests that these effects were largely dissipated during the following six months. For the utility and its parent company, the initial effects were only the beginning of mounting financial difficulties.

1.1 Evacuation

During the height of the crisis period, approximately 39% of the population within a 15-mile radius of the facility left the area. The costs of this evacuation have been estimated at $9.8 million, not including lost income or wages of the evacuees. Approximately $1.3 million has been reimbursed by insurers of the TMI facility, mostly to people living within five miles of TMI who met the criteria of the Governor's evacuation advisory.

1.2 Manufacturing Sector

The immediate impact on this sector was judged primarily by the results of a study conducted by the Pennsylvania Department of Commerce involving 363 manufacturing firms within a 20-mile radius of TMI. All firms with 100 or more employees were included. The major results were:

- The average manufacturing employee lost 1.8 hours of work in the first week following the accident.
- The average wage loss per employee was estimated at $15.
- The average loss in value of production was estimated by the firms at $75 per employee, or a total immediate loss of less than $8 million.

- The low amount of employment losses is further confirmed by the low figure of $118,750 paid out for TMI-related unemployment compensation claims by the Pennsylvania Bureau of Employment Security before mid-April 1979.
- 96% of the farmers contacted reported minimal losses. On the other hand, milk juggers reported losses of $60,000 in the first month after TMI.
- Dairies experienced some initial losses due to radiation concerns, evacuation and school closings.
- Food processing firms experienced average losses per employee of one man-hour, $5.77 in wages, and $11.53 in value of output - less than those experienced by other manufacturing industries.

These results indicate that the overall immediate effects of the accident were small. Of course, some individuals and individual firms experienced losses which were greater than the average and some which were less.

The short-term impact of the accident on employment was assessed by examining employment in the TMI area in comparison with the rest of the state for the 27 months preceding the accident. Predicted levels were compared with the actual employment figures. See Table 1 in Appendix D. These results indicate that for manufacturing industries, the behavior of employment in the post-TMI months was not visibly different from the pre-TMI months.

1.3 Non-Manufacturing Industries

The immediate impact of TMI on non-manufacturing industry was evaluated using data collected from 577 firms by the Pennsylvania Department of Commerce in September 1979. Businesses in Dauphin, York, Lancaster, Cumberland, Lebanon and Perry Counties were contacted. These data suggest that <u>the immediate effects on the non-manufacturing sector were somewhat greater than on the manufacturing.</u>

- Average manpower losses were four hours per employee.
- Average wage loss per employee is estimated at $20.
- Retail and wholesale trade and service establishments experienced dislocations in supply and marketing.
- Immediate losses in the value of output were estimated at $74 million. Some evidence indicates that these losses may have been recovered in succeeding months.

Another source of information on short-term effects in this sector is the Small Business Administration's Economic Dislocation Loan Program. Set up after the accident, this program as of December 1979 had approved loans to businesses in the affected area amounting to $510,000. Most applications came from retailers having cash flow problems because of pre-Easter sales losses. It should be noted, however, that other types of firms are eligible for this program. More recent applications may not reflect the same trend. The SBA program is discussed more fully in Section IV-B.

The short-term impact on non-manufacturing industry was assessed in the same way as the manufacturing impact. See Table 2 in Appendix D. For non-manufacturing industries, the behavior of employment in the post-TMI months was not visibly different from the pre-TMI months. Only contract construction ran consistently below expected levels, and stayed below through September.

1.4 Tourism

It has been estimated that tourists spend about $600 million per year in the South-central Pennsylvania area. Although tourist data are reflected in the non-manufacturing analysis, the industry deserves specific attention because of its importance to the region and the Commonwealth. The evidence is scattered, but it is clear that the tourist industry was directly and adversely affected.

- Ten major lodging and convention sites contacted by the Pennsylvania Department of Commerce immediately after the accident estimated losses at $2 million resulting from convention and conference cancellations. The Department estimates total losses to major tourist centers in the area at $5 million.
- Some offsetting gains to other parts of the tourist industry occurred in April and May 1979 because of an influx of people curious about the accident or involved with the aftermath and clean-up operations. Visitor center registrations in York and Cumberland Counties were about 34% above what would be predicted in April, and 7% above in May.

- For the rest of the summer, the visitor center registrations near TMI were consistently below numbers that might be expected on the basis of registrations at other Pennsylvania visitor centers. From June through September, numbers in York and Cumberland Counties ran 4% to 7% lower than past patterns would suggest.

This comparison with the rest of the Commonwealth enables the impact of the gasoline shortage to be factored out. Further, the persistence of lower tourist levels in the area suggests that the polio scare in the Amish community of Lancaster County which occurred early in the summer could not be the main explanation.

1.5 Residential Housing

Unlike other sectors of the economy that showed immediate effects of the accident, sales and prices in the housing market could not respond so promptly to events. Arrangements for sales are usually made 30 to 90 days in advance of closings. So it is not the April, 1979 data which reveal the immediate effects, but the May, June and July data. Table 3 in Appendix D, derived from State Tax Equalization Board* data, reveals that the accident adversely affected the residential housing market within a 20-mile radius of TMI, and that the five-mile radius area was hardest hit.

<u>These and other data indicate that the housing market in the 20-mile radius suffered adverse effects in the immediate post-TMI months:</u>

- The number of sales in the 20-mile radius dropped sharply over the previous year, and in contrast to the behavior in the comparison area.

- The 12-month changes in the average value of housing in the 20-mile radius equalled the 12-month changes in the average price of housing in a comparison area through June, but dropped behind sharply in July.

- The 12-month change in the number of sales in the five-mile radius showed very sharp declines in May and June, and a drastic decline in July.

- The average value of housing in the five-mile radius actually declined between June 1978 and June 1979, in contrast to a 12.4% increase in prices for the comparison area over the same period.

- Data from Central Penn Multi-List,* Inc. confirm the findings for the five-mile radius, with supplementary information that the average number of days houses were on the market in the second quarter of 1979 was 93.4. This is in sharp contrast to the 71.0 days in the second quarter of 1978, and the 82.7 days in the 20-mile radius for the second quarter.

- The Multi-List data do not reveal the same problems for the total 20-mile area that the Tax Equalization Board data do. However, comparing preliminary data on the number of deeds on which a real estate transfer tax was collected in 1978 with 1979 suggests a housing market in trouble during the summer of 1979.

<u>Only scattered data are available for July, August and September of 1979. These do suggest, however, that the housing market has been somewhat restored both in the five-mile and 20-mile radii.</u>

1.6 The Utility

The gravity of the financial problems of General Public Utilities, particularly Metropolitan Edison, in the post-TMI period is clear. The full financial impact of the accident during these months results from the following:

- Pre-TMI conditions in the investor-owned electric utility industry.
- Pre-TMI condition of General Public Utilities and its subsidiaries.
- Direct changes of GPU and Met Ed's cash position in the aftermath of the accident.
- Rulings and non-rulings of the Pennsylvania Public Utilities Commission.

<u>Pre-accident Conditions in Industry and of GPU</u> - A report prepared for the Presidential TMI Commission by M.J. Whitman Co., Inc. characterized the environment in the electric industry from 1968-1978 as follows:

- There was an enormous expansion in installed generating capacity.

- This expansion caused electric utilities to seek substantial, outside financing from capital markets, generally at higher cost.

- An increasing proportion of that financing was derived from new common and preferred stock issues rather than long-term debt financing such as bonds. Further, larger numbers of shares had to be sold in each offering, since the price-to-earnings ratio of industry stocks was on the whole declining.

- The shift from long-term debt to stock issues made the industry more sensitive to investor activity in the stock markets.

- The electric industry is capital intensive. For example, the Whitman study indicates a ratio of $4 in capital investment to $1 in annual revenue. The costs of financing are therefore a major determinant of the industry's fiscal strength.

Equally important, but not mentioned in the Whitman report is the effect of regulation on the industry. Since a certain rate of return on investment has been guaranteed in law and granted by regulatory bodies, the industry traditionally has been stimulated to expand to meet increased demand. However, regulatory commissions more recently have been reluctant to pass costs through to customers. The effects of this shift in regulatory policy have added to the industry's vulnerability to investor reaction.

The Whitman report concluded that there was a decline in the investment attractiveness of such utilities over the ten-year period.

During this decade, GPU operated in the same economic climate and with the same characteristics as the industry. The

Whitman report concluded that GPU was on an equal financial footing with comparable companies. Its rates were neither the highest nor the lowest in the Commonwealth. It experienced the same need to raise more of its expansion funds with more common stock sales. The corporation had ready access to outside financing, though on less favorable terms. The relevant public utility commissions, in their rate decisions, played an important role in these developments.

Impact of the Accident on GPU and its Subsidiaries - The accident at TMI-2 had an immediate financial impact on Metropolitan Edison, which owns 50% of the TMI installation, on Pennsylvania Electric which owns 25%, on Jersey Central which owns 25% and on their holding company, General Public Utilities. The latter not only experienced the loss of revenue from its large capital investment in TMI-2, but also suffered a dramatic decline in the value of its stock. The major economic consequence of the accident for GPU and Metropolitan Edison is a precarious financial condition that threatens the fiscal health of the parent corporation and from which Metropolitan Edison may not recover.

This condition is illustrated by the following facts:

- Metropolitan Edison has changed from a seller of excess power, generated largely at the TMI units, to a purchaser of power. The cost to the utility for purchase of replacement power to serve its customers has been estimated at $32 million per month. The PUC has allowed 85% of this cost to be passed through to the consumers, leaving 15% of that cost to the company.

- GPU has faced a cash demand to pay accident-related costs. The SRI International report prepared for the President's TMI Commission estimated that GPU spent $57 million by the end of July on plant stabilization, preparations for decontamination, monitoring radiation exposure, and participating in the investigations of the accident. GPU estimated they had spent $110 million by January 31, 1980.

- Metropolitan Edison's cash flow problems have resulted in substantial short-term borrowings. A consortium of 43 bankers are lending a maximum of $408,650,000, at interest rates significantly higher than the normal cost of such funds.

Pennsylvania Public Utility Commission Rulings - The following occurred as a result of the PUC's April 19, 1979 and June 15, 1979 rulings:

- In April, TMI-2 was removed from the utility's rate base. This meant that expenses related to the $750 million investment for TMI-2 could not be passed through to customers. GPU estimated these costs at about $8 million per month. This action also cancelled a scheduled rise in rates that had been approved prior to the accident.

- In June, the temporary rates set in April were made permanent. This included the removal of costs associated with TMI-2 from rate base.

- None of the utility's costs associated with the accident were allowed to be passed through to customers.

- A large portion, but not all, of replacement energy costs were passed through to customers. A complex formula was set up which permitted the company to recover 85% of those costs. However, application of the formula has resulted in less than that percentage being recouped.

Currently, the PUC is in the midst of major hearings that will determine whether TMI-1 will remain in the rate base, whether Metropolitan Edison will be granted a rate increase to recover additional replacement power costs from TMI-1, and whether Metropolitan Edison should retain its certificate of operation.

The proceedings of the Pennsylvania Public Utility Commission will largely determine the future of Metropolitan Edison/GPU. The decision to suspend TMI-2 from the rate base was offset, in terms of rates to consumers, by the decision to allow rates to reflect replacement power costs. However, this initial action was followed by a series of conflicting signals. Since the June 15 order, the PUC has undergone a major membership change. Perhaps due to the change, the trend of PUC thinking still is not clear. The rulings on the continuance of TMI-1 in the rate base, the possible revocation of Metropolitan Edison's certificate, standards for continuance of that permit, and allocation of costs for clean-up and restoration/decommissioning all create additional risk factors for investors in GPU. These factors are likely to affect other investor-owned electric utilities which have nuclear capacity.

The lack of additional PUC rulings since June 15 has had direct implications for Metropolitan Edison and GPU. The utility and its parent company have had to make decisions about clean-up costs, borrowing needs and the development of alternative future plans without knowledge of how the Commission will

rule on key factors that lie within its powers. The utility will not be able to move toward the most efficient way of supplying energy to its 345,000 customers until a clear set of contraints is laid down.

2. Long-Term Effects

Introduction - The analysis in the previous section suggests that in the six to eight months following TMI, the overall impact on employment has been small; the effect on two specific sectors, tourism and housing, has been more significant; and the effect on the financial condition of the utility has been of overriding importance.

The long-term economic consequences are dependent on the decisions that will be made by the Pennsylvania Public Utility Commission, the utility, the courts, the Commonwealth and federal government, and the citizens. While it is important to recognize that these decisions will determine the institutional framework within which the economic effects will take place, it is equally important to see that the economic effects will help determine corporate, regulatory and legislative responses.

There is no similar precedent to use in predicting the long-term impact of the accident on the region's economy. However, determining factors will be the decision on continued nuclear energy production at the TMI site, the decision on the safety requirements for siting of nuclear reactors, and the price and availability of energy in the region.

Thus far, only scattered information is available to assess what these decisions may be since a cohesive set of national and state policies remains to be articulated. There are, however, these relevant pieces of information:

- TMI-1, which was down for routine refueling at the time of the accident, has been refueled and could begin functioning as soon as permission to do so is received.

- The earliest estimate for returning TMI-2 to service is January, 1983. However, this date presupposes a regulatory climate that will not delay the clean-up and GPU's financial capability to carry it out. Current activities of the NRC make this schedule appear unrealistic.

- The President's TMI Commission recommendation which, if carried out, would require the NRC to locate new power plants in areas away from population centers, may preclude Unit 2's restoration to service. Of central importance to the final decision will be the NRC's perspective in treating TMI as a case apart from other operating sites.

- National energy costs can be expected to increase due to international pressures, and because the TMI accident is evidence that the true costs of nuclear energy are higher than previously estimated.

- Generating capacity in the Pennsylvania-New Jersey-Maryland Interconnection, a consortium of the electric utilities serving those three states, is currently in surplus of demand for peak load requirements. The continued outage of both TMI units places a strain on the PJM grid, and makes

it necessary to rely on more expensive oil-fired generating facilities.

- 4900 out of 5100 megawatts of additional generating capacity now under construction in the Commonwealth are nuclear. When the new facilities are brought into service, roughly 30% of the total capacity in Pennsylvania will be nuclear.

- Econometric studies* on the price of fuel and its effects on demand lead us to believe that increased prices for nuclear-produced electricity may cause industrial, commercial and residential consumers to curtail their use and to seek alternate fuels. The price of available alternate fuels such as natural gas and coal would then rise due to increased demand.

2.1 Employment

There are a number of possible developments on employment in the region. The SRI International report for the President's Commission made the following estimates for jobs directly related to work required at the TMI site: an increase of 1900 jobs per year for five years if the plant is refurbished, 2000 jobs per year for two years if the plant is decommissioned, 1800 jobs per year for ten years if there is a nuclear facility replacement, and 1800 jobs per year for eight years if a coal facility is the replacement. These numbers are about one-third of 1% of total employment in the region.

There is likely to be a lengthy period ahead during which the regulatory and legislative decisions on nuclear reactor location policy will evolve. During the period of uncertainty, areas in close proximity to nuclear plants may be viewed as more speculative by businesses interested in relocating or expanding. However, there are currently insufficient data available from which we may draw conclusions.

Further, all present information indicates the relative price of energy in the region served by Metropolitan Edison will increase. Econometric analysis of the effects of such price increases suggests that commercial and industrial demand for energy will be reduced. For high energy users in particular, such as machinery and metal industries, the impact of price increases is likely to be substantial. Data collected by the Pennsylvania Department of Commerce found that about one-third of the respondent manufacturing firms and a somewhat higher proportion of the non-manufacturing firms felt that their expansion plans would be curtailed by increases in electricity rates that were as small as 10%.

Equally significant is the effect of the utility's tenuous financial situation on area industrial expansion. A recent study done at the Wharton School of the University of Pennsylvania indicates that a dependable supply of energy is a more important factor than cost in business siting decisions.

2.2 Housing

Housing in the TMI area may be affected by the national policy on the appropriate degree of isolation for reactors, the decision on restarting the TMI facilities, and the psychological response of people to events such as the March 28 accident. The importance of these factors is likely to diminish as the distance from the facility increases.

The broad issue of appropriate siting standards for nuclear plants should be considered very carefully by the federal government. If an isolation zone is mandated for new reactors, there is reason to believe the real estate values in populated areas close to existing reactors would be affected.

The housing pattern for the Three Mile Island area is more likely to be affected by the restoration or decommissioning of the reactors there. If the TMI facility is not restored, then a small decline in the housing market could be expected in response to a decline in utility employment after the decommissioning period. If the facility is restored to a non-nuclear one, then the part of the housing market reflecting TMI employment would probably expand. If the facility is restored as a nuclear plant, the psychological effect of the accident on people's locational preferences for living must be weighed. There are no real guidelines to use here, but fragmentary data lead us to believe that the psychological impact of the accident will probably not significantly alter the housing pattern of the region.

2.3 Tourism

The weak psychological impact of the accident on residential location decisions suggests that tourism in the region is not likely to be affected. Other factors directly related to nuclear power development and the future of TMI are also unlikely to affect tourism over the long-term.

2.4 Financial Demands

There are three major sources of financial demands arising from the accident in the next several years: replacement power expenditures; replacement of capacity of TMI; and the liabilities arising from the accident. The method of meeting these demands will be determined by future regulatory, legislative and judicial decisions.

Replacement Power Costs - The SRI International report included estimates of GPU expenditures that would be required to purchase replacement power. The cost estimates range from a low of $576 million to a high of $1644 million, depending upon the date of return to service of TMI-1 and TMI-2, whether TMI-2 is refurbished or replaced, and whether (if replaced) it is replaced with a coal or nuclear facility, and whether (if replaced) it is located on the TMI site or a new site. Table 4 in Appendix D lists these estimates.

It is important to note that the costs that actually develop are very sensitive to the timing, refurbishment, and replacement decisions.

Replacement of Capacity - The SRI report also calculated and arrayed the range of expenditures that might be involved in the replacement of TMI capacity. The estimates, reproduced in Table 5 of Appendix D, range up from the lowest estimate for refurbishment ($249 million) to the medium cost estimate for replacing the plant with coal at a new site ($670 million) to the highest estimate of replacing the plant with another nuclear plant at a new site ($1176 million). The SRI report also estimates a cost range of $157 million - $241 million if Unit 2 is decommissioned. Table 6 of Appendix D contains detailed information on this alternative.

Liabilities Arising from the Accident - By mid August 1979, there were many outstanding claims. There were approximately 27 from government agencies, 115 from businesses, 18

individual lawsuits from plaintiffs, and 11 class action suits.* Many of the claims are for unspecified damages and a number of the class action suits are for damages of $560 million. Available to meet these pending liabilities is the $560 million arising under the Price-Anderson Act provisions, the legal possibility of additional Federal assistance, and the assets of the utility.

2.5 Alternatives Available to Respond to Financial Demands

There are many mechanisms available for meeting costs resulting from the accident. Some involve additional costs for investors in GPU and, indirectly, for investors in all utilities involved in nuclear power; some involve additional costs for GPU's customers; and some involve additional costs for all American taxpayers. The assignment of costs associated with each alternative has a direct bearing on incentives that will affect both nuclear energy development and energy consumption. The alternatives to be considered are:

- Types of voluntary reorganization including merger and consolidation.
- Reduction of common stock dividends.
- Rate relief which would include costs not covered by insurance.
- Creation of a state Power Authority.
- Federal responsibility for some of the costs.
- Bankruptcy proceedings including liquidation and reorganization under court-appointed trustees.

Voluntary Reorganization - Several forms of voluntary reorganization are available to the parent corporaton including merger of subsidiaries, management consolidation, and operations changes. GPU's recent announcement of plans providing a separate corporation for nuclear operation and consolidated management of Metropolitan Edison and Penelec indicates the parent company's interest in accomplishing major internal changes within a short time period.

Complete merger of the two subsidiaries appears unattractive for the short-term due to legal restrictions on increasing the debt level of the stronger subsidiary to take in the weaker firm. Other legal requirements mandate a period of about five years to accomplish a merger.

Management consolidation does not involve changes in financial holdings or debt of either subsidiary. This alternative requires approval of the respective Public Utility Commissions, the NRC and the SEC, but can be accomplished within several months. The parent company has reported that it will take this step in conjunction with its plan to transfer nuclear operations to a separate corporation with an infusion of new high-level management. However, the plans' success in improving GPU's financial situation will depend on the Public Utility Commission's perception of their merit.

Reduction of Common Stock Dividends - Dividends currently being paid by GPU have been reduced from $.45 to $.20 per quarter. The option exists for further reduction in dividends to meet growing financial demands. The argument could be developed that investors take risks for which they receive returns, and in the event of an unpredicted disaster, they bear the cost. While the electric utility market previously operated on an assumption that nuclear power was almost without risk, the accident at Three Mile Island alters the financial risk calculation. This revised risk calculation should be a decision factor for investors.

GPU has argued that a reduction in dividends below $.20 a quarter would close the company out of the market. Consolidated Edison's temporary omission of a dividend in 1974, however, resulted in only a limited loss of access to capital markets. A drastic dividend reduction, or an omission lasting longer than one quarter would, according to a government expert, have a much more pronounced effect on the utility taking such action.

As this report went to press, the Commission learned of GPU's decision to omit its dividend for the next quarter.

Rate Relief - The utility estimates that a combination of a 15% increase in charges to customers and a timely return to service of TMI-1 would restore its financial capability for raising the capital required to meet its expansion plans. One issue this Commission examined is how much rate relief the utility should expect. The issue is complex and controversial, and breaks new ground in the nuclear debate.

Forms of rate relief the utility might expect from the PUC are:

- The continuation of TMI Unit 1 in the rate base.
- A change in the economic formula currently used to recover replacement energy costs. 100% recovery could be permitted instead of the 85% presently allowed.
- The inclusion in the rate base of mandated extraordinary expenses for safety modification, community programs and emergency management.

The Public Utility Commission has before it proceedings that address the continuation of TMI-1 in rate base and GPU's petition for a rate increase of $55 million. In the first proceeding, the utility has been asked to show cause for continuing Unit 1 in the rate base as "used and useful property", a requirement established by public utility law. Unit 1 has not been on-line for over ten months to date, and is the subject of a lengthy NRC proceeding that will ultimately rule on its future operation. The central issue for the PUC is to interpret whether Unit 1 is "used and useful" in its present status: apparently technically ready to go back on-line, but needing the special approval of a separate regulatory body. If the PUC determines that Unit 1, like Unit 2, is no longer "used and useful", there may be a loss of state revenues that would have been collected on the facilities through the Public Utility Realty Tax.

In a related proceeding, the PUC must rule on the utility's request for a change in formula for recovering replacement energy costs from the TMI units. Here, too, Unit 1's return to service is the key factor. The present formula, set up in the PUC's order of June 15, 1979, presupposed Unit 1 to be in service by January 1, 1980. The utility's rate request would change the formula to reflect both TMI-1's delayed return to service and the increased cost of replacement energy being purchased from other companies. GPU has requested an additional $55 million to cover the shortfall.

It is also clear from this rate request that a possible lengthy delay in returning TMI-1 to service may result in periodic filings, as the utility will need increased rates to keep pace with rising replacement energy costs.

As this report went to press, the PUC granted Metropolitan Edison a temporary rate increase of $55 million, pending out-

come of the current proceedings.

Bankruptcy Measures - It is possible that Metropolitan Edison or GPU may find the burden of costs resulting from the TMI accident too great for it to bear, notwithstanding that it may reduce dividends, that it may have obtained a measure of rate relief through inclusion of some costs in the rate base, and that the federal government makes monetary contribution in the form of some sort of cost sharing. In this event, Metropolitan Edison and/or GPU would have to consider some sort of reorganization, either outside or within the courts. If the utility is unable to pay its debts as they become due, it may seek relief under the reorganization sections of the National Bankruptcy Act. The most extreme and last resort, of course, would be liquidation bankruptcy, which would involve a total wind-up of the affairs of the company.

The National Bankruptcy Act, which has recently undergone a thorough revision, specifies two ways in which bankruptcy proceedings occur. First, a company may seek to reorganize or liquidate on its own initiative by instituting voluntary proceedings in the federal bankruptcy court. Second, a qualified group of the company's creditors may file suit to institute involuntary proceedings.

Bankruptcy Reorganization - An official from the Securities and Exchange Commission stated during testimony in May 1979 before the New Jersey Board of Public Utilities that reorganization in a bankruptcy context has never been imposed on an electric utility in the United States. According to the official, certain legal requirements for such a proceeding might result in much higher costs for consumers. If there was a default in interest payments on any debentures, the trustee would be likely to call in all the bonds. Interest on these bonds would then accrue at the highest rate of any series. The official also argued that the revenue problems which induced the bankruptcy would not be resolved by it. Rate relief previously denied would not be more likely and credit would not be more available unless the trustee possessed impeccable financial credentials.

Although no precedent exists for this option, it is conceivable that credit not available to the financially unsound utility would be granted to new management, and that Public Utility Commissions might look more favorably on granting rate relief to a newly reorganized utility.

Those who feel the utility should be penalized for its role in the accident and those who want to create incentives for ceasing or slowing down nuclear power development might support this alternative. The uncharted path of bankruptcy reorganization for a public utility and the evidence that the problems of Metropolitan Edison that contributed to the TMI accident were shared by other nuclear facilities both suggest that financial reorganization in a bankruptcy context would not be a recommended option. In any case, the decision on instituting this option rests with the utility and its creditors and, if made, is likely to flow from financial causes.

Bankruptcy Liquidation - As described previously, liquidation is an extreme measure that would force a total cessation of Metropolitan Edison's operations. Since the service delivered by the utility is regarded as essential, the risks entailed in liquidation would make it an unwelcome alternative for both the Commonwealth and utility customers.

Creation of a State Power Authority - The TMI accident has done more than raise the real costs of producing electric power. It has also strengthened the premise that private industry may

not be able to finance large-scale facilities such as power plants. This Commission examined the formation of a quasi-public financing body as an alternative for Pennsylvania.

An agency such as the Power Authority of the State of New York could provide the funds for constructing and operating new power generating facilities. State power authorities in this country are limited almost entirely to areas where hydroelectric power was the primary resource to be developed. A public agency was a necessity because waterways are the state's property. The backing of credit by the state, and the exemption of the Authority from federal and state income taxes makes capital easy to acquire and utility rates appear lower. However, use of state credit for this purpose would probably affect other financing by the state, and the taxes that are not collected through state authority rates would be collected elsewhere. Further, the decision to allocate available resources among energy producing alternatives are not made most efficiently when artificially protected prices are far from what true market prices would be.

The creation of a state power authority raises issues of feasibility (since hydroelectric power development is not the impetus in Pennsylvania) and efficiency. The artificially low prices would increase energy consumption, and if the increased capital were used to develop nuclear facilities, this would occur without the citizen statement of preferences that happens in the market through public investment or non-investment.

Federal Responsibility - The role of the federal government in the development of nuclear energy in this country is well documented. Congress passed the Price-Anderson Act to protect the industry from the possibility of overwhelming liabilities in order to encourage its development. And it has poured vast amounts of research and development funds into the industry. Clearly, the federal government has regarded the encouragement of growth in the industry to be of public benefit. National defense, insulation from foreign oil dependency and relatively cheap energy are considered to be national goals warranting national support.

There is a strong case to be made for federal government participation in some costs associated with the accident. It has contributed to the nature and pace of development in the industry, and it has exclusive authority over the industry's operation and safety standards. However, full recognition should be given to the considerable subsidization of the industry which has already occurred and to the residual $80 million insurance liability the federal government is obligated to assume. The announcement effect of a federal disaster bail-out would not be consonant with efforts to encourage the industry to survive to some important extent on its own merits, with a national policy of energy conservation, or with an efficient determination of energy resource development.

Effect on Price - The TMI accident has shown that the financial risks of nuclear accidents and the associated costs are higher than previously perceived, though they remain statistically low. If the PUC determines that consumers of nuclear power should bear part of the added risk, and grants one or more of the types of rate relief mentioned earlier, the price of that electricity will rise. It will rise because there is now more complete information on the real costs of nuclear energy. More importantly, the alternative of a utility drawn into bankruptcy carries with it certain heavy costs to both its customers and investors, and to other Pennsylvania electric utility shareholders and consumers. In any event, the

passing on of new, higher costs to the consumer should effectively reduce energy consumption as people and industry conserve to hold down monthly electric bills. Nuclear energy could therefore become less attractive on a cost-per-kilowatt-hour basis if its price rises more than other major sources of electric energy.

D. LEGAL ISSUES

As the TMI accident has affected the environment, economics and citizenry of South-central Pennsylvania, so it has had legal consequences giving rise to both public and private litigation. Legal issues to be discussed include federal preemption of state's authority to regulate nuclear power; lawsuits stemming from the TMI accident; NRC proceedings involving TMI Units 1 and 2; the Price-Anderson Act; the effect of declaring an Extraordinary Nuclear Occurrence (ENO) and legal concepts which may apply in the absence of an ENO declaration.

1. State's Authority to Regulate Nuclear Power

Regulation of the nuclear power industry has always been and still is almost exclusively the right and responsibility of the federal government. Pervasive federal statutory and regulatory enactment and the supremacy clause of the U.S. Constitution have preempted state authority in the field.

A state may, however, regulate power plants, including nuclear power plants, as long as the regulation is not based on nuclear hazards. Thus, nuclear and conventional power plants alike are subject to state regulation by the Public Utility Commission and other state governmental agencies. Similarly, the Pennsylvania Legislature has considered several bills within the past few years relating to plant siting and the need

for additional generating capacity. These bills pertained to nuclear and conventional power plants alike. But to date, none have been adopted.

Although a state is not allowed to regulate radiological aspects of the nuclear industry, it does have the right to participate in NRC proceedings as an "interested state" or as an "intervenor"* in the proceedings.

Finally, states do have significant responsibility with regard to planning for and responding to nuclear accidents. Thus, while a state is not in a position to regulate the day-to-day operation of a nuclear power plant, it does bear the burden, with assistance from the federal government, for insuring the health and safety of its citizens in the event of an accident.

2. Legal Suits

2.1 City of Lancaster vs. Nuclear Regulatory Commission (NRC)

On May 21, 1979, the City of Lancaster, its water authority and Mayor filed a suit against the NRC in the U.S. District Court for the District of Columbia. They asked the Court to prevent the NRC from permitting Metropolitan Edison to use the EPICORE-II treatment system on several hundred thousand gallons of water radioactively contaminated by the accident. Lancaster depends on the Susquehanna River for its water supply. Although the utility did not announce its intention to dump water, the parties filing suit were concerned that the quality of the city's drinking supply would be jeopardized by dumping EPICORE-II treated water into the river. Metropolitan Edison became a party to the proceeding as an intervenor.

On May 28, 1979, with the consent of the NRC and the City, the Court ordered the NRC to perform environmental assessments prior to permitting use of EPICORE-II. The Commonwealth's application to participate as amicus curiae ("friend of the court") in this suit was granted on July 26, 1979. The Commonwealth sought amicus status so that it could participate in this important proceeding without taking a position on the matter.

On January 4, 1980, the City of Lancaster, NRC, and Metropolitan Edison reached an agreement, settling the suit out-of-court. This agreement provided for the following:

- The NRC will perform the environmental impact assessment promised on November 21, 1979.
- There will be no discharge of the radioactive wastewater into the Susquehanna until the environmental assessement is completed, or until the end of a two-year period unless emergency conditions occur.
- The NRC will notify Lancaster of any Commission meeting to discuss the wastewater problems and permit the city to present technical data.
- The City of Lancaster and the others will bring all future complaints concerning the wastewater to the NRC first, then to the Court of Appeals if they are not satisfied.
- Metropolitan Edison will provide water monitoring equipment and technical support to the City at the utility's expense, for the City to monitor water downriver from TMI.

2.2 Susquehanna Valley Alliance Lawsuit

On May 25, 1979, the Susquehanna Valley Alliance, comprising a group of area citizens, and a number of other individuals filed a lawsuit in the United States District Court for the Middle District of Pennsylvania against Metropolitan Edison and the NRC over the issue of wastewater disposal at TMI-2. The suit was dismissed by the Court on October 13, 1979. The Susquehanna Valley Alliance then appealed the dismissal. The Court heard the argument on appeal in November 1979, but has not yet issued its decision.

2.3 Pending Private Lawsuits and Class Action Management of Initial Private Suits

Within eight days after the TMI-2 accident, the first private lawsuit was filed, followed during the next few weeks by over 25 more suits. Most of these lawsuits were filed as class actions and have asserted the following: negligence in the design, manufacture, construction and operation of TMI-2; strict liability not dependent on negligence due to the ultrahazardous nature of operating a nuclear power plant; and an actual taking of private property by Metropolitan Edison.

Consolidated Class Action - (Fantasky v. General Public Utilities Corporation) - As required by the Federal Rules of Civil Procedure, many of the pending private lawsuits have been consolidated into one class action. This was filed on June 27, 1979. The suit represents three classes: all individuals or firms within a 25 mile radius of TMI-2 who suffered economic harm as a result of the nuclear incident; all homeowners or residents within a 25 mile radius of TMI-2 who suffered economic harm; and all individuals within a 25 mile radius who suffered personal injury, incurred medical expenses or suffered emotional distress as a result of the accident.

Those included in this class action suit are seeking the following: monetary damages for losses including pain and suffering; an order to shut down TMI-2; and the creation of a trust fund to pay for medical diagnosis and treatment of cancerous or genetic conditions which might develop over the next 20 years as a result of the accident. This suit is also pending before the Court.

All suits filed since the class action are being consolidated unless the person bringing the suit can show a reason why his or her case should be treated separately. The purpose for consolidating all suits is to permit questions common to all cases to be considered in one proceeding.

It should be noted that insurance carriers have to date paid $1.3 million for lost wages and other claims. Although these individuals have not been required to release their right to bring suit after receiving payment, it is presumed that the payments will reduce the number of claims that must be litigated.

3. NRC Proceedings

3.1 TMI-1 Restart

On August 9, 1979, the NRC ordered an Atomic Safety and Licensing Board* to hold hearings to decide whether or not TMI-1 should be allowed to restart and, if so, under what conditions. In November, a pre-hearing conference was held to discuss the petitions and contentions. Public hearings will begin in February or March 1980.

3.2 Emergency Planning

Since the accident, the NRC has been revising its own rules and regulations. One change proposed on November 21, 1979 would require NRC approval of utility, state and local emergency response plans as a condition of the utility's license to operate a nuclear facility. The NRC is currently receiving comments on the proposed regulation.

4. Price-Anderson Act and Public Liability Claims

The Price-Anderson Act, which is a 1957 amendment to the Atomic Energy Act of 1954, provides a three-tier system for compensating victims of a nuclear accident. To form the first tier, each utility is required to provide financial protection equal to the maximum amount of liability insurance available from private insurance companies. This must be done before the plant is allowed to operate. On March 28, 1979, Metropolitan Edison had coverage of $140 million.

The second tier of financial protection is provided under a deferred premium industry plan whereby each nuclear facility is assessed a premium of $5 million to cover public liability claims which exceed $140 million. As of March 28, 1979, this second tier created a fund of $335 million.

The federal government is required to provide the remaining amount up to $560 million. This share would have been $85 million on March 28. As new nuclear facilities are licensed, the second tier amount increases by $5 million for each facility, and the federal contribution decreases by the same amount.

The Price-Anderson Act currently limits liability for a single nuclear accident to $560 million. If an accident occurs where public liability claims might exceed this amount, the Act requires the NRC to survey the causes and extent of damage, and to report its findings to Congress. The Act also provides:

> "In the event of a nuclear incident involving damages in excess of ... ($560 million), the Congress will thoroughly review the particular incident and will take whatever action is deemed necessary and appropriate to protect the public from the consequences of a disaster of such magnitude ..."

Although Congress specifically desired to limit payment of claims exceeding $560 million and to approach accidents of greater magnitude on a case by case basis, the $560 million figure has not been adjusted since 1957. It is important to note that because of inflation, $560 million in 1957 is equal to approximately $1375 million or almost $1.4 billion in 1979.

5. Extraordinary Nuclear Occurrence

An Extraordinary Nuclear Occurrence (ENO) is a nuclear accident which the NRC finds to be particularly severe, especially when considering its effect upon persons or property off-site. If the NRC declares an accident to be an ENO, an individual will normally recover damages upon proving that the accident occurred and that the individual was injured or his property was damaged. This eliminates the need to prove negligence by the utility.

The ENO concept is not designed to drastically alter state laws concerning recovery because of a private or civil wrong. It is intended, however, to create rules which must be uniformly applied by the courts throughout the country.

One complicating factor in compensating radiation victims is that many of the symptoms or resulting diseases may not appear until months or years after the exposure. It is possible, for example, that certain radiation exposure might cause a victim to contract a form of cancer five, ten, or more years after the accident. An ENO declaration allows an individual to bring suit within three years from the date he discovers or reasonably should have discovered his injury, for a time up to 20 years after the nuclear incident.

When an accident is not found to be an ENO, the period of limitation will probably be the period allowed by state law: two years in Pennsylvania. An increasingly common trend has been for courts to hold that the period of limitation begins not at the time of the event causing injury, but when the individual discovers or reasonably should have discovered the injury. This type of ruling, if adopted by the courts, is similar to the requirements of the Price-Anderson Act. The advantage of an ENO declaration would be to extend the period of limitations to three years.

On November 21, 1979, the NRC held a hearing to receive public comment on whether the TMI accident should be declared an ENO. The NRC is not expected to decide the matter until early 1980, but it is not likely that an ENO will be declared.

6. Theories of Legal Liability Absent an ENO

If an ENO is not declared, an individual will be required to prove his claim under state law, and may be required to prove that the utility has acted negligently before he can recover. It is possible, though, that under the concept of absolute liability, the individual will not be required to prove negligence. The concept of absolute liability for injury resulting from an abnormally dangerous activity has been stated as follows:

> "One who carries on an abnormally dangerous activity is subject to liability for harm to the person, land, or property of another resulting from the activity, although he has exercised the utmost care to prevent the harm."

Courts have yet to decide whether operating a nuclear power plant is an abnormally dangerous activity under Pennsylvania law. In one recent case, Silkwood v. Kerr-McGee Corp., (August 16, 1979), a U.S. District Court in Oklahoma has applied strict liability to radiation induced injuries. This case is being appealed.

III. COMMONWEALTH AND FEDERAL PREPAREDNESS AND RESPONSE MARCH 28 THROUGH APRIL 2, 1979

A. ENVIRONMENTAL PREPAREDNESS AND RESPONSE

1. Preparedness

1.1 Commonwealth of Pennsylvania

Pennsylvania Department of Environmental Resources (DER) - The Department of Environmental Resources' Bureau of Radiation Protection (BRP) is responsible for environmental monitoring around Pennsylvania's nuclear power plants. This is accomplished by BRP's Division of Environmental Radiation, which also conducts emergency planning and laboratory activities. The BRP's primary activities relate to inspecting, licensing, and regulating over 9000 non-NRC licensed users of x-ray equipment and radioactive material in the Commonwealth. The Bureau of Radiation Protection's total staff is approximately 25, including one nuclear engineer.

The BRP was transferred to the new Department of Environmental Resources in September of 1970. The transfer was desirable since it eliminated duplicating BRP staff functions in both the Departments of Health and Environmental Resources. Potential inter-agency conflict was eliminated, and the BRP was now located within an environmental regulatory agency.

The DER/BRP is the Commonwealth's lead agency for emergency response during any incident at a Pennsylvania nuclear power plant requiring Commonwealth action. It operates as the "technical arm" for the Pennsylvania Emergency Management Agency; relaying plant conditions and recommending protective actions as necessary to minimize exposures to the population.

The Bureau had an emergency plan in place on March 28. The BRP's original planning document, "Pennsylvania Plan for Implementation of Protective Action Guides" was written in 1973 by the chief of the Division of Environmental Radiation. The Three Mile Island annex was written in 1974, and the entire plan was completely revised in 1977.

The Nuclear Regulatory Commission reviews state nuclear emergency reponse plans, and concurs with the plans if certain NRC criteria are met. Although BRP personnel worked closely with the NRC in drafting the three plans mentioned above, none were formally submitted for concurrence. This was not because of shortcomings with the plans, but the perception of BRP emergency planners that NRC concurrence was not necessary.

Prior to March 28, the BRP/Division of Environmental Radiation had placed 4 thermoluminescent dosimeters (TLDs) at locations within a 15-mile radius of the plant. Where possible, the BRP dosimeters were placed at the same locations as Metropolitan Edison dosimeters. This enabled the Commonwealth to authenticate any readings reported by the utility.

Pennsylvania Department of Agriculture - At the time of the accident Pennsylvania's Department of Agriculture had a 1976 draft version of its Emergency Response Plan for a Nuclear Accident. Although the draft had not been revised since 1976, it did provide guidance for the management of milk and other potentially contaminated foodstuffs.

1.2 Federal Government

Interagency Radiological Assistance Plan (IRAP) - The Federal Interagency Radiological Assistance Plan was created "to provide technical federal assistance, prinicipally radiological monitoring and communication capabilities, during a peacetime nuclear incident". Federal agencies participating in this plan include the Nuclear Regulatory Commission (NRC), Department of Energy (DOE), Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA), among others.

Nuclear Regulatory Commission (NRC) - Under the IRAP, the NRC was designated to collect and evaluate facts and circumstances of radiological incidents. Although the NRC maintains large technical, managerial and professional staff capabilities for use under IRAP, it does not have extensive emergency equipment available.

Department of Energy (DOE) - The Department of Energy is responsible for coordinating the overall IRAP response, including the use of its own and other agencies' emergency response capabilities. Unlike the NRC, DOE has extensive emergency monitoring and analysis equipment available.

Separate and in addition to its participation in IRAP, DOE administers the Radiological Assistance Program, whereby national laboratories offer states and nuclear facilities assistance during radiological emergencies. This assistance includes monitoring radiation levels and assisting as otherwise necessary.

Environmental Protection Agency (EPA) - The Environmental Protection Agency coordinates the emergency radiological assistance response of its own Office of Radiation Programs, the

Food and Drug Administration's Bureau of Radiation Health, and its Office of the Executive Director for Regional Operations, also in the FDA. This coordinated response includes maintaining regional monitoring teams, evaluating the extent of contamination, collecting and analyzing samples, and providing advice on actions that should be taken to protect public health and safety.

2. Response

2.1 Commonwealth of Pennsylvania

Pennsylvania Department of Environmental Resources (DER) - At 7:03 a.m. on March 28, 1979, the Bureau of Radiation Protection (BRP) duty officer* and Nuclear Engineer was contacted at his home by the Pennsylvania Emergency Management Agency (PEMA) duty officer, and informed that a "site emergency"* had been declared at the TMI-2 facility. As planning required, the BRP duty officer contacted the chief of the Division of Environmental Radiation and requested that she and other staff members report to the BRP office immediately. He then attempted to telephone the TMI-2 control room, but a Metropolitan Edison telephone operator could not make the connection; the control room called him back at 7:06 a.m.

In this conversation, the BRP duty officer learned that a "site emergency" had been declared because of high radiation levels inside the plant, and that there may have been a small "loss-of-coolant accident".* The utility reported that there were no radiation readings above normal background on-site, and no protective action recommendation was made.

In the meantime, the BRP Director arrived at his DER office and established an open line with the TMI-2 control room

by 7:25 a.m. At 7:30 a.m., the plant declared a "general emergency".* Based on information from the plant, the BRP alerted PEMA that an area south-west of the plant may have to be evacuated. This alert was later cancelled when no radiation levels above normal background were detected in that area.

Later in the morning, the BRP requested environmental radiation monitoring assistance from the federal government. BRP also requested the Pennsylvania Department of Agriculture to begin milk sampling for iodine-131* at area farms. For the remainder of the day, ground-level radiation surveys performed by the BRP, NRC, Department of Energy (DOE), and the utility confirmed that off-site levels of radioactivity were in the range of 1 to 10 millirem per hour.

The BRP offices assumed a 24-hour alert status on March 28, and continued monitoring and accident assessment throughout the next day.

On Friday morning, March 30, BRP personnel were instrumental in preventing an unwarranted evacuation recommended by NRC officials. Friday morning's events are discussed in Section III-C of this report.

The BRP remained on a 24-hour alert for the next two weeks and continued monitoring activities with the NRC, DOE, and Environmental Protection Agency.

The Bureau of Radiation Protection was not properly equipped to monitor the TMI accident for the following reasons:

- The Bureau had only a modest environmental monitoring program in place at the time of the accident. Designed for routine checks, the program did not include portable air sampling equipment including instruments for iodine monitoring. More thermoluminsecent dosimeters (TLD's) were needed in the field to monitor the environment. BRP personnel were forced to rely upon utility readings until federal monitoring teams arrived late in the morning of March 28. From this point, the environmental monitoring program was adequate to provide accurate data independent of the utility.

- Monitoring efforts were hampered by a lack of communications until radio-equipped cars from DER's Bureau of Forestry were made available to BRP. Monitoring personnel either had to return to their offices to relay data, or locate telephones if the information was urgent.

- BRP manpower was severely taxed. During the first two weeks of the accident, BRP personnel were placed on 12 hour shifts, manning the Bureau's office 24 hours per day. During the crisis period, no one was available to provide technical representation for BRP at the Pennsylvania Emergency Management Agency (PEMA) Emergency Operations Center. During this accident as in most Commonwealth emergencies, various Commonwealth agencies are to be represented in the PEMA Emergency Operations Center.

Pennsylvania Department of Agriculture - The Pennsylvania Department of Agriculture, Bureau of Foods and Chemistry was notified about the TMI accident by the Bureau of Radiation

Protection on March 28, 1979 at 8:15 a.m. At 2:00 p.m. the same day, the Bureau was requested to begin sampling milk for radiation. Samples were retrieved from various farms in the TMI area, with a negligable reading appearing in only one milk sample. From almost the beginning of the accident, milk samples were collected in pairs. One sample was tested by the Pennsylvania DER's Radiological Health Laboratory in Harrisburg, and the Food and Drug Administration tested the other sample for verification purposes.

As of April 1, 1979, tests on foods other than milk had not been performed since milk is used as the indicator commodity. If radioactivity is not present in milk, it is not likely to be found in other foods. An exception is field-grown, leafy green vegetables. But since the accident occurred at the beginning of the growing season, this was not a concern.

At least two milk marketing associations have commended the Department of Agriculture for its TMI related performance.

2.2 Federal Government

Nuclear Regulatory Commission (NRC) - The NRC was notified about the accident early Wednesday morning March 28, 1979, and its Region I Office in King of Prussia, Pennsylvania, soon dispatched a five-member emergency team, including three health physicists, who arrived shortly after 10:00 a.m. A portable laboratory van being used in Connecticut was ordered to Harrisburg, where it arrived by 7:00 p.m. on the 28th. This van contained a variety of equipment used to analyze environmental samples collected by NRC personnel. By Saturday, March 31, the NRC's environmental monitoring effort received needed support from both Department of Energy personnel and equipment.

Department of Energy (DOE) - The Brookhaven National Laboratory, which is available under DOE's Radiation Assistance Program (RAP) was also notified shortly after 7:00 a.m. on March 28, and was placed on standby. The BRP accepted Brookhaven's second offer of assistance at 9:45 a.m. on Wednesday, March 28. After the team was transported to the accident site by helicopter, it immediately began collecting soil, air and vegetable samples for radiation testing.

The NRC also declined an earlier offer of assistance from the Department of Energy, but at 11:00 a.m. on Wednesday, March 28, accepted the help of a DOE helicopter which had radiation plume tracking capabilities. This helicopter and its crew remained on hand for two months to assist, if needed, during periods of potential releases. According to a DOE official, the NRC badly needed off-site monitoring assistance. By Saturday, March 31, DOE was the only federal agency performing any substantial monitoring. One RAP team spent most of its time working with the NRC, assisting its environmental monitoring staff.

Several Bureau of Radiation Protection officials have praised DOE's environmental monitoring assistance and cooperation during the accident.

Environmental Protection Agency (EPA) - The EPA's Office of Radiation Programs was notified of the accident by 9:04 a.m. on Wednesday, March 28, and placed itself and its mobile laboratory on alert. Although the Commonwealth did not request EPA environmental monitoring assistance, the Office of Radiation Programs, unaware of its IRAP role, began an ad hoc response by sending a van laboratory outfitted with a limited amount of radiation monitoring equipment and eight to ten people to the site. EPA also dispatched an instrumented aircraft from its

Las Vegas Office of Research and Development (ORD). This plan, staff and monitoring equipment are usually used by ORD in connection with nuclear weapons testing in the Western United States. The last of EPA's ad hoc response team arrived at TMI early on Saturday afternoon, March 31. EPA's monitoring response was not well coordinated with that of DOE, but it nevertheless contributed substantially to an adequate environmental monitoring effort.

The radiation releases and related events on Friday, March 30, led to the direct involvement of the Environmental Protection Agency and the Department of Health, Education and Welfare. Officials from these agencies were concerned about the need for additional attention to environmental and health concerns over and above that of the NRC and DOE, whose orientation was towards nuclear technology. Responding to this concern, the President on April 13, 1979 designated EPA as the lead agency for environmental monitoring related to TMI.

Food and Drug Administration (FDA) - The Food and Drug Administration was the only federal agency besides DOE sampling area food, water and milk on Saturday morning, March 31. The FDA also made available over 200 thermoluminescent dosimeters (TLD's) used by the Commonwealth to improve its own environmental monitoring program.

III. COMMONWEALTH AND FEDERAL PREPAREDNESS AND RESPONSE
MARCH 28 THROUGH APRIL 2, 1979

B. HEALTH PREPAREDNESS AND RESPONSE

1. Preparedness

1.1 Commonwealth of Pennsylvania

Pennsylvania Department of Health (DOH) - After the Bureau of Radiological Health transferred from the Pennsylvania Department of Health to the Pennsylvania Department of Environmental Resources (DER) in 1971, the DOH did not have any specialized capabilities in the radiation health area. It lacked personnel with appropriate competencies, equipment, and a public health library.

After the transfer, the Secretary of Health was replaced by the Secretary of Environmental Resources as an ex-officio member of the Governor's Advisory Committee on Atomic Energy Development and Radiation Control. This Committee was created by a legislative act in 1965 to promote commercial nuclear energy and to respond to radiation-related problems.

The Department of Health did not have a formal response plan for health aspects of a radiation emergency, and was not involved in developing the nuclear emergency annex to the Commonwealth's Disaster Operations Plan* which had been under preparation since 1975. As a result, the Commonwealth plan did not make adequate provision for community health needs. Designated responsibilities of the DOH included only emergency

medical care and identification of dead and mortuary services. The plan did not designate specific responsibilities for the unique needs of hospitals and private health care facilities during an emergency or for mass public health needs, such as plans for distributing potassium iodide.*

Pennsylvania Department of Public Welfare (DPW) - The Department of Public Welfare has responsibilities in the field of mental health. Its Office of Mental Health had no special preparation for radiation emergencies, and the Department's responsibilities were not defined in the nuclear emergency annex to the Commonwealth's Disaster Operations Plan.

1.2 Federal Government

U.S. Department of Health Education and Welfare (HEW) - At the time of the accident, no coordinated federal response plan existed for meeting public health needs during nuclear emergencies. As detailed in the Emergency Management section of this report, the Federal Response Plan for Peacetime Nuclear Emergencies, which included health planning, was not completed at the time of the accident. Discussions on the availability of an approved form of potassium iodide (KI) had been held prior to the accident between DER's Bureau of Radiation Protection and the Food and Drug Administration (FDA), Bureau of Radiological Health. KI is used to prevent uptake of radioactive iodine by the thyroid gland in the event of iodine-131 releases during a nuclear power plant accident. However, an approved form was not available on March 28, 1979. The federal government did not maintain a supply of potassium iodide for expeditious distribution to large populations.

Radioactive iodine accumulates in the thyroid gland primarily during the first 12 hours after exposure, and at a slower rate over the second 12 hour period. KI will therefore significantly decrease uptake and retention of radioactive iodine if administered before or shortly after exposure. It will not be effective if administered more than 24 hours after exposure. Use of KI was not intended for exposures below 10 rem and exposures during the TMI accident did not come close to approaching that level.

2. Response

2.1 Commonwealth of Pennsylvania

Pennsylvania Department of Health (DOH) - The Pennsylvania Department of Health's response to the TMI accident involved three major areas: providing proper technical guidance to the Governor and other public and private agencies on decisions related to health; providing useful information; and providing resources for mitigation of any population health impact.

In order to provide technical guidance, the DOH required knowledge about the potential effects of radiation, their prevention, and amelioration. Dr. Gordon MacLeod, who was the Secretary of Health at that time, established contact with the Bureau of Radiation Protection (BRP) in DER, and on March 31, arranged for Dr. Niel Wald, Chairman of the Department of Radiation Health, University of Pittsburgh, to assist the Health Department as a full-time advisor. Wald drew upon his Department's capabilities, including its library, to supplement DOH resources. Contact was maintained with the BRP and the Governor's Office to obtain information on the potential for population exposure, including information on the status of the Unit 2 reactor, and any radiation releases and dose estimates.

The Department arranged to have medical personnel and other resources available for the treatment of radiation injuries by contacting the federal Departments of HEW and Energy. In conjunction with the Governor, Lieutenant Governor and others, the Department discussed preventive measures, including: sheltering and evacuation to minimize radiation exposure; potassium iodide administration to block thyroid uptake of radioiodine; and dissemination of accurate radiation health information to minimize unwarranted psychological stress.

At BRP's request, the FDA arranged for a private firm to manufacture approximately 250,000 bottles of a super-saturated KI solution. The KI shipments, which began to arrive in Harrisburg on Sunday, March 31, 1979, became the subject of discussion between the Secretaries of Health and Environmental Resources, and led to the shift in responsibility from DER to the Department of Health for KI management and distribution. Subsequently, DOH took physical custody of the shipment and prepared procedures for potential distribution

The need for distributing KI was continuously re-evaluated, and the DOH rejected an untimely federal recommendation for its distribution and administration. The Secretary of Health advised the Governor against distribution to nearby communities for the following reasons:

- The shipments arrived at a time when reports from the site indicated an improving situation and smaller risks of additional public exposure.
- The quality of the liquid KI shipment was not good:

- Many bottles were not labeled.
- Filaments and other particulate matter were found in some samples.
- Many eye-droppers were improperly calibrated for the required dose.

- Only very low levels of radioactive iodine had been measured in milk and air samples taken frequently since March 28.

- Public awareness of KI and its use was almost non-existent prior to March 28, and reports on it after that date were not entirely accurate. Misuse of the drug could produce side effects.

- Announcement of the drug's availability at such a late date in the crisis could have produced a fearful public reaction.

The Department of Health refused to release the drug to the public and to emergency management workers, and stored the shipment in a centrally located warehouse. The FDA has since reclaimed the shipment.

As the accident continued, psychological stress on the public and on health professionals produced by the barrage of conflicting information became an increasing concern to the Health Department. Overloaded telephone exchanges contributed to significant communication problems among health organizations. Although the Health Department made attempts to coordinate the response of the private health care system with activities of Commonwealth agencies, efforts were fragmented at

best. The Department of Health contacted professional organizations including the Pennsylvania Medical Society, the Hospital Association of Pennsylvania, and others, but no systematic attempt was made to inventory or monitor the capabilities of these organizations. The Department's Bureau of Quality Assurance began telephoning area nursing homes and hospitals to substantiate rumors of facilities being abandoned by their staffs, but accurate assessments of the problem were difficult to obtain. Due to the rapidly changing situation and inadequate communications, the Department was unable to give clear guidance to institutions concerning patient care priorities. The Department provided information through its Health Line, and later in the accident through the Governor's emergency hotline.

Area hospitals and related agencies continued to provide emergency health and psychiatric services during the crisis, although overall demand on the health delivery system was lower during this period due to the large voluntary exodus of area residents. The Hershey, Pennsylvania, Sports Arena was utilized to house evacuees under the Governor's evacuation advisory. At PEMA's request, Pennsylvania Red Cross units working with Hershey Company employees provided volunteers to staff the evacuation center. Specialized health care personnel including psychologists, pediatricians and nurses, were available at the center.

During later stages of the accident, the Department, through its Bureau of Health Research, began preparing for a longer term assessment of the accident's health impact. A list of possible health studies was prepared and consideration was given to potential funding sources. The Secretary of Health advised the Governor of the need for health research, and requested that the Pennsylvania Department of Health be designated the lead agency for implementing these studies. This was approved by the Governor.

Pennsylvania Department of Public Welfare (DPW) - The Department of Public Welfare Disaster Coordinator maintained contact with PEMA and emergency management offices in the affected counties around TMI. Its Office of Mental Health also established and maintained contact with County Mental Health administrators for the affected counties, and made preparations for dealing with area residents experiencing psychological stress caused by the accident. However, heavy demand for this service never materialized. An informal survey done in May, 1979, showed a marked decrease in the number of client calls to mental health offices in the week following the accident. This decline was perhaps attributable to the large voluntary evacuation of area residents. Client call levels returned to normal in later weeks, and did not rise above previous levels.

Other mental health activities included assigning crisis counselors to the Hershey Evacuation Center following Governor Thornburgh's evacuation advisory. In addition, the Office of Mental Health and five County Mental Health administrators planned for evacuating mental health clients from community living centers and short-term/in-patient units within a 20-mile radius of TMI. Hospitals in the affected area with short-term psychiatric in-patient units began limiting admissions to extreme emergencies. A plan was developed by Dauphin County for Mental Health personnel to staff mass care centers, and DPW facilities at Harrisburg State Hospital received 140 nursing home patients who had been evacuated.

On April 3, 1979, an evacuation was also carried out at a private care facility in Dauphin County. Initial contact was

made on Friday, March 30 with DPW's Central Region Office to discuss the necessity for evacuating and special transportation needs of the facility. However, from Friday evening, March 30 to Sunday morning, April 1, there was no answer at the Central Region Office when the facility tried to telephone for assistance and guidance. Although special transportation needs for the facility were communicated to the Dauphin County Emergency Management Office, the County was not adequately equipped to meet those needs. When communications were restored on Sunday morning, evacuation plans were finalized. The DPW Central Region Office took responsibility as transportation provider, and the evacuation was completed smoothly.

This example illustrates the need for a specific line of communication between Commonwealth health-related agencies and private health care facilities, and also for one Department to have primary responsibility for evacuation and special needs of health care facilities. When the crisis period had passed, discussions were held on possible long-term research to measure psychological impacts on the area population.

2.2 Federal Government

The federal government did not become actively involved in public health response until after the radiation releases and events of Friday morning, March 30. Since there was not a coordinated federal response plan, the Environmental Protection Agency (EPA) and the Department of Health, Education and Welfare (HEW) began an ad hoc response. Two disease epidemiologists* from the Communicable Disease Center in Atlanta, Georgia were made available on a temporary basis. The Food and Drug Administration also assigned an official from its Bureau of Radiological Health as HEW's liaison with the State Health Department, and offered medical teams and hospital beds in

Public Health Service hospitals as necessary. The DOE sent a physician for liaison purposes on April 2, and offered medical teams and hospital beds from its National Laboratory facilities. Two representatives from the National Institute of Occupational Safety and Health also arrived on April 4.

As detailed earlier, FDA's Bureau of Radiological Health made arrangements with DER's BRP to provide large quantities of a saturated KI solution. The Secretary of Health conferred with an FDA endocrinologist* on details of KI usage.

The Secretary of HEW at the time, Joseph Califano, was convinced that the developing situation called for a public health response, and directed his staff to formulate recommendations for the President. He also expressed an interest in accumulating data for studying future health effects. Both the Center for Disease Control and the National Institute of Health were kept informed of the growing federal health response, and the National Institute of Mental Health was involved in evaluating research possibilities with DPW's Office of Mental Health.

2.3 Other Agencies - Other agencies active during the crisis included the Radiation Management Corporation and the University of Pittsburgh's Radiation Protection Assistance Program.

The Radiation Management Corporation (utilizing facilities at Hershey Medical Center) and the Radiation Protection Assistance Program (operated by the University of Pittsburgh's Department of Radiation Health) were prepared to offer medical assistance to radiation injured people. These agencies deal primarily with individuals or small numbers of workers who are occasionally involved in industrial radiation accidents,

but are not equipped to treat large numbers. Radiation Management Corporation was utilized during the accident for whole body scans* assessing exposure of site workers, and the Department of Radiation Health provided its personnel and resources in an advisory capacity.

III. COMMONWEALTH AND FEDERAL PREPAREDNESS
AND RESPONSE
MARCH 28 THROUGH APRIL 2, 1979

C. EMERGENCY PREPAREDNESS AND COMMUNICATIONS

A major responsibility of this Commission was to evaluate the adequacy of Commonwealth, federal and local preparedness and response during the emergency. This included an examination of Pennsylvania emergency preparedness and response, and its interaction with the federal and local levels.

1. Preparedness

1.1 Commonwealth of Pennsylvania

In 1975, the federal government published notice of an interagency effort to assist state and local emergency management agencies in planning for peacetime nuclear emergencies. State and local participation in the program was voluntary. The NRC established guidelines for the plans, and through Regional Advisory Committees, worked with states to produce plans meeting these guidelines. Pennsylvania's plan was informally submitted in draft form in 1975 but failed to meet the guideline standards. The NRC so notified the Commonwealth, and suggested that the plan be further refined. Despite several meetings with NRC personnel and extensive Commonwealth planning efforts, the Pennsylvania plan had not been formally submitted for NRC concurrence at the time of the accident. This was not a unique circumstance. Only 11 of 25 states having operating nuclear reactors at that time had NRC-approved emergency plans.

Testimony from the President's TMI Commission and other investigations suggest that state and federal agencies shared the same attitude toward emergency planning for nuclear accidents. Neither wanted to commit the staff and funds necessary to plan for events they considered extremely remote. It should be noted however, that the standards set by Pennsylvania's emergency plan were more conservative in terms of evacuation distance (five-mile radius for TMI) than NRC low population zone* guidance (2.2-mile radius for TMI).

Plans in Place at the Time of the Accident - PEMA's emergency response to peacetime nuclear incidents was included as Annex E of the Commonwealth's Disaster Operations Plan. This plan was developed in 1977, although as the President's TMI Commission staff has pointed out, Pennsylvania had operating nuclear reactors prior to that date. A copy of Annex E as it existed in March 1979 is attached as Appendix E. Since the early 1960's, planning for nuclear reactor sites had been done by the Bureau of Radiation Protection and its predecessors.

Funding for Commonwealth emergency planning came largely through a grant from the Federal Disaster Assistance Administration (FDAA). The thrust of this program was for general emergency planning, and not specifically for nuclear emergency planning. FDAA did not review Annex E as it did other parts of the overall Commonwealth emergency plan. There was little incentive for Commonwealth emergency planners to go beyond minimal standards in preparing for a nuclear emergency.

Annex E was updated twice in 1978 under a second FDAA sponsored planning grant. Study of this document reveals several problem areas addressed in other sections of this report. Generally, the plan provided a basic notification sequence and delineated major areas of responsibility for local and county emergency management agencies, PEMA, BRP and other Commonwealth agencies. It did not outline responsibility for mass emergency health care, or for marshalling resources in host areas.

1.2 County and Local Government

At the time of the accident, Dauphin, York and Lancaster Counties had written nuclear emergency plans in place for a radius of five miles surrounding Three Mile Island. As stated earlier, this was a result of the Commonwealth more than doubling federal requirements for the distance for TMI's evacuation planning.

With the exception of some larger cities in the area and a few smaller municipalities, the majority of communities in the TMI area did not have written emergency plans at the time of the accident. This is contrary to the Pennsylvania Emergency Management Act 323 which requires all political subdivisions in the Commonwealth to "establish a local emergency management organization in accordance with the plan and program of the Pennsylvania Emergency Management Agency. Each local organization shall have responsibility for emergency management, response and recovery within the territorial limits of the political subdivisions...".

The Act also provides for appointment by the Governor of a local emergency management coordinator, upon recommendation by officials from that community. In the absence of such a recommendation, the Governor may still appoint a coordinator.

Through subcommittee conferences conducted by the Commission and review of testimony from other TMI investigations, the Commission has learned that participation of local

emergency management coordinators in training programs offered by their respective counties has been minimal in the past. It should be noted that the Pennsylvania Emergency Management Act provides a method for their removal from office if they fail to attend such sessions. This may be little incentive to participate though, because with the exception of large municipalities, community emergency management coordinators are almost exclusively volunteers. Consequently, levels of emergency planning expertise were widely divergent among municipalities. The Commission also learned that local coordinators had little interest, support or monetary aid from their governments.

1.3 Federal Government

Both the Federal Disaster Assistance Administration (FDAA) and the Defense Civil Preparedness Agency (DCPA) shared lead roles in federal preparedness and planning for attack and natural disasters. FDAA, located within the Department of Housing and Urban Development, had been more involved with assistance and recovery from natural disasters. It became somewhat involved with natural disaster planning in 1974 when it made available a grant of $250,000 to aid states in their natural disaster planning programs.

DCPA, located in the Department of Defense, had given guidance on planning and preparedness for situations of enemy attack. More recently, it had been involved with planning guidance for dual-risk situations; plans that could be used for both enemy attack and natural disasters.

In 1974, the Federal Preparedness Agency (FPA) assumed a lead role in formulating the Federal Response Plan for Peacetime Nuclear Emergencies (FRPPNE). This plan stemmed from FPA's awareness that certain radiological emergencies would create special demands that could not be met by existing federal response programs. FRPPNE encountered extensive bureaucratic delays during its development, centering on non-concurrence by FDAA and its parent agency HUD. Agreement had just been reached on the thrust of the plan in early 1979, but it was not in place when the accident occurred.

By July 15, 1979, FDAA, DCPA, and three other federal agencies had merged into the new Federal Emergency Management Agency (FEMA).

2. Response

2.1 Commonwealth of Pennsylvania

March 28 - April 2 - On March 28, the Commonwealth's nuclear emergency response went into motion with a phone call at 7:02 a.m. from the shift supervisor at TMI to the PEMA duty officer. (PEMA uses a switchboard diverter system to alert the duty officer during non-daylight hours.) The notification system detailed in Appendix E functioned as designed. The Bureau of Radiation Protection was notified within five minutes. Dauphin and Lancaster Counties were notified within ten minutes, and York County was notified within 18 minutes.

If large quantities of radioactive material had been released to the environment at that point in the accident, the utility's three-hour delay in notifying the Commonwealth could have caused serious response problems.

Based on early advice from the Bureau of Radiation Protection, PEMA notified York County emergency management officials of the possible need to evacuate a nearby island and town (Brunner Island and Goldsboro) both south-west of the

plant site. This alert was cancelled later in the morning of the 28th, although emergency management personnel in nearby counties remained on standby throughout the next few days.

During the following 48 hours, PEMA's Emergency Operations Center (EOC) operated at full complement, including a representative from DER, but without a BRP representative, on a round-the-clock basis. The EOC attempted to assist counties in their requests for additional information on the status of the accident.

However, the lack of information coming directly to PEMA, coupled with conflicting reports issued by the utility and an ever-growing press contingent, created a frustrating atmosphere for the EOC staff. PEMA officials as well as county and local coordinators stressed the lack of pertinent information as a major obstacle to their efforts both to inform the public and to plan for a possible evacuation.

Significant problems developed on Friday morning when the utility began a controlled release of gas from one of Unit 2's reactor back-up systems. The shift operator at Unit 2, apparently seeking assurance on evacuation preparedness, called PEMA to report the release. His account of this communication with PEMA differs dramatically with the agency's records. Regardless of the discrepancies, the outcome was a perception by PEMA, and at least one county official, that the plant's situation had deteriorated substantially. At the same time, NRC officials in Bethesda incorrectly identified a reading of 1200 millirem per hour taken by a helicopter positioned 600 feet above the stack as an offsite measurement. Thirty-five minutes after PEMA received the call from TMI, Harold Collins from the NRC Operations Center in Bethesda telephoned PEMA to recommend an evacuation out to ten miles.

Within seven minutes (9:22 a.m.), both the Lt. Governor and the BRP Director had been notified by PEMA of the NRC recommendation. At 9:35 a.m. the latter learned that the controlled release was being terminated, but was unable to get a phone connection to advise PEMA. Based on information from the TMI shift supervisor, the NRC (Collins), and no information from BRP because of technical communications problems, the PEMA Director chose to recommend an evacuation of a five-mile radius based on his view of Commonwealth and local capability at that time. PEMA then notified county EOC's of a possible evacuation. The BRP Director aware that technical information on the decreased radiation exposure was urgently needed to head off a premature evacuation decision, dispatched BRP's nuclear engineer to PEMA while he went to the Governor's Office to relay the Bureau's opinion that events at the plant did not warrant an evacuation.

The events of Friday morning were the only instance in which the Commonwealth's notification procedures did not function as designed. The TMI shift supervisor telephone call and the Collins recommendation both contributed to emergency management officers' perception of a deteriorating situation. The result was an untimely public announcement by Dauphin County officials that an evacuation was imminent, followed by a clarifying statement from the Governor.

The Governor's decision to advise pregnant women and families having pre-school age children living within a five-mile radius of the plant to leave the area was based on information supplied by NRC Chairman Joseph Hendrie and Commonwealth health officials. The advisory was not intended to be a follow-up to the morning scare, but was a precautionary measure for the benefit of two groups in the population considered to be most vulnerable to radiation. Both Governor Thornburgh and the BRP Director stated in testimony that if events had warranted action at any time during the crisis, a decision to evacuate would have followed immediately.

PEMA personnel and local emergency management officials remained on-duty around the clock through the weekend. For the most part, they were engaged in refining and later expanding existing evacuation plans. From March 30 to April 2, Commonwealth officials were aware of the potential for a large-scale evacuation, and directed considerable effort to plan for that possibility.

Evacuation Planning - From Wednesday, March 28 until noon on Friday, March 30, evacuation planning had been limited to a five-mile radius. From the body of testimony, this Commission's members agree that emergency management personnel had sufficient information through Annex E and through normal communications channels to effect an orderly evacuation of this radius if the circumstances had warranted it. The Commission interviewed members of the emergency management network at all government levels, including the Pennsylvania State Police and the Pennsylvania National Guard, and is convinced of the network's capability to respond despite the lack of detailed written procedures. It was fortunate that emergency management personnel from the Commonwealth, counties and communities in the affected area were professional in their attitudes and knowledgeable of unique local needs. They were able to draw on formal and informal support systems as required.

The Presidential TMI Commission Legal Staff Report on Emergency Response states: "The events of Friday morning had a profound impact on federal, state, and county emergency management agencies. They realized that the accident could have effects that reached beyond the five-mile radius that had heretofore been considered the outer limit in nuclear planning. That realization provoked a period of intense activity at all levels of government to prepare for a potentially massive evacuation."

The 20-mile radius was first mentioned in the White House briefing on Friday afternoon in Washington. The figure was used by NRC Chairman Hendrie as the area that would be affected in a "worst case" outcome if the hydrogen bubble uncovered the core. Hendrie (and possibly other NRC Commissioners) believed that evacuation could best be handled by a limited sector approach similar to slicing a piece of pie. A memo outlining this approach was circulated in Harrisburg among Commonwealth officials, along with Hendrie's suggestion that it be adopted.

Commonwealth officials decided on Sunday, April 1, to prepare for a potential ten-mile radius evacuation. The voluntary large-scale exodus of area citizens after the Governor's advisory on Friday demonstrated that any evacuation order would cause a similar reaction far beyond the critical area being evacuated. This movement of people, along with an awareness of rapidly changing weather conditions, led Commonwealth officials to reject Hendrie's "slice-of-the-pie" approach. If an evacuation were to be ordered, it would be conducted on a 360 degree basis rather than by a sector, or "slice-of-the-pie" approach.

The Kemeny Commission Legal Staff Report on Emergency Response states: "Throughout Friday night and early Saturday morning, PEMA officials worked to identify the basic geographical spread of population within the five, ten, and 20-mile evacuation radii. Evacuation routes were then assigned over the major roads out of the evacuation areas to coordinate

movement from one county to another. The State Police and Department of Transportation were working with PEMA to develop instructions for the counties on the assignment and use of evacuation routes to coordinate the flow of vehicle traffic ... More difficult problems remained in arranging for the resources necessary to transport people, particularly the incapacitated, and to secure relocation centers."

Evacuation of hospitals, nursing homes and other special facilities was a major problem for emergency management planners after Friday morning's events expanded the planning zone. The five-mile radius contained only a few nursing homes and no other major facilities. The ten-mile radius contained four hospitals, ten nursing homes, and many private care facilities. The 20-mile radius greatly expanded this inventory and added a major prison facility. Planners discovered that no agency had clear authority to assume responsibility for health facilities. Further, no agency was charged to arrange for adequate mass health care, particularly facilities to treat radiation related illness in host areas. After Friday morning, area hospitals had voluntarily reduced their patient loads substantially and arranged for emergency cases to be transferred to facilities well beyond the affected area. This was done to reduce lead time necessary to carry out an evacuation and to reduce risks to patients. The evacuation of two nursing homes in southern Dauphin County on Saturday underscored the special problems inherent in transporting sick or elderly people.

A particular problem for planners was securing adequate commitments from outlying areas for vehicles to be used in the evacuation. School districts were reluctant to promise their vehicles due to their belief that an evacuation might extend well beyond any radius thus far identified. Mass transit systems as far away as 70 miles showed the same reluctance.

The evacuation center set up at the Hershey Sports Arena as a result of the Governor's Advisory on Friday performed in a superior fashion. Over 171 people, mostly women and children, were sheltered and cared for at the center, and Herco, owner of the facility, donated material and employee time to assist the evacuees.

Communications - Despite regular news conferences by the Governor, Lt. Governor, and principals involved during the first three days of the accident, conflicting information caused confusion. The problems were compounded by statements from outside "experts" who had no direct knowledge of events at the plant site. While providing much-needed assistance in some areas, the ad hoc response of the many federal agencies added to communications problems evident from Friday through the balance of the crisis period. Further, public information coming from the utility attempted to cast the best possible light on the event, severely damaging the company's credibility and affecting the credibility of government agencies as well.

Communications problems culminated on Friday morning with the evacuation scare. This did several things:

- Pointed out the lack of proper communication channels between the federal government (NRC) and the Commonwealth.

- Indicated the problems created by the premature release of information through emergency management channels. This in large measure caused the untimely perception of impending evacuation.

- Caused the Governor to request a single spokesman from the federal government. The Governor also took steps to consolidate information given to the public from the Commonwealth. As a result, normal emergency management communication procedures were bypassed. This caused confusion for emergency management agencies, but did not jeopardize the state of readiness.

- Information on radiation dose guidelines was available through DER and NRC, but not fully understood by all emergency management personnel or media reporters. Conflicting statements from government officials and scientists representing both sides of the nuclear issue contributed to the public's perception of an event that might result in substantial health risks.

2.2 County and Local Government

On Wednesday morning, March 28, 1979, Dauphin, York, and Lancaster counties all received timely notification of the accident at TMI. According to procedure, initial notification was made by telephone. Dissemination of other information through the Commonwealth-county emergency management network was done via a teletype system originating in the Pennsylvania Emergency Management Agency (PEMA), with terminals in county emergency management offices throughout the Commonwealth.

This system was used until Friday morning, March 30, when news of a possible evacuation was released by Dauphin County officials. This radio broadcast prompted a decision by the Governor to discontinue providing emergency management organizations information of a sensitive nature, thus preventing any further unnecessary apprehension among the general population. Technical information about TMI-2's condition continued to be distributed over the PEMA teletype, but was so "jargony" as to be of little use to PEMA and county emergency personnel.

The Governor's decision to prevent further sensitive information "leaks" received some criticism from county coordinators, because they were often informed of current news releases by concerned citizens, but were unable to confirm the stories.

On Friday morning, March 30, when federal officials recommended an evacuation out to ten miles, Dauphin, York and Lancaster county emergency planners began to expand their plans. Because a radius of ten miles around TMI also included Lebanon and Cumberland counties, their emergency planners were suddenly pressed to complete the necessary planning. The problem was again compounded Saturday morning, March 31, when it was suggested that emergency plans be extended out to 20 miles. This necessitated action by Perry County emergency management personnel. Although none of these evacuation plans were ever used, all officials interviewed felt that they were workable.

Other notable problems surfacing during the accident were:

- Some county officials were unclear at the time about who had authority to "order" an evacuation. Subsequent investigation by the Commission shows that only the Governor may "order" an evacuation. Officials at other levels of government in the Commonwealth may only "recommend" or "advise" an evacuation.

- It was also unclear at the time among county emergency management personnel and various school

district supervisors who had authority to close schools, thus freeing school district resources for a potential evacuation. Subsequent investigation by the Commission has revealed that only the Governor or the school district board or supervisor may direct that schools be closed. A county or local emergency management coordinator may not order schools to close.

- As evacuation distances were increased to ten and 20 miles during the crisis, arranging for mass transportation became increasingly difficult for emergency planners. A regional pool of transportation resources did not exist.

2.3 Federal Government

According to the Legal Staff Report of the President's TMI Commission, FDAA wanted to send personnel to PEMA to evaluate its crisis response shortly after the former agency learned of the accident. Lacking an invitation from the Commonwealth to do so, FDAA held off until the events of March 30 caused the agency to feel an urgent need to respond. Representatives were dispatched and arrived later on Friday. Robert Adamcik, Regional FDAA Director, was named as lead contact with the agency and the Governor's Office for developing emergency response strategies. Adamcik served as a disaster relief advisor and coordinator for federal agencies for the duration of the crisis. He was concerned initially that the lack of a declared state of emergency would prevent the Commonwealth from securing help usually offered in time of a disaster. However, after several days he felt that federal response to Commonwealth requests for assistance was timely and adequate without such a declaration.

Federal agency representatives were sent to Harrisburg to assist at PEMA headquarters on Wednesday. PEMA later accepted DCPA's offer to send two representatives to each of the now expanded group of threatened counties (a fourth - Cumberland - had been added when evacuation radius planning stretched to a ten-mile radius on Friday afternoon). These representatives were dispatched on Friday to assist with emergency planning in those counties. John McConnell, Assistant DCPA Director, was named lead contact for federal evacuation planning purposes. He, along with Adamcik, served as advisors to Commonwealth officials as emergency management plans were expanded.

DCPA attempted to become coordinator for federal agencies involved in emergency response. PEMA rejected this early attempt, and DCPA later demurred to FDAA's leadership after the latter was assigned the federal coordinating role by the President.

IV. REVIEW OF RECOVERY RESPONSE
APRIL 3, 1979 TO PRESENT

A. COMMONWEALTH

The full scope of long-term recovery needs is not yet known because the total impact of the accident is still to be determined. Presently, Pennsylvania has committed itself to several areas of recovery response.

1. Emergency Planning

After the March 28, 1979 accident, it became evident that the Commonwealth needed to review and reconstruct its emergency planning. Evacuation plans for a five-mile radius were in place before the accident. Since the initial crisis period, the Commonwealth has begun examining the adequacy of its emergency plans and methods of informing the public about them. There has been a renewed effort to obtain NRC concurrence of the newly rewritten Annex E of the Pennsylvania Disaster Operations Plan. The new Annex E more accurately describes responsibilities of Commonwealth agencies than did the old plan, and requires more extensive emergency planning activities by these agencies.

Since July 17, the Pennsylvania Emergency Management Agency (PEMA) has been hosting regular weekly meetings for agencies concerned with the Commonwealth's nuclear emergency response. These Radiation Emergency Response Planning sessions have served as an information exchange for the participating agencies and have encompassed activities like reviewing county emergency plans. Agency participation in these meetings has been good to date, and participants are enthusiastic.

Meanwhile PEMA has completed its revision of evacuation plans for all nuclear sites in the Commonwealth. These plans cover ten-mile radii, and draw on lessons learned from the TMI accident.

2. Environmental Monitoring

The DER's Bureau of Radiation Protection is rapidly expanding its reactor review, emergency response and environmental monitoring programs. The Pennsylvania Legislature provided an additional $300,000 for the Bureau to assist with these efforts. Important features of the program, which are expected to be completed in stages over the next 24 months, include the following:

- A new thermoluminescent dosimetry (TLD) system has been purchased to increase the number of environmental monitoring stations around each nuclear power plant in Pennsylvania. There are now ten TLD's around TMI, four around Beaver Valley/ Shippingport and four surrounding the Peach Bottom facility.

- A second gamma-ray analyzer has been purchased. This model separates and measures quantities and types of gamma-emitting isotopes, and is capable of analyzing several samples at the same time. It can analyze all types of material (milk, water, air, etc.) and will be installed by June 30, 1980.

- A converted motor home/laboratory has been purchased and will arrive by March 30, 1980. Its wet chemistry radiation counting facility* will

be available for use at the most remote nuclear incident sites. The motor home will be based in Harrisburg, but will travel where needed. The vehicle will also contain a radio-telephone, Department of Environmental Resources radio and Pennsylvania State Police radio.

- DER's radio communications system is being expanded by purchasing 70 radios for department vehicles. Five of these cars will be assigned to the Bureau, and will also include Pennsylvania State Police radios. Additional radio-equipped DER cars will be made available as necessary.

- A van has been purchased for use in the TLD-environmental monitoring program. The van will be equipped so that TLD's may be read in the field, and will be available by June 30, 1980.

- Portable air sampling equipment with field analyzers is being purchased. This equipment will collect and measure radioiodine and particulates.

- Direct telephone lines have been installed between each operating nuclear reactor control room in Pennsylvania and the Bureau of Radiation Protection. An additional direct telephone line will be installed in March between the Bureau and the Pennslvania Emergency Management Agency.

- Six additional positions for the Bureau were approved for fiscal year 1979-80; and more have been requested for 1980-81. Eventually, the

Bureau hopes to employ enough nuclear engineers so that each can be assigned to become intimately familiar with a different nuclear power plant in Pennsylvania.

- Ten stationary air sampling devices, additional hand-held radiation detectors, and new radiation survey probes* for existing equipment have been recently purchased.

3. Health

In early April 1979, after the initial TMI crisis period, the Secretary of Health discussed with Governor Thornburgh the need for health studies of the population affected by the accident. The Governor designated the Department of Health (DOH) as the coordinating agency for these studies.

The Director of the Health Department's Bureau of Health Research prepared a tentative listing of possible follow-up studies. A number of these potential projects then materialized as investigations to be performed by DOH itself or in collaboration with outside investigators.

In mid April, 1979, the Department of Health convened a meeting of Health professionals from appropriate Commonwealth agencies including the Department of Health, and DER; federal agencies including the NRC, FDA and HEW's Center for Disease Control; and Commonwealth universities, including the University of Pennsylvania, the University of Pittsburgh and the Pennsylvania State University.

Health effect assessment projects have been undertaken by the Pennsylvania Department of Health and the Department of

Public Welfare's Office of Mental Health. Both have committed extensive resources to monitor any physical or psychological impacts to the public resulting from the accident. Following is a summary of these projects. Appendices F and G contain more detailed information on these studies.

Three Mile Island Census - A special census of all persons living within a five-mile radius of TMI was completed in August 1979. The information collected from each resident included basic identification and exposure information such as time spent in the TMI area between March 28 - April 7, 1979. The population will be followed over a 20-year period and monitored for cancer, genetic diseases,* mental or stress-related disorders, and other disorders and diseases. Summarizing tabulations of the data will be completed in February 1980.

TMI Population Radiation Dose Assessment Study - Radiation dosages for individuals recorded in the TMI Census will be calculated by merging all information on radiation contamination from March 28-April 7, 1979 with individual evacuation information. This study will also include a reevaluation of previous radiation dose estimates done by NRC, EPA, and Metropolitan Edison.

Pregnancy Outcome - By April, 1981, data collection will be completed on a two-year study of all pregnant women living within a ten-mile radius of TMI. These data will be compared with a similar five year study just completed in the Harrisburg area to determine any changes in established trends.

Congenital/Neonatal Hypothyroidism* - Pennsylvania law requires the screening of all newborns for congenital/neonatal hypothyroidism, and the Department of Health has been collecting these data statewide since July, 1978. In conjunction with the Pregnancy Outcome Study, screening data on births and women living within a ten-mile radius of TMI will be compiled, analyzed and compared to statewide norms. Final analysis of this and the Pregnancy Outcome Study will be completed in June, 1982.

Health Behavioral Impact of the Three Mile Island Accident - This study is designed to assess the behavioral response of residents living within a five-mile radius of TMI. Specific information will be collected on stress-related health problems, use of health delivery systems, health costs, and strategies and social support used by residents to cope with the situation. A preliminary telephone survey was completed in August 1979, and final analysis of the data should be completed by June 1980.

Long Term Disease Surveillance - Planning for several studies in this area has begun using the TMI Census data. Persons in the census registry will be tracked over a period of 20 years or more to determine the incidence of diseases and death, as well as specific cancer rates. Additionally, a child growth and development study using the babies from the Pregnancy Outcome Study is planned, and a thyroid disease study is being considered.

By the first week in April 1979, DPW's Office of Mental Health focused attention on long-term psychological effects of the crisis on residents in the Three Mile Island area. In cooperation with the National Institute of Mental Health, by mid-April the Office of Mental Health had begun reviewing and evaluating a variety of proposals to study the long-term health effects on the local population. The Office of Mental Health is maintaining a catalog of current studies listed below.

Behavioral Effects Task Force Study - This study, conducted for the President's Commission on Three Mile Island, was based on survey data collected during or immediately after the TMI event by researchers from colleges and universities in the vicinity. The task force found the data to be of high quality; collected through reliable and accepted research methods. Staff members in the Office of Mental Health assisted in coordinating this project.

Surveys were conducted on four different population groups:

- Male and female heads of households located within 20 miles of TMI.
- Mothers of pre-school age children located within 20 miles of TMI.
- Teenagers in the seventh, ninth and 11th grades from a school district within the 20-mile radius of TMI.
- Workers employed at TMI at the time of the accident.

Two of the studies conducted by local researchers on which the report is based include a study focusing on the accident's effects on children from kindergarten to the 11th grade, and another study assessing any socio-psychological impact on various population groups in the Harrisburg area, including mothers of young children and a randomly selected general population group. Findings of the Behavioral Effects Task Force study were completed October 31, 1979 and are available to the general public.

Reaction to the Reactor Accident - A General Population Study - This research effort completed in September 1979, examined the social and psychological effects on the community of Carlisle, Pennsylvania located within a 25-mile radius of TMI.

Middletown Telephone Survey - This survey conducted in April 1979, attempts to assess resident's reception of the TMI situation and their emotional and behavioral reaction to evacuation.

Mountain West Telephone Survey - This survey was completed for the NRC in August 1979. It studied the social, psychological and economic effects of the accident on residents within a 15-mile radius, including the extent of evacuation, costs to households, stress and disruption of normal activities and attitudes toward TMI, nuclear power in general and the area.

Newberry Township Study - This study was designed and conducted through the cooperation of area residents to assess the short and long term effects of the accident on those living in close proximity to TMI. It was completed in September 1979.

Office of Mental Health Pilot Project - This study described opinions of Dauphin County Mental Health Center supervisors on service needs and rates of utilization for the county's community mental health centers resulting from the accident. This is a pilot study for a larger assessment, and focuses on changes in client contact, service and staff modifications, and planning and development of a mental health emergency disaster plan. This project was begun in August 1979.

Psychological, Behavioral and Social Aspects of the TMI Incident Study - This study was designed to assess the mental health status of selected population subgroups in the TMI vicinity, especially those thought to have been most affected by stress: plant workers, mental health system clients and mothers of young children. This is a long term study which builds upon existing data compiled by the President's TMI Commission. Completion is set for September 1980.

Demographic and Attitudinal Characteristics of TMI Evacuees - This telephone survey was conducted during the March 1979 crisis to measure public opinion of residents within a 15-mile radius of TMI. Final analysis was completed in April 1979.

TMI Stress Study - This study focuses on the stress impact, coping behaviors and social support systems during the TMI accident, and the impact on health delivery systems. Completion is set for September 1980.

The Rutgers Study - This study analyzes the changes in opinions of persons living around TMI regarding the risk of nuclear power plant accidents, and preparedness for emergency evacuation. The initial assessment was completed in June 1979.

The Organizational Development of Social Movements - The purpose of this study is to assess the community response to the TMI accident and its continuing impact, focusing on the background and functioning of TMI-related citizen groups. Completion is set for September 1980.

Evacuation Planning in the TMI Accident - This study focuses on government agency response to the unique crisis situation represented by the TMI accident, as opposed to government response to previously encountered disasters. The study was completed in July 1979.

Events and Values Affecting Professional Performance - This study explores factors affecting professional performance and decision-making during medical disaster mobilization. The study was completed in September 1979.

In June 1979, the Secretary of Health named a panel of nationally recognized physicians and scientists to oversee Three Mile Island health-related studies. They act in an advisory capacity to the Departments of Health and Public Welfare, and set priorities for Commonwealth research activities. This includes reviewing study protocols and research findings. In addition, their help was sought to procure additional funding as necessary.

When the group met for a second time on September 12, 1979, they agreed to approve study proposals and continue a close overview through completion. The panel is divided into subgroups for radiation, socio-economic, and behavioral projects, and meets every other month. A list of panel members can be found in Appendix H.

4. Social and Economic Impact

The Commonwealth has arranged for an assessment of the economic impacts of the TMI accident. Federal funding has permitted the Governor's Office of Policy and Planning to conduct a comprehensive Socio-economic Impact Study. The study includes two categories: immediate and short-term impacts precipitated by the evacuation and which abated in the weeks and months following the crisis period, and the continued potential for longer-term economic costs to the region served by TMI associated utilities. The study will be completed in

June 1980. Several interim reports have provided the Commonwealth a preliminary look at the socio-economic problems resulting from the accident. The latest report was issued in early January 1980.

5. Public Education

There has been tremendous public interest in radiation and its effects since the accident. At the time of the accident, a general state of confusion existed because the public was not familiar with nuclear reactor operation and related terminology. As a result of court cases, NRC hearings, and other related events, the public has become increasingly aware and interested in the implications of nuclear power. Nuclear energy education is imperative if the public is to gain a better understanding of the subject.

The President's TMI Commission addressed nuclear education in its report, commenting that the state has "primary responsibility for protecting the health and safety of its citizens." They further stated that if emergency planning and response to a radiation-related emergency is to be effective, the public must be better informed about nuclear power. Those who would be affected by such emergency planning must have clear information on actions they would be required to take in an emergency." The President's TMI Commission recommended, "as a State and local responsibility, an increased program for educating health professionals and emergency response personnel in the vicinity of nuclear power plants."

Different branches of Commonwealth government have held seminars to acquaint citizens with various aspects of nuclear power. The Pennsylvania State University Colleges of Medicine and Engineering in cooperation with the Pennsylvania Medical

Society sponsored a Radiation Health Conference on September 13 and 14, 1979, in Hershey, Pa., for medical persons who would respond in the event of a nuclear accident. The conference included representatives from municipal, the Commonwealth and federal governments, educators, health professionals and those with social and environmental interests. There has also been a TMI Seminar for secondary school teachers at the Capital Campus of the Pennsylvania State University, and a physicians' seminar in Pittsburgh in the late spring of 1979.

B. FEDERAL GOVERNMENT

1. Non-Declaration of Disaster Area

At the time of the accident, the Harrisburg area was not formally declared a disaster under the Federal Disaster Relief Act.* The Commonwealth's decision not to request a disaster declaration was based on two factors. First, it was questionable that the Commonwealth could qualify for assistance under the Federal Disaster Relief Act because there was no immediate property damage. Secondly, officials wanted to avoid a public panic which such a declaration could have triggered. In place of this declaration, President Carter promised Governor Thornburgh that support provided by that act would be available at Pennsylvania's request. In the long-term, this pledge turned out to be less than satisfactory. The President's initial commitment for complete support was later modified to cover personnel and equipment in lieu of cash. Even this proved difficult, because federal agencies were either not instructed to waive certain bureaucratic requirements, or failed to follow such a directive. For example, DER submitted a request for additional environmental monitoring equipment for use at Commonwealth nuclear reactor sites. Despite a required revision that scaled down the request to cover only the TMI site, it was denied. Coordinating federal assistance through the Middle Atlantic Federal Regional Council* has been of minimal value to the Commonwealth.

Much of the confusion relating to this assistance results from the non-declaration of an emergency or a disaster in the first place. In normal disaster circumstances, the Commonwealth would have requested the President to declare such a condition in the affected area. This declaration signifies a situation demanding a federal response, and guarantees certain federal recovery funds. The TMI accident was a new precedent in a formerly routine process, charting an uncertain course for those states that may suffer similar accidents in the future.

2. Nuclear Accident Financial Protection

As discussed earlier, the Price-Anderson Act provides financial protection to both the public and the nuclear power industry in the event of a serious nuclear accident. When the legislation was enacted in 1957, its major objectives were to assure the availability of funds to satisfy liability claims in the event of a nuclear incident, and to remove the growth deterrent for the nuclear power industry presented by the threat of unlimited liability claims for a nuclear accident. Presently, Metropolitan Edison has paid claims to several communities within a ten-mile radius that experienced extraordinary expenses as a result of the accident. After all insurance claims have been settled, the utility has also stated they will offer financial reimbursement to fire companies within the same radius. These community reimbursements are being drawn from company funds. In this instance the utility went beyond legal requirements by paying communities their costs, but there can be no guarantee of this practice in future incidents.

Other claims have been paid from Metropolitan Edison's $140 million public liability insurance coverage mandated under the Price-Anderson Act. These claims totaled $1,306,055.20 as of December 3, 1979. Because of numerous pending lawsuits, the total amount which will eventually be compensated under Price-Anderson is unknown.

3. Small Business Administration Loans

Another source of TMI-related federal assistance is the Small Business Administration's (SBA) Economic Injury Assistance Loan Program. This program was designed to grant long-term loans to small businesses experiencing economic injury resulting from the accident to enable these businesses to remain in or return to operation.

On April 18, 1979, Governor Dick Thornburgh requested the Small Business Administration to declare an economic disaster area in South-central Pennsylvania counties affected by the Three Mile Island accident. This included Dauphin, Lancaster, York, Cumberland and Lebanon Counties. His request was made in order to entitle area merchants, farmers and businessmen who could substantiate economic losses as a result of TMI to receive SBA loans at significantly reduced interest rates, as well as other forms of economic and technical assistance.

Governor Thornburgh noted that economic hardships had been brought about by the incident and the precautionary measures it necessitated - including the limited evacuation of pregnant women and young children, and the placement of emergency management forces on alert status. As a result, he recognized that normal business activity had been disrupted and firms had experienced millions of dollars in losses. He believed that these businesses qualified for the economic injury assistance which the SBA could provide.

An assessment of the impacts on small businesses was developed via an examination of the number of applications or business loans from the Small Business Administration. In the beginning of May, the SBA established temporary offices to receive applications for loans in Harrisburg, York and Lancaster. Later in May an office was set up in Middletown.

Applicants were required to use the SBA loans for economic injuries suffered because of the TMI accident. Proof of the injury had to be furnished with the loan application. Loans could only be provided for the losses not recoverable through normal commercial channels, or internal resources. The SBA accepted TMI-related applications until January 28, 1980. Loans up to $100,000 were available at an annual interest rate of 7 3/8% for a period of up to 30 years. The actual repayment period could be shorter, and was determined by an applicant's ability to repay the loan.

As of January 31, 1980, the SBA had conducted 490 interviews with potential applicants to explore eligibility. As a result, 76 applications have been accepted. The dollar amount associated with these eligible applications was over $3.9 million. Most accepted applications were from retail establishments, and the main cause of the loss due to TMI was the drop in sales prior to Easter. Another group affected was realtors which experienced a slight downturn in activity following the accident. Thus far, 22 applications have been approved for loans amounting to $510,000 and 36 applications have been declined by the SBA. Eighteen applications are still being processed. Four applications totaling $197,000 have been withdrawn. The complete current statistic sheet on the number and amount of loans can be found in Appendix I.

Because of the nature of the SBA program and its eligibility requirements, those firms which had experienced financial trouble prior to the TMI accident were rejected because they could not establish that their problem was due to TMI alone. Also, establishments which could have easily obtained credit through normal commercial financial channels or which could have absorbed the losses with their existing resources were not reflected in the figures above, because they were ineligible.

The Harrisburg SBA office closed on January 28, the Middletown office closed in mid-June, and the Lancaster and York offices closed in mid-August due to the lack of activity. Most of the activity in the SBA program occurred in May and June.

Many members of the business community did not apply to the federal government for help. Several area businesses complained about the complex and lengthy loan procedure, and about the lack of publicity the program received.

4. Environmental Monitoring

Since April 3, the Three Mile Island environmental monitoring program has continued with the combined resources of the Environmental Protection Agency (environmental radiation levels); the Food and Drug Administration (milk and food surveillance); the Nuclear Regulatory Commission (air, water, radiation, TLD's); and the Pennsylvania Department of Environmental Resources/Bureau of Radiation Protection.

The Environmental Protection Agency has been named by the President as the lead federal agency for conducting the comprehensive long-term environmental radiation surveillance follow-up program to the March 28, 1979 accident.

The purpose of the surveillance program is to provide:

- A measure of the radiological quality of the environment in the vicinity of Three Mile Island during a period of potential further releases.
- A basis for informing the public of any environmental radioactivity levels.

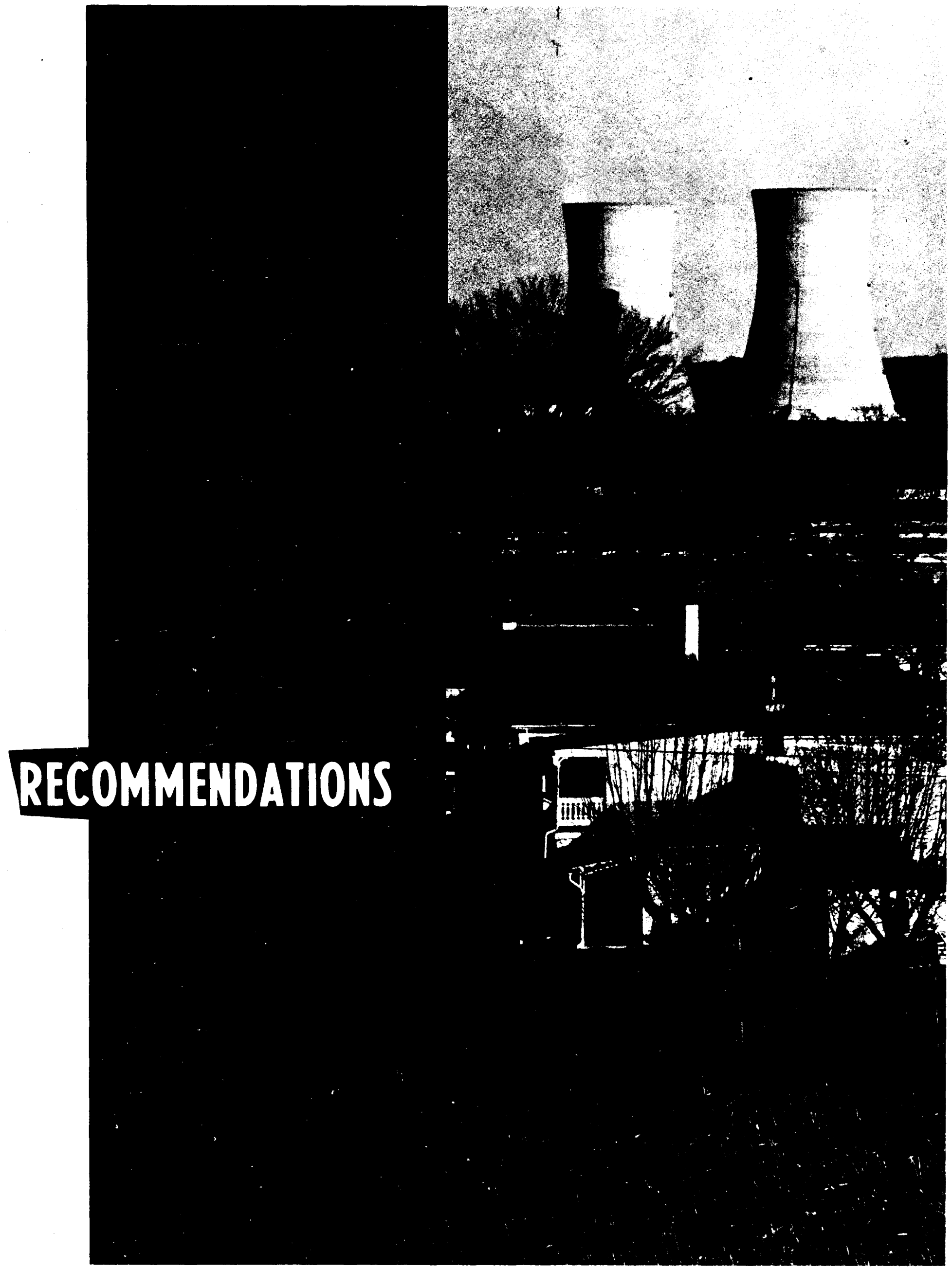
- Confirmation and "feedback" regarding success in controlling radioactive releases to the environment.

- An established monitoring program ready for immediate use if an accidental release should occur.

This surveillance program is not a substitute for, but is in addition to the environmental surveillance program conducted by the Metropolitan Edison Company.

The plan provides for increased surveillance if a release is anticipated; if planned activities increase the potential for a release; or if a release occurs unexpectedly. Due to uncertainty about clean-up operations and changing concentrations of radioactivity in the containment, the plan will need to be assessed and revised as appropriate. The next planned revision is scheduled for February 1980.

The Department of Energy also continued full-support activities for a month after March 28 to make certain that any radioactive releases were within acceptable levels. At the NRC's request, the DOE helicopter and crew remained for two months to assist if needed during periods of potential airborne releases.



V. RECOMMENDATIONS AND CONCLUSIONS

A. ENVIRONMENTAL

1. Expeditious Clean-Up

The TMI-2 facility must be cleaned up as expeditiously as possible. If the present situation at Unit 2 is allowed to deteriorate, a significant public health risk could result.

Without prompt clean-up, the facility could become both a low-level and high-level nuclear waste threat. Equipment currently maintaining the containment building at negative pressure is likely to fail over an extended period, because some of the equipment is functioning without maintenance under abnormal conditions. If a failure occurs, the chance for ground level radiation releases severe enough to impose a public health risk is increased. The Commonwealth's primary concern should be for completion of a timely and thorough clean-up effort.

The clean-up has progressed satisfactorily to date, but further measures must include the following:

1.1 Clean-up of Contaminated Auxiliary Building Water with EPICORE-II

The Commission affirms that decontamination of the water stored in these tanks is essential for several reasons: it continues to be a source of releases of gaseous radioactivity to the building resulting in small releases to the environment; it is a direct source of radiation exposure to workers who need

access to the building; the continued safe shutdown of Unit 2 depends on the operability of original plant equipment in the building and the use of additional equipment being installed; and the auxiliary building tanks could be needed to store water removed from the reactor building to protect equipment necessary for continued safe shutdown.

The potential doses from the operation of EPICORE-II are well within current acceptable federal guidelines, and impose no unwarranted risks to public health.

Present plans call for using EPICORE-II treated water in decontamination efforts elsewhere in the plant. If it becomes necessary, decontaminated water from EPICORE-II could be safely discharged into the Susquehanna River if it meets federal drinking water standards, NRC water discharge requirements, and if the environmental impact statement required by the NRC is acceptable.

1.2 Clean-up of the Containment Building Atmosphere

In light of our review of the alternative risks, this Commission urges the NRC to make a prompt decision concerning the proposed venting of the Unit 2 containment building atmosphere. Avoidance of this decision by the NRC is unacceptable. This Commission would not oppose an NRC decision to vent the krypton gas, provided that dose levels projected in the environmental impact assessment are acceptable. This position is based on a careful review of the best evidence available at this time.

If the NRC approves venting, it should not impose a public health risk if the operation adheres to present plans for a gradual release during favorable weather conditions.

Venting would require vigilant monitoring efforts by the Commonwealth and the NRC. Also venting schedules would have to be publicly announced. No scheduled venting should be allowed to take place without prior announcement.

If the controlled releases are made from elevated stacks, they would impose less risk to the public health than the potential for ground releases inherent in other methods of dealing with the gas. This is the most expeditious way to dispose of the krypton gas, and the safest of all alternatives reviewed.

The following actions should be completed before any actual release:

- The Bureau of Radiation Protection should concur with the venting plans and play an active role in a comprehensive monitoring program.

- The Commonwealth should explore funding that would permit direct read-out from monitors now installed in the vent stacks of Unit 2 to the Bureau of Radiation Protection Office.

- Notices of the intent to vent if weather conditions are appropriate must be published and aired on local TV and radio before venting occurs. Notification should include information on expected radiation levels and appropriate protective actions.

1.3 Clean-up of Containment Building Water

Clean-up of this contaminated water should begin as soon as acceptable procedures and equipment have been approved by the NRC, and an acceptable environmental impact statement has been completed. If any of this water is discharged into the Susquehanna, it must meet or exceed federal drinking water standards, and also be subject to an acceptable environmental impact statement.

The rising water level has covered a number of important instrumentation leads and electrical cables, but the utility has been able to compensate for the loss of these items. However, the electric motors on two valves which must remain operable for continued safe cooling of the reactor are only one and one-half to two feet above the present water level. This situation is potentially dangerous, and requires careful monitoring.

1.4 Clean-up of Containment Building Interior Surfaces

It is premature to draw any specific conclusions regarding plans for clean-up of the containment building interior surfaces. No assessment has been made of the potential doses associated with this part of the clean-up. Radiation levels in the containment building are high enough to make manned entry dangerous at this time. Careful planning for this phase of the clean-up is required.

1.5 Clean-up of the Reactor

Caution is warranted in weighing any plans that go beyond the clean-up phases already discussed. Procedures for decontaminating the primary coolant system, opening up the reactor vessel, and removing the damaged core are highly speculative at this time, and may impose larger risks on the local population and environment than any of the other clean-up operations.

2. Commonwealth Review of Unit-2 Clean-up Procedures

Metropolitan Edison's proposals and schedule for Unit-2 clean-up should be reviewed and subject to approval by the Pennsylvania Department of Environmental Resources, Bureau of Radiation Protection. The public should be informed of each step in the clean-up. This will provide the Commonwealth continued assurance of the public's health and safety.

Following Commonwealth approval, the public, particularly those living close to Three Mile Island, will be prepared to react responsibly to scheduled clean-up events.

3. Environmental Impact Statements

Assessments of potential radiation doses must be completed prior to NRC approval of any future clean-up operation. The Commonwealth should review these environmental impact assessments to ensure that additional and cumulative exposures are within safe limits.

4. Nuclear Waste Disposal

The Pennsylvania Advisory Committee for Atomic Energy Development and Radiation Control, currently existing under Act 578, 1965, should be reconstituted by Governor Thornburgh, and be charged with duties that include investigating the feasibility of developing a low-level radioactive waste disposal site within the Commonwealth, or within the Northeastern United States. Three Mile Island is not a desirable place for such a site.

Metropolitan Edison is now shipping TMI-2 waste to the State of Washington. However, that arrangement is based on the willingness of the State of Washington to continue to accept out-of-state wastes, and on the status of the Washington-Hanford waste disposal site. In January 1980, Governor Ray announced that she would support legislation to limit the Hanford site to receiving radioactive wastes from within Washington State only. This may evolve into a severe problem for Pennsylvania. It is in the Commonwealth's interest to seek a regional and/or a Pennsylvania site so that nuclear waste disposal from medical facilities and nuclear power plants will not be jeopardized in the future.

TMI will become a de facto low-level waste dump if this problem is not solved, because clean-up activities will produce large amounts of concentrated radioactive wastes that will be stored on-site until permanent storage is available.

5. Expanding Commonwealth Environmental Monitoring Capability

The Commonwealth should continue to increase the Bureau of Radiation Protection's staff and equipment so that it can develop a more comprehensive environmental monitoring program at Three Mile Island and other reactor sites in Pennsylvania.

The current monitoring effort being conducted by the U.S. Environmental Protection Agency and other federal agencies in cooperation with the Pennsylvania Department of Environmental Resources, is adequate to detect any radioactive releases from the TMI facility. The Bureau of Radiation Protection's monitoring capability should be improved because:

- Commonwealth monitoring capability should be adequate to provide an accurate measurement independent of the utility's findings.
- Federal agencies under the Environmental Protection Agency's lead may cease their monitoring activities before the Commonwealth is satisfied that a low probability of future releases exists.
- Long-term public concern and resulting psychological stress may be decreased by usage of a Commonwealth-operated monitoring system.

While federal assistance has been invaluable to the Commonwealth, we recommend that the Bureau of Radiation Protection have independent monitoring capability.

B. HEALTH

1. Commonwealth Program for Physical and Mental Health Studies

The program of physical and mental health studies to evaluate the consequences of the TMI accident should be continued by the Commonwealth.

Certainty on the health effects from the accident at Three Mile Island could not be established during the time in which this Commission made its evaluation, but presently there is no reason to disagree with the findings of the President's Commission on the Accident at Three Mile Island, which identified immediate psychological stress, but no immediate or expected long-term physical health effects. One difficulty this Commission recognizes is the uncertainty existing among health professionals about the effects of very low levels of radiation on humans, due to the scarcity of scientific studies. Most of the available scientific data stem from studies on the effects of high level exposure in man and extensive animal studies at high and low levels. The Commonwealth studies are necessary because of the continuing controversy on the effects of low-level ionizing radiation.

2. Lead Status for Commonwealth Bureau of Radiation Protection

The Bureau of Radiation Protection in the Pennsylvania Department of Environmental Resources should retain its status as lead Commonwealth agency in responding to nuclear reactor and radiation-related incidents. There is a need for good communications and continued liaison between the Bureau of Radiation Protection and the Department of Health, because the latter is properly responsible for health concerns and medical services in times of emergency. It is further recommended that the Advisory Committee on Atomic Energy Development and Radiation Control keep under continual review the working relationship between the Bureau of Radiation Protection and the Department of Health to assure that the mechanisms are in place to deal with the health aspects of such emergencies.

3. Resources in the Pennsylvania Department of Health

The Health Department should employ a health professional, technically conversant with radiation as an environmental or occupational hazard, and assign the individual as a liaison with the Bureau of Radiation Protection as required. The Health Department should also re-establish a library on radiation health.

4. Blue Ribbon Health Advisory Panel Continuation

The Blue Ribbon Health Advisory Panel on TMI, appointed by the Secretary of Health as an expert independent review group for research projects, should be continued. The scope of responsibility and continued necessity of this panel should be evaluated periodically by the Secretary of Health to ensure the panel's views continue to be useful in assuring the quality and value of health research programs.

5. Health Care Capabilities

The Commonwealth should inventory and assess its emergency health care capabilities in all locations that might be affected by a nuclear accident, with the Pennsylvania Department of Health assuming the lead role in this effort.

6. Iodine-131 Blocking Agent Program

A stable form of an iodine-131 blocking agent (Potassium Iodide) should be maintained in adequate supply for the general population in the emergency planning zones surrounding all nuclear power plants in the Commonwealth. In conjunction with PEMA, the Department of Health should develop a specific Potassium Iodide distribution plan as soon as possible, including provision for availability of Potassium Iodide for emergency personnel. The Health Department should also develop a specific education program for health care personnel and the public in the emergency planning zones outlining procedures for its distribution and administration.

V. RECOMMENDATIONS AND CONCLUSIONS

C. ECONOMIC

1. Expeditious PUC Decisions on Three Mile Island Economic Issues

The Pennsylvania Public Utility Commission should reach decisions rapidly on the continued inclusion of TMI-1 in Metropolitan Edison's rate base, the status of that company's utility license, and the amount of costs from the accident that should be passed through to consumers.

The set of orders arising from the proceedings of the Pennsylvania Public Utility Commission involving Metropolitan Edison will largely determine the ability of the utility to serve present and future customers. This Commission is concerned that continued regulatory delay adds substantially to the costs of the accident. Further, it recognizes that the uncertainty about the regulatory rulings affects business decision-making adversely, and that this may be counter to the economic development objectives of the Commonwealth.

2. Distribution of Costs

As a result of the accident and subsequent decisions by the Pennsylvania Public Utility Commission, Metropolitan Edison faces a financial dilemma that must be addressed and resolved promptly.

A larger portion of the accident's costs (than that currently being borne) could be added to GPU shareholders'

responsibility without causing irreparable economic repercussions to the parent corporation. Shareholders are bearers of risks even in highly regulated industries like electric power generation. Additional dividend reductions might not have more than a temporary effect on GPU's ability to arrange long-term financing.

The Commission believes that, in the future, owners of nuclear power plants should be required to carry insurance on their plants which is adequate to cover the potential costs of clean-up and replacement in the event of an accident.

Further, because it appears that Congress has reaffirmed its initial stimulation of and commitment to continued nuclear power generation, there is a legitimate claim on the federal government to extend some additional financial support. And, since precedent exists for extraordinary costs to be passed on to both industrial and residential ratepayers, Metropolitan Edison's customers can reasonably be expected to share in the accident's costs.

3. Summary

This Commission acknowledges that, as a result of the TMI accident and the subsequent technical and safety modifications mandated by the federal government, nuclear energy will be more costly to produce.

In summary, we urge a speedy resolution of the decisions before the Pennsylvania Public Utility Commission. We conclude that there should be a sharing of the current and future costs of the TMI accident among the federal government, private investor-owned utility shareholders, and ratepayers.

D. EMERGENCY MANAGEMENT

1. Evacuation Possible

Given the fact that the TMI accident occurred over a period of several days and involved low levels of radiation exposure to the immediate area, the Commonwealth's emergency response structure could have safely evacuated people in risk areas if that had become necessary. However, the outcome of an evacuation may have been in doubt had the accident occurred over a much shorter period of time.

The Commission's study identified problems in planning and in resources that must be examined in the event of a faster developing or more complex accident.

The Three Mile Island accident was a unique event in the context of emergency management. The conditions it imposed were new. There was inadequate understanding of potential radiation amounts and effects, and there were problems in understanding the technology of events transpiring at the site. These factors made the job far more difficult, as might be expected in a first-of-its-kind event that potentially endangered the health and safety of many people.

2. No new nuclear facilities in Pennsylvania should receive licenses unless the NRC has concurred with Commonwealth and local nuclear emergency response plans.

The Commission recognizes that the Commonwealth, while not authorized to set standards for nuclear power plant operation, is responsible for the health and safety of people living near reactor sites. This responsibility mandates a level of emergency planning and coordination that will meet the strictest guidelines. At the same time, this Commission affirms the federal responsibility to provide timely, clear-cut standards applicable to state plans.

The federal approval process advocated by the President's Commission on TMI is essential to assure the public that no new nuclear reactors will start up in areas lacking adequate emergency planning, and that utilities operating nuclear plants will help nearby communities to be prepared in case of an accident. That process involves coordination of state, local and federal planning.

2.1 NRC Concurrence

All state and local emergency plans should be submitted for NRC approval, and these plans should be reviewed by the NRC at frequent intervals after they receive concurrence.

- Neither TMI-1 nor TMI-2 should come back on-line without concurrence in Pennsylvania's state and local emergency plans.
- The Governor should use all means within his power to assure Commonwealth citizens that emergency planning for areas close to existing nuclear plants meets strictest standards.

2.2 Federal Role

The role of the federal government in relation to emergency management should be to develop planning goals and objectives, to concur in state plans, and to give needed support to states in the event of an evacuation, protective action, or an advisory similar to that issued by the Governor on March 30, 1979. Financial support to assist state planning is desirable and necessary.

2.3 Commonwealth Role

The role of the Commonwealth should be to develop plans consistent with federal goals and objectives, to assist in the development of county and local plans consistent with federal objectives, and to execute an evacuation when ordered. Plans should stipulate conditions for evacuation and other protective actions.

In the absence of federal standards, the Commonwealth should rely on continually updated plans for a ten-mile radius for all fixed nuclear sites. If clear federal guidelines are lacking, Pennsylvania planners will use their time more effectively in refining Commonwealth plans as reflected in Annex E of the Commonwealth Disaster Operations Plan.

If strict federal standards are not developed and applied expeditiously, the Commonwealth should join with other concerned states in pressing for legislation providing greater state authority in nuclear power plant operations.

3. Guidelines for Local Planning

Although Commonwealth agencies have achieved progress in their planning since the accident, the Governor should direct the Pennsylvania Emergency Management Agency and the Advisory Committee on Atomic Energy Development and Radiation Control to develop guidelines for detailed written emergency plans specific to each county and municipality within a ten-mile radius of any nuclear station in Pennsylvania. PEMA should also provide guidelines for five-mile and 20-mile radius plans that would be available as a reserve. These guidelines should incorporate suggestions made by the Emergency Management Subcommittee found in Appendix J.

4. PEMA's Role

The role of the Pennsylvania Emergency Management Agency should be to assist affected counties in carrying out an evacuation or to execute other protective actions when necessary. Further, PEMA should have the authority to assure that strictest standards are followed in county and local nuclear emergency plans.

4.1 Authority and Funding

The Governor's Office should recommend to the Legislature a series of amendments to Act 323 (the Pennsylvania Emergency Management Act), that would:

- Clarify and strengthen PEMA's role in helping county and local governments to formulate nuclear emergency response plans.

- Provide a source of funding for necessary emergency management services in areas near nuclear reactor sites. The cost of necessary emergency management services should be part of the cost of producing nuclear power.

5. Commonwealth Interagency Planning Meetings

The series of ad hoc meetings of an inter-agency group under the sponsorship of PEMA should continue until Commonwealth nuclear emergency response plans gain the approval of all agencies involved. This form of informal inter-agency communication is an ideal way to meet specific problems as they arise, and to respond to the evolving federal direction regarding nuclear emergency management.

6. General Commonwealth Planning

The following should be addressed in the general Commonwealth nuclear emergency response plan:

6.1 Dosimeters for Emergency Workers

PEMA should develop a plan as soon as possible for the purchase, storage, maintenance and distribution of dosimeters for emergency worker use. PEMA should also develop plans to train emergency workers in dosimeter reading and calibration.

6.2 Hospitals and Nursing Homes

Emergency plans should include provisions for the early warning of hospitals and nursing homes and should provide necessary equipment for these facilities in the event of evacuation. The Secretary of Health should establish communications with all area hospitals and be prepared to advise the Governor on the evacuation of these facilities. This recommendation should also cover private health care facilities located in emergency planning zones.

The following recommendations pertain to communications and public information:

7. Credibility of Information

During an accident, reliable information sources for both government officials and the public should be established. During the emergency, the Governor's Office had access to a variety of information sources and officials were able to separate fact from speculation. However, lack of a centralized information source for the media until well into the crisis caused the public's perception of the accident to be initially clouded. This contributed to the widespread apprehension not only of local residents but also among groups at great distances from Three Mile Island. To prevent a similar situation from developing in the future, the following are recommended:

7.1 Centralized Information Sources

In the event of a reactor accident with off-site implications:

- The NRC or a representative designated by the President should speak for technical on-site matters.

- The Governor or his designated representative should be the sole Commonwealth spokesman for evacuation or alternate protective action, health care and other responsibilities.

7.2 Relaying Information

In the event of a reactor accident with off-site implications:

- The Governor's spokesman should hold public briefings at regular intervals to apprise the press on the status of Commonwealth response to the event.

- The Governor or his designated representative should maintain constant contact with the Pennsylvania Emergency Management Agency. Agency representatives working at PEMA would thereby be fully informed of the accident's status and planned responses.

- The Governor or his designated representative and the NRC or its representative should confer and exchange information regularly and frequently.

- Regular communications through emergency management agency teletype systems should be maintained.

- The counties should be adequately briefed. Their responsibility in communicating with the public should be limited to relaying information necessary to carry out an evacuation or other protective action when so ordered.

- The utility should not be an official source of public information. In the event of an accident with consequences limited to the nuclear site, the Pennsylvania Department of Environmental Resources should be the official source.

7.3 Delegating Authority for Local Response

A nuclear reactor accident with off-site implications initially requires Gubernatorial intervention. The Governor or his designee should assume a direct and visible leadership role as quickly as possible, consistent with emergency plans and legislative mandates. The Governor should consider delegating operational command through existing PEMA channels to an individual or office designated by county commissioners in affected counties, if the incident so warrants.

The Commission recommends that the Governor draw up a plan for delegating operations command in each ten-mile area with an operating or licensed nuclear reactor. Such a plan should require designation of the individual or office at the appropriate level to assume responsibility for directing a localized emergency response.

7.4. Managing a Nuclear Reactor Crisis

The Bureau of Radiation Protection in DER should continue to hold primary responsibility for radiation protection and also be responsible for recommending general protective actions to the Governor. The Secretary of Health should be responsible for special advisories in the health area.

The NRC should specifically designate its staff person authorized to make recommendations to the Governor. If this is done in advance of a crisis, the Governor will not have to check the authenticity of such recommendations.

Radiation levels necessary to require an evacuation and radii affected by such should be reviewed by a federal task force and revised in light of the TMI accident. Knowledge of such requirements among decision-makers at all governmental levels is necessary to avoid the degree of confusion that existed during the early days of the TMI crisis.

E. LEGAL ISSUES

1. Federal Regulation of Radiation Hazards

The Commonwealth should participate to the greatest extent permitted in the federal government's nuclear licensing and rule-making process. This would insure that reasonable environmental and safety standards are achieved.

Federal legislation, particularly the 1946 Atomic Energy Act and its amendments, has prohibited states from regulating nuclear power plants on the basis of radiation hazards to the public or releases to the environment.

2. Proposal for Legislation regarding the Environmental Acceptability of Proposed Plant Sites

2.1 The Pennsylvania Legislature should be urged to adopt legislation which would plan and regulate the sites for and the environmental acceptability of proposed and future power plants including nuclear power plants.

2.2 Congress should be urged to adopt legislation granting specific authority to states to determine the environmental acceptability of proposed nuclear plant sites.

3. The Price-Anderson Act

3.1 Congress should be urged to increase the $560 million liability limitation set by the Price-Anderson Act, at least to the extent necessary to reflect the present value of the dollar in relation to its value in 1957 when the statute was enacted. Congress should also consider an increase above $5 million in the deferred industry premium plan for each operating nuclear reactor. This action would allocate to the nuclear industry an appropriate amount of the overall Price-Anderson increase.

3.2 The Commonwealth should review the Price-Anderson Act and submit its findings and recommendations to the Nuclear Regulatory Commission for consideration before 1983, when the NRC will review and report on Price-Anderson to Congress.

The Price-Anderson Act requires the NRC to submit a report on the need to continue or modify the provisions of Price-Anderson to Congress by January 1, 1983. This report is to reflect "the conditions of the nuclear industry, availability of private insurance, and the state of knowledge concerning nuclear safety at the time."

4. Pennsylvania Statutes

The Pennsylvania Department of Labor and Industry should review the definitions of radium poisoning and disability, as included in the Workmen's Compensation Act of 1915, as amended in 1972, to ensure that they are adequate in light of current medical knowledge.

In Pennsylvania, the Workmen's Compensation Act of 1972 provides coverage for employees who have been exposed to radiation and thereby suffer injury or disease. Definitions of radium poisoning and disability at the time the original Occupational Disease laws were enacted in 1939 are still included within the 1972 acts.

F. LONG-TERM RECOVERY

1. Governor's Advisory Committee

The Advisory Committee on Atomic Energy Development and Radiation Control should be reconstituted and charged with responsibility for the Commonwealth's long-term recovery efforts. The Commission recommends that the Pennsylvania Legislature adopt an amendment to Act 578 which would restructure the Advisory Committee's purpose and function.

The time frame for completion of the Commission's work, as set forth in the Executive Order, does not allow for involvement of the Commission beyond its initial study and evaluation of the accident. However, there is need for a centralized body to be responsible for continued follow-up for the Commonwealth in the different areas investigated by the Commission. It is important to continually certify the public health and safety at existing reactor sites.

Act 578 of 1965 established the Advisory Committee for the purpose of encouraging "the development and use of atomic energy for peaceful purposes, consistent with the health and safety of the public". However, the atmosphere created by today's energy dilemma warrants the re-evaluation of the original purpose of this Committee. The emphasis of nuclear power has shifted away from the need for development to one of control, safety assurances and greater public awareness. As a result of the accident at TMI, a major responsibility of the Commonwealth has been the study and evaluation of the accident, with a continuing responsibility to monitor the long-term effects. This continuing evaluation of nuclear power and its implications should now become the major purpose of this Advisory Committee.

1.1 Interim Measures

Until the necessary amendments are adopted by the Legislature, the Governor should do the following:

- Appoint new members to the Committee as soon as possible.

- Designate the Secretary of Health as an ex-officio member.

- Direct the Committee to meet on a regular basis to carry out duties charged to it. Those duties might include, but not be limited to the following:

  - Reviewing TMI-2 clean-up activities. The Advisory Committee should work closely with the Department of Environmental Resources in recommending positions to be taken by the Commonwealth in ongoing Nuclear Regulatory Commission proceedings.

  - Recommending the development of educational programs on nuclear power to be carried out by appropriate agencies and institutions. Special information on radiation health is urgently needed by people living close to TMI so that they

may understand the effects (or lack thereof) from clean-up events.

  - Reviewing the refinement by PEMA of existing ten-mile emergency plans and alternative protective action strategies for incorporation into Annex E of the Commonwealth's Emergency Plan.

  - Reviewing work being done by federal agencies involved with post-accident matters. This will include monitoring programs, emergency planning, long-term research and analysis activities, and recovery programs.

  - Reviewing Commonwealth inter-agency programs related to TMI, and coordinating future recovery efforts.

  - Reviewing federal and Commonwealth legislative initiatives in the area of nuclear power plant regulation and emergency management planning. This should include efforts to monitor and comment on federal regulations.

  - Reviewing the purchase of equipment and training of personnel for the community monitoring program outlined in the Commission's recommendations.

  - Monitoring long-term economic implications of the accident.

1.2 Advisory Committee Staff

The Advisory Committee should be supported by a small full-time staff housed in DER.

2. Public Education Program

Public awareness and education on nuclear power are essential for effective Commonwealth emergency planning and response for nuclear emergencies. Development of education programs has been designated as a state and local responsibility. This Commission recommends that the Advisory Committee on Atomic Energy Development and Radiation Control be the coordinator for Commonwealth programs.

Recommended programs include:

- An education program which would be directed toward the general public and included in the educational process at all levels. Subjects of importance are nuclear power plant operation, radiation and its health effects, protective actions, etc.

There is also need for more specific education programs directed toward specific groups:

- A program should be established for the population living within the emergency planning zones of nuclear power plants. Specific information should be included on evacuation plans, sheltering and the availability, distribution and procedure for administration of potassium iodide.

- There should be a program of continuing education for all health professionals on radiation health, radiation medicine and handling of contaminated personnel. Radiation health information should also be incorporated into the curricula of the various health professions taught in the Commonwealth.

- Special instruction for farmers should be provided on care of livestock and crops during nuclear emergencies.

- Special education programs are needed for certain religious groups (Amish) who do not have access to conventional communication methods such as telephones, TV or radio, and who do not attend public schools.

- In cooperation with the state colleges and universities, periodic seminars should be held to provide basic radiation information to government officials, the media and other related groups.

- All levels of emergency management personnel should receive training in radiation health and terminology, in addition to war-time nuclear emergency education. Programs of this type are offered by the NRC, and the Commonwealth's primary concern is that all emergency personnel attend these or similar programs.

- Although education for nuclear site workers on occupational safety measures and emergency procedures is a primary responsibility of the utility and the NRC, the Commonwealth should have assurance that these programs are continually implemented.

3. Community Radiation Monitoring

The Department of Environmental Resources/Bureau of Radiation Protection should design, implement and supervise a pilot community radiation monitoring program. A program of this type would assure local officials and residents of having quick access to information on environmental radiation levels. Monitors could be set up in one community near Three Mile Island and one near the Beaver Valley/Shippingport plants. The program should focus on providing appropriate equipment and training for personnel who will be using it. At the end of one year, the program's effectiveness should be evaluated in a report submitted to the reconstituted Atomic Energy Advisory Committee.

4. Federal Assistance when Disaster Relief Act is not Invoked

The United States Congress should design a program similar to present provisions of the Federal Disaster Relief Act to guarantee federal financial assistance to states in nuclear accident situations when an emergency is not declared, but during which financial assistance is required. This program should include compensation for local governments which experience extraordinary costs as a result of an incident.

Federal support to the Commonwealth during the initial crisis period was adequate, but support for follow-up activities was not as strong as the Commonwealth believed it would be. There is a need for a special program to guarantee

federal assistance in instances when an emergency is not declared, but during which documented emergency services are required.

5. Job Protection

The Pennsylvania Legislature should adopt legislation prohibiting job termination or discrimination against persons providing volunteer services during a defined emergency period.

The success of handling emergency situations depends not only on the efforts of those in emergency management positions, but also on the efforts of volunteers. Since volunteer support is essential during an accident, they should not stand the risk of losing their jobs as a result of their cooperation with emergency agencies.

6. Completion of TMI-2 Clean-up

In the event Metropolitan Edison or GPU Nuclear Corporation cannot continue with clean-up operations at Unit 2 due to financial, legal or other constraints, the federal government should assume that responsibility without delay. It is in the public interest for the clean-up to proceed regardless of the utility's status. Further, the Governor should request the federal government to assume full authority for clean-up operations if he has reason to believe that the utility no longer has the technical or management expertise to fulfill those duties.

Commonwealth of Pennsylvania
GOVERNOR'S OFFICE
EXECUTIVE ORDER

SUBJECT			NUMBER
Commission to Study and Evaluate the Consequences of the Incident at Three Mile Island			**1979-3**
DATE: **May 14, 1979**	DISTRIBUTION: **B**	BY DIRECTION OF: **Dick Thornburgh, Governor**	

WHEREAS, our Commonwealth has undergone an unprecedented crisis as the result of occurrences at Three Mile Island nuclear power plant near Middletown, Pennsylvania; and,

WHEREAS, the precise consequences of these occurrences remain unknown; and,

WHEREAS, the ascertainment of such consequences, and the facts surrounding the incident, as precisely as possible, is necessary to protect the safety and welfare of the region and to take every possible precaution against a recurrence of such an incident; and,

WHEREAS, it is imperative that the best possible civil defense and emergency preparedness capacity be maintained to respond to any such future crisis, if necessary; and,

WHEREAS, this incident may involve possible health consequences, physical and psychological, of a type and duration not now known; and,

WHEREAS, this incident may involve adverse environmental consequences of a nature, extent, and duration not now known; and,

WHEREAS, this incident has occasioned economic loss and harm to our Commonwealth and its citizens, of an extent and duration yet to be fully ascertained; and,

WHEREAS, the Governor has an obligation to protect the health, safety, and well-being of the citizens of this Commonwealth to the utmost of his powers and abilities; and,

WHEREAS, public safety, health, well-being, and confidence require that the consequences of the incident at the Three Mile Island facility be ascertained with the greatest precision possible.

NOW, THEREFORE, I, Dick Thornburgh, Governor of the Commonwealth of Pennsylvania, do hereby establish a **Commission to Study and Evaluate the Consequences of the Incident at Three Mile Island** (hereinafter referred to as the "Commission"), as hereinafter set forth:

1. **Purpose of the Commission.** The Commission is established to ascertain, as precisely as possible:

a. The consequences of the incident at Three Mile Island and any facts surrounding the incident which may be germane;

b. The adequacy of preparedness and response by all parties involved, including local and state government, and the nature and adequacy of interaction with the federal government, during the crisis period following the incident;

c. The existence, nature, and extent of health effects, physical or psychological, to any portion of the populace as a result of the incident;

d. The existence, nature, extent, and duration of any adverse environmental consequences as a result of the incident; and

e. The nature and extent of economic loss and harm to the Commonwealth and its citizens occasioned by the incident.

2. **Functions of the Commission.** The Commission shall:

a. Seek and obtain from all available sources such information, written or testimonial, technical or lay, as may be necessary to fulfill the purposes for which it is created;

b. Analyze, assess, and evaluate all such information and make recommendations on what, if any, precautions and remedies may be appropriate in view of the incident, including:

(1) Changes in relevant laws, regulations, and procedures;

(2) Changes in the administration and enforcement of relevant laws, regulations, and procedures;

(3) Changes in civil defense plans and emergency preparedness;

(4) Health tests and precautions, and obtaining necessary funding for same; and

(5) Economic aid and relief, and sources of funding for same.

c. Cooperate and coordinate, to the extent possible, with other responsible commissions and committees conducting similar reviews and assessments.

3. **Appointment of Members.** a. The Commission shall consist of fourteen members, to be appointed by the Governor as follows:

(1) The Lieutenant Governor, who will serve as Chairman;

(2) The Secretary of Environmental Resources;

(3) The Secretary of Health;

(4) The Secretary of Revenue;

(5) The Secretary of Commerce;

(6) The Secretary of Community Affairs;

(7) The Secretary of Public Welfare;

(8) The Secretary of Agriculture; and

(9) Six citizens of the Commonwealth, including persons knowledgeable about nuclear science and medicine, emergency preparedness, and economic analyses.

b. Citizen members of the Commission shall not be compensated for their services but shall be entitled to reimbursement for expenses necessarily incurred, in accordance with procedures established by the Governor's office.

c. Commonwealth officials serving on the Commission shall do so as part of the performance of their duties in their respective areas of responsibility and expertise.

4. Process and Procedure of the Commission.

a. The Commission shall adopt such rules of procedure and operation, hold such hearings, and receive such reports and evidence as may be necessary and desirable to fulfill the purposes and perform the functions for which it is created.

b. The Commission may use the resources of the Office of State Planning and Development and such other staff and support resources as the Chairman determines are necessary.

c. The Commission shall make such report or reports to the Governor as are appropriate and feasible.

d. The Commission shall make every effort to complete its work within six months. Upon completion, the Commission shall cease to function and this Order is thereafter rescinded.

SUBCOMMITTEE ASSIGNMENTS

Emergency Management

General Frank Townend, Chairman
Sec. William Davis
(until Oct. 30, 1979)
Mayor Robert Reid
Sec. Clifford Jones
Acting Sec. Shirley Dennis
(starting Oct. 30, 1979)

Legal

Justice Thomas W. Pomeroy, Jr.
Chairman
General Frank Townend
Sec. Clifford Jones

Environmental Impact

Dean Nunzio J. Palladino, Chairman
Sec. Penrose Hallowell
Sec. Clifford Jones

Health Impact

Dr. Niel Wald, Chairman
Sec. Gordon MacLeod
(until Nov. 1, 1979)
Sec. H. Arnold Muller
(starting Dec. 1, 1979)
Sec. Helen O'Bannon

Economic Impact

Ms. Anita Summers, Chairman
Sec. James Bodine
Sec. William Davis
(until Oct. 30, 1979)
Acting Sec. Shirley Dennis
(starting Oct. 30, 1979)
Sec. Howard Cohen
Sec. Helen O'Bannon

Programs & Recovery

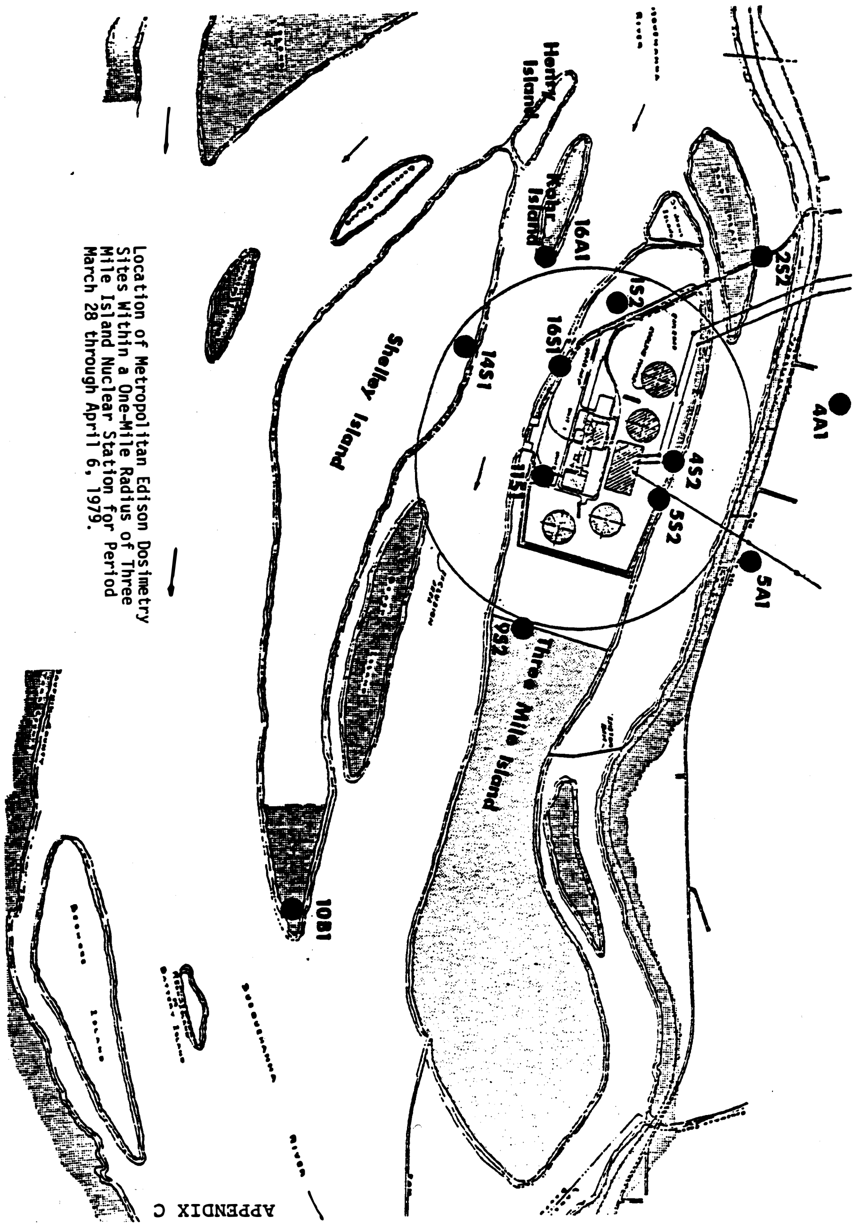
Mayor Robert Reid, Chairman
Sec. William Davis
(until Oct. 30, 1979)
Acting Sec. Shirley Dennis
(starting Oct. 30, 1979)
Sec. Howard Cohen

METROPOLITAN EDISON TLD STATION LOCATIONS

STATION CODE	LOCATION DESCRIPTION*
1S2**	0.4 miles N of site at N Weather Station
1C1	2.6 miles N of site at Middletown Substation
2S2	0.7 miles NNE of site on light pole in middle of North Bridge
4S2**	0.3 miles ENE of site on top of dike, East Fence
4A1	0.5 miles ENE of site on Laurel Rd., Met. Ed. pole #668-0L
4G1**	10 miles ENE of site at Lawn - Met. Ed. pole #J1813
5S2**	0.2 miles E of site on top of dike, East Fence
5A1**	0.4 miles E of site on north side of Observation C Building
7F1**	9 miles SE of site at Drager Farm off Engle's Tollgate Road
7G1	15 miles SE of site at Columbia Water Treatment Plant
8C1**	2.3 miles SSE of site
9S2	0.4 miles S of site at South Beach of Three Mile Island
9G1	13 miles S of site in Met. Ed. York Load Dispatch Station
10B1	1.1 miles SSW of site on south beach of Shelly Island
11S1**	0.1 miles SW of site on dike west of Mechanical Draft Towers
12B1	1.6 miles WSW of site adjacent to Fishing Creek
14S1	0.4 miles WNW of site at Shelley Island picnic area
15G1**	15 miles NW of site at West Fairview Substation
16S1**	0.2 miles NNW of site at gate in fence on west side of Three Mile Island
16A1	0.4 miles NNW of site on Kohr Island

*All distances measured from a point midway between the Reactor Building of Units One and Two. All 20 stations had Teledyne-Isotopes Environmental TLD's.

**Stations with Radiation Management Corporation (RMC) TLD's. Data Obtained with RMC TLD's at these locations are designated by adding the letter "Q" as a suffix to the station code.



Location of Metropolitan Edison Dosimetry Sites Within a One-Mile Radius of Three Mile Island Nuclear Station for Period March 28 through April 6, 1979.

APPENDIX C

APPENDIX C

METROPOLITAN EDISON TLD DATA - RADIATION EXPOSURES FOR PERIODS ENDING 04/06/79

Station(1)	Exposure Period 12/27/78 -03/29/79	03/29/79 -03/31/79	03/31/79 -04/03/79	04/03/79 -04/06/79
	mR ± std. deviation per exposure period (includes background)			
1C1	20.1±1.3	3.2±0.7	1.4±0.4	0.5±0.1
7F1	24.1±1.8	1.1±0.1	0.5±0.5	0.9±0.1
7F1Q	23.3±0.5	0.8±0.2	1.5±0.2	0.9±0.0
15G1	18.4±2.0	1.9±0.3	-0.7±0.1	0.5±0.0
15G1Q	17.6±0.6	1.1±0.1	0.8±0.1	0.7±0.2
12B1	16.3±0.9	9.4±1.6	0.2±0.3	1.2±0.2
9G1	21.3±1.4	1.4±0.1	0.1±0.2	0.6±0.1
5A1	18.6±1.0	8.3±2.8(3)	7.7±2.5	3.0±1.2
5A1Q	16.1±1.3	5.4±1.0	5.2±0.9	2.0±0.6
4A1	20.2±1.3	34.3±8.6	41.4±8.5	2.2±0.4
2S2	43.7±4.4	32.5±5.6	3.4±0.6	0.9±0.2
1S2	97.9±1.9	20.0±3.4	-0.1±0.1	0.6±0.1
1S2Q	95.7±5.0	15.3±3.2	1.3±0.1	0.8±0.1
16S1	1044.2±128.2	83.7±17.5	7.0±0.7	1.5±0.3
16S1Q	929.4±90.5	61.6±12.2	5.6±1.0	1.3±0.5
11S1	216.0±24.1	107.1±12.7	45.0±15.2	21.8±7.3
11S1Q	168.5±15.6	75.7±12.7	35.2±3.3	14.2±1.1
9S2	25.0±3.0	25.3±2.6	4.6±1.0	1.8±0.3
4S2	35.5±4.3	124.3±32.7	28.0±9.1	7.9±2.3
4S2Q	31.4±1.6	71.4±13.0	21.3±6.6	4.7±0.4
5S2	30.5±1.3	49.3±11.2	26.7±5.3	15.5±5.0
5S2Q	27.7±4.0	36.6±0.8	21.2±3.1	11.5±2.4
4G1	17.2±2.1	1.2±0.2	0.6±0.2	0.6±0.1
4G1Q	17.7±0.1	0.6±0.1	1.4±0.1	0.7±0.1
8C1	13.0±0.3	10.7±1.6	1.7±1.1	1.3±0.4
8C1Q	12.6±0.6	8.4±1.0	2.6±0.2	1.1±0.1
7G1	25.8±0.6	1.0±0.1	-0.5±0.0	0.8±0.0
16A1	907.7±49.4(2)	45.1±2.1	1.7±1.1	0.9±0.1
	453.4±12.2(2)			
14S1	131.2±20.6(2)	48.8±8.6	9.5±4.3	1.5±0.4
	148.3±9.7(2)			
10B1	40.6±3.5(2)	14.9±0.9	0.4±0.3	1.1±0.2
	36.6±1.3(2)			

(1) Suffix "Q" indicates RMC data; otherwise data are from Teledyne Isotopes.
(2) Results for 6-month exposure period 09/27/78-03/29/79.
(3) Additional values for 5A1: 7.8±1.5, 7.4±1.2.

(From the Ad Hoc Population Dose Assessment Report, May 10, 1979)

APPENDIX

RESULTS OF NRC DOSIMETERS EXPOSED APRIL 1, 1979 THROUGH MAY 1, 1979 AND APRIL 5, 1979 THROUGH MAY 3, 1979(*)

(From NUREG 0637, U.S. Nuclear Regulatory Commission, January, 1980)

Sector	Station No.	Distance	Direction	Gross Reading(a) mR	Location
N	N-1a*	2.4 mi	356°	5.2±0.5*	
	N-1	2.6 mi	358°	missing	Middletown
	N-1c*	3.0 mi	0°	missing*	
	N-1e*	3.5 mi	349°	5.0±0.3*	
	N-1f*	4.0 mi	351°	5.0±0.3*	
	N-2	5.1 mi	0°	5.2±0.3	Clifton
	N-3	7.4 mi	6°	5.5±0.3	Hummelstown
	N-4	9.3 mi	0°	5.6±0.2	Union Deposit
	N-5	12.6 mi	3°	5.6±0.2	
NNE	NE-1	0.8 mi	25°	4.9±0.5	North Gate
	NE-2	1.8 mi	19°	4.9±0.5	Geyers Ch.
	NE-3	3.1 mi	17°	5.7±0.3	Township school
NE	NE-3a*	3.6 mi	44°	4.9±0.4*	
	NE-4	6.7 mi	47°	5.5±0.3	
ENE	E-1	0.5 mi	61°	8.2±0.9	
	E-5(E-1a)	0.4 mi	90°	7.9±1.1	
	E-3	3.9 mi	94°	6.7±0.4	Newville
	E-4	7.0 mi	94°	5.9±0.5	Elizabethtown
ESE	E-2	2.7 mi	110°	5.3±0.5	
SE	SE-4	4.6 mi	137°	7.7±1.2	Highway 441
	SE-4a*	5.0 mi	146°	5.0±0.4*	
	SE-5	7.0 mi	135°	5.7±0.5	Bainbridge
SSE	SE-1	1.0 mi	151°	15.7±2.5	
	SE-2	1.9 mi	162°	8.9±1.0	Falmouth
	SE-3	2.3 mi	160°	7.6±1.3	Falmouth
S	S-1	3.2 mi	169°	7.3±0.7	York Haven
	S-1a*	3.35 mi	173°	5.0±0.4*	
	S-2	5.3 mi	178°	5.9±0.5	Conewago Heights
	S-3	9.0 mi	181°	7.6±0.3	Emigsville
	S-4	12.0 mi	184°	6.3±0.4	Woodland View
SSW	SW-1	2.2 mi	200°	6.1±0.6	Bashore Island
	SW-2	2.6 mi	203°	7.8±0.6	Pleasant Grove
SW	SW-3	8.3 mi	225°	5.9±0.4	Zions View
	SW-4	10.4 mi	225°	6.5±0.5	Eastmont

APPENDIX D, Table 1

Table 1

TMI Area[1] Manufacturing Employment By Industry, Actual and Predicted,
April September 1979
(Thousands of Employees, Not Seasonally Adjusted)

	April		May		June		July		August		September	
	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.
ALL MANUFACTURING	182.5	177.2	181.3	178.5	184.4	183.5	183.5	179.6	185.3	176.6	183.4	180.2
Durable Goods	105.5	103.1	105.4	104.6	108.3	107.5	108.2	106.1	109.0	102.3	107.5	106.1
Primary & Fab. Metals	31.5	29.5	31.1	29.6	31.7	30.0	31.7	29.8	31.9	30.0	31.8	29.8
Machinery	42.9	42.8	43.1	42.5	43.9	43.1	43.9	42.7	44.2	33.8[2]	43.7	43.3
Other	31.3	31.5	31.2	32.6	32.7	33.4	32.6	33.0	32.9	32.8	32.0	32.8
Nondurable Goods	77.0	75.2	75.9	75.0	76.1	75.7	75.3	74.9	76.3	75.2	75.9	75.1
Food & Kindred	20.1	20.0	19.4	20.0	19.6	19.8	20.4	19.9	21.0	19.8	20.9	19.7
Textile & Apparel	22.5	22.0	22.2	22.0	22.0	22.0	21.3	21.8	21.0	21.9	21.3	21.9
Leather & Products	7.7	8.0	7.5	8.0	7.6	8.0	7.0	7.9	7.4	7.9	7.1	8.0
Other	26.8	26.4	26.9	26.4	26.9	27.1	26.6	27.1	26.9	27.2	26.6	26.8

[1] Harrisburg, York, Lancaster, and Lebanon Labor Market Areas.
[2] Low number relates to strike activity in non-TMI area.

421

APPENDIX C

Sector	Station No.	Distance	Direction	Gross Reading(a) mR	Location
WSW	W-2	1.3 mi	252°	5.7±0.5	Goldsboro
	W-3a*	4.4 mi	247°	5.0±0.4*	
W	W-1	1.3 mi	263°	7.3±0.9	Goldsboro
	W-3	2.9 mi	270°	6.5±0.5	
	W-4	5.9 mi	272°	7.9±0.6	Lewisberry
	W-5	7.4 mi	262°	5.8±0.5	Lewisberry
WNW	NW-1	2.6 mi	303°	7.2±0.7	Harrisburg-York Airport
	NW-3	7.4 mi	297°	6.2±0.2	New Cumberland
NW	NW-2	5.9 mi	310°	5.3±0.5	Highspire
	NW-4	9.6 mi	306°	4.1±0.2	Harrisburg
	NW-5	13.8 mi	312	5.3±0.2	Harrisburg
NNW	N-1b*	2.75 mi	346°	4.9±0.4*	
	N-1d*	3.5 mi	333°	5.0±0.3*	

*dosimeters placed at schools 4/5/79-5/3/79
(a)"Gross" no transit dose or background corrections made

Table 3

Residential Housing Market, TMI Five And Twenty Mile Areas, April-July 1978 and 1979

	Change from 1978 to 1979			
	April	May	June	July
20 Mile Radius				
No. of Sales	- 4.6%	- 8.8%	-13.1%	-27.4%
Av. Value	+15.0%	+15.9%	+13.3%	+ 5.8%
5 Mile Radius				
No. of Sales	+30.4%	-33.3%	-34.9%	-75.5%
Av. Value	0	+ 4.7%	- 2.3%	+ 3.1%
B.L.S. Price of Housing in Pittsburgh Metro Area	+14.1%	n.a.	+12.4%	n.a.
Comparison Area* - No. of Sales	- 2.8%	+12.8%	+12.8%	+ .3%

*Five County area: Berks, Carbon, Lehigh, Northampton and Schuylkill.

Table 2

TMI Area[1] Nonmanufacturing Employment by Industry, Actual and Predicted, April - September 1979
(Thousands of Employees, Not Seasonally Adjusted)

	April		May		June		July		August		September	
	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.	Actual	Pred.
All NON-MANUFACTURING	372.3	372.6	376.2	377.9	377.4	378.6	373.7	372.2	372.6	372.1	373.3	370.7
Contract Construction	23.6	24.3	24.7	25.5	25.3	25.7	26.0	26.5	25.7	26.5	25.6	26.4
Trans. & P.U.	30.9	30.7	31.0	31.0	31.4	31.2	31.2	30.5	31.3	30.6	31.1	31.1
Wholesale & Retail Trade	118.2	114.1	118.2	115.1	118.2	115.0	117.5	112.8	117.4	112.6	116.4	113.0
Fin., Ins. and R.E.	22.4	22.7	22.3	23.0	22.7	23.4	22.6	23.6	22.7	23.6	22.7	23.2
Other	80.2	81.7	81.6	81.9	83.0	82.0	82.8	81.7	82.9	81.7	83.1	81.9

[1]Harrisburg, York, Lancaster, and Lebanon Labor Market Areas.

Table 5

SUMMARY OF EXPENDITURES FOR REPLACEMENT CAPACITY
(millions of dollars)

	Refurbishment			Plant Replacement											
				Coal						Nuclear					
				Old Site			New Site			Old Site			New Site		
	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High	Low	Med	High
Decontamination for decommissioning	-	-	-	$ 97	$107	$131	$ 97	$107	$131	$ 97	$107	$131	$ 97	$107	$131
Decontamination and refurbishment	$179	$216	$398	-	-	-	-	-	-	-	-	-	-	-	-
Plant removal	-	-	-	60	85	110	60	85	110	60	85	110	60	85	110
New Plant	-	-	-	311	311	373	430	478	574	381	401	478	623	782	935
New fuel and start-up	70	90	105	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	$249	$306	$503	$468	$503	$614	$587	$670	$815	$538	$593	$719	$780	$974	$1176

Source: SRI Final Report, Economic Impact of the Accident at Three Mile Island, SRI Project 8698, p. 45.

APPENDIX D, Table 5

APPENDIX D, Table 4

Table 4

GPU Replacement Power Cost Estimates

Refurbishment of TMI-2	
Low (#1, 1/80; #2, 1/83)	$ 576 million
Medium (#1, 1/81; #2, 1/84)	864 "
High (#1, 4/81; #2, 1/85)	1,026 "
Replacement of TMI-2	
Nuclear - TMI Site	$ 1,644 million
New Site	1,644 "
Coal - TMI Site	1,404 "
New Site	1,164 "

Source: SRI Final Report, Economic Impact of the Accident at Three Mile Island, SRI Project 8698, p. 35.

Table 6

DECOMMISSIONING COSTS FOR TMI-2
(Millions of Dollars)

	Low	Medium	High
Initial decontamination	$ 48	$ 56	$ 76
Fuel removal	8	8	8
Final decontamination	20	20	20
Licensing	10	10	10
G&A	11	13	17
Subtotal	$ 97	$107	$131
Removal of structures	60	85	110
Total	$157	$192	$241

COMMONWEALTH OF PENNSYLVANIA
DISASTER OPERATIONS PLAN

ANNEX E

NUCLEAR INCIDENTS
(FIXED FACILITY)

I. REFERENCES

A. State Council of Civil Defense Act of 1951, P.L. 28, as amended.
B. Atomic Energy Development and Radiation Control Act, January 28, 1966, P.L. 1625, as amended.

II. PURPOSE

A. Establish policies and procedures for emergency response to fixed facility nuclear incidents within the Commonwealth.

B. Assign responsibilities to State agencies, and county and local governments in responding to a fixed facility nuclear incident.

III. SCOPE

A. Provides guidance for the preparation of detailed plans and procedures for warning the public of nuclear fixed facility incidents.

B. Provides a basis for the preparation of county and local emergency response plans for nuclear incidents.

C. Identifies technical and operational responsibilities for fixed nuclear facility incidents.

IV. DEFINITIONS

A. Nuclear Incident: The uncontrolled release of radioactive material.

B. Classes of nuclear incidents based upon offsite consequences:

1. Class 1: Includes those incidents which have no offsite radiological consequences but which arouse public concern. These incidents may require the support of offsite service organizations (fire fighting and ambulance services).

2. Class II: Includes those incidents which involve an actual loss or major reduction in the protection provided for public health and safety, such as; fire in safety related equipment, security breaches, or accidents which produce effluents in excess of that permitted for continuing operation.

3. Class III: Includes incidents of sufficient severity for offsite organizations to take action to protect populations from direct exposure and inhalation hazards.

C. Mode of Discharge: Discharge of radioactivity to surface water, to the atmosphere or both.

D. Protective Action Guides: Quantitative dose projections which indicate the need for some action to be taken in avoiding the exposure.

E. Fixed Nuclear Facility: A site where nuclear materials are employed in an operation which could cause a nuclear incident.

F. Facility Operator: The management person or persons responsible for the operation of a fixed nuclear facility at the time of and during recovery from a nuclear incident.

V. SITUATION

A. Peacetime nuclear incidents include situations ranging from uncontrolled release of a small quantity of radioactive material with no casualties or damage to incidents causing widespread dissemination of radioactive material which could result in casualties and extensive property damage.

B. Fixed nuclear facility sites are:

1. Power Plants:

   a. Three Mile Island Nuclear Power Station, Dauphin County

   b. Beaver Valley Power Station, Beaver County

   c. Shippingport Power Station, Beaver County

   d. Peach Bottom Atomic Power Station, York County

   e. Susquehanna Steam Electric Station, Luzerne County (1980)

   f. Limerick Generating Station, Montgomery County (1981)

2. Fabrication Plants:

   a. Westinghouse Cheswick, Westmoreland County

   b. Babcock and Wilcox, Armstrong County

C. The warning time before a nuclear incident may vary from none to hours or days. For most incidents there will be very little warning time.

D. Areas contaminated or threatened by radiation could require the population to seek protection in shelters or to be evacuated.

E. The offsite radiological effects of an incident on populated areas are dependent upon the mode of discharge, population distribution, weather and terrain.

VI. CONCEPT OF OPERATIONS

A. Offsite operations in response to emergencies at fixed nuclear facilities are distinct from other emergencies only in the technical aspects of the materials involved.

B. County and local governments have primary responsibility for offsite response to a nuclear incident and will provide the initial response to the incident.

CHANGE 2
AUG. 1978

E. The Federal government will provide assistance upon request by the Governor.

F. During peacetime the Bureau of Radiological Health, Department of Environmental Resources will determine levels of radiation in the environment and recommend emergency measures to protect the public from exposure.

G. Appendix 1 provides the notification channels for response to nuclear incidents.

H. Appendix 2 provides a list of selected references relating to emergency planning and response to nuclear incidents.

VI RESPONSIBILITIES

A. County Civil Defense/Local Government Civil Defense

1. Coordination with Local Authorities
2. React to initial Notification by Facility Management
3. Alert and Warning of Local Population
4. Emergency Services
5. Situation Analysis

B. Bureau of Radiological Health (DER)

1. Radiological Monitoring
2. Accident Assessment
3. Notification of Federal Authorities
4. Recommendation of Protective Actions
5. Recommendations for Protection of Potable Water and Food
6. Recommendations for Recovery and Reentry

C. State Council of Civil Defense

1. Issue Planning Guidance
2. Coordination of State Response to nuclear incidents
3. Maintain Emergency Communications Facility
4. Operate State Emergency Operations Center
5. Emergency Public Information
6. Coordination of State Agencies and Departments

D. Pennnsylvania State Police

1. Maintenance of Law and Order

CHANGE 1
OCT. 1977

2. Search and Rescue

3. Traffic Control

4. Area Isolation/Quarantine

5. Evacuation

6. Control of Reentry

E. Department of Military Affairs

1. Search and Rescue

2. Traffic Control

3. Evacuation

4. Control of Reentry

5. Emergency Transportation

6. Aircraft for Aerial Monitoring

7. Installation Security

F. Department of Justice

1. Legal Counsel to Governor

2. Negotiations with Terrorists

G. Department of Transportation

1. Assist in Direction of Traffic Flow

2. Clearance of Roads and Highways

H. Department of Health

1. Emergency Medical Care

2. Identification of Dead, and Mortuary Services

VII STATE ASSISTANCE

A. Bureau of Radiological Health (DER)

Fifth Floor, Fulton Building
3rd & Locust Streets
Harrisburg, PA 17101
Telephone: 717-787-2480

Provides technical guidance and direction in an emergency where the public is, or may be, exposed to nuclear radiation.

IX. FEDERAL ASSISTANCE

A. U.S. Department of Energy (DOE)

Regional Coordinating Office for Radiological Assistance
Brookhaven Area Office
Upton, Long Island, New York 11973

Through Bureau of Radiological Health; DOE makes available from its resources radiological advice and assistance to minimize injury to people, to minimize loss of property, to cope with radiological hazards, and to protect public health and safety. DOE serves to coordinate other Federal Agencies.

B. U.S. Nuclear Regulatory Commission (NRC)

Regional Office
631 Park Avenue
King of Prussia, PA 19406
Telephone: (215) 337-1150

Through Bureau of Radiological Health; responsible for collecting and evaluating the facts attending accidental release of radioactive material from a licensed nuclear facility. NRC can provide a significant manpower resource in the event of serious radiological incidents.

C. First U.S. Army

Department of Defense (DOD)
Fort George G. Meade, MD
Telephone: (301) 677-6535

Through State Council of Civil Defefense: Army Nuclear Incident Control Teams and Explosive Ordinance Disposal Teams aid and protect personnel and equipment. Army has primary command responsibility for control of incidents of such scope as to constitute a domestic emergency.

APPENDICES

1 – Notification Channels

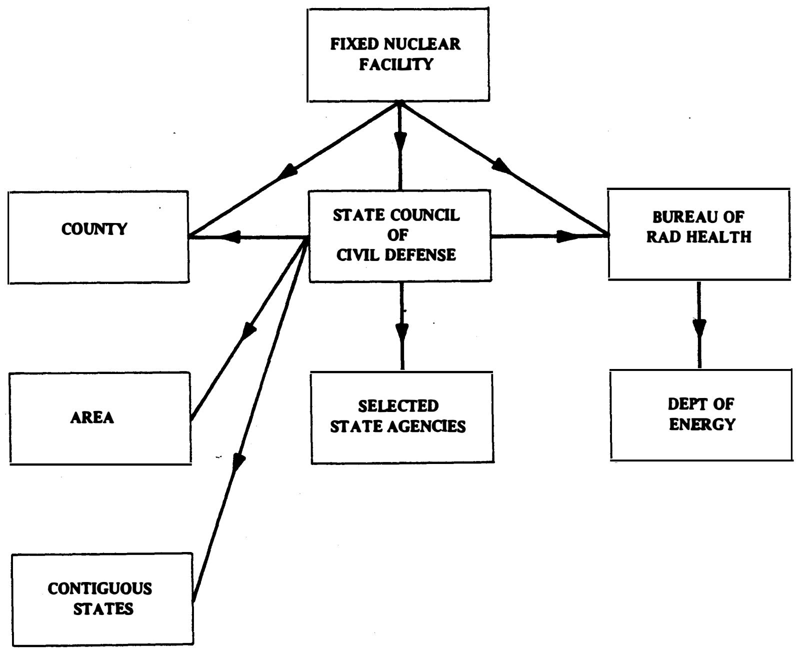
2 – Protective Action Guides

3 – Nuclear Incident References

APPENDIX 1

ANNEX E

NOTIFICATION CHANNELS



THREE MILE ISLAND
PROJECTS IDENTIFIED BY THE
PENNSYLVANIA DEPARTMENT OF HEALTH

1. Three Mile Island Census:

Five-Mile Radius - 50,000 Population
Up to $300,000 funded by Center for Disease Control and National Institute of Health.

Technical and Personnel support by Center for Disease Control and Census Bureau.

Projected period: June 20 - July 31, 1979.

Coordinated and resources provided by Pennsylvania Department of Health:

Bureau of Health Research (Edward Digon, M.P.H.; Elaine Anderson, Ph.D.) (Paul Digon, Marilyn King, M.P.H.).

Bureau of Health Data Systems.

On June 20, 1979 the Pennsylvania Department of Health began a special census of all persons living within five miles of TMI. The information collected on each resident consisted of basic demographic (identifying) data and exposure information (time spent in the TMI area between March 29 and April 7). The population will be followed over a 20-year period and monitored for cancer, genetic diseases, mental or stress-related disorders and other disorders and diseases.

A staff of 150 enumerators was hired by the Pennsylvania Department of Health to canvas the TMI area. Other personnel and procedural guidance were supplied by the U.S. Bureau of the Census and the U.S. Center for Disease Control to assist the research staff of the Pennsylvania Department of Health.

At the time of this report, census forms were completed on 98% of all households identified as being in the five-mile radius. The remaining 2% represent about 100 temporary absences (vacationers) not yet contacted, 70 permanent movers not yet contacted, and another 100 "questionable" households. Two of the original TMI census enumerators are still on staff to finish the cleanup phase. This involves telephoning, mailing out questionnaires and doing otherwise innovative detective work. The total number of households is estimated as 13,000. A hand count revealed approximately 38,000 residents who live within the five-mile radius.

The response of residents was very good (less than 2% refusal). Quality control measures showed that coverage was very good (about 98% coverage). A five percent random sample verification by telephone revealed that the data is highly reliable. Of the 150 families who have permanently moved out of the area since March 28, 1979, most are being successfully contacted by phone. Of the moved families already contacted (55 out of 150), 25% say they moved from the area because of the TMI accident.

The census data is being stored in a double-locked vault in the Department of Health. Every precaution is being taken to guard its confidentiality. A contract has been made with Keypunch Incorporated, Allentown, Pennsylvania, for data processing. A raw data tape was completed by mid-December.

2. Evaluation of Pregnancy Outcome:

Ten-Mile Radius
$80,000 (Title V "B") funded by Health Services Administration, Department of Health, Education and Welfare, to initiate study.

Projected period: July 1, 1979 - June 30, 1982 (Pregnancy cohort starts March 28, 1979).

Additional funds are expected from Health Systems Agency, Department of Health, Education and Welfare to completion. Total budget needed first year: $210,000.

Project Director: George Tokuhata, Dr. P.H., Ph. D. (Department of Health) Staff: Joyce Kim, Ph.D., Jane Bratz, Edward Digon, M.P.H.

Co-Project Director: Ronald Chez, M.D. (Hershey Medical Center).

For the two years following the TMI accident, information on pregnancy outcomes will be collected on all pregnancies of women living within ten miles of TMI. The information is being supplied by hospital medical records as well as from comprehensive interviews with the mothers in their homes. Data on over 160 variables will be collected. A pregnancy outcome will be analyzed in relation to prenatal care, maternal characteristics and previous medical history, radiation exposure from TMI and other sources, and the emotional impact of TMI. Results will be compared to a similar five-year study just completed which will allow a comparison of "before" and "after" data.

All 11 hospitals servicing the area have agreed to participate. The Department of Health has hired six interviewers to administer questionnaires to every mother who delivers in the ten-mile radius. The interviewing began the first week of August. This study has received a good deal of local press coverage since the interviewing began. The community response is expected to be very good.

3. Congenital Neonatal Hypothyroidism:

Ten-Mile Radius
This study is designed as a special feature of Pregnancy Outcome Study, as well as a special feature of Long-Term Disease Surveillance.

Project Director: George Tokuhata, Dr.P.H., Ph.D. (Department of Health)
Staff: Elaine Anderson, Ph.D.

Co-Project Director: Robert Brent, M.D., Ph.D. (Jefferson Medical College).

Associate Directors: Evan Riehl, Dr.P.H. (Department of Health)
Evelyn Bouden, M.D. (Department of Health).

Projected period: July 1, 1979 - to be determined.

This study will be done in conjunction with the Pregnancy Outcome Study. All newborns, by Pennsylvania law, must be screened for congenital/neonatal hypothyroidism. The Department of Health has been collecting statewide data through the Neonatal Metabolic Screening Program on all infants born in Pennsylvania. This program has been operating since July 1978. Screening data on all births to women living within ten-miles of TMI will be compiled, analyzed and compared to statewide norms.

The interviewers working for the Pregnancy Outcome Study are currently testing the effectiveness of using the hypothyroidism data stored at the Department of Health (Metabolic Screening Program) as compared to perusing the baby's medical chart for the identical information.

4. Health Behavorial Impact of the TMI Accident:

Funded, in part, by Electric Power Research Institute (approximately $40,000 - 14 months).

Project Director: Bureau of Health Research (Department of Health)
Staff: Kum S. Ham, Ph.D.

Co-Project Director: Peter S. Houts, Ph.D. (Hershey Medical Center).

Projected period: July 1, 1979 - August 31, 1980.

This study is a joint effort of the Pennsylvania Department of Health and the Milton Hershey Medical Center of Pennsylvania State University. It calls for the collection of both primary data (via telephone interviews) and secondary data (via a survey of health care providers) to assess the behavioral response of residents living within five miles of TMI.

The primary data collection phase was completed August 15, 1979. Approximately 700 persons were contacted in a five-mile radius from TMI via random digit telephone dialing. Chilton Research Services in Radnor, Pennsylvania was contacted to do the telephoning. Subjects were asked questions dealing with stress-related health problems, use of health delivery systems, health costs, coping strategies and social support of the respondents. Preliminary results should be available by September 12, 1979.

The survey instrument (questionnaire) was initially based on pilot data collected soon after the TMI accident by researchers at the Hershey Medical Center. Before finalizing the questionnaire, Dr. Houts, Principal Investigator, sought expert consultation from Dr. Kramer of Johns Hopkins University and Dr. Streuing of Columbia University. The questionnaire was then extensively field tested with the aid of Chilton Research Services.

The demographic profile of the 700 respondents will be compared to that of the complete population (the entire TMI census population) to measure how well the respondents represent the total population. The refusal rate for the survey was about 13%, whereas it was less than 2% for the TMI census.

The survey was confined within the five-mile radius. Conveniently, the NRC has conducted its own survey of 1,500 residents going out to 50 miles from the plant. Initial collaborative efforts allowed the NRC (who also used Chilton Research Services to do its telephoning) to use the identical wording in many common questions and to "borrow" some stress questions from the Health Behavior Study survey. Both parties will have access to each other's data. This will benefit both studies and allow more reliable interpretation of the results.

Secondary data will consist of health care facility utilization following the TMI accident. Analysis of this data will indicate what pressures were put on the health care system in the aftermath of the accident. Compilation of secondary data will begin January, 1980.

5. Health Related Economic Costs:

Funded, in part, by Electric Power Research Institute (approximately $40,000 - 14 months).

Project Director: Teh-Wei Hu, Ph.D. (Pennsylvania State University).

Co-Project Director: Bureau of Health Research (Department of Health)
Staff: Marion Yoder, M.S.

This study will concentrate on the immediate and short term excess health costs due to TMI. Two types of data sources will be utilized. The first will be "primary data" obtained from the household survey (Health Behavioral Impacts of the TMI Accident) on personal expenditure and loss. Individual hospital utilization, as well as other health related costs incurred due to TMI, will be obtained from the survey. The second type of data, "secondary data" will consist of information from institutions and hospitals. Health costs will be assessed by examining utilization patterns and trends for physical and mental health services and social services one year prior to the event and one year after. Data sources on service utilization will include the Hospital Utilization Project, Pennsylvania Blue Cross and Blue Shield, the State Employee Health Benefits Program, the Pennsylvania Department of Health and Welfare, local social service agencies, school absenteeism and work absenteeism.

The assessment of economic costs to households will be derived from the telephone survey conducted by the Health Behavioral Impacts Study. Computer analysis of the data will be a major task of this study. The results should be available by the end of October.

Pennsylvania Blue Shield has been contacted and has agreed to supply monthly physician visit data (before and after the TMI accident) from each physician's office within the TMI impact area (five, ten and 20 miles). The physician and patient identifying data will be withheld. The Capital Blue Cross, together with eight hospitals in the area, will supply the hospital utilization and cost information.

The Governor's Office of Policy and Planning is coordinating a TMI Socioeconomic Impact Study undertaken by the State Departments of Agriculture, Revenue, Community Affairs, Labor and Industry, and Commerce. This study is contacting these agencies for potential data sources, so that the health-related secondary efforts in the area will be estimated.

6. TMI Population Radiation Dose Assessment:

Funded, in part, by Electric Power Research Institute (approximately $68,000 - First Year).

Project Director: David Gur, Ph.D. (University of Pittsburgh).

Co-Project Director: Bureau of Health Research (Department of Health)

Projected period: July 1, 1979 - to be determined.

The task of this project is to calculate radiation dosages for individuals recorded in the Three Mile Island Census. This will require merging all existing information about radiation contamination, March 28-April 7, in the five-mile area of TMI with individual evacuation information on each person reported in the census. The University of Pittsburgh will be working in conjunction with the Pennsylvania Department of Health.

7. Long-Term Disease Surveillance:

General approach and plan have been completed.
Specific disease studies (morbidity) to be developed.
Fund sources not yet identified.

Project Director: George Tokuhata, Dr.P.H., Ph.D. (Department of Health)
Staff: Edward Digon, M.P.H.

Co-Project Director: Anita Bahn, M.D., Sc.D. (University of Pennsylvania)
Staff: Loren Houten, Ph.D., Janet Cherry, M.A.

Two "brain-storming" sessions were held June 13 and August 22, 1979 with Department of Health staff and several TMI Research Advisory Committee members, to discuss plans for additional TMI research. Of special consideration were plans for the utilization of the TMI census.

The TMI census of persons residing in the five-mile radius will provide denominator data for future calculations of morbidity and mortality rates. Persons in the registry will be followed for 20 years or more. Their conditions will be compared to standard or control populations.

Because the TMI census is to be operative for a variety of uses over time, it will be necessary to periodically update the data. This will involve "tracking" the residents every year (or, perhaps, every five years) for changes in addresses, names and health status.

Cancer incidence will be monitored over the years by matching the TMI census file to Cancer Tumor Registry files. A Cancer Tumor Registry was to be operative in the eight counties around TMI by 1981 (funded by the Commonwealth). However, the availability of these funds is now suspect. Other sources of funding are now being sought.

A child growth and development study is being planned. The population from which to sample will be the cohort of babies born in the ten-mile radius of TMI (those in the Pregnancy Outcome Study). The cohort will be stratified by the length of gestation at the time of the TMI accident and cross comparisons will be made between the groups.

A study of thyroid diseases is also being considered.

No contracts or funds have yet been allocated for long-term studies.

APPENDIX F

SUMMARIZED TIME SCHEDULES: THREE MILE ISLAND STUDIES
PENNSYLVANIA DEPARTMENT OF HEALTH
BUREAU OF HEALTH RESEARCH

December 1, 1979

I. TMI Census

- Census Completed - August 1979

- Summarized Cross Tabulations of the Data - February 1980

II. Evaluation of TMI Pregnancy Outcome Study

- Data Collection Completed - April 1981

- Final Analysis - June 1982

III. Health Behavioral Impacts

- First Telephone Survey Completed - August 1979

- Preliminary Analysis of Survey Data - December 1979

- Second Telephone Survey - January 1980

- Final Analysis of Survey Data - June 1980

- Proposed Telephone Resurvey - August 1980

IV. Health Related Economic Costs

- Telephone Survey Completed - August 1979

- Preliminary Analysis of Consumer Data - December 1979

- Physician Survey by Mail to Begin - January 1980

- Collection of Health Provider Data Completed - April 1980

- Final Analysis of Survey Data - June 1980

V. Proposed Long-Term Surveillance Studies

A. Population Registry: Continuous Update
B. Child Growth and Development
C. Cancer Incidence

APPENDIX F

Three Mile Island Census

Investigating Agency: Bureau of Health Research
Pennsylvania Department of Health
P.O. Box 90
Harrisburg, PA 17120

Progress Report
12/4/79

Status: The final date of the contract between the Department of Health and Keypunch Incorporated for key entry of the TMI Census data was November 30, 1979. The hardcopy data are being returned to the Health Department where they will remain in the doublelocked security vault indefinitely. Eight electromagnetic computer tapes constitute the "raw data" (approximately 14,000 household records).

The Department's data processing services will begin validation of the data immediately. It is estimated that this will take about one month (until January 1980). Once the data are validated, a master file of individual records will be created from the master file of household records. Both master files will be employed to run computerized frequency tables and generate analyses of the data. Imputations of the data (to compensate for missing or refused data) based on median values will be incorporated into, at least, the demographic frequency counts.

Missing Data: Less than 300 households refused to be interviewed. Another 50 or so who were unobtainable during the enumeration of the census, but are still living in the same house (temporarily absent), have not responded to repeated mailings (these might be considered refusals?). Still another group (less than 100) temporarily absent were unable to be subsequently contacted by mail or phone for one reason or another. This totals approximately 450 temporarily absent households for which no data were ever collected. Another 50 or so "completed questionnaires" turned up missing. Thus, data on 500 households of this type are missing.

It was discovered that during the three to four months from the time of the accident to the enumeration of the census approximately 150 households relocated[1] (some within the same area). Also, 50 students living on or near the Penn State Capital Campus moved permanently from the area. About 100 of the 150 movers have been successfully contacted. About half of the relocated students have been contacted.

[1]Data to determine if the moves were related to TMI are being sought via a "mover survey". Expected relocation rates are also being sought.

In addition, the enumerators missed (due to incomplete coverage) an estimated 2% of the households during the census and misclassified an estimated 4% of the vacancies.

Thus, slightly less than 7% of the data are missing.

Household Analyses: The number of household refusals, movers, unobtainables, vacancies and completed questionnaires will be determined by township or borough. For the completed questionnaires, the persons - per household distribution will also be determined by township or borough. The number of households with

1. pregnant women
2. preschool children
3. TMI workers

and those deemed as

1. nursing home "households"
2. summer cottages
3. student dormitories

will be determined. The rural population vs. suburban will be stratified (if possible).

Person Analyses: Frequency distributions of the total five-mile radius population by

1. age
2. sex
3. race
4. birth origin (state or county)
5. education
6. marital status
7. occupation

will be generated to characterize the demographic profile of the population. Similar distributions will be run for townships and boroughs.

The occupational profile will pay particular attention to the TMI workers and to those exposed to radiation on the job. A health profile will be constructed by calculating the prevalence of smoking, cancer, thyroid disease and radiation treatment or therapy. Cross tabulations of cancer prevalence by age, race, sex, occupation and smoking history will be constructed.

Evacuation Behavior: Of particular importance in this survey is the evacuation activities of the population. In particular, those persons reporting having left the five-mile radius due to the TMI threat will be analyzed by demographic descriptors. On the opposite end, those who

stayed the entire time (ten days subsequent to the March 28 accident) will be likewise analyzed. And, of course, those in the middle will be stratified and analyzed in various ways.

Possibilities of matching the Census data against the telephone survey data (Health Behavior/Economics) of 700 residents within the five-mile radius will be explored (logistics, legality, confidentiality).

Evaluation of TMI Pregnancy Outcome

Principle Investigator: George K. Tokuhata, Dr. P.H., Ph.D.
Director, Bureau of Health Research
Pennsylvania Department of Health
P.O. Box 90, Room 725
Harrisburg, PA 17120

Progress Report
12/4/79

The six interviewers (Science Research Associates) collecting data on the TMI Pregnancy Outcome Study have been assigned 1,488 of the total 2,399 childbirth cases identified to date from the 11 participating hospitals servicing the ten-mile radius area. For these 1,488 cases, 1,768 household visits to the mothers were attempted and 967 home interviews were completed. Seven hundred and thirty-six visits were attempted unsuccessfully due to the mother not being home. In addition, 59 homes were "not found" (located) and six refused to participate in the study.

TMI Pregnancy Outcome Study
Interview Status of Childbirth Cases
December 1, 1979
(Cases Reported March 28-Mid-November 1979)

I. Assigned Cases	1,488
A. Completed (Sub-total)	1,027
1. Home interview	967
2. Phone interview	58
3. Birth/Death certificates	2
B. Incomplete (Sub-total)	461
1. Not home	348
2. Homes not found	59
3. Refusals	14
4. Unobtainables	40
II. Not Yet Assigned to Interviewers	911
Total	2,399

In addition to the 967 completed home interviews, 58 interviews were completed over the phone because the obstetric patient either had moved from the study area or could not be reached during working hours. An additional eight refusals were received over the phone. From the 14 total refusals, 64.3% did not give specific reasons why they refused to participate in the study, even though they were asked.

Of the 1,488 cases received by the interviewers, 40 of them have been returned as "unobtainables" - i.e., the interviewers have explored all avenues in order to obtain an interview, but to no avail. In 82.5% of the cases, the interviewees moved but left no forwarding address. Two "unobtainables" which were registered as neonatal deaths had questionnaires completed for them based solely on birth and death certificate data.

Of the 1,027 completed questionnaires, 1.1% interviewees refused to sign the Consent Form in order to have her medical records abstracted.

The six interviewers made 160 hospital visits, including 131 for identifying names, etc., and 111 to abstract medical records.

During these 111 visits to abstract hospital medical records, 606 mother and 592 baby charts have been reviewed. In addition 299 thyroid screening test results filed in the Division of Parent and Child Health (Department of Health) have also been reviewed by the interviewers.

To date, 231 questionnaires have been coded, of which 184 have been verified.

Continued weekly reviewing of birth announcement lists found in various newspapers is taking place.

Continued weekly identification and collection of names, addresses, and other baseline data of obstetric patients delivering at one of the 11 participating hospitals and residing in a ten-mile TMI radius community is being monitored. To date, the number, percentage, and time frame of applicable obstetric patients are summarized as follows:

Number, Percentage, and Time Frame of Obstetric Patients
Residing in a Ten-mile Radius Community by Hospital

Hospital	No. of Cases	Percentage	Time Frame (3/28/79-)
Holy Spirit	200	8.3	11/12
Community General Osteopathic	184	7.7	11/05
Harrisburg Hospital	842	35.1	11/20
Hershey Medical Center	104*(57)	4.3	11/22
Polyclinic Medical Center	487	20.3	11/16

*Includes returned "Release Forms" only.

(Chart Continued)

Hospital	No. of Cases	Percentage	Time Frame (3/28/79-)
Columbia	5	0.2	11/26
Lancaster General	100*(3)	4.3	11/30
Lancaster Osteopathic	33	1.4	11/13
St. Joseph	36	1.5	10/12
Memorial Osteopathic	70	2.9	10/25
York	331	13.8	11/04
At Home Delivery	7	0.3	11/15
Total	2,399(60)	100.0	

*Includes returned "Release Forms" only.

The only questionable identified cases are when the obstetric patients have "R.D." addresses. These addresses are then checked at the applicable post office.

Of these 2,399 cases, 22 (9.1 rate per 1,000 deliveries) fetal deaths and 26 (10.9 rate per 1,000 live births) neonatal deaths have been identified for the Study.

Health Related Economic Costs

Principle Investigator: Tehwei Hu, Ph.D.
Department of Economics
Pennsylvania State University
University Park, PA 16802

Progress Report
12/4/79

Health Related Economic Costs: This study will be examining changes in utilization rates of physical and mental health services and related social services which might reflect the impact of the TMI accident. The economic value of these services, the value of loss of economic productivity, and the changes or planned changes in health care services section (health manpower, hospital, capital expenditures, etc.) will also be studied.

This study in cooperation with the Health Behavioral Impacts Study (Hershey Medical School) conducted a telephone survey within the five-mile radius. Processing of the data and computer programming has been and continues to be a major task of this study. Preliminary analyses of economic costs to households resulting from actions taken to avoid the perceived health threats were run and will be presented to the TMI Advisory Panel on December 12, 1979.

Contact was made with the Pennsylvania Blue Shield for procurement of monthly physician visit data (one year before and one year after the TMI incident). Pennsylvania Blue Shield has agreed to supply information from each Physician's Office Visit Summary within the TMI impact area (five, ten, and 20 miles), without identifying the names of the physicians. The Capital Blue Cross together with eight hospitals in the area will supply hospital utilization and costs information.

Another source of physician data will be obtained through a mail survey to be conducted in January, 1980. All physicians practicing in the five counties surrounding TMI will be included. A total of 969 physicians have been identified through American Medical Association directories. Twenty-five percent are expected to respond to the survey. The survey will seek information on types of patients, types of practices, types of procedures and fees as well as hours worked. The survey questionnaire was developed with the aid of Hershey Medical School staff and Pennsylvania Department of Health staff.

The Governor's Office of Policy and Planning is coordinating the TMI Socioeconomic Impact Study, undertaken by Departments of Agriculture, Revenue, Community Affairs, Labor and Industry, and

Commerce. Contact with these agencies for potential data sources is being made so that the health-related secondary efforts can be estimated.

Health Related Behavioral Impacts of the Three Mile Island Nuclear Accident

Principal Investigator: Peter S. Houts, Ph.D.
Associate Professor
Department of Behavioral Science
Pennsylvania State University College of Medicine
Hershey, PA 17033

Progress Report
12/2/79

Data Collection: Telephone interviews with 692 residents within five miles of the Three Mile Island nuclear facility were carried out in July, 1979. These interviews covered the following topics:

1. Demographic information on all family members (e.g., age, sex education, occupation, marital status, kind of medical insurance, how long lived in area, ethnic background, church attendance, etc.).
2. Presence of chronic diseases in the family and whether these diseases exacerbated during the TMI crisis.
3. Whether anyone was pregnant in the household, and, if so, whether medical advice was sought and whether abortion was considered.
4. Protective health actions taken (e.g., change diet, tests for radiation, etc.).
5. Visits to health professionals since TMI including reason and costs.
6. Degree of distress felt by family members during the crisis, including symptoms frequently associated with stess (e.g. headaches, sleeplessness, irritability, etc.).
7. Whether any members of the family left the area during the crisis, reasons for leaving or staying, where they went, and costs of evacuation.
8. Perceptions of economic impact on the area.
9. Coping strategies utilized to reduce stress (including behaviors such as seeking advice from friends, praying, letting off steam, as well as consumption of alcohol, cigarettes and tranquilizers).

10. Future plans for moving from the area or changing jobs.

Sampling method: Random digit dialing method was used which insures access to all homes with a phone (listed plus unlisted). Response rate was 75% with refusals 11%, no answer on four calls 9%, and unsuccessful callbacks 5%. These figures are average for telephone interviews. Demographic characteristics of this sample will be compared with those of the population census carried out by the Department of Health to determine whether any biases exist in this sample.

Data analysis

Data analysis has been carried out in collaboration with Dr. Teh Hu who is also responsible for the project on the economic impact of the nuclear accident.

A telephone interview study carried out for the Nuclear Regulatory Commission used many items from our survey. This survey included 1400 respondents and extended to 50 miles from Three Mile Island. We have had access to their data tapes and are analyzing both sets of data at the present time.

Descriptive summaries have been completed for the population as a whole as well as for leavers and stayers separately and for male and female respondents separately. These findings will be reported at the meeting on December 11.

Regression analyses have been completed to identify characteristics of persons who were most distressed during the crisis. Preliminary results will be discussed at the December 11 meeting.

Plans for future data analyses

Future data analyses will include the following questions:

1. The role of coping strategies and social support in mediating the stress effects of the incident
2. The degree to which medical and other human services were utilized as a result of the incident and the extent to which the health delivery system met population needs
3. Identifying characteristics of persons most at risk for severe stress reactions
4. Comparisons of evacuees and persons who remained to determine their needs during and after the incident.

Additional data collection

While analyses completed to date indicate that a significant number of persons close to the plant were distressed during the two weeks following the accident it is not clear to what degree, if any, those effects have continued. There have been allegations in the public press that many persons in the immediate area do continue to experience distress many months after the accident. In order to address this question, it was proposed to the panel subcommittee on behavioral effects (Drs. Kramer, Fredericks and Pattishall) that a follow up telephone survey be conducted in January. The subcommittee approved the survey which will focus on distress levels experienced in January, perceptions of the TMI situation in January plus additional information about previous health history and mental status which will help in interpreting both the July and January data. Interviewees will be persons who were interviewed in July and who agreed to be reinterviewed in the future. Five hundred and fifty-eight out of the original sample of 592 agreed to be reinterviewed. It is proposed to reinterview 400 of these persons in January. Three hundred additional persons will be interviewed outside of the five mile radius. This sample will extend out to 50 miles from Three Mile Island. The survey outside of the five mile radius is being carried out in collaboration with Dr. David Mechanic of Rutgers University, a medical sociologist with extensive experience in studying response to stress and its impact on health delivery. Dr. Mechanic is also a consultant to this project.

APPENDIX F

Radiation Dose Assessment

Principle Investigator: David Gur, Sc.D.
Department of Radiation Health
University of Pittsburgh
School of Graduate Public Health
A513, Crabtree Hall
Pittsburgh, PA 15261

Progress Report
12/4/79

Radiation Dose Assessment: This project officially began on September 14, 1979. Its goal is to assign the best possible radiation exposure estimate to each person registered through the TMI Census. Liaisons have been established with the various groups - federal, Commonwealth and private - responsible for making dosimetric estimations for the TMI area, and with key personnel within the Health Department responsible for the TMI Census data processing format and TMI area maps. A computerized interface has been successfully constructed to allow digitation and processing of the TMI maps. About one-third of the streets have been mapped onto the graphical display computer.

The major effort so far has been directed towards dosimetric assessments of the ten-mile radius geography. All previous calculations done by various groups MetEd, NRC, EPA, etc. - are being reevaluated. Some overlooked problems are being discovered in the previous dose estimates.

Individual dose estimates calculated from merging the geographic dosimetry with personal evacuation activities recorded in the census will be the final step in this project's responsibilities.

APPENDIX G

THREE MILE ISLAND
PROJECTS IDENTIFIED BY
PENNSYLVANIA DEPARTMENT OF PUBLIC WELFARE

I. Study Title: Social-psychological Impacts of the TMI Accident for the General Population and Selected Subpopulations.

A. Brief Description: This is a behavioral research project designed to study the possible social-psychological impacts of the TMI accident on various populations in the greater Harrisburg area. We are concerned with their social support systems, previous life events, trust, resources and their perceived health conditions.

B. Sponsor: Individual.

C. Level of Funding: Personal loans, approximately $15,000.00 for data collection.

D. Sources of Additional Funding: None at present. Additional funds are being sought from the Behavioral Effects Task Force of the President's Commission, the National Institute of Mental Health project or the Office of Mental Health for study of additional high risk populations.

E. Sources of Technical or Staff Support: Individual/independent selection.

F. Project Director: Ray Goldsteen, M.A.
Pennsylvania State University - Capitol Campus
Home Address: 2400 Pineford
Middletown, PA 17057

G. Project Staff:

Title	Degree
Secretary	
Field Coordinator	B.A.
Administrative Associate	B.A.
Administrative Assistant	B.A.
45 Interviewers	

H. Study Populations:

1. General Population

a. Procedure: This study is a telephone interview with a sample of the population randomly selected from the Harrisburg telephone directory. The sample was stratified by area within a 20-mile radius.

b. Study Period: The study began on Memorial Day and will terminate July 25, 1979.

c. Number of Persons in the Sample: N=700. Approximately 50% response rate; older persons not responding.

2. Hospital Employees

a. Procedure: A questionnaire was given to a selected sample which included: (1) x-ray technicians; (2) nuclear technicians; (3) nurses; (4) medical residents. The hospitals from which the sample selections were made are: (1) Hershey Medical Center; (2) Harrisburg Hospital; (3) Polyclinic Hospital.

b. Study Period: The study began March 1979 and ended June 1979.

c. Number of Persons in the sample: N=450. 28% response rate. Hope to resample and expand. N given monies.

3. Parents of School Children

a. Procedure: Mailed questionnaires were sent to the homes of children who were selected from the Lower Dauphin School District roster.

b. Study Period: The study began within the first week following the TMI accident and ended June 1979.

c. Number of Persons in the Sample: N=1375. Response to date is 500 persons. Second request sent out by school.

4. Mothers of Young Children

a. Procedure: Mailed questionnaires were sent to mothers who had given birth within the last three (3) years drawn from birth announcements in the local newspaper.

b. Study Period: The study began three (3) days before Memorial Day and will terminate July 25, 1979.

c. Number of persons in the sample: N=615. Response rate is 85%. 60 mothers had had children born after TMI.

5. Pregnant Women

a. Procedure: The sample was selected from the Harrisburg Hospital OB/Gynecological Clinic. Questionnaires sent but no response yet.

b. Study Period: Just initiated.

c. Number of persons in the sample: N=250.

6. Teachers

a. Procedure: Questionnaires given to teachers in the Lower Dauphin School District.

b. Study Period: Study began the first week following the TMI accident and ended June 1979.

c. Number of persons in the sample: N=199. Response rate is 100%.

II. Study Title: The Reaction to the Reactor Accident - A General Population Study.

A. Brief Description: This study is an interdisciplinary research effort studying the social and psychological effects of the TMI incident in the community of Carlisle, which lies within a 25-mile radius. The methodology is an open-ended anthropological study using a limited set of standard questions with probing for individual and unique response.

B. Study Period: The study began April 1, 1979 and is expected to end August 1979.

C. Number of persons in the sample: N=400 and increasing.

D. Sponsor: No primary funding sponsor but supported administratively by Dickinson College.

E. Level of Funding: Estimate total expenditure is approximately $5,000.00. Funding is piecemeal and includes:

1. work-study students.

2. a Challenge Grant from the National Endowment of Humanities.

F. Sources of Additional Funding: Insufficient, at best. The Office of Mental Health and the Behavioral Effects Task Force of the Presidential Commission will consider assisting in data analysis.

G. Sources of Technical or Staff Support: Dickinson College

H. Project Directors: Professor Daniel R. Bechtel, Ph.D.
Department of Religion
Dickinson College
Carlisle, PA 17013
Office: 717/245-1218
Home: 717/243-0416

Professor Julius Kassovic, M.A. (A.B.D.)
and
Professor Mellissa Kassovic, M.D. (A.B.D.)
Department of Sociology and Anthropology
Dickinson College
Carlisle, PA 17013
Office: 717/245-1294
Home: 717/243-2247

Professor Lonna Malmsheimer, Ph.D.
Director of the American Studies Program
Dickinson College

Carlisle, PA 17013
Office: 717/245-1520

I. Project Staff: M. Thompson, B.A.
Research Coordinator
Full Time

Numerous trained interviewers affiliated with Dickinson College.

III. Study Title: The Middletown Telethon.

A. Brief Description: To study the reception of the situation, use of information, and emotional/behavioral reaction to evacuation via an open-ended telephone interview using a limited set of questions developed by the Project Director.

B. Study Period: The study began March 31, 1979 and ended April 21, 1979.

C. Number of Persons in the Sample: N=135.

D. Sponsor: No primary sponsor. Administratively supported by Franklin and Marshall College, Lancaster, PA.

E. Level of Funding: Voluntary financial assistance ($75.00). Computer costs, xeroxing, etc., borne by the college.

F. Sources of Additional Funding: None.

G. Sources of Technical Staff Support: Primarily self with minimal voluntary assistance.

H. Project Director: Martin Smith, Ph.D.
919 Virginia Avenue
Lancaster, PA 17063
Home: 717/299-3521

I. Project Staff: Project Director only.

IV. Study Title: Children and Youth Behavioral Study

A. Brief Description: Questionnaires and interview schedules developed by project director were used to study the effects (primarily behavioral) that the TMI accident had on children from kindergarten to 11th grade.

B. Study Period: 1½ weeks following the TMI accident to June 1979.

C. Number of Persons in the Sample: Some 600 questionnaires returned on younger children N=600 from 7th, 9th, and 11th graders. N=100 from 4th, 5th and 6th graders. Total N=1300.

D. Sponsor: Project Director.

E. Level of Funding: Unknown.

F. Sources of Additional Funding: Unknown.

G. Sources of Technical or Staff Support: Hershey Medical Center.

H. Project Director: Dr. Glenn Bartlett
Pediatrics Department
Hershey Medical Center
Hershey, PA

I. Project Staff: Unknown.

V. Study Title: TMI Telephone Survey (NRC) Preliminary Report on Procedures and Findings

A. Brief Description: Studies the social, psychological and economic effects of the TMI accident.

B. Related Issues:

1. Extent of Evacuation.

2. Costs of accident to area households.

3. Social and psychological effects (stress, upset, threat, disruption of normal activities).

4. How area person evaluated information. Notification procedures.

5. Attitudes towards TMI, nuclear power and the area.

C. Study Period: Interviewing: 7/23/79 ---- 8/6/79 (5 p.m. to 9:30 p.m.).

D. Sample: N=1500.
Within 15 mile radius +, along transects N, E, S, W. Telephone interview - Random Digit Dialing 55 Interviewers.

E. Sponsor: Nuclear Regulatory Commission.

F. Level of Funding: Not available (Post Licensing Studies of the Socioeconomic Impacts of Nuclear Power Stations [Contract #NRC 04-78-192]). The TMI study is a case study conducted under the auspices of an existing contract to assess the socioeconomic impact of nuclear facilities across the United States.

G. Sources of Additional Funding: None indicated.

H. Sources of Technical or Support Staff:

Chilton Research Associates

Robert Munzenreider, Ph.D.
Pennsylvania State University, Capital Campus

Peter Houts, Ph.D.
Hershey Medical Center

I. Project Director: Dr. James A. Chalmers
Arizona State University
Mountain West Research, Inc.

J. Project Staff: Dr. Cynthia Bullock Flynn
(author of Prelim. Rep.)
University of Kansas
Social Impact Research, Inc.

Chilton Research Services
Radnor, PA
Used for the interviewing and for production of the raw data tape.

Peter Houts, Ph.D. - provided consultation and survey questions on health behavior that were used in his study of Health Behavior funded by the Department of Health.

VI. Study Title: Psychological, Behavioral, and Social Aspects of the Three Mile Island Incident ("The Mental Health of Residents Near the Three Mile Island Reactor: A Comparative Study of Selected Groups").

A. Brief Description: The purpose of this study is to assess the mental health status of the population subgroups in the TMI vicinity who are thought to have been most affected by the stress of the nuclear reactor accident by virtue of their occupation (plant workers), their psychological status (Mental Health system clients), or their familial status (mothers of young children). The mental health status of the vicinity of a non-problematic nuclear power facility. Changes in mental health status will be examined as a function of the anniversary date of the accident (March 28, 1980). The study will assess the role of social support networks in mediating the impact of stress.

B. Study Period: October 1, 1979 to September 30, 1980.
Interviews - 11/1/79 to 12/15/79 and 3/15/80 - 4/30/80.

C. Number of Persons in the Sample:

1. TMI area: 700 within 5-10 mile radius.

2. Comparison Site: 350.

D. Level of Funding: $270,776.

E. Sources of Additional Funding: None.

F. Sources of Technical or Staff Support: Western Psychiatric Institute and Clinic Staff and Students.

G. Project Director:

1. Principal Investigator

a. Evelyn Bromet, Ph.D.
Assistant Professor of Psychiatry and Epidemiology
Director of Psychiatric Epidemiology Training Program at Western Psychiatric Institute and Clinic
University of Pittsburgh
Western Psychiatric Institute and Clinic
3811 O'Hara Street
Pittsburgh, PA 15261
412/624-3372

2. Co-Investigators

a. David Parkinson, M.D.
Medical Consultant to U.S. Steelworkers of America
Associate Professor of Occupational Health at Graduate School of Public Health
University of Pittsburgh
412/624-3041

b. Herbert C. Schulberg, Ph.D.
Professor of Clinical Psychiatry and Psychology
Director of the Office of Educational and Regional Programming
Western Psychiatric Institute and Clinic.

H. Project Staff:

1. Coordinator

Leslie Dunn, M.P.H.
Senior Associate in Research
Associate Project Director
Western Psychiatric Institute
412/624-3372

2. Additional Staff Positions:

a. Onsite supervisor.
b. (1) Statistician 100%.
c. (1) Junior Research Associate 100%.
d. (1) Junior Research Associate 50%.
e. (1) Secretary 50%.
f. Interviewers (20+) - Several years clinical experience. M.S.W. or Ph.D.'s in clinical or counseling psychology.

VII. Study Title: Newberry Township Study

A. Brief Description: In response to community concern, Newberry Township Commissioners contacted Raymond Goldsteen to study the social psychological effects of the TMI accident on the community. Residents are concerned about a) the short-term effects of the accident and b) the long-range effects on residents (and other living creatures) living in close proximity to a nuclear reactor operating at normal capacity. Ray Goldsteen assisted the community by developing a level of interest questionnaire, training volunteers and collating data. Mr. Goldsteen received no monetary compensation for his work.

As a result of the findings and agreement by the Steering Committee to abide by standard research safeguards and procedures, Mr. Goldsteen is collaborating with the health subcommittee to conduct a Newberry Township/Goldsboro Community survey using his questionnaire for which there is extensive comparative data from the TMI area.

B. Study Period: N=284 September 1979.

C. Sponsor: Newberry Township Steering Committee
Health Sub-Committee
Volunteers did all the work.

D. Level of Funding: No funds available. Volunteers did all the work.

E. Additional Funding: None.

F. Source of Technical or Support Staff: Ray Goldsteen on a voluntary basis.

G. Project Director: Linda Dominsoki
Chairperson
Health Committee
Newberry Township Supervisors.
717/938-6993

H. Project Staff: Ten volunteers - female (aged 25 - 40).

I. Procedure: This is a "grass roots" effort, executed by volunteers, arising from profound concern for their health and safety on a short-term and a long-range basis. Survey findings substantiate widespread willingness of community residents to commit themselves to a study. Mr. Goldsteen trained volunteers in the same manner as his paid interview staff with emphasis on not biasing respondents' replies.

APPENDIX G

VIII. Study Title: OMH Pilot Project: Dauphin County MH/MR Centers.

A. Brief Description: This pilot project describes the opinions of clinical supervisors about the service needs and utilization rates within community mental health centers in the two Dauphin County MH/MR Centers as a result of the TMI accident.

This study focuses on:

1. Changes in client contact.
2. Point and period prevalence rates of presenting problems.
3. Service or staff modifications in the event of a crisis.
4. Planning and developing a mental health emergency/disaster plan.

Also deals with staff and client reactions.

B. Study Period: July 18 to August 1, 1979
N 5 Clinical Management Level, Mental Health service providers.
Age range: 30 - 42
Male: 5
Education: 3 M.S.W.
1 M.S.
1 M.D.

C. Sponsor: OMH through Student Intern Program.

D. Level of Funding: None.

E. Additional Source: None.

F. Source of Technical or Staff Support: Office of Mental Health
Victor X. Fongemie
Janet Kelley

G. Project Director: Alva Barnett, M.S.W., M.P.H.
Doctoral Candidate, School of Social Work
University of Pittsburgh
Pittsburgh, PA

H. Project Staff: Project Director.

I. Comments:

1. This is a pilot study for a larger assessment.
2. Has significance because it focuses on mental health system decision makers and, therefore, on mental health system delivery of services.

IX. Study Title: Demographic and Attitudinal Characteristics of TMI Evacuees.

A. Brief Description: A descriptive study of TMI evacuees, this project was conducted during the March 1979 crisis and was designed to measure public opinion of residents of a simple random sample taken from three telephone directories: Middletown, Marietta and Elizabethtown. All respondents live within the 15-mile radius of the TMI nuclear power plant.

B. Study Period: April 2, 1979 through April 8, 1979.

C. Sample: N=375.

1. Sex - Male 47%
   Female 53%.

2. Age - 18 - 24 12%
   25 - 34 24%
   35 - 49 24%
   50 + 40%.

3. Education - Less than High School - 28%
   High School - 42%
   High School + 14%
   Completed College - 16%.

4. Distance of residence from plant

   0 - 5 miles - 52%
   6 - 15 miles - 48%.

5. Evacuated Area - Yes - 42%
   No - 55%.

D. Methodology

1. Eleven item questionnaire.

2. Multi-stage, simple random sample.

3. Residential telephone directories of Middletown, Marietta and Elizabethtown.

4. Telephone interviews.

E. Sponsor: Social Research Center
Elizabethtown College
Cross Reference: Lane Intelligence Journal.

F. Level of Funding: Approximately $1,000.

G. Sources of Additional Funding: None.

Lane Intelligence Journal bought the results from Elizabethtown College.

H. Sources of Technical or Staff Support: Social Research Center.

I. Project Director: Donald B. Kraybill, Ph.D.
Department of Sociology
Elizabethtown College
Elizabethtown, PA 17022
Office: 717/367-1151 Extension 310

J. Project Staff: Trained staff at the Social Research Center, Elizabethtown College (10).

X. Study Title: TMI Stress Study

A. Brief Description: This study focuses on the stress impact, coping behaviors, social support systems, and the impact on the health delivery systems.

B. Study Period: April 10, 1979 to June 1979 plus follow-up interview in January 1980.

C. Sample: 692 - Heads of Households - five-mile radius in first study and 300 follow-up interviews in January.

D. Methodology: 110 item questionnaire by telephone; random digit dialing.

E. Sponsor: Pennsylvania Department of Health.

F. Level of Funding: $48,000.

G. Source of Additional Funding: None.

H. Sources of Technical or Support Staff: Chilton Research Associates
Radnor, PA.

I. Project Director: Peter Houts, Ph.D.
Hershey Medical Center
Behavior Sciences Department
Hershey, PA 17033
717/ 534-8265

J. State of Report: Computer printouts

K. Comments:

1. Dr. Houts provided valuable assistance to the President's Commission on TMI.

2. Dr. Houts' Instrument includes (but is not limited to) the following items:

a. Distance of residence from TMI.
b. Demographic data.
c. History of health problems.
d. Pregnancy during TMI.
e. Information source regarding health effects of TMI.
f. Utilization of the health care delivery system.
g. Symptomology.
h. Evacuation behavior.
i. Dynamics of and effects of evacuation behavior.
j. Coping strategies.

APPENDIX G

3. Final report to be submitted to Pennsylvania Department of Health by September 1980.

4. We will be reporting some of our results to the TMI Panel on December 11, 1979.

XI. Study Title: The Rutgers Study - Responses of Impacted Populations to the TMI Nuclear Reactor Accident: An Initial Assessment

A. Reference: Discussion Paper Number 13, (Mitchell, Jas, K., Susan L. Cutter, Kent Barnes and James Brosius), Rutgers University, New Brunswick, New Yersey, 1979.

B. Brief Description: Analyses the processes by which people assess risks and the preparedness for emergency evacuation.

C. Study Period: April 21, 1979 to May 21, 1979. N=360.

D. Sponsor: Department of Environmental Resources, Cook College, Rutgers University and New Jersey Agricultural Experiment Station.

E. Investigator: James K. Mitchell
Associate Professor
Department of Environmental Resources
Cook College
Rutgers University
New Brunswick, New Jersey 09803
201/932-9633 or 201/932-7809

F. Methodology:

1. Mailed Questionnaires - 26 item.

    a. Sources of information, reliability, personal assessment of dangers.
    b. Evac B.
    c. Perceived consequences of threat.
    d. Demographic and social questions.

2. Stratified random sample based on distance and direction. Resulted in 20 sampling units - from 5 zones (0-5 to 20+ mile radius) x 4 quadrants (NE, SE, SW, NW).

    a. N From telephone directories.
    b. N 359.
    922 questionnaires mailed.
    39% R rate.
    c. N characteristics.

        1. 85% male.
        2. 87% homeowners.
        3. 83% within 20-mile radius.
        4. 16% over 60 years of age.
        5. 42% 40 - 59.
        39% 20 - 39.
        6. 14% did not complete high school.
        23% - four year college graduate.
        7. Pre-school children - 20%.
        8. Pregnant women - 2%.

XII. Study Title: The Organizational Development of Social Movements as a Result of the Three Mile Island Nuclear Accident.

A. Brief Description: The purpose of this study is to collect data on the background, structure, and functioning of area groups through in-depth interviews, participant observation and historical research.

B. Study Period: 10/15/79 to 10/15/80.

C. Number of Persons in Sample: Not available.

D. Sponsor: National Science Foundation.

E. Level of Funding: $27,000.

F. Source(s)of Additional Funding: None.

G. Source(s) of Technical or Staff Support: None.

H. Project Director: Edward J. Walsh
Assistant Professor of Sociology
Department of Sociology
Pennsylvania State University
University Park, PA 16802
814/865-1694

I. Project Staff: None.

XIII. Study Title: Evacuation Planning in the TMI Accident.

A. Brief Description: Focuses on government agency response to the TMI accident. Government agencies respond to crisis situations based on scenarios of pre-conceived disasters, crises, etc. The TMI nuclear plant accident presented a very different scenario.

B. Study Period: 3/20/79 to end of July 1979.

C. Sample: N=100 (approximation).

D. Sponsor: Federal Emergency Management Agency.

E. Level of Funding: $40,000.

F. Source of Additional Funding: None.

G. Source of Technical Support: Human Science Research, Inc., McLean, VA.

H. Project Director: William Chenault, Ph.D.
Human Science Research, Inc.
McLean, VA
703/893-5200

I. Project Staff: Geth Reichlin
Department of Sociology
University of Pittsburgh
412/624-4141

Gary Hibert, M.A.
Human Sciences Research, Inc.
McLean, VA

XIV. Study Title: An Initial Exploration of Events and Values Affecting Professional Performance During Medical Disaster Mobilization.

A. Brief Description: Explores factors affecting human/professional behavior patterns influencing professional performance. Identifies critical events impacting health care delivery and explores decision-making processes.

B. Study Period: April through September 1979.

C. Sample: N=Command Group: 27.
General Hospital Employees: 86.

D. Sponsor: Robert Wood Johnson Foundation.

E. Level of Funding: $15,000.

F. Source of Additional Funding: None.

G. Source of Technical or Staff Support: None.

H. Project Director: E.A. Vastyan
Chairman, Humanities Department
Penn State Hershey Medical Center
Hershey, PA
717/534-8778

I. Project Staff: John Burnside, M.D.
Chief, Division of Internal Medicine

Robert Sevensky, Ph.D.
Assistant Professor of Humanities

David Hufford, Ph.D.
Assistant Professor of Behavioral Science.

APPENDIX G

Mental Health Studies on TMI

Study Title	Completion Date
1. Behavior Effects Task Force Report President's Commission on TMI	October 31, 1979
2. The Reaction to the Reactor Accident Dickinson College	September 1979
3. The Middletown Telethon Martin Smith, Ph.D.	April 21, 1979
4. Response of Adolescents to TMI Glen Bartlett, M.D., Ph.D.	May 1979
5. NIMH/WPIC Mental Health Assessment Evelyn Bromet, Ph.D.	September 30, 1980
6. TMI Telephone Survey (NRC) Cynthia Flynn, Ph.D.	August 6, 1979
7. Newberry Township Study Raymond Goldsteen, M.A.	September 1979
8. OMH Pilot Project: Dauphin Co. MH/MR Centers Alva Barnett, M.S.W., M.P.H.	August 1, 1979 To be continued
9. The Rutgers Study James K. Mitchell, Ph.D.	June 1979
10. Demographic and Attitudinal Characteristics of TMI Evacuees Donald Kraybill, Ph.D.	April 8, 1979
11. Events and Values Affecting Professional Performance E.A. Vastyan, M.A.	September 1979
12. Evacuation Planning (FEMA) William Chenault, Ph.D.	July 1979
13. TMI Stress Study (Hershey Medical Center) Peter Houts, Ph.D.	September 1980
14. The Organizational Development of Social Movements Edward Walsh	October 15, 1980

APPENDIX H

TMI ADVISORY PANEL TO THE PENNSYLVANIA DEPARTMENT OF HEALTH ON HEALTH RESEARCH STUDIES

The Chairman of the panel is Dr. Leroy Burney, M.D., former Surgeon-General, U.S. Public Health Service, and former President of the Milbank Memorial Fund. Other members include Victor Bond, M.D., Ph.D., Associate Director, Brookhaven National Laboratory (Radiation Biology); Calvin Fredericks, Ph.D., Chief of Disaster Systems and Emergency Mental Health, National Institute of Mental Health (Mental Health); George B. Hutchison, M.D., M.P.H., Professor of Epidemiology, Harvard University School of Public Health (Radiation Epidemiology); Troyce Jones, Ph.D., Research Staff Member, Health and Safety Research Division of Oak Ridge National Laboratory (Radiation Physics); Morton Kramer, Sc.D., Professor, Department of Mental Hygiene, Johns Hopkins University School of Hygiene and Public Health (Mental Health); Abraham Lilienfeld, M.D., University Distinguished Service Professor of Epidemiology, Johns Hopkins University School of Hygiene and Public Health (Epidemiology); Evan Pattishal, M.D., Ph.D., Professor and Chairman, Department of Behavioral Science, Hershey Medical Center (Behavioral Science); Mark Perlman, Ph.D., University Professor of Economics, University of Pittsburgh (Health Economics); P.W. Purdom, Ph.D., Director, Environmental Studies Institute, Drexel University (Environmental Science); and Leonard Sagan, M.D., Program Manager, Biomedical Studies, Electrical Power Research Institute (Radiation Medicine). Another member who died recently was Professor Jerome Cornfield, Director of The Biostatistics Center, George Washington University. He has recently been replaced by Professor Paul Sheehe, D.Sc., Department of Preventive Medicine, Up-State Medical Center, Syracuse University (Biostatistics).

APPENDIX I

SMALL BUSINESS ADMINISTRATION ECONOMIC INJURY LOAN

PROGRAM STATISTICS AS OF JANUARY 31, 1980

a. Number of interviews ---------------------------490

b. Number of loans accepted ----------------------76

c. Amount of loans accepted ----------------------$3,918,000.00

d. Number of applications withdrawn --------------4

e. Amount of withdrawn applications --------------$197,000.00

f. Number of applications declined ---------------36

g. Amount of applications declined ---------------$2,668,000.00

h. Number of applications still in processing ----18

i. Number of loans approved ----------------------22

j. Amount of approved loans ----------------------$510,000.00

APPENDIX J

EMERGENCY MANAGEMENT SUBCOMMITTEE
PENNSYLVANIA COMMISSION ON
THREE MILE ISLAND

As a result of many meetings, the Emergency Management Subcommittee has formulated recommendations for certain standards a county nuclear emergency response plan should meet.

1. Desirable features of such a plan include:

- Warning System

  Provisions should be included for a warning system capable of alerting people living within a ten-mile radius of the nuclear facility.

  Methods of notification could include civil defense sirens, radio and television broadcasts, public address systems, and tone-alert weather radios.

- Clearly Outlined Evacuation and other Protective Actions

  The plan should include an explanation of warning signals, protective actions including taking cover, administering potassium iodide, evacuation procedures, evacuation routes including maps, public shelter locations, instructions on protecting foodstuffs, livestock, etc....

- Provisions for Mass Care in Host Areas

  Risk counties should coordinate with host counties to plan for mass care of at least half the population to be evacuated. Evacuation facilities should be located at least 25 miles from the nuclear facility.

- Pooling of Vehicles and Equipment

  Planners should consider regional pooling of transportation and mass care equipment.

- Public Awareness

  Planners should conduct "town meetings" at which emergency plans could be explained and public questions could be answered.

- Yearly Tests for Effectiveness

  Before a nuclear facility is allowed to begin operation, all emergency plans (state, county, local, utility) should be tested in an exercise involving emergency personnel only. Plans should be tested at least once a year. To evaluate the success of each exercise, a set of approp- riate questions similar to those found in the attachment to this Appendix could be developed.

- Trained Staff

An Emergency Operations Center staff of professionals augmented by qualified volunteers should be organized and trained.

- An Emergency Operations Center

An Emergency Operations Center should be available on a stand-by basis and equipped with telephone lines and other necessary equipment. It should be located at least five miles from the nuclear facility and have adequate parking and interior space available. Some schools and county court houses may be suitable.

- Provisions for Schools

Provisions for use of public and private school facilities should be included in emergency plans. If an evacuation is ordered during school hours, an area should be designated for parents to reunite with their children. Further, the authority to close schools should be clearly designated in the plan.

EMERGENCY MANAGEMENT SUBCOMMITTEE

1. Are citizens prepared for an emergency evacuation announcement?
2. Do citizens know the warning signals?
3. Do citizens know how to decontaminate?
4. How large is the evacuation area--5, 20, 40, 70, 250, 500 miles?
5. How will citizens know which routes to take for evacuation?
6. Are certain state and state aid highways closed in case of a disaster?
7. During school hours, are children to be evacuated out by bus?
8. What transportation is available to those without cars?
9. What provisions for reuniting families if children are in school, mother at home, husband at work?
10. What authorities are in charge and do citizens know this?
11. Are government officials prepared?
12. Are city hospitals prepared?
13. Are doctors and personnel trained to handle radiation victims?
14. Will some hospitals refuse to treat radiation victims because it is costly to decontaminate their emergency rooms?
15. Are hospitals prepared to evacuate?
16. Are nursing homes prepared to evacuate? Prisons?
17. Will volunteer rescuers have qualms about going into a radioactive zone?
18. Will contaminated people be forcibly stopped from entering a noncontaminated zone?
19. How much monitoring equipment is available and to what extent can this equipment monitor alpha, beta and gamma?
20. How long does a meltdown take?
21. How long does it take to evacuate?
22. What part do wind and weather play in an evacuation?
23. What provisions are made to cope with a deep snow, fog, driving rain, hurricanes, dust storms or a combination of inclement weather conditions?
24. Are emergency plans being updated frequently?
25. If full evacuation testing of units being done within one year of a reactor's being fueled as required by NRC regulations?
26. Are evacuation instructions being sent at least once each year in all electric bills to all customers?
27. Are emergency plans available to neighboring states when reactors may be just across the river or state or county boundaries?
28. Would factories, residences, military bases--be given priority treatment in decontamination?
29. What provisions for evacuation of increased populations due to tourists and/or reacreational activities?
30. Are there enough trained personnel outside the immediate reactor site who would know how to handle and treat radiation victims?
31. Do hospitals have disconnects to prevent dissemination of radioactive material through the general air conditioning systems?

32. Since citizens are not able to sense radiation by seeing, smelling or hearing--how would authorities persuade people to go at all in the absence of any visible or sensible threat when the citizens have been assured over and aver again that nothing will ever happen?
33. Would evacuees be willing to part from their property on a long-term basis?
34. Would evacuees understand they cannot return to an area to begin cleaning up because this must be done by decontaminated crews?
35. Who will pay and make up the decontamination crews?
36. How will runoff from contaminated areas be prevented such as via rivers, streams, etc.?
37. If citizens perceive they will have to remain out of an area, will they try to stock up on food and gasoline causing traffic congestion?
38. Will farmers be willing to abandon their livestock on a long-term basis?
39. Do escape routes bring people closer to the plant?
40. What if a tornado causes fallen trees and cuts off escape routes?
41. Who pays the evacuation expenses of citizens living away from home?
42. How do citizens get the cash reimbursement for their expenses without waiting for long periods of time and without a maze of red tape?
43. How would looting be prevented?
44. What instruments for measuring radioactivity are in use today? How many? What do they cost?
45. Would civil defense fallout instruments be adequate for measuring coremelt releases?
46. Will sufficient doctors' and nurses' clothing changes be available?
47. Will sufficient lead containers be available to enable the saving of all contaminated bedding, clothing, wastes, etc. without hazard to personnel from the presence of gamma emitters?
48. How do you safely store a supply of drinking water?
49. Does the utility have the ability to assess (within ½ hour or less) recommendations for consequent actions to state and local officials?
50. How big must a city be before it is considered unevacuable in the required time-frame?
51. What would city governments do if they could not evacuate their citizens fast enough?
52. Why does section 13.3 of the Regulatory Guide 1.70.14 Dec 74, specify that emergency response plans for neighboring states be described in the Safety Analysis Report (SAR) "if any part of the neighboring state is . . . within 4 miles of the facility."? Why 4 miles?
53. With a pressure vessel rupture, no warning time would be given. What would the consequences of the RSS accidents be then inasmuch as protection measures could most likely not be taken in time?

54. In such a case, what would the consequence of just "sheltering" be?
55. In the worst case accident when people would die immediately, what would be done with the bodies? When? Where?
56. What would become of the contaminated (dead and injured) wildlife and other domestic animals? Roosting birds will carry contamination from ledges of city buildings to areas as much as 40 miles away?
57. Are any individuals in the emergency response organization being given more responsibility then they can handle?

A PARTIAL LIST OF REFERENCES

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2. Logs of the Pennsylvania Emergency Management Agency, March 28, 1979 to April 2, 1979.

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4. Disaster Operations Plan, Commonwealth of Pennsylvania, July, 1977.

5. Pennsylvania Department of Agriculture Nuclear Emergency Response Plan, 1966.

6. Catalog of Research Programs Identified by the Pennsylvania Department of Health, 1979.

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8. Three Mile Island Socio-Economic Impact Study, Governor's Office of Policy and Planning, 1979.

9. Nuclear Insurance/Indemnification: The Price-Anderson Act, Issue Brief 1B-75013, Library of Congress, Congressional Research Service.

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16. Natural Radiation Exposure in the United States, EPA Report ORP/SID 72-1, U.S. Environmental Protection Agency.

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18. Three Mile Island Unit 2 Reactor Building Program Safety Analysis and Environmental Report, Metropolitan Edison Company.

19. Data from Central Penn Multi-List, Inc.

20. Financial Practices of General Public Utilities Corporation, 1968 through March 1979, M.J. Whitman Co., Inc.

21. Electricity Demand in the United States: An Econometric Analysis, The Oak Ridge National Laboratory.

22. Disaster Insurance Protection: Public Policy Lessons, Howard Kunreyther, et al.

23. Economic Impact of the Accident at Three Mile Island, SRI International, 1979.

24. Factors Influencing the Economic Development of Pennsylvania, Wharton Applied Research Center, University of Pennsylvania.

25. Report of the Office of Chief Counsel on Emergency Preparedness to the President's Commission on the Accident at Three Mile Island, 1979.

26. Report of the Office of Chief Counsel on Emergency Response to the President's Commission on the Accident at Three Mile Island, 1979.

27. Testimony from hearings conducted by the Pennsylvania House of Representatives Select Committee on Three Mile Island.

28. Testimony from hearings conducted by the President's Commission on the Accident at Three Mile Island.

29. Federal Response Plan for Peacetime Nuclear Emergencies, Federal Preparedness Agency, now the Federal Emergency Management Agency.

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34. Atoms and the Law, E. Stason, S. Estep, and W. Pierce.

35. U.S. v. City of New York, 463 F. Supp. 604 (S.D. N.Y. 1979).

36. Pacific Legal Foundation v. State Commission, 472 F. Supp. 191 (S.D. Cal. 1979).

37. Slaying the Nuclear Giants: Is California's New Nuclear Power Plant Siting Legislation Shielding Against the Attack of Federal Preemption?, 8 Pacific L.J. 741, 766 (1977).

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GLOSSARY

Atomic Safety and Licensing Board - A board appointed by the NRC to conduct the licensing proceedings for new nuclear power plants, as the need arises.

Auxiliary building - A structure housing a variety of equipment and large tanks necessary for the operation of the reactor.

Background radiation - Radiation arising from natural radioactive materials always present in the environment, including solar and cosmic radiation and radioactive elements in the upper atmosphere, the ground, building materials, and the human body.

Beta particles - High-energy electrons; a form of ionizing radiation that normally is stopped by the skin, or a very thin sheet of metal.

Central Penn Multi-List, Inc. - A listing of all property for sale by member realtors in the greater Harrisburg area.

Cesium-134 - Radioactive form of cesium, with a half-life of two years.

Cesium-137 - A radioactive form of cesium, with a half-life of 30 years. Emits both gamma and beta radiation.

Class-action suit - A legal action undertaken by one or more plaintiffs on behalf of themselves or others having an identical interest in the alleged wrong.

Congenital/neonatal hypothyroidism - A condition present at birth or within the first month after birth in which there is deficient activity of the thyroid gland, resulting in a lowered metabolic rate and general loss of vigor.

Containment building - The structure housing the nuclear reactor; intended to contain radioactive solids, gases, and water that might be released from the reactor vessel in an accident.

Core - The central part of a nuclear reactor that contains the fuel and produces the heat.

Debenture - A certificate or voucher acknowledging a debt.

Disaster Operations Plan - A written response plan for all types of emergencies and disasters occurring within the Commonwealth. Prepared and implemented by the Pennsylvania Emergency Management Agency.

Duty Officer - A person who provides responsible coverage for the designated Commonwealth agency during non-working hours.

Econometric - Application of statistical methods to the study of economic data and problems.

Endocrinologist - A scientist specializing in the study of the endocrine glands.

Environmental assessment report - An evaluation of the environmental impact of the stated activity.

Epidemiologist - A scientist specializing in study of the incidence, distribution and control of disease in a population.

Federal Disaster Relief Act - A special Congressional act providing federal assistance to state and local governments during emergencies and major disasters.

Fission - The splitting apart of a heavy atomic nucleus into two or more parts when a neutron strikes the nucleus. The splitting releases a large amount of energy.

Fuel handling building - One of the adjacent structures to the containment building where uranium fuel rods are stored.

Gamma rays - High-energy electromatic radiation; a form of ionizing radiation of higher energy than X-rays that penetrates very deep into body tissues.

General emergency - Declared by the utility when an incident at a nuclear power plant poses a potentially serious threat of radiation releases that could affect the general public.

Genetic diseases or defects - Health defects inherited by a child from the mother and/or father.

Half-life - The time required for half of a given radioactive substance to decay. The radioactivity of an isotope with a half-life of five days would be reduced by one-half in a five-day period. After the second five day period, the radioactivity would be one-fourth of the original, and so on.

Health physics - The practice of protecting humans and their environment from the possible hazards o radiation.

Hydrogen bubble - A volume of hydrogen gas in the top of the reactor vessel.

Iodine-131 - A radioactive form of iodine, with a half-life of 8.1 days, that can be absorbed by the human thyroid if inhaled or ingested and cause non-cancerous or cancerous growth.

Ion - An atom or group of atoms that carries a positive or negative charge.

Ion exchange - A chemical reaction involving the exchange of ions present in a solid with ions of like charge present in a surrounding solution. Used in the EPICORE-II system for removal of radioactive isotopes from the water.

Intervenor - One who intervenes as a third party in a legal proceeding.

Krypton-85 - A radioactive noble gas, with a half-life of 10.7 years, that is not absorbed by body tissues and is soon eliminated by the body if inhaled or ingested.

Loss-of-coolant accident - An accident involving a broken pipe, stuck-open valve, or other leak in the reactor coolant system that results in a loss of the water cooling the reactor core.

Low population zone - An NRC term to define the area around the reactor with low population density. This is the area for which evacuation had to be planned for under NRC rules and regulations.

Middle Atlantic Federal Regional Council - A coordinting council for a group of federal domestic agencies.

Millirem - One-thousandth of a rem; see rem.

Negative pressure - Less than the pressure of the atmosphere.

Person-rem - The sum of the individual doses received by each member of a certain group or population. It is used to estimate the incremental number of health effects cases which a radiation exposure might produce in the given population. It is not used to determine which individuals in the population might be affected or in dealing with individual medical care needs.

Plume - Radioactive material released to the atmosphere from a stack or point source which dissipates with distance depending upon wind speed and other atmospheric conditions. Its form is similar to smoke released from a smoke stack.

Potassium iodide - A chemical that readily enters the thyroid gland when ingested. If taken in sufficient quantity prior to exposure to radioactive iodine, it can prevent the thyroid from absorbing any of the potentially harmful radioactive iodine-131.

Primary system - The system containing water that cools the reactor core and carries away heat. Also called the reactor coolant system.

Radiation Management Corporation - An independent company which maintains dosimetry stations around the Three Mile Island facility as a quality check of the utility's environmental surveillance program.

Radiation survey probe - A portable radiation detection device.

Reactor head - Removable top on the reactor vessel.

Reactor vessel - The steel tank containing the reactor core.

Rem - A standard unit of radiation dose. Frequently radiation dose is measured in millirems for low-level radiation; 1,000 millirem equal one rem.

Resins - Chemical compounds which selectively attract other elements and compounds. Used in the EPICORE-II system to attract radioactive isotopes.

Site emergency - Declared by the utility when an incident at a nuclear power plant threatens the uncontrolled release of radioactivity into the immediate area of the plant.

State Tax Equalization Board - A Commonwealth agency whose main function is to determine annually the aggregate market value of real property in the Commonwealth.

Strontium-90 - A radioactive form of strontium, with a half-life of 28 years. Emits only gamma radiation.

Thermoluminescent dosimeter (TLD) - A device to measure environmental radiation.

Wet-chemistry and radiation counting room facility - Radioisotope analysis center where radiation detection equipment is located. Would contain gamma ray analyzer and equipment for chemical separation of radioisotopes for identification purposes.

Whole body scan - A detailed examination of the human body for the presence or localization of radioactive material.

Xenon-133 - A radioactive noble gas with a half-life of 5.3 days that is not absorbed by the body tissues and is soon eliminated by the body if inhaled or ingested. Xexon-133 was the principle radioactive isotope released to the environment during the TMI accident.

OA-501 12-67 COMMONWEALTH OF PENNSYLVANIA

May 15, 1980

SUBJECT: DER Review of NRC's Environmental Assessment for Decontamination of the TMI-2 Reactor Building

TO: The Hon. Dick L. Thornburgh
Governor of Pennsylvania

FROM: Clifford L. Jones, Secretary
Department of Environmental Resources

The Department of Environmental Resources has reviewed the Nuclear Regulatory Commission's Environmental Assessment for Decontamination of the TMI-2 Reactor Building Atmosphere and submits the following report:

In conducting our review, the department considered the following technical issues:

(1) the ongoing need to gain greater access to the reactor building for maintenance and decontamination in order to lessen the unknown risks that may be inherent in delays for uncertain benefits,

(2) the comparison of the risks from accidents between the alternatives,

(3) the comparison of occupational and public exposure between the alternatives,

(4) the insignificant risk to the public from radiation exposures for any of the alternatives when compared to the variation in natural background radiation, and the extensive monitoring program that will assure these goals can be achieved.

Based on our evaluation using these issues as a basis, we have concluded that controlled purging using the hydrogen control system, as recommended by the NRC staff, is the preferrable alternative for removing the Krypton from the reactor building atmosphere.

If other issues, such as psychological stress, which by their nature are intrinsically more difficult to evaluate, are deemed to override the technical issues, then the other alternatives which should be considered in their order of desirability are listed below:

(1) A purging procedure which allows the release to be completed in a very short period of time. This procedure would not be desirable unless used in conjunction with an enhanced dispersion

system such as a more elevated release point or a heated discharge.

(2) The selective absorption system and cryogenic processing system which should be reevaluated to determine whether they could be made operational within a reasonable period of time.

Regardless of the final determination, the hydrogen control system and the reactor building purge system should be made immediately available and the procedures in place to allow a controlled purging of the reactor building in the event that an unexpected occurrence would require immediate action to protect public health and safety.

In evaluating these alternatives, the following criteria should be taken into consideration:

(1) Six months is the maximum reasonable delay that should be incurred for installation and testing of any alternative. This is primarily due to the necessity for accelerating the decontamination process to assure protection of public health and safety from unknown risks from unnecessary delays. Any of the processing alternatives would require several months to complete the decontamination effort under ideal conditions. Considering previous experience with new systems, operational problems could extend the total time to well over a year for completion. In addition, the Submerged Demineralization System for decontamination of the reactor building water should be operational within less than six months; and since this effort will be more critical to completing the reactor building decontamination, the decontamination of the reactor building atmosphere should not be in a position to interfere with this effort.

(2) Since the psychological stress of the public is one of the most difficult problems to address in the evaluation of the alternatives, consideration should be given to the negative aspects of this phenomena due to delays; and the possibility that the highly visible nature of some of the enhanced dispersion alternatives could exascerbate rather than alleviate this problem. In addition, consideration should be given to the potential hazard to commercial aircraft from certain enhanced dispersion alternatives due to the location of the plant near an approach path to the Harrisburg International Airport.

Our specific comments on the Environmental Assessment by section are as follows:

Section 4.2 - It appears that the most important justification for near-term decontamination of the reactor building atmosphere has to do with the unknown condition of the core and the continuing ability to assure the reactor is subcritical. The only way this condition could not be assured is to assume that a large enough quantity of control rod material has melted from the core and that somehow a

sufficient amount of unborated water could enter the core. Considering the emergency core cooling systems which are available to add borated water, this would appear to be an extremely unlikely scenario.

There needs to be more detailed justification of the need to have less limited access to the reactor building in the near term. The only critical maintenance task which was unidentified was the replacement of out-of-core neutron detectors. An estimate of the additional occupational exposure to perform this task prior to krypton removal would be helpful.

Section 5.2 - Other radioisotopes which may be present in the reactor building atmosphere need to be quantified, particularly strontium 89/90 and iodine 129. It should then be explained in greater detail why their concentrations would be insignificant off site.

Section 6.1.2 - The use of real time continuous off-site monitoring during purging should be utilized to the fullest extent in providing feedback to control the release rate.

References to meterological data or conditions should be established for venting periods.

Specific consideration should be given to the following on limiting the conditions for venting:

1. Night time hours.
2. Wind velocity of 7 mph at the surface during venting.
3. Sky cover is greater than 50%.

In addition to specific favorable meteorological conditions, purge rates could be specified that are proportional to wind speed in excess of 7 mph.

Calculations of accumulated off-site doses should be made at all off-site monitors. As presently written, it is not clear that all monitors will be considered.

Section 6.1.4 - The estimated cumulative total population exposure should be given in this section, as well as its sensitivity to change in the release rate and/or meteorological conditions. In addition, some perspective should be provided to compare these exposures with natural background radiation and the variation in natural background radiation.

Section 6.5.2 - A time period of 1½ to 2 years for designing and installing the selective absorption system appears somewhat unreasonable. If this concept is at the same level of development as the cryogenic system, but much less complex using off-the-shelf items, it therefore should be available in less time than the cryogenic system. More justification should be provided for the estimated schedule.

Section 6.6 - The administrative off-site skin dose limit for this purge variation appears to change from 0.1 mrm/hr. (using the hydrogen control system only) to 3 mrm/hr. This is perceptually a very large increase and approaches the dose rates during the accident. Although the maximum individual cumulative exposure limits are the same as the longer purge, the total population exposures could increase slightly depending on the predominant wind direction over the shorter period of time. In addition, the total time for completing the evolution could be much greater than five days due to more stringent meteorological requirements.

Due to the fact that this method results in larger incremental exposures to the public and to account for rapidly changing meteorological conditions and possible terrain effects, a much more extensive monitoring program would be required to assure that the regulatory limits were not exceeded. The problems with coordination of all these efforts coupled with the limited conditions would tend to make this option somewhat undesirable unless used with an enhanced dispersion system which makes this coordination less critical.

Commonwealth of Pennsylvania

DEPARTMENT OF HEALTH

HARRISBURG

THE SECRETARY

May 15, 1980

The Honorable Dick Thornburgh
Governor of Pennsylvania
Room 225, Main Capitol Bldg.
Harrisburg, PA 17120

RE: Stress and Venting of Krypton at Three Mile Island

Dear Governor Thornburgh:

The issue of stress is addressed by the Union of Concerned Scientists in their consideration of the krypton present in the containment building and its possible venting.

I discussed the concept of psychological stress as it might relate to the various proposals for venting krypton gas at Three Mile Island with Abram Hostetter, M.D., psychiatrist and former Regional HSA President.

Dr. Hostetter recommends that venting be accomplished in as brief a time period as possible. He stated that a delay in venting or prolonged venting would be more apt to incite stress or prolong stress than would more rapid venting, despite the possibility of slightly higher levels of radiation exposure attendant with the latter method. Dr. Hostetter, in consideration of the stress that is apt to obtain among that segment of the population who might remain concerned about adverse health affects despite the numerous statements to the contrary that have been made by the Union of Concerned Scientists and others, emphasizes the need to inform the citizens of the particulars of any venting process chosen. Specifically, the people should be informed of the prospective time for venting and made aware that there would be no adverse health effects from that process.

For my part, I would like to add that there is a segment of the population that does not feel stressed by the presence of TMI or the krypton issue per se, but is stressed by those who express concerns over TMI and krypton. There is natural concern about members of society who talk of marching in the streets, rioting and the like. There is also concern that if steps are not taken in the near future to decontaminate the containment building, that failure of

POST OFFICE BOX 90, HARRISBURG, PA. 17120 717-787-6436

Hon. Dick Thornburgh
May 15, 1980
Page 2

maintenance machinery in the building may occur and might result in an uncontrollable release of radioactive material. Thus, some elements of society are in effect being stressed by those whose expressed concerns and threats may be delaying the decontamination process.

In summary the Health Department recommends that in an effort to minimize stress, both present and accumulative, that venting of krypton be accomplished as soon as possible and in as brief a time period as possible.

Sincerely,

H. Arnold Muller

H. Arnold Muller, M.D.
Secretary of Health

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF PUBLIC WELFARE

HELEN B. O'BANNON
SECRETARY

May 15, 1980

TELEPHONE NUMBER
(717) 787-2600/3600

The Honorable Dick Thornburgh
Governor of Pennsylvania
Harrisburg, Pennsylvania 17120

Dear Governor Thornburgh:

You have requested my opinion on psychological stress as it relates to the various decontamination options under consideration for Three Mile Island. Following consultation with Scott H. Nelson, M.D., Deputy Secretary for Mental Health, and appropriate staff from the Office of Mental Health, I have reached the following conclusions.

The available psychological research indicates that for some in the immediate area, mental stress did result and continues to result from the TMI accident. There are many sources of stress in people's lives, and while TMI may add to those, it is not expected, barring unforeseen developments, to lead to chronic mental or physical health problems within the population. While anxiety cannot be eliminated, the way in which the TMI clean-up is handled can minimize it. One point here is key: the availability to the public of accurate and timely information which they can trust, and use to help them cope with stress-producing situations.

The symptoms of stress are cumulative and can mount over time. One factor which can be expected to add considerably is continued indecision on how to proceed with the TMI clean-up. While the venting of krypton may be more stressful to some, continued inaction and the containment of radioactive wastes in a facility that was not designed for long-term storage may also produce anxiety. If the perceived danger of venting krypton decreases, the symptoms of anxiety and depression generated by the idea of venting also will decrease.

There will be individuals who will perceive danger in venting, despite their access to accurate and timely information, and for these people symptoms of anxiety will continue. However, prolonging the TMI clean-up will most certainly increase the mental health effects and their accompanying behaviors. Making a decision on venting and proceeding in a responsible fashion could in the long run minimize stress and reduce the potential for anxiety and depression among the population that lives near TMI.

If a decision is made by the NRC to vent krypton gas, a network should be created to provide the public with accurate and timely information on what is happening and when. The Health Department's hotline, county crisis intervention centers and mental health programs should be prepared to provide this information. The Office of Mental Health is prepared to help train persons who would operate these phone lines. The Commonwealth should be ready to make a full and complete report to the public on what is happening before, during and after the venting.

The people of Central Pennsylvania have demonstrated remarkable strength during the entire unsettling TMI episode, and I am certain that under your carefully reasoned leadership, in a climate in which the public is kept fully informed with reliable information from government agencies and the utility company, this strength will prevail.

I hope my comments are of help to you in your deliberations.

Sincerely,

Helen B. O'Bannon

Helen B. O'Bannon

PRELIMINARY DRAFT

COMPARISON OF CONTROLLED PURGE AND APPLICATION

OF THE SELECTIVE ABSORPTION PROCESS ALTERNATIVES

FOR DECONTAMINATION OF TMI-2 REACTOR BUILDING ATMOSPHERE

C. D. Thomas, Jr.
P. G. Voilleque
J. E. Cline
D. T. Pence
B. E. Kirstein
C. A. Pelletier

Science Applications, Inc.

May 1980

PRELIMINARY DRAFT

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

FIGURES

TABLES

Section 1
INTRODUCTION

Background information on the current status and planned recovery operations at the Three Mile Island Unit Two (TMI-2) nuclear power plant is presented in this section. The first subsection discusses the current status of the reactor core and airborne radioactivity levels within the containment. The need for reentry into the TMI-2 reactor containment building is then discussed. The doses due to the radioactive krypton gas (^{85}Kr) and other radiation sources in the containment are presented in subsection 1.3. The fourth subsection briefly reviews the alternatives for ^{85}Kr removal, the conclusions reached in previous evaluations, and the need for the present evaluation. Subsection 1.5 briefly discusses the pertinent regulations and subsection 1.6 describes the present world atmospheric inventory and other sources of ^{85}Kr in the environment.

1.1 Status of TMI-2 Reactor Core and Containment Building

The exact condition of the reactor core at TMI-2 is presently unknown. There have been several estimates of the damage but until the core can be examined there is no way to determine its actual condition. It is generally accepted, however, that the core did undergo severe damage resulting in disruption of the core geometry. The damaged fuel in the reactor vessel remains in a safe shutdown mode, with natural circulation cooling. Only one core neutron monitoring device is presently operable. It provides the only real time information confirming the safe shutdown configuration. The core is in corrosive environment (pH 8) as a result of the addition of sodium hydroxide to the coolant during the accident.

There are three areas of increasing concern about the status of the core. The first is that of a further loss of coolant may occur due to corrosion. The primary coolant is itself corrosive and portion of the reactor coolant system piping is submerged in corrosive sump water. The primary coolant pump seals are another possible source of leakage. Further loss of primary coolant is not a great concern, but having the system far beyond design conditions is not a comfortable position. The second area of concern is a possible change in fuel geometry. A core geometry shift could disrupt the present coolant flow paths and change the core cooling situation. The fuel itself may be corroded and further distributed throughout the primary system, increasing the difficulty of system decontamination. The last area of concern is that of recriticality. This would have to be considered an "accident" in that it appears that the core could not achieve a critical condition with the present levels of boron in the reactor coolant system. The boron would have to be substantially reduced before critically could become possible. The only mechanism for this to happen would be the inadvertent admission of unborated water to the primary coolant system.

The TMI-2 reactor containment building has been sealed since before the accident on 28 March 1979. The containment has been maintained below atmospheric pressure for more than a year by the building air cooling system. This has prevented leakage of fission products out of the reactor building to the environment. Most of the gaseous fission products initially present in the reactor building atmosphere have decayed to undetectable and insignificant levels during the past year. Repeated measurements have shown the principal nuclide remaining in the containment atmosphere to be ^{85}Kr. The reactor containment building atmosphere of TMI-2 presently contains approximately 57,000 Ci of ^{85}Kr. The measured ^{85}Kr concentration is 1.0 $\mu Ci/cm^3$.

The concentrations of other isotopes are much smaller: approximately $4x10^{-5}$ $\mu Ci/cm^3$ for tritium (^3H), $1x10^{-9}$ $\mu Ci/cm^3$ for radiocesium (^{137}Cs), and $1x10^{-10}$ $\mu Ci/cm^3$ for ^{129}I. The airborne ^3H and ^{137}Cs inventories are approximately 2 Ci and 0.00006 Ci, respectively.

1.2 Reactor Building Reentry Requirements

There are several important reasons why reentry into the TMI-2 reactor building is necessary. In summary, it is necessary to assess the damage resulting from the accident and to plan and prepare for reactor building decontamination and removal of the damaged fuel. These general needs encompass a large number of specific tasks that require reentry. Some examples are:

- assess the levels and distribution of surface contamination within the reactor containment building
- obtain samples to determine the optimum procedure for surface decontamination
- perform detailed surveys required to define the radiation fields in the building
- perform maintenance on vital equipment, such as the building air coolers
- install additional neutron and radiation monitoring equipment
- inspect equipment needed for decontamination and fuel removal

All these tasks must be completed before the building can be decontaminated and the fuel removed. Detailed preparation and planning cannot proceed significantly until data on actual conditions are obtained by reentry teams.

The planned decontamination of the TMI Unit 2 reactor building is in two phases: (1) removal of the contaminated water from the building sump and

(2) removal of contamination from building and component surfaces and removal of components that have high levels of internal contamination. Both phases must be completed before removal of the reactor core can begin.

The schedule for removal of the sump water calls for processing to begin in December 1980. It is estimated that sump water processing will take four to five months. It is not necessary that the ^{85}Kr be removed from the containment for this task to proceed. Decontamination of the building and component surfaces is a two-step process: assessment and planning followed by actual decontamination. Both efforts require removal of ^{85}Kr from the building atmosphere. To maintain the schedule of beginning the decontamination when the majority of sump water has been removed, it is necessary to start the contamination assessment and planning work in September 1980. Hence the presence of ^{85}Kr in the building will delay decontamination at about that time.

1.3 Dose Rates From ^{85}Kr and Other Sources in the Containment

The estimated contributions to the total dose rate from airborne ^{85}Kr, surface deposition of fission products, and radionuclides in the sump water are presented in Table 1-1 for the areas to be visited in the first containment reentry efforts (1).

Table 1-1

TMI-2 CONTAINMENT DOSE RATE ESTIMATES FOR GENERAL AREAS ON EACH ELEVATION

			Dose Rate at Specified Location (rem/hour)		
Location	Tissue	^{85}Kr	Surface Deposits	Sump Water	Total
305' Elevation	Whole Body	0.9	0.2	1.5	2.6
(Air Lock Elevation)	Skin	9	1	--	10
347' Elevation	Whole Body	1.2	0.4	--	1.6
(Operating Floor)	Skin	9	2	--	11
Stairs #1 and #2	Whole Body	1.2	0.2	9.0	10
	Skin	9	1	--	10
Airlock	Whole Body	0.9	--	--	0.9
	Skin	9	--	--	9.0
Anteroom	Whole Body	0.1	--	--	0.1
(Outside Airlock)	Skin	1	--	--	1

Since the principal mode of decay of the ^{85}Kr gas is by beta particle emission, the dose rate to unprotected skin would be quite large, 9 rem/hour inside the containment. The ^{85}Kr contribution to the whole body dose is 35% of the total on the 305' level and 75% of the total on the 347' level. The radiation field in the stairwells and on lower levels is dominated by the sump water source. The whole body dose rate from ^{85}Kr in the reactor building reduces the maximum stay time of any reentry team and the unexposed skin dose rate necessitates the use of heavy and cumbersome diving suits for skin protection during reentry.

1.4 Alternatives for ^{85}Kr Removal

A brief review of previous evaluations of alternative methods for removal of ^{85}Kr from the reactor building atmosphere is presented to place the present comparison in context. Five alternative methods of ^{85}Kr removal have been considered:

- controlled purge of the containment atmosphere
- adsorption and storage of ^{85}Kr on charcoal
- compression and storage of the gas containing ^{85}Kr
- cryogenic treatment to remove the ^{85}Kr from the gas in steel cylinders and long-term storage
- selective fluorocarbon absorption of ^{85}Kr from the gas and long term storage in steel cylinders

The controlled purge discharges the ^{85}Kr in the reactor building to the environment under meteorological conditions that would provide good dispersion and dilution of the effluent. The ^{85}Kr release would be conducted under prescribed conditions to limit doses to individuals and to the population near the site. The other four systems involve treatment of the containment atmosphere to remove and concentrate most of the ^{85}Kr for long term storage (^{85}Kr has a 10.7-year half-life). Use of one of these systems would reduce planned releases of ^{85}Kr to the local environment but result in increased risk of accidental releases.

In November 1979, the Metropolitan Edison Company submitted a safety analysis and environmental report (2,3,4,5) to the Nuclear Regulatory Commission (NRC) in support of their proposal to conduct a controlled purge of the TMI-2 reactor building atmosphere. In March 1980, the NRC Staff published an environmental assessment for the decontamination of the TMI-2 reactor building atmosphere (6). The Staff concluded that a controlled purge was an acceptable decontamination method; it met all pertinent regulatory requirements. The NRC Staff also determined that the alternative systems were acceptable with regard to radiation exposure of nearby residents. The anticipated delay required to design, procure, install, and test such systems was a factor in their recommendation that the controlled purge plan be adopted. In late March 1980, an independent review (7) of the alternatives concluded that a treatment that has zero, or nearly zero, release to the atmosphere and concentrates the ^{85}Kr in gas cylinders would be the most desirable. The reviewer ranked the selective absorption process and the cryogenic processing system as the best and next best alternatives, respectively. The reviewer judged the implementation time and system cost estimates of 1 1/2 years and $4 million to be reasonable. The "near zero release" criterion appeared most important in the selection of the selective absorption process. The impacts of time delay, occupational radiation exposure, and system cost were not evaluated.

Differing estimates have been made (References 2-8) of parameters important to the decision process. The purpose of this report is to provide an independent review of two alternatives now being considered to decontaminate the containment atmosphere: controlled purge and selective fluorocarbon absorption.

1.5 Regulations Pertaining to Environmental Radiation Exposure

The NRC regulations controlling environmental radiation exposure are contained in 10 CFR 20 (Reference 9). Design guidelines for light water cooled reactors (LWRs) like TMI-2 are contained in Appendix I to 10 CFR 50 (Reference 10).

In developing Appendix I to 10 CFR 50, the Nuclear Regulatory Commission performed a thorough evaluation of radioactivity releases in effluents from LWRs. The goal of the evaluation was criteria to provide numerical definition of release rates that were "as low as reasonably achievable". The first draft

numerical criteria, stated in terms of dose to the maximally exposed individual, were proposed in mid-1971. A public rule-making hearing was initiated. An environmental impact statement was drafted, reviewed by many interested parties, and finalized. After an extensive hearing procedure, review, and analysis the final dose criteria were established. The two criteria most relevant to the present consideration are the 5-mrem annual dose to the whole body and the 15-mrem annual dose to the skin. Limiting effluent releases to achieve the Appendix I dose criteria assures that the operations meet the ALARA criterion and that the annual whole body doses resulting from LWR operation will be less than 5 percent of average doses from natural background radiation. Natural background radiation doses average about 100 mrem/year in the United States.

The radioactivity release rates required to meet the ALARA dose criteria are more restrictive than those set forth in the Technical Specifications for operation of TMI-2. Meeting Appendix I criteria also assures compliance with the relevant Environmental Protection Agency guidance for nuclear reactor fuel cycle facilities in 45 CFR 190 (11).

1.6 Sources and Atmospheric Inventory of ^{85}Kr

The current average concentration of ^{85}Kr in the world's atmosphere is between 15 and 20 pCi/m^3. It rose from a level of about 1 pCi/m^3 in the mid-1950s, principally due to nuclear weapons production and testing and other defense related activities of several countries. Most of the ^{85}Kr in the environment remains in the atmosphere. The current atmospheric inventory of ^{85}Kr is about 80 million curies (12).

Releases from the Savannah River Plant (SRP) and the Idaho Chemical Processing Plant (ICPP) are the principal sources of ^{85}Kr in the United States. Between

March 1975 and September 1977, for example, SRP releases averaged about 53,000 Ci/month (13). Releases from the ICPP have been intermittent but have been as high as 20-30,000 Ci per month (14).

1.7 Report Organization

The reports and background material described in the previous subsection have been reviewed in detail as part of the present assessment of the relative merits of the selective absorption process and a controlled purge as methods of decontaminating the TMI-2 reactor building atmosphere. Portions of those documents are discussed in more detail in later sections. Section 2 presents the criteria considered in the evaluation of these two processes. Section 3 describes the technical features of the two proposed alternative techniques. Section 4 contains comparisons of the two systems. Section 5 the conclusions and recommendations of the study.

Section 2
TECHNICAL EVALUATION CRITERIA

Six principal criteria were used in the technical evaluation of the two systems now being considered for decontamination of the TMI-2 reactor building atmosphere. These criteria are

- o feasibility
- o effectiveness
- o practicality
- o schedule
- o health and safety
- o resource requirements

Each is discussed separately below.

2.1 Feasibility

To merit serious consideration, any technological decontamination alternative must be feasible; that is, it must have been developed to the point that its' application to the problem is reasonable from a scientific and engineering standpoint.

2.2 Effectiveness

Any proposed decontamination technique must be capable of removing the ^{85}Kr from the reactor building in a reasonable period of time after installation.

2.3 Practicality

The practicality criterion addresses the operational complexity of the system, its reliability, and maintenance requirements during the period of performance.

2.4 Schedule

The overall schedule for accomplishing the decontamination is important for reasons described in the Introduction.

2.5 Health and Safety

The most important criterion in the evaluation of the alternative systems is health and safety. There are several aspects that deserve consideration. From the radiological safety point-of view, the collective dose to the population (also termed the population dose) is generally taken as the principal measure of impact on human health. There are three principal sources of population dose to be considered: exposure to the public residing near the facility, exposure to the workers within the plant, and, because any released ^{85}Kr will be gradually dispersed around the world, exposure of the world population. Other health and safety aspects of the area requiring consideration are general worker safety, industrial hygiene, potential consequences of fluorocarbon releases to the atmosphere, and mental stress.

2.6 Resource Requirements

Resource requirements for the alternative techniques are also an important consideration. Space and building requirements for the decontamination system, technical manpower needs, use of critical materials, and energy consumption are all components of this criterion.

Section 3

SYSTEM DESCRIPTIONS AND TECHNICAL EVALUATIONS

The two decontamination alternatives, controlled purge and selective flourocarbon absorption followed by purge, are described in subsections 3.1 and 3.3 respectively. Each alternative is evaluated in each of the six technical areas described in Section 2. The results of the technical evaluation are presented in subsections 3.2 and 3.4.

3.1 System for ^{85}Kr Decontamination by Controlled Purge of the Reactor Building

Metropolitan Edison has proposed removal of the ^{85}Kr from the TMI-2 reactor building using a controlled purge rate to limit the offsite doses. The venting would be accomplished in a manner that would meet all regulatory requirements including the TMI-2 Technical Specifications. The controlled reactor building purge program is described in References 2-5.

Figure 3-1 shows the existing hydrogen control subsystem, as modified, that would be used for decontamination by controlled purge. The system flow rate can be controlled in steps up to a maximum of 1000 cfm. The gas removed from the reactor building would first pass through a sequence of filters: a prefilter, a high efficiency particulate (HEPA) filter, a charcoal adsorber, and a second HEPA filter. This combination would remove more than 99.9% of the airborne particulate material and about 99% of the airborne ^{129}I. The ^{85}Kr and the ^{3}H in the reactor building atmosphere would pass through these filters and be released to the atmosphere via the Unit 2 vent stack.

To meet the Appendix I dose objectives the ^{85}Kr release rate ($\mu Ci/sec$) would be controlled and adjusted hourly as a function of atmospheric dispersion conditions. For a specified release rate, the acceptable purge flow rate depends on the measured ^{85}Kr concentration in the containment. At the start of the

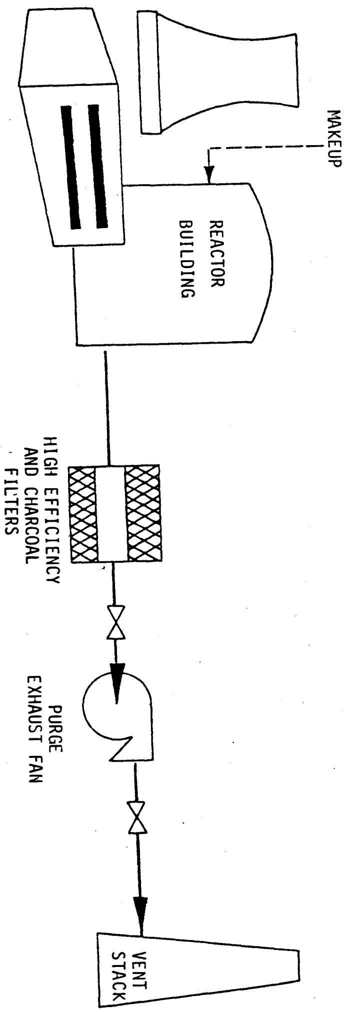


FIGURE 3.1

SYSTEM FOR CONTROLLED PURGE OF REACTOR BUILDING

controlled purge, the ^{85}Kr concentration in the reactor building will be 1.0 μCi/cm^3 and the purge flow rate would be relatively low (perhaps about 100 cfm). As venting continues the krypton concentration in the reactor building will decrease and, for the same dispersion conditions, the flow rate can be increased. During periods of unfavorable meteorology when dispersion would be poor the release would be decreased or stopped, and increased or restarted only when meteorological conditions improved. Reference 6 describes an accelerated venting program using the station's normal containment purge system. This would provide increased flow rate capacity that could be used when ^{85}Kr containment concentrations are low and meteorological conditions are favorable. As described, this approach would meet all regulatory requirements with the exception of the TMI-2 operating Technical Specification for instantaneous release of noble gases. The NRC staff had proposed this modification if it could be implemented by the middle of May.

3.2 Technical Evaluation of Controlled Purge Decontamination System

The results of the technical evaluations in each of the six areas are presented below.

3.2.1 Feasibility

The controlled purge system is a technically feasible method of decontaminating the TMI-2 reactor building atmosphere. It is similar in principle to containment purge systems installed at Three Mile Island and other pressurized water reactors (PWRs) and routinely employed for the same purpose.

3.2.2 Effectiveness

Reactor building purges have been shown to be an effective method of removing noble gases from PWR reactor buildings. The technique is used routinely at operating reactors to remove radioactive gases prior to containment entry. The decontamination factor (DF) of the system is proportional to the volume of gas purged. The DF can be increased to any desired level by continued purging. In this case, it has been estimated that a total volume of about 30 million cubic feet must be purged to hieve a reactor building concentration of 10^{-6} $\mu Ci/cm^3$. At a continuous purge rate of 1000 cfm this could be accomplished in 21 days. The approximate duration of purge is estimated to be 60 days, but will depend on actual meteorological conditions.

3.2.3 Practicality

Operation of the purge system itself is a relatively simple manner. A detailed operational procedure that incorporates all the steps required to assure proper system operation during the controlled release has been prepared. Eight modifications of the hydrogen control system are required before the controlled purge could take place. We have determined that all but one of these modifications have been completed. The one remaining modification, uncapping the Unit 2 vent stack, cannot be completed until approval of the controlled purge option is obtained.

3.2.4 Schedule

It is estimated that 1-4 days would be required to perform the last system modification described above and to obtain the initial approvals required by the controlled purge operational procedure. The overall duration of the controlled purge is estimated to be 60 days from the time of initiation. This estimate is based on computer simulations performed using historical meteorological data. The historical data are only a general guide since conditions vary from year to year and cannot be predicted in advance. However, since the purge could begin promptly after approval, a longer purge duration would probably not have a deleterious impact on the planned schedule (Section 1.2).

3.2.5 Health and Safety

The health and safety aspects of the controlled purge decontamination alternative are considered in this section. The three subsections consider radioactivity releases to the environment, radiation doses to individuals and to populations, and the potential health effects resulting from selection of this alternative.

3.2.5.1 Radioactivity Releases to the Environment

In Table 3-1, the expected and potential ^{85}Kr releases are given for the controlled purge decontamination alternative. It was assumed that one containment entry would be made before the controlled purge was initiated and that subsequent entries would be delayed until the purge was completed. It was assumed that the controlled purging removed all the ^{85}Kr in the reactor building. An upper limit estimate of the ^{3}H release during the purge is also given in the table.

An unplanned release could occur if the full flow of the controlled purge system were unintentionally activated. This release is considered unlikely but, if it did occur, approximately 1700 Ci of ^{85}Kr could be released to the environment in one hour. If the accidental release occurred, the total ^{85}Kr activity released during the purge would be decreased by the amount of the accidental release.

Table 3-1

EXPECTED AND POTENTIAL RELEASES OF RADIONUCLIDES FOR THE CONTROLLED PURGE ALTERNATIVE

Activity Causing Release	Radionuclide Release (Ci)	
	^{85}Kr	^{3}H
EXPECTED		
Controlled Purge	57,000	30
Containment Entry	25	0.0008
POTENTIAL		
Accidental Initiation of Purge	1700	0.06

3.2.5.2 Radiation Doses to Individuals and Populations

Three population groups will receive radiation exposure as the result of selecting the controlled purge alternative. These are the general population of nearby residents, nearby residents who are plant workers, and the entire population of the world. The expected maximum individual doses for each group are shown in Table 3-2. These doses result almost entirely from the discharge of the ^{85}Kr; there is no significant contribution from the discharged ^{3}H. The maximum individual doses for a release of 57,000 Ci was computed using an annual average dispersion factor of 1.8×10^{-6} sec/m^3 for a vent release and the dose conversion factors given in Regulatory Guide 1.109 (15). The maximum skin dose under those conditions would be 4 mrem. The maximum whole body dose to a member of the local population is 0.05 mrem. Doses received by individuals at locations remote from the plant are variable but extremely small. All the doses from expected releases

Table 3-2

RADIATION DOSES TO INDIVIDUALS FOR THE CONTROLLED PURGE ALTERNATIVE

Exposed Group	Maximum Individual Dose (mrem)	
	Whole Body	Skin
EXPECTED		
Nearby Residents		
General Population	0.05	4
World Population	$<10^{-5}$	$<10^{-3}$
POTENTIAL		
Nearby Residents		
General Population	0.7	50

are well below those received from natural background sources.

The consequences of accidental initiation of the reactor building purge system were computed using a site boundary dispersion factor of 6.8×10^{-4} sec/m^3 and the dose conversion factors from Reference 15. The maximum potential doses are 50 mrem to the skin and 0.5 mrem to the whole body. These are well below the guide values in Reference 16.

Table 3-3 contains the maximum population doses expected from the controlled purge of ^{85}Kr. The largest contribution to the total comes from the lifetime integrated population dose received by the world's inhabitants (12).

Table 3-3

RADIATION DOSES TO POPULATION GROUPS FOR THE CONTROLLED PURGE ALTERNATIVE

Exposed Group	Population Dose (person-rem)	
	Whole Body	Skin
Nearby Residents		
General Population	1	80
Plant Workers	1	(a)
World Population	20	2500
Total	22	2600

(a) None in addition to that from whole body exposure.

3.2.5.3 Health Effects

The number of radiation induced health effects expected in an exposed population is generally considered proportional to the total population dose (person-rem). The proportionality factor is the incidence rate per unit population dose (cases/person-rem). Incidence rates have been derived from data on human exposure to relatively high radiation doses delivered at high dose rates. However, it is recognized that when the individual doses received are quite small use of such derived incidence rates and the population dose probably overestimates the number of health effects (17). The

incidence rates used to calculate health effects in this report are shown in Table 3-3.

Table 3-4

HEALTH EFFECT INCIDENCE RATES

Exposed Tissue	Incidence Rates (cases/person-rem)		
	Fatal	Not Fatal	Genetic Defects[(a)]
Whole Body	2×10^{-4}	2×10^{-4}	3×10^{-4}
Skin	1×10^{-6}	1×10^{-5}	None

(a) All such cases are assumed to result in deaths of fetuses in the early stages of development.

With these incidence rates, the population doses summarized in Table 3-2 can be used to estimate the maximum number of health effects expected from selection of the controlled purge alternative. The maximum number of health effects expected in the nearby population is 0.0005 fatal cancers, 0.001 non-fatal cancers, and 0.0006 genetic defects. The maximum number of health effects expected in the world population is 0.007 fatal cancers, 0.03 non-fatal cancers, and 0.006 genetic effects.

The same incidence rates can be used to estimate the risks to individuals or family groups who reside near the facility. Consider an interrelated group of families containing 200 persons who are all located at the point of highest offsite dose during the controlled purge. Each would receive a whole body dose of 0.05 mrem and a skin dose of 4 mrem. The dose received by this population would be 0.01 person-rem to the whole body and 0.8 person-rem to the skin. The maximum total lifetime risks of fatal cancer, non-fatal cancer, and genetic effects for the group as the result of the controlled purge would be 0.000003, 0.00001 and 0.000003 cases, respectively.

3.2.6 Resource Use

The fact that most components of the controlled purge system were already in place in the existing hydrogen control subsystem at TMI-2 limited the resource requirements for this alternative. Some additional components were required for the system modifications. The principal additions were a 60-horsepower fan and the associated controller. An existing radioactive effluent monitor was modified slightly to extend its monitoring range. The electrical power required for equipment operation during the controlled purge is approximately 40 kilowatts. It is estimated that 12 man-months of TMI staff effort would be required to perform and monitor a controlled 60-day purge.

3.3 System for Decontamination Using the Selective Absorption Process to Remove ^{85}Kr

A schematic of the Selective Absorption Process (SAP) for the recovery of ^{85}Kr from TMI-2 is shown in Figure 3-2. The reactor building atmosphere containing the ^{85}Kr is withdrawn and filtered to remove particulates. The gas is then cooled, dried, and compressed to 682 kPa (100 psig) and cooled again to -34°C (-30°F). The gas is then further dried with a 3A molecular sieve column. The cooled, dried gas containing the ^{85}Kr is then fed into the bottom of the absorption section of the combination column. The fluorocarbon solvent flows downward through the column. The ^{85}Kr dissolves in the solvent and the upward flowing gas leaves the top of the column

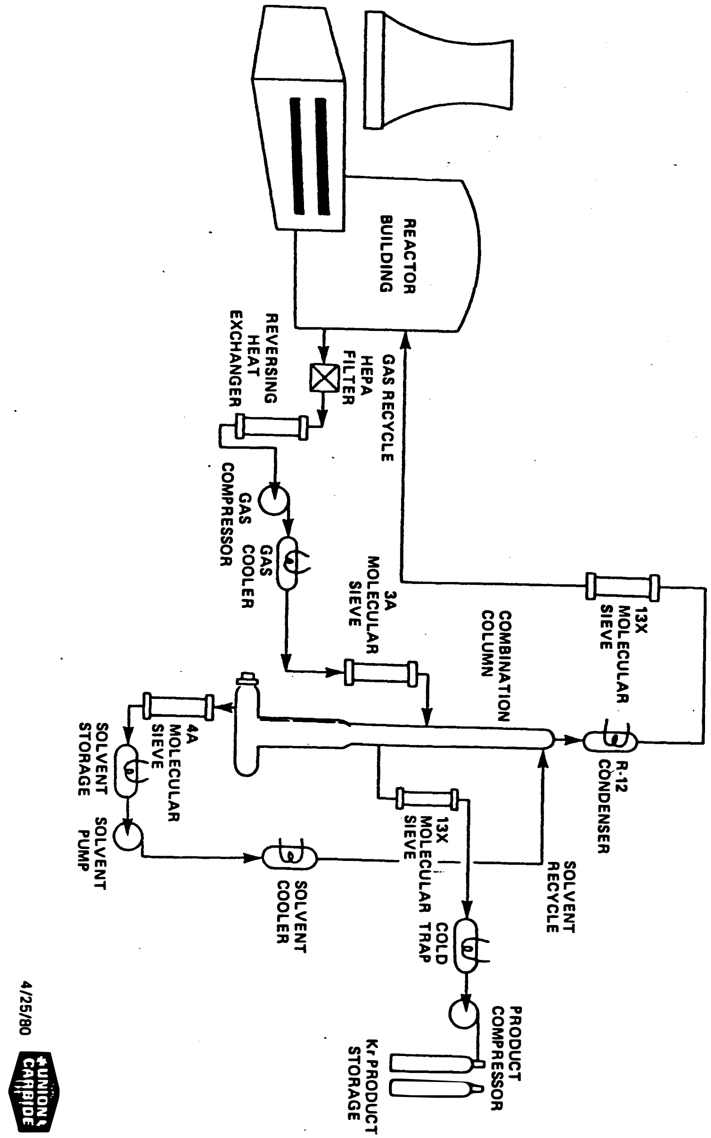


FIGURE 3.2
SCHEMATIC OF THE SELECTIVE ABSORPTION PROCESS

DWG. NO. K/G-80-1280-R1

containing 5 to 10% solvent in the vapor phase. This decontaminated gas is then passed through a condenser for solvent recovery and returned to the reactor building. The solvent containing the dissolved ^{85}Kr and other gases flows down into the fractionating and stripped sections of the combination column. Solvent is boiled up from the reboiler where there are essentially no dissolved gases present. The ^{85}Kr is withdrawn from the column in a gas stream at a position below the gas feed point where its concentration in the vapor phase reaches a maximum value. The recovered ^{85}Kr and other gases pass through a 13X molecular sieve bed and a cold trap for further purification. The gas is then compressed and stored in steel cylinders. The fluorocarbon solvent is pumped through a cooler and returned to the top of the column.

3.4 Technical Evaluation of the Selective Absorption Process

A comprehensive evaluation of the selective absorption process was performed as it would be applied for ^{85}Kr removal from the TMI-2 reactor containment building. This evaluation was based on a review of the various technical topical reports concerning the process (19-26); a description, cost estimate and schedule for the use of the SAP for TMI-2 prepared by the Nuclear Division of Union Carbide Corporation (UCC-ND) (27); and a visit and discussion with UCC-ND personnel. It should be emphasized that the evaluation applies primarily to the use of the SAP for treatment of the atmosphere in the TMI-2 containment building when the process is used in a recycle configuration. In this scheme, the treated gas effluent from the SAP is returned to the containment building. A processing rate of 255 m^3/h (150 ft^3/min) as proposed by UCC-ND was assumed.

3.4.1 Feasibility

There were no technical issues identified that would indicate that the SAP could not be applied for the removal of krypton from the TMI-2 containment building. The process is based on well established technology that has been used in the petrochemical and other industries for many years. Personnel from UCC-ND have adapted this technology using a fluorocarbon solvent absorbent specifically for noble gas recovery and have characterized the behavior of the interactions of the noble gases and a number of potential interferences with the fluorocarbon solvent. A review of the measured gaseous components in the TMI-2 containment and the development work performed and reported by UCC-ND did not identify any airborne contaminants that would interfere with the operation of the system shown in Figure 3-2. Although UCC-ND has only had about 1.5 years of experience in operating a system in which the absorption, fractionation, and stripping functions are performed in a single column, UCC-ND personnel appear to have adequately demonstrated its applicability for noble gas recovery. A number of minor technical issues exist regarding this application of the process, but none would preclude satisfactory operation.

With regard to equipment requirements, no components were identified that would require development or testing to verify its applicability. The only required custom-built component appears to be the absorption column for which general design specifications have already been prepared.

3.4.2 Effectiveness

The two main criteria considered in evaluating the effectiveness of the SAP were the removal efficiency of the process and its capability for providing a relatively pure product that could be safely stored or transported for permanent disposition. When a recycle scheme is used, the time required to decrease the containment building ^{85}Kr concentration is fairly insensitive to the process krypton removal efficiency, especially if the removal efficiency is above about 90%. No reasons were identified for operating the process as a single-pass operation whereby the treated effluent would be directly discharged to the atmosphere. There are no apparent technical or theoretical reasons why the SAP could not be used to reduce the ^{85}Kr concentration in the containment building by a factor of 1000 or more. Operation of the process for a period of about 25 days at the capacity of 255 m^3/h (150 ft^3/min) would reduce the ^{85}Kr concentration by a factor of 10.

Several technical issues were identified regarding the capability of the process to provide a relatively pure product, but these are considered to have little effect on the proposed system application. At this point, neither the composition of the stored gas nor the number of required storage cylinders is certain. However, it appears the maximum quantity of product can be limited to several 50-liter (1.5-cf) storage cylinders by judicious selection of column product withdrawal rates and/or product recycle.

3.4.3 Practicality

The SAP is a relatively complex system that requires trained engineers and technicians. Because of its complexity, its satisfactory operation will probably require several weeks of checkout. On the other hand, the process is based on sound technical principles that have been studied extensively and are well understood. Although there are many operations involved in the overall process, adequate design of control systems and sufficient preoperational checkout should assure a high probability of satisfactory process performance.

Once the process is operating satisfactorily, few operational problems are expected. Maintenance should be minimal and on-line reliability very high. A reliability analysis of the process for nuclear fuel reprocessing applications was performed by a private consulting firm, and no major adverse equipment shortcomings were identified for extended operation (28).

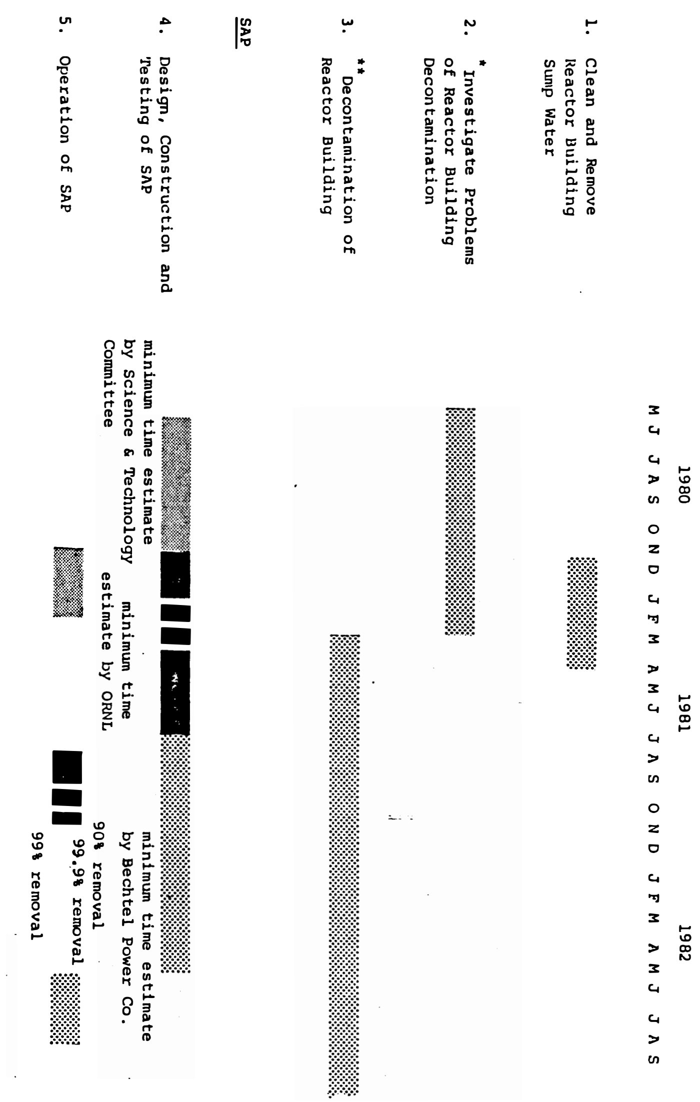
3.4.4 Schedule

Reported estimates for the time required to design, procure, construct, test, and install the 150-cfm selective absorption process at TMI-2 range from 6 to 24 months and are shown in Figure 3-3. Each schedule is based on different assumptions.

The shortest schedule of six months (29) is based on the assumptions that construction to standard ASME codes for unfired pressure vessels would be sufficient, that adequate funding would be provided [to ensure there would be no manpower limitations], and interagency transfer or loan of property would be expedited [if necessary].

A "best effort" construction and installation schedule of 13 months involving no contingency and other qualification was prepared by UCC-ND personnel (27). This schedule is based on UCC-ND's experience in doing work in the Oak Ridge area utilizing the UCC-ND staff, craftsman, and facilities. Some of the main assumptions used in the proposed schedule are: (1) the project would be a high priority DOE project; (2) use of accepted conventional industrial standards, practices, and codes (including general adherence to Regulatory Guide 1.143); (3) negotiated procurements, including expediting with premiums; (4) adequate and timely site preparation at TMI-2; and (5) concurrent reviews and approvals. It was also emphasized that UCC-ND personnel have little basis for estimating schedules that would actually be required on [and for] the TMI-2 site.

TMI-2 REACTOR BUILDING DECONTAMINATION SCHEDULE



* Item 2 requires an estimate of 20-40 entries into reactor building and therefore requires the venting of the building prior to the large part of the effort.

** Item 3 requires both the venting of the reactor building and a substantial processing of the reactor sump water.

FIGURE 3-3

The 24-month schedule prepared by Bechtel Power Corporation for GPU (30) is based on the total project, including construction of the recovery system, a building to house the process, and the process installation and hookup. This schedule provides for three levels of building construction code classifications (non-seismic, seismic, and aircraft hardened) with no distinction made for the different times required for each. The piping design code varies from ANSI B-31.1/ASME VIII (the least expensive) to ASME Section III, Division 1, Class 3 (the most expensive). The schedule is based on industry standards for lead times and construction methods and was not optimized. The schedule assumes that regulatory requirements will not become a critical path issue. It also assumes the availability of base line technology, including design information and criteria for speciality equipment, at the start of the schedule.

Clearly these schedules vary according to the assumptions made and the past experience and perspective of those making them. It is within reason that a 150 cfm fluorocarbon absorption system can be designed, built and tested at ORNL in six months. However, if the system were to be built at ORNL, we are more inclined to accept the 13 month estimate of UCC-ND because they are the most familiar with the system and would be the group carrying out the work. When it comes to constructing the building to house the system and installing and testing the system at Three Mile Island, we believe GPU is in the best position to determine schedule. They and their contractors have the most experience with the practicalities of design and operations at TMI. Furthermore, GPU is financially liable for all operations at the site. Therefore, in our judgment the most realistic schedule for having the system installed and operating at TMI is between 13 and 24 months. The time available before ^{85}Kr removal from the reactor building atmosphere becomes a critical path item is approximately 4 months.

3.4.5 Health and Safety

Health and safety considerations related to use of the SAP system are presented in the four subsections that follow.

3.4.5.1 Radioactivity Releases to the Environment

Radioactivity releases for the SAP alternative are given in Table 3-5. A range of expected releases is presented for different assumed periods of SAP operation. Approximately one month of operation is required to achieve a DF of 10, two months for a DF of 100, etc. After SAP operation the remaining activity would be released by purging. It was assumed that ten containment entries would be required before the fluorocarbon system could begin operation.

Both "probable" and potential releases were considered. Leakage from the containment as a result of failure of the fan coolers is considered a probable occurrence. Failure of these fan coolers is considered probable because they have had no preventative maintenance since they were installed about a year prior to the accident and have been operating in a high humidity (and therefore high load) environment since the accident occurred. Based on the last leak rate test, the leak rate from the containment subsequent to cooler failure has been estimated to be 0.13% per day (18). The total ^{85}Kr release was calculated for two release durations. It was assumed that (a) the fan coolers fail after six more months of operation and that the SAP is operational six months later and (b) the fan coolers fail immediately and the SAP is operational in two years. It was also assumed that the containment leaked only during the day. At night it was assumed that no leakage occurred.

Table 3-5

EXPECTED, PROBABLE AND POTENTIAL RELEASES OF ^{85}KR

FOR THE SELECTIVE ABSORPTION PROCESS ALTERNATE

Activity Causing Release	^{85}Kr Release (Ci)	Total Expected Release (Ci) for Assumed DF
Expected		
10 Containment Entries	250	
Venting of Residual ^{85}Kr After Operation of SAP		
DF = 10	5700	6000
DF = 100	570	820
DF = 100	57	310
DF = 1000	5.7	260
Probable		
Fan Cooler Failure		
6-Month Release Before SAP	5800	
2-Year Release Before SAP	15000	
Potential		
Interim Storage Tank Failure	3000	
Loss of Stored Product	57000	

Potential releases are those that could occur due to an accident during operation of the fluorocarbon absorption system. Failure of the interim product storage tank and total loss of the ^{85}Kr product were considered. Both accidents are considered highly unlikely events.

Although some ^{3}H would be released, the amounts would be small (as shown in Section 3.3.5) and the dose consequences are insignificant. For that reason the ^{3}H releases are not shown in Table 3-5. Also, it should be noted that if the fan coolers fail, the leakage of ^{85}Kr from the containment would reduce the expected quantities to be purged after operation of the SAP system.

3.4.5.2 Radiation Doses to Individuals and Populations

The expected maximum doses to individuals residing near the plant are shown in Table 3-6. The doses to individuals residing elsewhere in the world are variable but very small and are not included in the table. The dose calculation assumptions and techniques employed were the same as those used in Section 3.3.5.

The maximum skin dose from expected releases is estimated to be 0.5 mrem for a 1-month period of operation of the SAP. The maximum skin dose for a 4-month operational period is 0.02 mrem. The maximum whole body dose for a 1-month period of operation is 0.006 mrem and changes in the same way as skin doses with the assumed DF. The maximum individual doses resulting from fan cooler failure are estimated to range from 2-6 mrem to the skin and 0.03 to 0.08 mrem to the whole body. Both the expected and probable doses are less than 6% of the annual doses from natural sources.

Potential offsite doses from accidental releases could be as large as 1600 mrem to the skin and 20 mrem to the whole body. These are well within the guidelines of Reference 16.

Table 3-6

RADIATION DOSES TO INDIVIDUALS FOR THE SELECTIVE ABSORPTION PROCESS ALTERNATIVE

Exposed Group	Maximum Individual Dose (mrem) for Assumed Decontamination Factor For SAP Operation			
Expected				
Nearby Residents	10	100	1000	10,000
General Population				
Skin	0.5	0.06	0.02	0.02
Whole Body	0.006	0.0007	0.0003	0.0002

Probable	Maximum Individual Dose (mrem)	
Nearby Residents	6-month Release	2-year Release
General Population		
Skin	2	6
Whole Body	0.03	0.08

Potential		
Nearby Residents	Tank Failure	Total Loss of Product
General Population		
Skin	90	1600
Whole Body	1	20

The expected and probable population doses are presented in Table 3-7. The expected total population doses range from 10-310 person-rem to the skin and 50-60 person-rem to the whole body as the assumed SAP DF varies from 10,000 down to 10. Probable population doses range from 250-660 person-rem to the skin and from 2-5 person-rem to the whole body depending on the assumed duration of leakage. Again, it should be remembered that containment leakage would reduce the population doses expected from the operation of the SAP system.

3.4.5.3 Fluorocarbon Releases to the Environment

It is conceivable that the entire fluorocarbon inventory of about 1000 lbs could be released to the environment. This is considered to be a low probability event. The amount of fluorocarbons produced each year is now several hundred million tons and a large fraction of this is eventually released to the environment. Thus the potential fluorocarbon release represents at most a small addition to the total.

3.4.5.4 Health Effects

The maximum numbers of health effects resulting from the expected population radiation doses were computed using the incidence rates in Table 3-4. The potential health impact of fluorocarbon discharges is considered negligible.

A maximum of 0.01 fatal cancers, 0.01 non-fatal cancers, and 0.02 genetic effects would be expected in the local population as the result of using the SAP system to remove ^{85}Kr. These maximum values are insensitive to the DF selected. For the world population, the corresponding maxima are 0.0007, 0.003, and 0.0006 cases of fatal cancer, non-fatal cancer, and genetic effects, respectively. These upper limit consequence estimates are also relatively independent of the DF selected.

Table 3-7

POPULATION DOSES FOR THE SELECTIVE
ABSORPTION PROCESS ALTERNATIVE

Exposed Group	Population Dose (person-rem) for Assumed Decontamination Factor For SAP Operation			
Expected	10	100	1000	10,000
Nearby Residents				
General Population				
Skin	8	1	0.4	0.4
Whole Body	0.1	0.01	0.005	0.005
Plant Workers, Whole Body	50	50	50	50
World Population				
Skin	250	40	10	10
Whole Body	2	0.3	0.1	0.1
Total				
Skin	310	90	10	10
Whole Body	60	50	50	50

Probable	Population Dose (person-rem)	
	6-Month Release	2-year Release
Nearby Residents		
General Population		
Skin	8	20
Whole Body	0.1	0.3
World Population		
Skin	250	660
Whole Body	2	5

3.4.6 Resource Requirements

In addition to requirements for construction and for process equipment, other resource requirements include site preparation, utilities, and operating manpower.

Site preparation involves construction of a building to house the process and connection of utilities. The required building dimensions are estimated to be 40 by 60 ft and 33 ft high. These dimensions are based on the required height of the combination column, space for installing overhead lifting equipment, the necessary floor space for the other major process components and auxiliaries, a separate krypton storage space, and a protected space for operating personnel.

The main utility requirement will be electrical. Approximately 1 Mw of electrical power will be required. This estimate is based on the power requirements of the 200 kw reboiler heater, the refigeration for re-cooling the solvent, the compression and cooling of the system feed stream, and auxiliary and ventilation motors.

The other utility requirements, such as cooling water and liquid nitrogen, are relatively small and are not quantified.

The estimated manpower requirements for operating the process are one operating engineer and an assistant. In addition, a qualified engineer thoroughly familiar with the design and operation of the SAP should be available for assistance during process operation. It is assumed that health physics services would be provided by regular TMI personnel.

Section 4

SYSTEM COMPARISONS

This section provides a comparison of the two alternative methods of ^{85}Kr removal from the containment atmosphere controlled purge and selective absorption. The methods are compared for each criterion listed in Section 2. In addition, comparisons are made of system cost and psychological stress on nearby residents. The comparisons are summarized in Table 4-1 and discussed in the following subsections.

4.1 Feasibility

Both alternatives are technically feasible.

4.2 Effectiveness

Both alternatives are effective ways of reducing ^{85}Kr concentrations in the containment atmosphere.

4.3 Practicality

Controlled purging is simpler than the use of the SAP system. However, after a few days of experience by trained operators at TMI, the SAP should be operable without difficulties.

4.4 Schedule

The controlled purge alternative can be ready for operation in 1 to 4 days. The SAP can probably be ready for operation at TMI in 13 to 24 months.

The best estimate of the duration for controlled purging is 60 days. For the SAP to reduce the quantity of ^{85}Kr from 57,000 Ci to 570 Ci would take approximately the same time. Using the assumption that 10 entries are made

Table 4-1

COMPARISON OF ALTERNATIVES

Criterion	Controlled Purge	SAP with Controlled Purge of Residual
1. Feasible	yes	yes
2. Effective	yes	yes
3. Practical	yes	yes
4. Schedule		
Time to Begin Process	1-4 days	13-24 months
Time Required to Process	60 days	1-3 months
5. Maximum Expected Health Effects		
Local Population		
Fatal Cancers	0.0005	0.01
Non-fatal Cancers	0.001	0.01
Genetic Effects	0.0006	0.02
World Population		
Fatal Cancers	0.007	0.0007
Non-Fatal Cancers	0.03	0.003
Genetic Effects	0.006	0.0006
6. Resource Use		
Manpower	1 man-year	19 man-years
Electricity	40 kilowatts	1000 kilowatts
7. Psychological Stress		
Level of Stress	lower	higher
Duration of Stress	Less than 6 months	14-30 months
8. Costs	$75,000	$9-$29 million

before the SAP is operational, 250 curies of ^{85}Kr would be released. Therefore, to reduce the quantity of ^{85}Kr in containment by more than a factor of 100 would not reduce the total dose to the populace much further.

4.5 Health and Safety

The computed maximum numbers of health effects expected in the local population and in the world population are shown in Table 4-1. They ignore any accidents to construction or operating personnel. The numbers of expected cases vary for the two alternatives but in all cases they are substantially lower than one. Therefore, no health effects would be anticipated from implementation of either alternative.

4.6 Resource Use

Manpower estimates for the controlled purge system are based on 1 shift engineer, 2 plant operators and 1 technician full time during the period of purging. In addition, two persons will monitor radiation and radioactivity levels off-site.

The 19 man-year effort for the fluorocarbon absorption system is based on an UCC-ND estimate for installation at Three Mile Island and includes one man-year for operation of the system. It does not appear to include construction of the building to house the system.

4.7 Psychological Stress

Studies have shown that psychological stress was experienced during the accident by people living in the vicinity of the plant (31,32,33). It has been estimated that between 10% and 20% of those living within 15 miles of the site still showed signs of distress in January 1980 (33). "Continued contradictory news coverage of TMI has provoked a desire [among these living near the plant] during the first six months for 'it to be over with'....

These people are already exasperated by the interminability of the discussion and are coming to resent the fact that TMI was every built" (32). Dr. Peter Houts, the principal investigator of the study reported in Reference 33, has indicated that had the January 1980 resurvey been carried out in April 1980 the fraction of the population showing signs of distress would have been greater (Personal Communication). Dr. Houts was alluding to news reports of releases of ^{85}Kr: on February 11 due to an instrument line failure and in April when a release of ^{85}Kr was reported as a result of purging an air-lock. There was also a news report of a coolant leak into the Auxiliary Building from a valve failure on March 20.

It appears that the psychological stress from these releases is more attributable to the fact that they were considered newsworthy than to the quantity of ^{85}Kr released. During the leak of February 11, approximately 0.3 curies of ^{85}Kr was released (5). Purging the containment personnel air lock in April resulted in a release of 0.045 curies of ^{85}Kr. These releases are trivial compared to the approximately 80 curies of ^{85}Kr reported as being released per month in normal ventilation exhaust air (34). Attention was drawn to the lesser release situations because they were highlighted by the NRC in Unusual Occurrence Reports.

Given that there would be no health effects from either alternative and that psychological stress is independent of the quantity released, it would appear that the least psychological stress is associated with the procedure that can be carried out with the least number of newsworthy incidents, the one which satisfies the desire for "it to be over with". This criterion favors the controlled purging of the reactor building atmosphere.

4.8 Cost Comparisons

The cost of the controlled purge including engineering, licensing, materials and operations is estimated to be $75,000. The costs for the SAP system were based on information supplied by UCC-ND and from an architect and engineering firm. Both supplied minimum and maximum costs. The estimated costs ranged from $9-29 million; our best estimate of the actual cost is $18 million.

SECTION 5

CONCLUSIONS AND RECOMMENDATIONS

The two alternatives considered here for removing ^{85}Kr from the TMI-2 containment building are controlled purging and fluorocarbon absorption (SAP) of most of the ^{85}Kr followed by purging the residual.

We offer the following conclusions and recommendations:

- From the points of view of feasibility, effectiveness practicality and the health and safety there is little to chose between the two alternatives.
- From the point of view of psychological stress on nearby populations, purging is the best alternative because it can be carried out in the least time with the fewest newsworthy incidents.
- From the points of view of schedule and cost, controlled purging is the best alternative because it is cheaper and can be started within days.
- Therefore it is our opinion that the SAP should not be adopted as a substitute for controlled purging.

REFERENCES

1. Metropolitan Edison Company, "Three Mile Island Unit 2 Reactor Building Entry", Docket 50-320, March 21, 1980. Available in the NRC PDR* for inspection and copying for a fee.
2. Metropolitan Edison Company, "Three Mile Island Unit 2 Reactor Building Purge Program Safety Analysis and Environmental Report", Docket 50-320, November 13, 1979. Available in NRC PDR for inspection and copying for a fee.
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4. Letter from John T. Collins, NRC, to R. G. Wilson, Metropolitan Edison Co., Subject: Additional information request for preparation of environmental assessment, Docket 50-320, Dec. 18, 1979. Available in NRC PDR for inspection and copying for a fee.
5. Letter from R. F. Wilson, Metropolitan Edison Co. to John F. Collins, NRC, Subject: Response to 33 questions on reactor containment building atmosphere cleanup, Docket 50-320, January 4, 1980. Available in NRC PDR for inspection and copying for a fee.
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7. Letters from Gerald Pollack, Michigan State University, to Victor Gilinsky, Nuclear Regulatory Commission. Available in NRC PDR for inspection and copying for a fee.
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9. U. S. Nuclear Regulatory Commission. Rules and Regulations, Title 10 Code of Federal Regulations Part 20, "Standards for Protection Against Radiation", June 1977. Available from public libraries.
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*The Nuclear Regulatory Commission Public Document Room (PDR) is located at 1717 H. Street, N. W., Washington, DC 20555.

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14. Energy Research and Development Administration, Final Environmental Impact Statement on Waste Management Operations at the Idaho National Engineering Laboratory, ERDA-1536 (1975).

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21. M. J. Stephenson, "Analysis of a Non-Isothermal Gas Stripper with Volatile Solvent", Presented at the 72nd AICHE Annual Meeting, San Francisco, CA, November 25-29, 1979.

22. J. H. Shaffer et al, The Solubilities of Krypton and Xenon at Infinite Dilution in Dichlorodifluoromethane, UCC-ND Report ORNL/TM-6652, (January 1980). Available in Technical libraries.

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26. J. R. Merriman et al, "Removal of Noble Gas by Selective Absorption", Presented at the International Symposium on Management of Gaseous Wastes from Nuclear Facilities, IAEA-SM-245/53 (February 1980). To be published in the conference proceedings.

27. J. R. Merriman et al, Use of the ORGDP Selective Absorption Process for Removal of Krypton from the Containment Building Atmosphere at Three Mile Island Unit 2, UCC-ND Report K/ET-500 (May 6, 1980). Available in the NRC PDR for inspection and copying for a fee.

28. D. E. Wood, Availability Analysis of the Freon Absorption System for Treating Effluents from Reprocessing, UCC-ND Report ORNL/TM-5797 (March 1977). Available in technical libraries.

29. Letter from Ron Williams, Committee on Science and Technology, U. S. House of Representatives, 9 May 1980. Available in NRC PDR for inspection and copying for a fee.

30. Letter from J. W. Thiesing, Bechtel Power Corporation to R. F. Wilson, GPU, 28 April 1980. Available in NRC PDR for inspection and copying for a fee.

31. J. G. Kemeny, et al., Report of the President's Commission on the Accident at Three Mile Island (October 1979). Available in the NRC PDR for inspection and copying for a fee.

32. C. B. Flynn and J. S. Chalmers, The Social and Economic Effects of the Accident at Three Mile Island, NRC Report NUREG/CR-1215 (January 1980). Available in technical libraries.

33. Peter S. Houts, et al. Health-Related Behavioral Impact of the Three Mile Island Nuclear Incident, Part I, (April 1980). Available from the Pennsylvania Department of Health.

34. Letter from Sydney Porter to John Collins, "Effluent Releases from TMI Units 1 and 2 for the month of January 1980" (21 March 1980). Available in the NRC PDR for inspection and copying for a fee.

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

OFFICE OF THE DIRECTOR

May 6, 1980

Department of Energy
Oak Ridge Operations
Attention: Mr. J. A. Lenhard
Assistant Manager for Energy Research
and Development
Post Office Box E
Oak Ridge, Tennessee 37830

Gentlemen:

Application of the Selective Absorption Process for TMI-2

For the past few weeks, we have been preparing responses to a series of questions and suggestions raised by Congressman Allen E. Ertel and NRC Commissioner Victor Gilinsky on the application of the selective absorption process for the removal of ^{85}Kr from the TMI-2 Containment Building atmosphere. Accordingly, we have recently completed a report (attached) which provides information on the existing technology, design calculations, capacities, procurement, costs and construction schedules. This information should not be regarded as a proposal for the Union Carbide Corporation-Nuclear Division to do this work.

A major item of concern in selecting a process for TMI is the amount of time necessary to construct and place into operation a system on the site. In this regard, the report outlines a "best effort" construction schedule of 13 months involving no contingency and with several qualifying assumptions. This schedule is based on our experience in doing work in the Oak Ridge area utilizing our technical staff, craftsmen, and facilities. This approach to scheduling was mandated to allow us to get estimates in the short time allowed for the study. It should be recognized that we have little basis for estimating what schedules would actually be on the TMI-2 site, for example.

From a technological standpoint, we would like to reiterate our opinion that while this technology certainly can be employed for the purpose the Congressman suggests, we believe that controlled venting is the most advisable approach for ^{85}Kr disposal at TMI-2. Controlled venting to the atmosphere, with adequate dilution and under favorable meteorological conditions, can be projected to have a radiological impact that is a small fraction of the annual dose from the natural background. Safety considerations force us to urge entry into the Containment Building as early as possible for much needed maintenance.

We are pleased to be of assistance to Congressman Ertel and Commissioner Gilinsky in this important matter, and we stand ready to assist them in any manner that you may direct.

Sincerely,

for D B Trauger
Herman Postma
Director

HP:atm

Attachment: Report K/ET-500

cc: S. W. Ahrends, DOE/ORO
R. L. Egli, DOE/ORO
D. E. Ferguson
R. F. Hibbs
C. C. Hopkins
J. R. Merriman
F. R. Mynatt
D. B. Trauger
P. R. Vanstrum
W. J. Wilcox, Jr.
File-RC

Department of Energy
Washington, D.C. 20585

MAY 8 1980

Honorable Allen E. Ertel
House of Representatives
Washington, D.C. 20515

Dear Mr. Ertel:

I am enclosing for your information a May 6, 1980, letter with enclosed report from Dr. Herman Postma, Director, Oak Ridge National Laboratory (ORNL). The letter forwards to the Department of Energy an ORNL report concerning possible use of the fluorocarbon selective absorption system for removing krypton gas from the TMI-2 reactor containment building. The report was prepared in response to the requests you made during your visit to Oak Ridge on Saturday, April 19, 1980. It is my understanding that the information in the enclosed report completes the commitment made to you by the Oak Ridge National Laboratory.

As I indicated to you when Oak Ridge discussed their preliminary findings with you, it is my desire to see that the Department of Energy is fully responsive to your needs and concerns. After reviewing this report if you feel there are any points which are not adequately covered, please let me know and we will provide whatever additional information Oak Ridge may have on this subject.

Sincerely,

George W. Cunningham
Assistant Secretary
for Nuclear Energy

Enclosure

cc: John Ahearne, Chairman, NRC
Victor Gilinsky, Commissioner, NRC

bcc: William Dircks, NRC
✓Bernard Snyder, NRC

K/ET-500

USE OF THE ORGDP SELECTIVE ABSORPTION PROCESS FOR REMOVAL OF KRYPTON FROM THE CONTAINMENT BUILDING ATMOSPHERE AT THREE MILE ISLAND UNIT 2

J. R. Merriman
J. A. Parsons
R. C. Riepe
M. J. Stephenson

May 6, 1980

Date of Issue: May 6, 1980

K/ET-500

USE OF THE ORGDP SELECTIVE ABSORPTION PROCESS FOR REMOVAL OF KRYPTON FROM THE CONTAINMENT BUILDING ATMOSPHERE AT THREE MILE ISLAND UNIT 2

J. R. Merriman
J. A. Parsons
R. C. Riepe
M. J. Stephenson

Operated for U. S. Department of Energy by
Union Carbide Corporation, Nuclear Division
under Contract W-7405 eng 26.

TABLE OF CONTENTS

INTRODUCTION

Selective absorption is a method for removing krypton (as well as xenon and CO_2) from various nuclear process off-gas streams. The process has been developed at the Oak Ridge Gaseous Diffusion Plant (ORGDP) in conjunction with the Oak Ridge National Laboratory (ORNL). The key to the process is the fact that krypton dissolves preferentially in fluorocarbon liquids, such as CCl_2F_2 (refrigerant-12). This permits the noble gas to be separated from other less soluble constituents; the dissolved gas can later be removed from the solvent for collection in concentrated form. The work at ORGDP, which began in 1967, has shown that the selective absorption process is very efficient, safe, flexible, and well suited to a variety of air-cleaning applications. A good body of scientific and engineering data has been acquired in the ORGDP experimental program, and rigorous design models for the key process hardware have been developed. The experimental program has been conducted in three different pilot plant systems, and several potential applications of the process have been evaluated. Recent program emphasis has been on off-gas treatment at fuel reprocessing plants. The ORGDP program is summarized in Appendix B, and a bibliography is provided in Appendix C. A process summary has been published recently*.

APPLICATION OF THE SELECTIVE ABSORPTION PROCESS TO TMI-2 CONTAINMENT BUILDING ATMOSPHERE CLEANUP

Initial Contacts with ORGDP

In the early part of October 1979, some initial discussions were held with, and reports provided to, General Public Utilities (GPU) technical staff to acquaint them with the ORGDP selective absorption process. The reactor operator's "Three Mile Island Unit 2 Reactor Building Purge Program Safety Analysis and Environmental Report," dated November 12, 1979, discussed charcoal adsorption, gas compression, and cryogenic processing techniques as alternatives to the purge; sufficient information about the absorption process had not been developed by the utility at that time. Additional information was provided to Metropolitan Edison/GPU over the next 2 months, and a meeting was held in Oak Ridge in December 1979 to review the absorption process.

During the period December 1979 through February 1980, several contacts were made by NRC technical staff. Again, some ORGDP reports were provided and there was one meeting in Oak Ridge in December 1979. The NRC draft

* Merriman, J. R., Stephenson, M. J., Kanak, B. E., and Little, D. K., *Removal of Noble Gases by Selective Absorption*, Union Carbide Corporation, Nuclear Division, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tennessee, January 1980 (K/ET-5007); presented at the IAEA/NEA International Symposium on Management of Gaseous Wastes from Nuclear Facilities, Paper Number IAEA-SM-245/53, February 18-22, 1980, Vienna, Austria.

environmental assessment* included a discussion of the selective absorption process as an alternative to the recommended purge. In late March 1980, NRC also arranged for a consultant to Commissioner Gilinsky, Professor Gerald L. Pollock, to visit Oak Ridge for discussions about the absorption process and a tour of the pilot plant.

In early January 1980, the DOE requested a study of a mobile selective absorption unit applicable to TMI-2†. The system considered during that investigation was a fully mobile system with a nominal capacity of 275 scfm. It was estimated§ that the deployment time and cost would be:

	"Crash" Program		Normal Program	
	Time, yr	Cost, $ Million	Time, yr	Cost, $ Million
Licensable	2	15 - 20	4	15 - 20
Not Licensable	1-1/2	10 - 15	3-1/2	10 - 15

Congressman Ertel's Initiative

On April 18, 1980, Congressman Allen E. Ertel (17th District of Pennsylvania) contacted Oak Ridge DOE/UCC-ND personnel to arrange a visit to Oak Ridge to discuss the selective absorption process. On April 19, he and Commissioner Gilinsky visited the selective absorption pilot plant at ORGDP. The Congressman expressed interest in innovative, creative approaches that might expedite deployment of the process on a faster schedule than that developed in January 1980 for DOE. Specifically, Congressman Ertel was interested in reducing the Kr discharged during the purge, and asked the Oak Ridge staff to:

1. Make some scoping calculations of the decontamination factors, processing times, and flow rates associated with a system sized at the pilot plant level (15 scfm) and at 10 times the pilot plant level. That is, indicate what reductions in venting might be possible with these sized units.

2. Make some "ball-park" estimates of the schedules, costs, problems, etc., associated with the 15- and 150-scfm cases, including possible use of the pilot plant itself.

* *Environmental Assessment for Decontamination of the Three-Mile Island Unit 2 Reactor Building Atmosphere*, U. S. Nuclear Regulatory Commission, March 1980 (NUREG-0662).

† Letter, J. A. Lenhard to H. Postma, *Krypton Gas Proposal*, U. S. Department of Energy, Oak Ridge Operations, Oak Ridge, Tennessee, January 8, 1980.

§ Letter, H. Postma to J. A. Lenhard, *Krypton Gas Proposal*, Union Carbide Corporation, Nuclear Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee, January 30, 1980.

With the concurrence of DOE, these items were addressed in studies which began on April 19, 1980. A verbal progress report was provided both to Congressman Ertel and later at an NRC hearing on April 25, 1980; however, at that time, the vendor contacts required to establish a project schedule had not been completed. This work was completed on May 2, 1980, and is summarized in the following sections.

Decontamination Times. The various trade-offs among decontamination factor, processing time, and absorption process flow rate are summarized in charts 1, 2, and 3. The nominal volume of the containment building at TMI-2 is 2 million cubic feet. The containment building ^{85}Kr activity level will have to be reduced by a factor of almost 10^5 in order to achieve MPC limits. This reduction can be accomplished via a purge, a recovery process, or some combination. If a recovery process such as selective absorption were used for bulk ^{85}Kr removal, then flow rates above 50 scfm appear to be most practical for the recovery step. At 150 scfm, for example, a containment building decontamination factor of 10^3 could be attained in 9 weeks' processing time.

Process Hardware. The most simplified version of the selective absorption process believed to be suitable for use at TMI-2 is shown schematically in chart 4. The hardware can be grouped into subsystems, as illustrated in chart 5. Chart 6 is a listing of the major equipment requirements. With the exception of the ^{85}Kr storage system, all hardware is of the type used routinely in the chemical process industry. A more complete outline of major hardware requirements for this application is provided in Appendix A. These listings are preliminary in nature and were developed only to provide an initial basis for contacting vendors and estimating schedules and costs.

Use of the Selective Absorption Pilot Plant at TMI-2. The ORGDP selective absorption pilot plant, being a "closed loop" experimental system, does not include all hardware needed in a stand-alone gas processing system. This is summarized in chart 7. Also, the capacity of the pilot plant is only 15 scfm, and the system was not designed for relocation. As indicated in chart 8, use of the pilot plant at TMI-2 does not appear to be practical or to offer any advantages, all things considered, over a new system having a larger capacity.

Difficulties in Estimating Actual Schedule. It is not possible at this time to estimate how much time it might actually take to design, construct, test, and start up a selective absorption system for TMI-2. This is because of a lack of familiarity with conditions at TMI-2 and because of several key uncertainties, summarized in chart 9. Most of these uncertainties are administrative and/or institutional. They include approval of an ^{85}Kr storage method, definition of basic system criteria, identification of project participants and roles, procurement problems, and TMI-2 site related issues. Each of these items obviously has an important bearing on the schedule.

Schedule for Oak Ridge "Turn-Key" Project. To establish just how fast it might be possible to construct a selective absorption system under a more easily defined set of conditions, an evaluation was made of the schedule

Kr REMOVAL AS A FUNCTION OF REACTOR VOLUMES PROCESSED

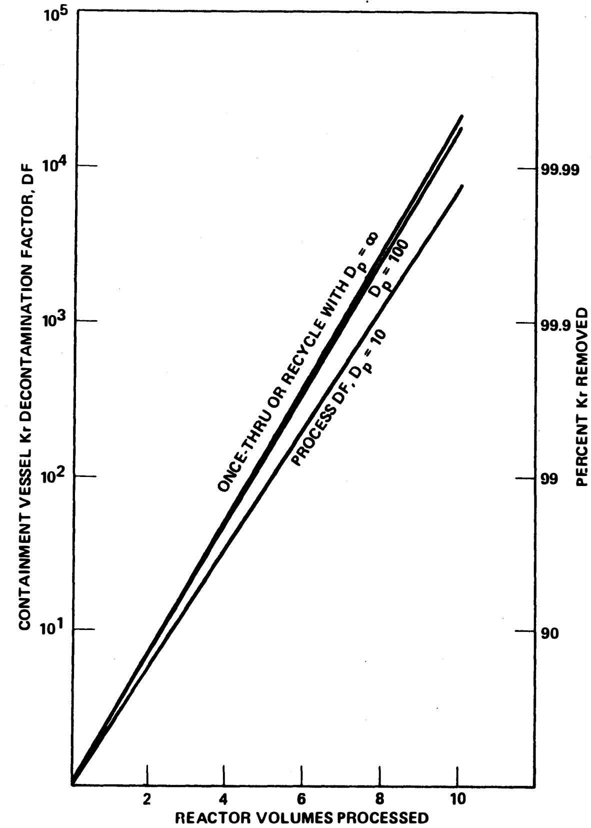

CHART 2

4/25/80 UNION CARBIDE

DWG. NO. K/G-80-1255

ESTIMATED TMI-2 CONTAINMENT Kr ACTIVITY AS A FUNCTION OF PROCESSING RATE AND TIME

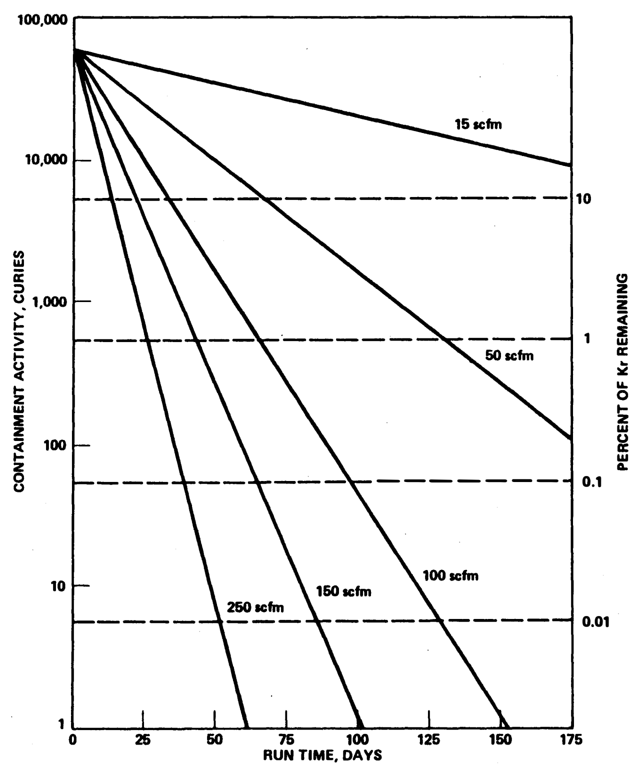

CHART 1

4/25/80 UNION CARBIDE

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DWG. NO. K/G-80-1280-R1

SCHEMATIC OF THE SELECTIVE ABSORPTION PROCESS

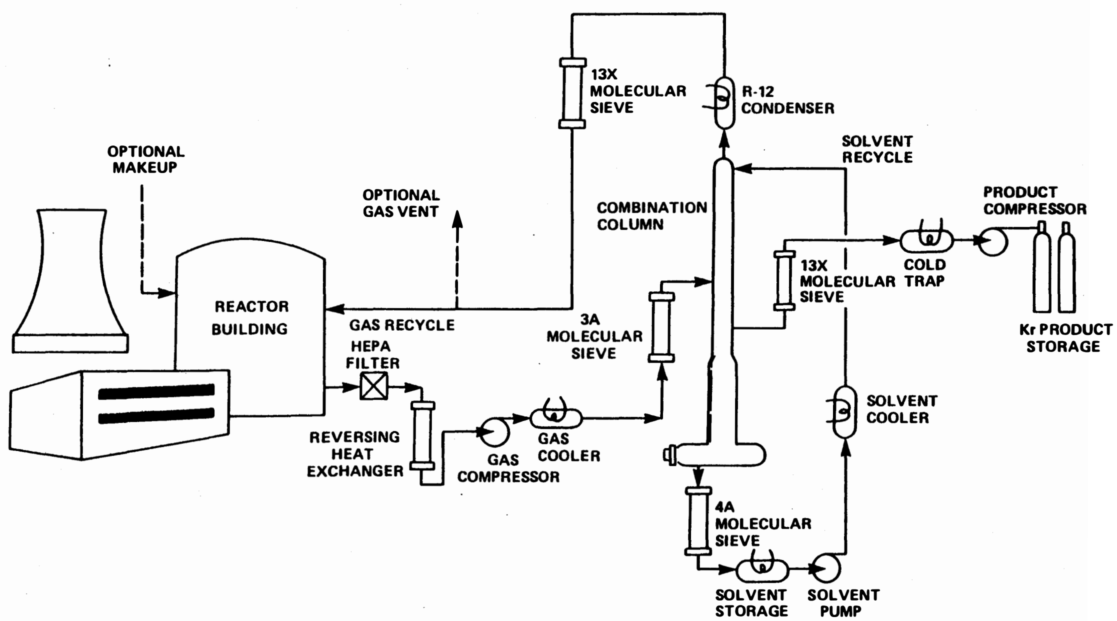

CHART 4

4/25/80 UNION CARBIDE

490

DWG. NO. K/G-80-1275

ILLUSTRATIVE TMI-2 KRYPTON PROCESSING TIMES

% REMOVAL	APPROXIMATE WEEKS TO ACHIEVE REDUCTION AT INDICATED FLOW RATE		
	15 scfm	50 scfm	150 scfm
90	33	10	3
99	66	20	6
99.9	99	30	9

CHART 3

4/25/80 UNION CARBIDE

MAJOR EQUIPMENT REQUIREMENTS FOR THE SELECTIVE ABSORPTION PROCESS

SUBSYSTEM	MAJOR EQUIPMENT ITEMS
FEED PREPARATION	HEPA FILTERS REVERSING HEAT EXCHANGERS GAS COMPRESSOR GAS HEAT EXCHANGERS/REFRIGERATION MOLECULAR SIEVE BEDS
Kr SEPARATION	COMBINATION COLUMN WITH INTEGRAL REBOILER
VENT GAS TREATMENT	CONDENSER/REFRIGERATION MOLECULAR SIEVE BEDS
SOLVENT TREATMENT	MOLECULAR SIEVE BEDS SOLVENT STORAGE TANK SOLVENT PUMPS SOLVENT COOLER/REFRIGERATION
PRODUCT TREATMENT	MOLECULAR SIEVE BEDS COLD TRAP/REFRIGERATION
PRODUCT STORAGE	GAS COMPRESSORS STORAGE CYLINDERS STORAGE CASK

CHART 6

UNION CARBIDE

11

SELECTIVE ABSORPTION PROCESS BLOCK DIAGRAM

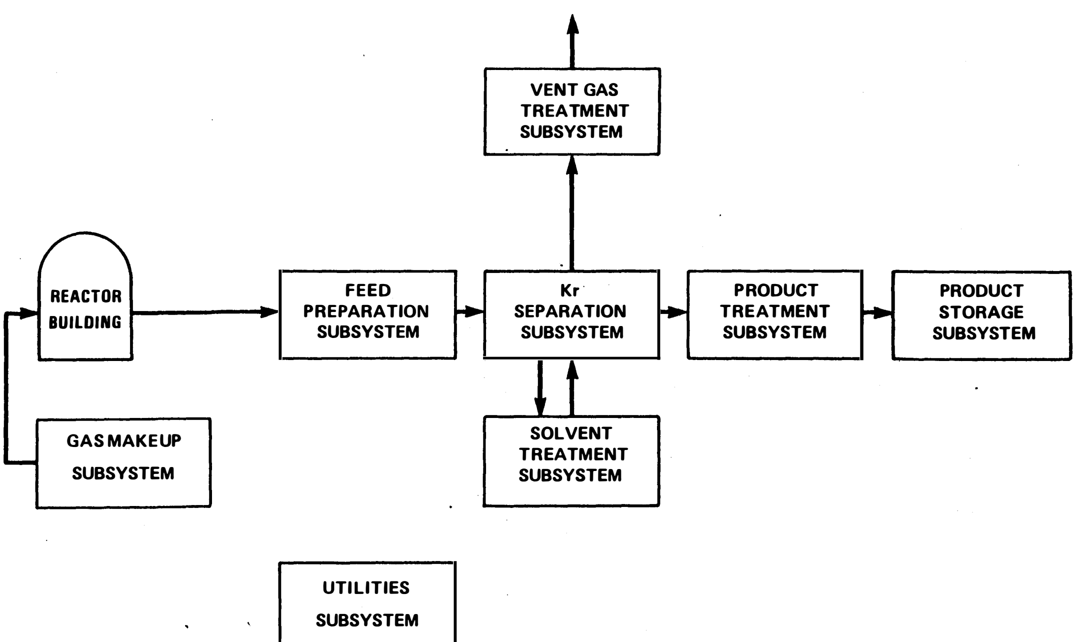

CHART 5

4/25/80

UNION CARBIDE

10

DWG. NO. K/G-80-1262-M

SOME CONCERNS ABOUT RELOCATION OF THE ORGDP SELECTIVE ABSORPTION PILOT PLANT TO TMI-2 AND INCORPORATION OF THE TEST UNIT AS PART OF A KRYPTON REMOVAL SYSTEM THERE:

- ONLY HALF OF THE MAJOR EQUIPMENT ITEMS NECESSARY FOR THE TMI-2 APPLICATION ARE USED IN AND AVAILABLE FROM THE PILOT PLANT
- EXISTING REFRIGERATION SYSTEMS ARE OLD AND UNPREDICTABLE
- OTHER ITEMS WHICH MIGHT BE AVAILABLE DO NOT APPEAR TO BE ON THE CRITICAL PATH. THEREFORE, SCHEDULE ADVANTAGES ARE NOT APPARENT
- THE PILOT PLANT FLOW RATE (15 SCFM) IS LOWER THAN WHAT WE CONSIDER TO BE A PRACTICAL MINIMUM (ABOUT 50 SCFM) FOR THIS APPLICATION
- RELOCATION COST SAVINGS (IF ANY) VERSUS NEW FABRICATION WOULD BE MODEST
- THE SYSTEM IS NOT DESIGNED FOR RELOCATION

CHART 8 4/25/80 UNION CARBIDE

PILOT PLANT HARDWARE APPLICABILITY

DWG. NO. K/G-80-1260-R1

SUBSYSTEM	MAJOR EQUIPMENT ITEMS	AVAILABILITY AT 15 SCFM SIZE FROM PILOT PLANT
FEED PREPARATION	HEPA FILTERS	NO
	REVERSING HEAT EXCHANGERS	NO
	GAS COMPRESSOR	YES
	GAS HEAT EXCHANGERS/REFRIGERATION	YES (ONE OF TWO)
	MOLECULAR SIEVE BEDS	NO
Kr SEPARATION	COMBINATION COLUMN WITH INTEGRAL REBOILER	YES
VENT GAS TREATMENT	CONDENSER/REFRIGERATION	NO
	MOLECULAR SIEVE BEDS	NO
SOLVENT TREATMENT	MOLECULAR SIEVE BEDS	YES (ONE OF TWO)
	SOLVENT STORAGE TANK	YES
	SOLVENT PUMPS	YES (ONE OF TWO)
	SOLVENT COOLER/REFRIGERATION	YES
PRODUCT TREATMENT	MOLECULAR SIEVE BEDS	YES (TWO OF THREE)
	COLD TRAP/REFRIGERATION	YES
PRODUCT STORAGE	GAS COMPRESSORS	NO
	STORAGE CYLINDERS	NO
	STORAGE CASK	NO
GAS MAKEUP SUBSYSTEM		NO
UTILITIES		NO
	INSTRUMENTATION	YES (PARTIAL)*

** SOME INSTRUMENTATION ALSO APPLICABLE TO LARGER SYSTEM.*

CHART 7 4/25/80 UNION CARBIDE

PROBLEMS, ISSUES, CONCERNS ASSOCIATED WITH ESTIMATING A REALISTIC SCHEDULE FOR USE OF A SELECTIVE ABSORPTION PROCESS SYSTEM ($\sim$100 ± 50 SCFM) FOR REDUCING Kr RELEASE AT TMI-2

- CRITERIA FOR Kr-85 STORAGE
- BASIC OBJECTIVES AND CRITERIA WHICH GOVERN PROJECT SCOPE, SCHEDULE, COST, AND PROGRAMMATIC IMPACT (IS SECTION 8 ASME ADEQUATE?, WHAT IS TARGET DF?, WHAT ARE REGULATORY REQUIREMENTS?, ETC.)
- RESPONSIBILITIES FOR PROJECT PHASES: TECHNOLOGY SPECIFICATION, DESIGN, APPROVAL, PROCUREMENT, CONSTRUCTION, OPERATION (DOE, NRC, AE'S, GPU/MET.ED.) AND INTERFACES AMONG PARTICIPANTS
- PROCUREMENT PROBLEMS
- BUILDING ISSUES (AVAILABILITY, ETC.)
- EXACT COMPOSITION OF REACTOR BUILDING ATMOSPHERE
- CONDITIONS AND CONSTRAINTS PECULIAR TO THE TMI-2 LOCATION

CHART 9

5/2/80

UNION CARBIDE

DWG. NO. K/G-80-1223R1

for a case where a 150-scfm capacity system would be designed, built, assembled, and tested by UCC-ND in the DOE Oak Ridge facilities, after which the unit would be moved to a prepared site at TMI and operated there. It was assumed that the project would be a high priority DOE project. Other key assumptions are listed in chart 10 and include:

- Use of accepted conventional industrial standards, practices, and codes (including general adherence to Regulatory Guide 1.143)
- Negotiated procurements, expedited with premiums
- Adequate site provisions at TMI-2; that is, any site work needed to prepare for deployment and hook-up of the absorption unit could be completed by the time the unit was moved to TMI
- Concurrent reviews and approvals with no time lapse
- "Conventional" DOE-Oak Ridge project safety analysis
- No delays due to any required environmental impact statements
- Some use of pilot plant instrumentation
- Continued validity of the "snapshot" of hardware availability taken during vendor contacts during the week of April 28, 1980
- Collection of ^{85}Kr in DOE cylinders and transfer to the DOE inventory

The key to preparation of this estimate was a vendor survey made during the week of April 28, 1980, by the UCC-ND Purchasing Division and other technical staff members to establish delivery times for key hardware components which were of concern as potential long-lead items. The results of this survey are summarized in chart 11. For example, adequate HEPA filters apparently are already available at the TMI-2 site; two 50-scfm gas compressors are essentially immediately available, with a third available within 3 months; and valves are available within 4 months. It should be emphasized that the vendor contacts resulted in estimates only; no firm commitments were given or sought.

Given the scenario just outlined, it is estimated that, on a "best efforts" basis, 13 months would be required from the start of the project until the system would be operational at TMI-2. This is shown in chart 12; the schedule includes time for engineering, hardware procurement and fabrication, installation and testing at Oak Ridge, disassembly and shipping to the TMI-2 site, and reassembly and start-up there. Procurement would be started in 2 months (although some early options might be placed) and installation at Oak Ridge would begin in 7-1/2 months following project initiation. The Oak Ridge installation and start-up phase is estimated at about 4 months. This gives an estimated total elapsed time of 11-1/2 months from the point of project activation to the point where the system would be operable at Oak Ridge. From that point, 2 weeks is allowed for

DWG. NO. K/G-80-1323-R1

TMI-2 SELECTIVE ABSORPTION SYSTEM
MAJOR HARDWARE AVAILABILITY

SUBSYSTEM	MAJOR EQUIPMENT ITEMS	CHARACTERISTIC SIZE	RESULTS OF VENDOR CONTACTS DURING WEEK OF 4/28/80: INDICATED AVAILABILITY OR PROCUREMENT TIME, MONTHS
FEED PREPARATION	HEPA FILTERS	24" x 24"	ALREADY EXIST AT SITE (4, OTHERWISE)
	REVERSING HEAT EXCHANGERS	2 AT 2.7-TON	3
	GAS COMPRESSORS	3 AT 50 SCFM	3 (2 EXISTING UNITS AVAILABLE WITHIN 1 MONTH)
	GAS HEAT EXCHANGER/REFRIG.	2 AT 2.4-TON	4
	MOLECULAR SIEVE BEDS	TBD*	IN-HOUSE FABRICATION
Kr SEPARATION	COMBINATION COLUMN WITH	10" - 12" - 14"	IN-HOUSE FABRICATION
	INTEGRAL REBOILER	200 kW	3
VENT GAS TREATMENT	CONDENSER/REFRIGERATION	1 AT 3.6-TON	3
	MOLECULAR SIEVE BED	TBD	IN-HOUSE FABRICATION
SOLVENT TREATMENT	MOLECULAR SIEVE BED	TBD	IN-HOUSE FABRICATION
	SOLVENT STORAGE TANK/COOLER	600 GAL/22-TON	3
	SOLVENT PUMP	2 AT 30 GPM	2
	SOLVENT COOLER/REFRIG.	1 AT 37-TON	3
PRODUCT TREATMENT	MOLECULAR SIEVE BED	TBD	IN-HOUSE FABRICATION
	COLD TRAP/REFRIGERATION	SMALL	COLD TRAP IS IN-HOUSE FABRICATION REFRIGERATION < 3
PRODUCT STORAGE	GAS COMPRESSOR	SMALL	4
	STORAGE CYLINDER & CASK	—	ASSUMED TO BE IMMEDIATELY AVAILABLE FROM DOE
GAS MAKEUP	LIQUID N_2 VAPORIZATION/ METERING	TBD	3
UTILITIES		TBD	ASSUMED AVAILABLE AT TMI SITE BY REQUIRED TIME
	VALVES	½ to 3-INCH	4
	INSTRUMENTATION	—	SOME TAKEN FROM PILOT PLANT; BALANCE < 3
	BUILDING TO HOUSE SYSTEM	TBD	ASSUMED AVAILABLE AT TMI SITE BY REQUIRED TIME

** TO BE DETERMINED*

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CHART 11

DWG. NO. K/G-80-1328-R1

KEY ASSUMPTIONS IN ESTIMATING "BEST EFFORTS" SCHEDULE FOR TMI-2 Kr SELECTIVE ABSORPTION SYSTEM

- ACCEPTED CONVENTIONAL INDUSTRIAL STANDARDS, PRACTICES, AND CODES USED (INCLUDING GENERAL ADHERENCE TO REGULATORY GUIDE 1.143)
- SYSTEM CAPACITY APPROXIMATELY 150 SCFM
- NEGOTIATED PROCUREMENTS; EXPEDITED TO MAXIMUM EXTENT, INCLUDING PREMIUMS FOR EARLY DELIVERY. NORMAL PROCUREMENT REGULATIONS WAIVED
- PROJECT RECEIVES VERY HIGH PRIORITY IN ALL PHASES BY ALL PARTIES INVOLVED
- DESIGN PROCUREMENT, FABRICATION, ASSEMBLY, AND TESTING IN OAK RIDGE
- FOLLOWING TESTING, THE UNIT WOULD BE DISASSEMBLED AND PACKAGED FOR TRANSPORT TO THE TMI-2 SITE
- TMI-2 REQUIREMENTS (UTILITIES, SPACE, ETC.) WOULD BE SPECIFIED WITHIN 2 MONTHS FOLLOWING PROJECT INITIATION AND ARE ASSUMED TO BE AVAILABLE WITHIN 10 MONTHS THEREAFTER
- REVIEWS AND APPROVALS WOULD PROCEED CONCURRENTLY WITH NO TIME LAPSE
- A SAFETY ANALYSIS OF THE TYPE NORMALLY USED AT OAK RIDGE ON DOE PROJECTS WOULD BE PREPARED
- AN ENVIRONMENTAL IMPACT STATEMENT, IF REQUIRED, WOULD NOT DELAY THE SCHEDULE
- SOME USE OF PILOT PLANT INSTRUMENTATION MIGHT BE REQUIRED
- CONCENTRATED ^{85}Kr WOULD BE TRANSFERRED TO DOE, USING AVAILABLE CYLINDER AND CASK DESIGNS
- SCHEDULES AND COSTS ARE BEST EFFORTS AND CANNOT BE GUARANTEED
- THE "SNAPSHOT" OF HARDWARE AVAILABILITY TAKEN DURING VENDOR CONTACTS DURING THE WEEK OF APRIL 28, 1980, REMAINS VALID

5/2/80

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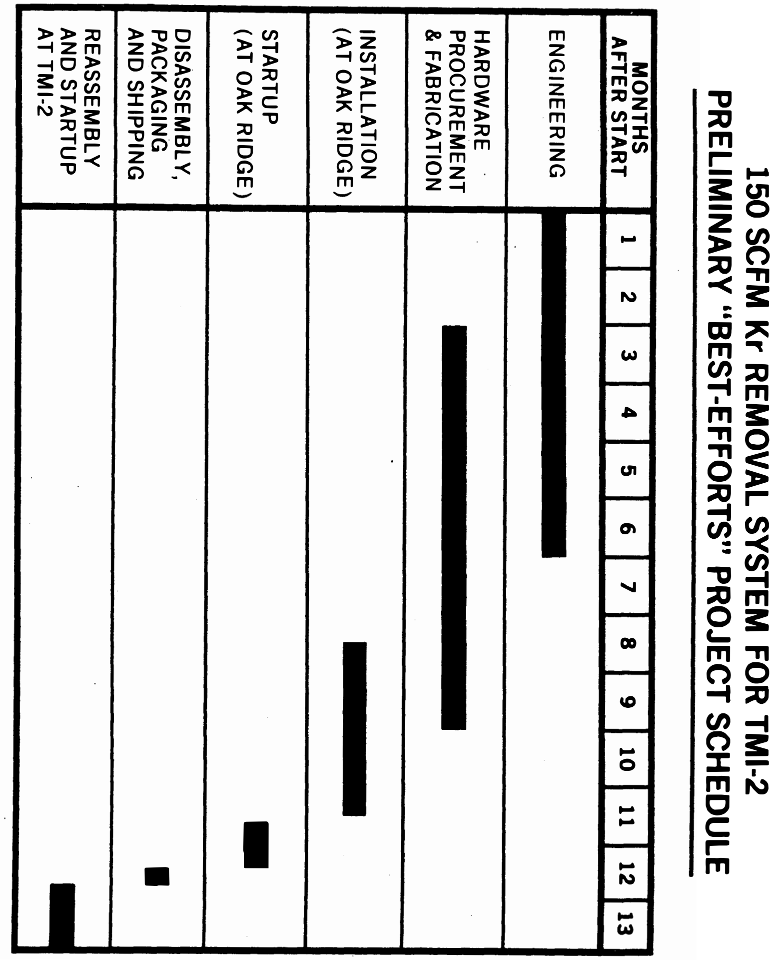
CHART 10

CHART 12



5/2/80

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DWG. NO. K/G-80-1318

disassembly and shipping to TMI-2. For purposes of this estimate, one month is shown for reassembly and start-up at TMI-2. Obviously, schedules for activities outside the Oak Ridge environment cannot be estimated with the same confidence as those for the Oak Ridge portion of the project.

This "best efforts" schedule is considered to be possible under the assumptions previously stated (chart 10). However, changes in those assumptions may invalidate the schedule. The assumptions, again, were established to provide an estimating basis and not to recommend a project approach.

The cost for this system is estimated to be between $9 and $12 million. Chart 13 summarizes the various estimates made to date for selective absorption systems for use at TMI-2.

CONCLUSION

The key results of the studies concerning use of the selective absorption process at TMI-2 are:

- The selective absorption process is a technically feasible method for removing ^{85}Kr from the containment building atmosphere. The process is effective and well developed, and technical risk in this application is low.

- The fastest "best efforts" schedule for deployment of a selective absorption system at TMI-2 appears to be about 13 months. This schedule is based on a project in Oak Ridge and is contingent upon several key assumptions. The schedule includes 11-1/2 months estimated to be required from the point of project initiation until a system could be in operation in Oak Ridge. From that point, an allowance of 6 weeks was made for moving the system to a previously prepared (assumed) location at TMI-2 and starting it up again at that site. The assumptions were established to provide an estimating basis rather than to recommend an approach.

- The actual time required for deployment of a selective absorption system at TMI-2 cannot be realistically determined without resolution of several important factors affecting project scope, approach, and criteria.

- Use of the existing 15-scfm selective absorption pilot plant at TMI-2 does not seem practical, primarily because of the small pilot plant capacity and number of additional equipment items which would be needed in the TMI-2 application.

- One feasible approach to the problem of storage of ^{85}Kr recovered from TMI-2 appears to be transfer to DOE. Designs are available within DOE for the appropriate cylinders, shields, and shipping casks.

APPENDIX A

TMI-2 SELECTIVE ABSORPTION PROCESS:
PRELIMINARY HARDWARE OUTLINE
ASSUMED FOR INITIAL ESTIMATES OF SCHEDULE AND COST

DWG. NO. K/G-80-1326-R1

SUMMARY OF UCC-ND ESTIMATES OF COSTS AND SCHEDULES FOR SELECTIVE ABSORPTION UNIT FOR TMI-2

DESCRIPTION	CONSTRAINTS	COST $ MILLIONS	SCHEDULE
275 SCFM CAPACITY; COMPLETELY MOBILE UNIT*	LICENSABLE - NORMAL PROGRAM	15-20	4 YRS.
	LICENSABLE - 'CRASH' PROGRAM	15-20	2 YRS.
	NOT LICENSABLE - NORMAL PROGRAM	10-15	3½ - 4 YRS.
	NOT LICENSABLE - 'CRASH' PROGRAM	10-15	1½ - 2 YRS.
APPROXIMATELY 150 SCFM CAPACITY; SPARTAN VERSION FOR ONE-TIME USE†	LICENSABLE - 'CRASH' PROGRAM	13-16	2 YRS.
	NOT LICENSABLE - 'BEST EFFORTS' ESTIMATE	9-12	13 MONTHS

** PREVIOUSLY DISCUSSED IN LETTER, H. POSTMA, TO J. A. LENHARD, DOE-ORO, KRYPTON GAS PROPOSAL, UNION CARBIDE CORPORATION, NUCLEAR DIVISION, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENNESSEE, JANUARY 30, 1980.*

† REQUESTED BY CONGRESSMAN ERTEL DURING HIS VISIT TO OAK RIDGE ON APRIL 19, 1980.

CHART 13 5/2/80 UNION CARBIDE

TMI-2 SELECTIVE ABSORPTION PROCESS: PRELIMINARY HARDWARE OUTLINE ASSUMED FOR INITIAL ESTIMATES OF SCHEDULE AND COST

In this Appendix, outline descriptions are given for key hardware items which would be required in a selective absorption system for TMI-2. A process schematic, breakdown of the components into subsystems, and an equipment listing were provided earlier in charts 4, 5, and 6. A more detailed flow sheet is shown in chart A-1. This information is preliminary; it was developed not as a recommendation, but as a basis for making vendor contacts and estimating cost and schedule.

FEED PREPARATION SUBSYSTEM

The reactor containment vessel is maintained at a pressure slightly below atmospheric and a temperature near ambient. As withdrawn from the reactor, the contaminated gas will contain particulates, such as traces of ^{137}Cs, and will be saturated with water containing trace amounts of tritium. The reactor gas has to be filtered and dried, and then compressed to 150 psig and cooled to minus 30°F before it can be fed into the noble gas separation column. The major components of the Feed Preparation Subsystem include a HEPA filter bank, reversing heat exchangers (for bulk water removal), a gas compressor system, a gas heat exchanger/refrigeration system, molecular sieve beds (for trace water removal), and water storage tanks. Pressure, flow, and temperature control loops are also required.

HEPA Filter System

Purpose: To remove particulates from the reactor gas

Design Basis: Operating Temperature - Ambient

Operatinq Pressure - 14.0 psia

Gas Flow Rate - 150 scfm

Frame Dimensions - 24 inches by 24 inches

Filter Thickness - 11-1/2 inches

Number Required - 1 (minimum)

The TMI-2 purge described by Met Ed/GPU* is designed to utilize the reactor building hydrogen control exhaust unit. This unit is comprised of a bank of filters housed in a steel cabinet and an exhaust fan. The

* *Three Mile Island Unit 2 Reactor Building Purge Program Safety Analysis and Environmental Report*, Prepared by Metropolitan Edison/GPU, November 12, 1979.

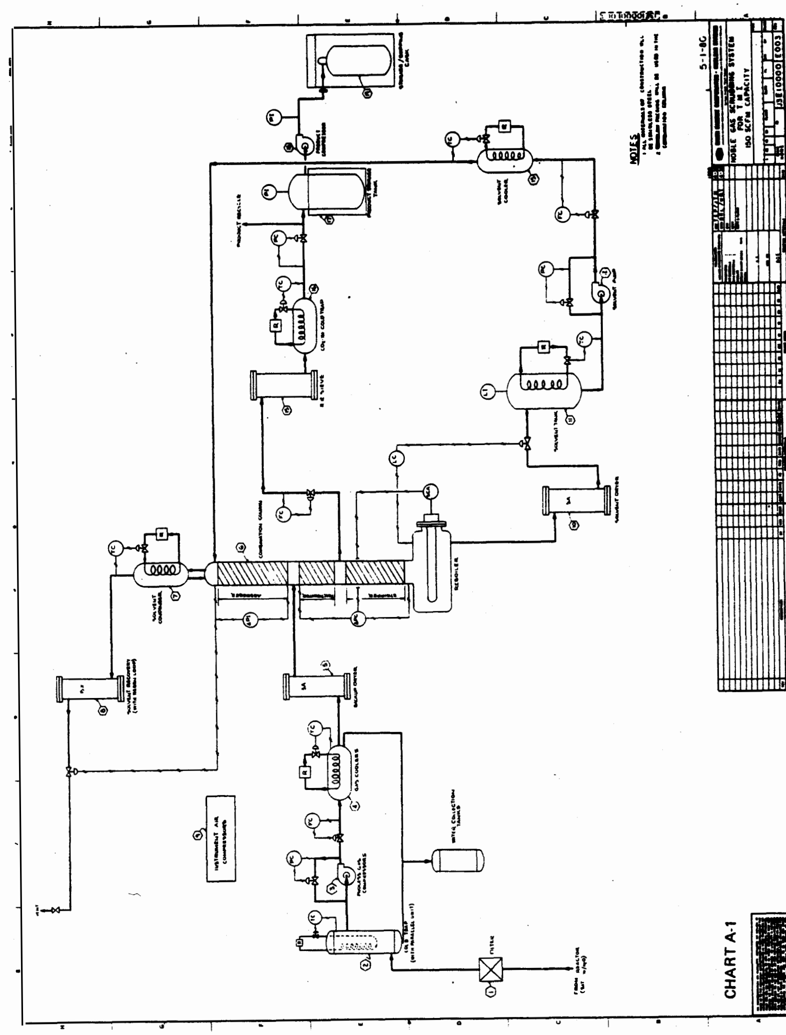

CHART A-1

filter bank consists of (in sequence) a pre-filter, a HEPA filter, an activated carbon filter, and another HEPA filter. The system evidently will accommodate flows up to 1000 scfm and thus appears suitable for use in the selective absorption process feed preparation subsystem.

Feed Gas Cold Trap

Purpose: To remove the bulk amount of the water from the reactor feed gas

Design Basis: Feed Gas - Air saturated with water at 80°F

Water Content of Feed Gas - 1.62×10^{-3} lb/std ft^3

Feed Gas Flow Rate - 150 scfm

Operating Pressure - 14.0 psia

Outlet Gas Temperature - 0°F

Refrigeration Requirements - 32,000 Btu/hr (2.7 tons)

Water Content of Outlet Gas - 7.92×10^{-5} lb/std ft^3

Amount of Water Removed - 1.54×10^{-3} lb/std ft^3 (1.66 gal/hr)

Water Removal Efficiency - 95%

Number Required - 2

The water removed from the reactor off-gas via cold trapping will be periodically drained from the heat exchanger during a defrost cycle. A desiccant-type dryer could be used instead of the refrigerated system, but the water recovery step would not be as direct.

Process Gas Compressor System

Purpose: To compress the reactor gas to the operating pressure of the absorber

Design Basis: Suction Pressure - 14 psia

Discharge Pressure - 150 psig

Gas Flow Rate - 150 scfm

Number Required - Dependent upon individual machine capacity

A diaphragm-type compressor is generally preferred for this application since a rotating shaft seal would not be required and the process gas would not contact compressor lubricant. A screw, lobe, or centrifugal machine could be considered, however, if placed in an isolation box to

ensure reactor gas containment. The compressors will be skid-mounted and equipped with gas discharge pressure and flow control loops. Stainless steel is the preferred material of construction. Water cooling will be required for the compressor head and after-cooler. Either a single unit or a group of parallel compressors could be utilized.

Process Gas Cooler

Purpose: To cool the reactor gas to the operating temperature of the absorber

Design Basis: Inlet Gas Temperature - 110°F

Water Content of Inlet Gas - 7.92×10^{-5} lb/std ft^3

Feed Gas Flow Rate - 150 scfm

Operating Pressure - 125 psig

Outlet Gas Temperature - minus 50°F

Refrigeration Requirements - 28,600 Btu/hr (2.4 tons)

Amount of Water Removed - 7.9×10^{-5} lb/std ft^3 (0.085 gal/hr)

Number Required - 2

The process gas cooler will remove essentially all of the remaining water in the reactor gas. This amount of water is small compared to the quantity removed by the feed gas dryer, but this heat exchanger, like the first, will still have to undergo a defrost cycle and the water collected. An evaporative-type refrigeration system employing a separate refrigeration compressor/condenser system and refrigerant such as R-502 will be used. Alternatively, a direct cooling liquid nitrogen system might be considered.

Backup Gas Dryer

Purpose: To provide backup desiccant service.

Design Basis: Desiccant Type - 3A molecular sieve

Inlet Gas Temperature - minus 50°F

Operating Pressure - 125 psig

Dryer Diameter - 12 inches

Dryer Length - 8 feet

Number Required - 2

Molecular sieves are preferred over other desiccants because they have a higher capacity at lower water partial pressures. The 3A-type molecular sieve is preferred over other sieves because the 3A will not load CO_2. The water load on the backup gas dryer will be exceedingly small, and a regenerative loop is optional. Traces of iodine might contaminate the sieves and disposal may be necessary at the completion of the cleanup job.

Water Storage Tanks

Purpose: To provide storage volume for the water removed from the reactor feed gas

Design Basis: 42 gal/day of operation

Since the water may contain trace amounts of tritium, it will ultimately be routed to the reactor liquid processing center for disposal.

KRYPTON SEPARATION COLUMN

The krypton separation will take place in a unique combination column developed expressly for the selective absorption process. The three functional steps of absorption, intermediate stripping, and final stripping are combined in a single packed column contactor. The actual krypton separation is performed in the absorber section or top part of the column. Here, the upflowing contaminated feed gas is contacted countercurrently with downflowing solvent. Refrigerant-12 (CCl_2F_2) is the preferred process solvent in this case. The absorber section is operated at a temperature, pressure, and gas-to-solvent flow rate ratio sufficient to bring about essentially complete dissolution of the radioactive gas. Decontaminated gas subsequently passes from the top of the column, while the loaded solvent flows immediately downward into the intermediate and final stripping sections of the process. Dissolved gases are stripped from the solvent through countercurrent contact with upflowing solvent vapor generated in an attached boiler located directly below the column. Regenerated solvent is withdrawn from the boiler for recycle to the top of the column. The radioactive krypton is concentrated in the intermediate section of the column and is subsequently drawn off as a side stream product.

Combination Column

Purpose: To remove krypton from the feed gas, concentrate the krypton for disposal, and regenerate the solvent for recycle

Design Basis: Krypton Decontamination Factor - 100

Krypton Concentration Factor - 10^4

Feed Gas Flow Rate - 150 scfm

Feed Gas Temperature - minus 30°F

Solvent Flow Rate - 30 gpm

Solvent Temperature - minus 30°F

Operating Pressure - 125 psig

Absorber Section - 10 inches in diameter, 12 feet tall

Intermediate Section - 12 inches in diameter, 7 feet tall

Final Stripping Section - 14 inches in diameter, 4 feet tall

Column Packing - Goodloe wire mesh, all sections

Material of Construction - 304L stainless steel

Number Required - 1

The Oak Ridge pilot plant combination column has an internal solvent vapor condenser located between the intermediate and final stripping sections of the combination column. The condenser is required when higher stripping upflows are needed to desorb more soluble feed gas components, such as CO_2 and Xe. In the reactor case, the internal condenser is not included, and the bulk amounts of the feed gas CO_2 and Xe will remain in the solvent and subsequently equilibrate with the column off-gas. The krypton product will contain less diluent gas as a result.

All sections of the combination column have to be packed with the same materials used in the pilot plant. Otherwise, the design models would not be applicable.

Solvent Boiler

Purpose: To provide a stripping vapor upflow to the combination column

Design Basis: Operating Pressure - 125 psig

Operating Temperature - 100°F

Solvent Flow Rate - 30 gpm

Heat Input - 200 kW

Number Required - 1

Heat is added to the reboiler as necessary to establish/maintain an intermediate section pressure drop of 1 inch of water/foot of packing. A capacitance probe liquid level system can be used to effectively measure/control the reboiler liquid level.

VENT GAS TREATMENT SUBSYSTEM

The decontaminated off-gas from the combination column will contain 8.6 mole percent R-12 vapor. A solvent recovery subsystem is an essential part of the krypton recovery process to prevent process disruptions caused by the loss of solvent. The bulk of the solvent can be effectively removed by passing the off-gas through a low temperature condenser. The residual solvent can be trapped on a 13X molecular sieve bed.

Solvent Condenser

Purpose: To remove solvent vapor from the combination column off-gas

Design Basis: Flow Rate - 150 scfm (solvent-free basis)

Inlet R-12 Content - 8.6 mole percent

Operating Pressure - 125 psig

Operating Temperature - minus 150°F

Effluent R-12 Content - 1000 ppm

Refrigeration Requirements - 43,400 Btu/hr (3.6 tons)

Number Required - 1

The condensate from the R-12 condenser will be refluxed to the top of the absorber column.

13X Molecular Sieve Solvent Trap

Purpose: To remove the residual solvent vapor from the R-12 condenser off-gas

Design Basis: Flow Rate - 150 scfm (solvent-free basis)

Inlet R-12 Content - 1000 ppm

Operating Pressure - 125 psig

Operating Temperature - minus 125°F

Effluent R-12 Content - Less than 1 ppm

Trap Diameter - 12 inches

Trap Length - 6 feet

Number Required - 3

13X molecular sieves can load 0.3 lb R-12/lb sieve. The sieves can be regenerated by pressure swing or hot nitrogen purge. Three traps would accommodate the usual load/regenerate cycle: one trap in service, one trap being regenerated, and one trap in standby.

SOLVENT RECYCLE SUBSYSTEM

The solvent will leave the combination column boiler at a temperature of 100°F, pressure of 125 psig, and may contain trace amounts of water and iodine. A solvent recycle subsystem is provided to purify the solvent as necessary, cool it to minus 30°F, and pump it back to the top of the absorber section of the combination column. A refrigerated solvent storage tank is also provided in the solvent circuit to give the system some additional capacitance and flexibility.

Solvent Dryer

Purpose: To remove trace quantities of water and iodine that might get into the solvent

Design Basis: Operating Temperature - 100°F

Operating Pressure - 125 psia

Solvent Flow Rate - 30 gpm

Trap Diameter - 12 inches

Trap Length - 4 feet

Number Required - 2

The solvent dryer molecular sieves will see only light duty. A regeneration loop is therefore optional. At the completion of the reactor cleanup job, the sieves may have to be discarded as low level radioactive waste.

Solvent Tank

Purpose: To provide solvent storage capacity

Design Basis: Tank Size - 600 gallons

Solvent Flow Rate - 30 gpm

Inlet Solvent Temperature - 100°F

Outlet Solvent Temperature - 50°F

Operating Pressure - 100 psig

Refrigeration Requirements - 261,000 Btu/hr (22 tons)

Number Required - 1

The solvent tank is sized to provide enough running inventory for 20 minutes of operation. Refrigeration is provided to prevent solvent pump cavitation.

Solvent Pump

Purpose: To pump solvent in a closed loop from the bottom of the combination column to the top

Design Basis: Capacity - 30 gpm

Suction Pressure - 100 psig

Suction Temperature - 50°F

Discharge Pressure - 135 psig

Pump Type - Turbine or Gear

Materials of Construction - 304L stainless steel

Number Required - 2 (one is a spare)

Pump discharge pressure and flow control loops are required to maintain proper absorber operation. Diaphragm-type pumps are not recommended because of pressure surges.

Solvent Cooler

Purpose: To cool the solvent to the operating temperature of the absorber section of the combination column

Design Basis: Solvent Flow Rate - 30 gpm

Operating Pressure - 130 psig

Inlet Solvent Temperature - 55°F

Discharge Temperature - minus 35°F

Refrigeration Requirements - 441,000 Btu/hr (37 tons)

Number Required - 1

PRODUCT TREATMENT SUBSYSTEM

The side stream product withdrawn from the combination column will be highly concentrated in krypton. In fact, the product krypton concentration will be 10^4 times more than that in the feed gas. Still, the bulk of the mixture will initially consist of solvent vapor, CO_2, and Xe. Solvent vapor can be easily removed from the product gas mixture via a 13X molecular sieve trapping system. Most of the CO_2 and Xe can then be removed by cold trapping. The volume of gas that will remain to be stored after the product treatment will be 40 times smaller than that taken directly from the combination column, resulting in an overall concentration factor of about 10^5.

13X Molecular Sieve Trap

Purpose: To remove solvent vapor from the product gas

Design Basis: Operating Pressure - 100 psig

Operating Temperature - 80°F

Inlet Gas Flow Rate - 3500 sccm (maximum)

Inlet R-12 Content - 50 mole percent

Outlet Gas Flow Rate - 1750 sccm (maximum)

Outlet R-12 Content - 1 ppm

Trap Diameter - 3 inches

Trap Length - 3 feet

Number Required - 3

Water cooling will be required on the outer surface of the trap to remove the R-12 heat of adsorption. A conventional hot nitrogen regeneration loop will be used.

CO_2-Xe Cold Trap

Purpose: To remove the bulk amounts of the CO_2 and Xe diluent in the Kr product and thereby further reduce the volume required for Kr storage

Design Basis: Operating Pressure - 100 psig

Operating Temperature - Minus 250°F

Inlet Gas Flow Rate - 1750 sccm (maximum)

Outlet Gas Flow Rate - 85 sccm (maximum)

Outlet Kr Concentration - 35%

Refrigeration Requirements - 130 Btu/hr

Number Required - 3

Cold trap cooling will be achieved with liquid nitrogen. Three cold traps will be provided to give the usual load/regeneration flow capability. The CO_2 and Xe will be vented during the defrost cycle or, alternatively, passed back to the reactor if krypton contamination is detected.

PRODUCT STORAGE SUBSYSTEM

The concentrated krypton product will be temporarily collected in a low pressure storage tank. Periodically, the gas will be pumped into a pressurized gas cylinder for storage/shipping. Existing DOE ^{85}Kr cylinders and shipping casks will be used as the design basis.

Interim Storage Tank

Purpose: To provide temporary storage volume for the concentrated krypton mixture

Design Basis: Operating Pressure - vacuum to 25 psig

Operating Temperature - ambient

Inlet Flow - 1750 sccm (maximum)

Tank Volume - 1 ft^3

Maximum ^{85}Kr Content - 3000 curies

Number Required - 1

The interim storage container will be shielded. A line will be provided to vent the storage container back to the reactor containment and/or to the absorber.

Product Compressor

Purpose: To compress the Kr product gas for pressurized gas cylinder storage

Design Basis: Maximum Suction Pressure - 25 psig

Maximum Discharge Pressure - 500 psig

Maximum Flow Rate - 10,000 sccm

Number Required - 2

A diaphragm compressor will be used to compress the concentrated Kr product.

Storage/Shipping Cylinder with Cask

Purpose: To provide an acceptable container for storing/shipping of ^{85}Kr removed from the reactor

Design Basis: Cylinder Volume - 1.54 ft^3

Cylinder Pressure - 500 psig maximum

DOE has designs for storage/shipping containers for ^{85}Kr. Details of the containers, which have been DOT-certified, are shown in charts A-2 and A-3.

DOE KRYPTON SHIPPING CONTAINER

DWG. NO. K/G-80-1320

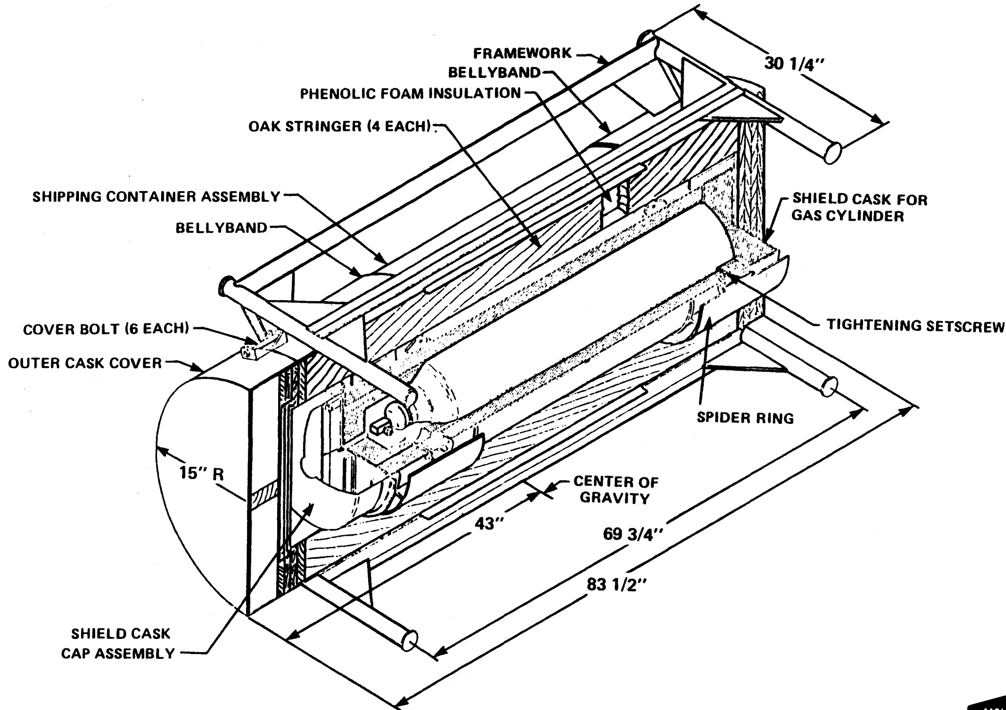

CHART A-3

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35

DOE SHIELDED KRYPTON CYLINDER

DWG. NO. K/G-80-1319

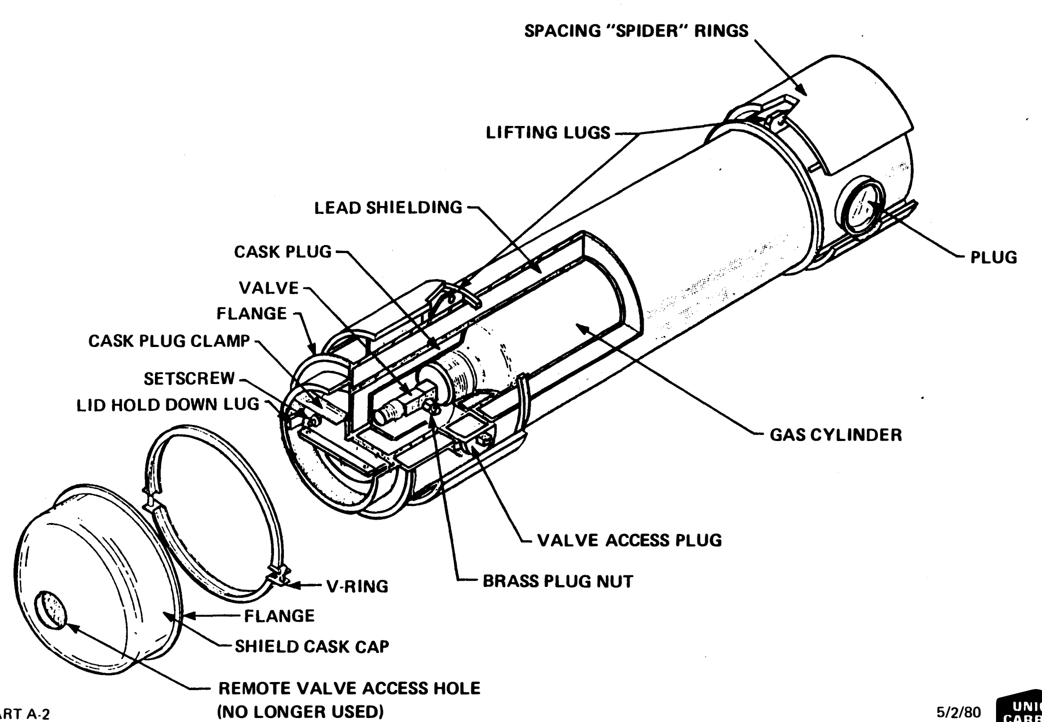

CHART A-2

5/2/80 UNION CARBIDE

34

APPENDIX B

SUMMARY OF THE ORGDP SELECTIVE ABSORPTION PROGRAM

SUMMARY OF THE ORGDP SELECTIVE ABSORPTION PROGRAM

In the late 1950's, work was reported in both the United States and the United Kingdom on the adaptation of conventional, chemical engineering absorption/stripping techniques to the removal and concentration of krypton and xenon from gas streams which their radioisotopes contaminate. As indicated in chart B-1, the UK work utilized carbon tetrachloride, CCl_4, as the process solvent. The U.S. work at that time was conducted at the Brookhaven National Laboratory (BNL) and involved some basic laboratory measurements of krypton and xenon solubilities in various liquids and scoping calculations related to process applications. The BNL studies recommended refrigerant-12, CCl_2F_2, as the process solvent of choice, considering selectivity, capacity, operability, safety, and stability to radiolytic and thermal decomposition.

In 1967, work on the selective absorption process for Kr-Xe collection was resumed in an experimental program initiated at the ORGDP. The main objectives of the ORGDP project were to acquire engineering-scale process data and to develop process design models which would permit confident design of scaled-up systems for a variety of applications. Both objectives have been met successfully.

The application first considered when the ORGDP program was started was a mobile system which could be transported to the site of a nuclear reactor following an accident which released fission gas to the containment and then used there to remove the radioactive gas from the containment and concentrate it in a form suitable for transportation and storage. Following studies aimed at this application, program emphasis was shifted toward treatment of off-gas from light water reactors during their normal operation. After that work was completed, the program was focused on reprocessing plant off-gas treatment. In addition, other applications, such as Fast Flux Test Facility (FFTF) and High Temperature Gas-Cooled Reactor (HTGR) cover gas cleanup, HTGR reprocessing (using ORNL's liquid CO_2 absorption scheme), and weapons test radioactive gas containment, have been evaluated.

Chart B-2 summarizes the ranges of key parameters investigated in the experimental program over the years. These tests have been conducted in three different pilot plant units, and the chronology of these test systems is summarized in chart B-3. Based on a projected FY 1980 expenditure of $250,000, the cumulative selective absorption program costs through FY 1980, as shown in chart B-4, are just below $4.7 million. Most of this sum, about $3.3 million, has been spent on basic process development via engineering tests in the three pilot plants.

SUMMARY OF SELECTIVE ABSORPTION EXPERIMENTS

DWG. NO. K/G-80-1329-R1

SOLVENTS	CCl_2F_2 (REFRIGERANT-12), CCl_3F (REFRIGERANT-11), CO_2
CARRIER GASES	AIR, N_2, Ar, H_2, He, CO_2
NOBLE GASES	Kr, WITH ^{85}Kr; Xe, WITH ^{133}Xe
IMPURITIES	CO_2, NO, NO_2, N_2O, CH_3I, I_2
TEMPERATURE, °F	-75 TO +25
PRESSURE, ATM	6.10 TO 34.8
SOLVENT FEED RATE, GPM	0.75 TO 2.0
GAS FEED RATE, SCFM	1.13 TO 22.2
FEED CONCENTRATIONS – Kr, PPM	0.014 TO 8800
– Xe, PPM	0.002 TO 100
– IMPURITIES, PPM	50 TO 6700 (FOR INDIVIDUAL COMPONENTS)
REMOVAL PERCENTAGES – Kr	62.9 TO 99.95
– Xe	99.96 TO 99.99

39

CHART B-2

5/2/80 UNION CARBIDE

505

SELECTIVE ABSORPTION PROCESS HIGHLIGHTS

DWG. NO. K/G-80-1324

1958 REPORT ON UK WORK USING CCl_4 AS PROCESS SOLVENT

1958 REPORT FROM BNL RECOMMENDING CCl_2F_2 AS PROCESS SOLVENT

1967 OAK RIDGE PROGRAM INITIATED: FOCUS ON MOBILE PROCESSING UNIT FOR REACTOR EMERGENCIES

1968 FIRST PILOT PLANT STARTED UP: FOCUS ON GENERAL PROCESS ENGINEERING DATA

1970 BASIC PROCESS DATA COLLECTION COMPLETED

1971 FOCUS ON DATA RELEVANT TO NORMAL OPERATING REACTOR OFF-GAS TREATMENT

1972 FOCUS ON DATA RELEVANT TO REPROCESSING PLANT APPLICATION; CONSTRUCTION INITIATED ON SECOND PILOT PLANT

1973 SECOND PILOT PLANT STARTED UP (BASIC COLUMNS)

1974 REPROCESSING PLANT-RELATED SUBSYSTEMS DEFINED AND ADDED

1977 COMBINATION COLUMN DESIGNED AND BUILT

1978 COMBINATION COLUMN STARTED UP

38

CHART B-1

5/2/80 UNION CARBIDE

DWG. NO. K/G-80-1322

SELECTIVE ABSORPTION PROCESS DEVELOPMENT COSTS (IN $1000)

ACTIVITY	PRIOR TO 1972	1972	1973	1974	1975	1976	76 T	1977	1978	1979	1980	TOTALS
PROCESS DEVELOPMENT	560	138	175	200	250	365	120	425	575	300	150	3,258*
SOLVENT CHEMISTRY		0	0	0	0	50	30	200	200	75	0	555
PROCESS RELIABILITY		0	0	0	0	25	0	0	0	0	0	25
PROCESS APPLICATION	50	0	0	0	0	35	30	225	245	150	100	835
TOTALS	610	138	175	200	250	475	180	850	1,020	525	250	4,673

* *INCLUDES DESIGN, FABRICATION AND OPERATION OF THREE PILOT PLANT SYSTEMS*

CHART B-4 5/2/80 UNION CARBIDE

41

DWG. NO. K/G-80-1325

SELECTIVE ABSORPTION PROCESS PILOT PLANT CHRONOLOGY

ACTIVITY	START	FINISH
DESIGN AND CONSTRUCTION OF FIRST PILOT PLANT	3/67	6/68
OPERATION OF PILOT PLANT I	7/68	5/72
JOINT ORGDP-ORNL PROGRAM OUTLINED	5/72	6/72
DESIGN AND CONSTRUCTION OF SECOND PILOT PLANT	7/72	10/73
ADDITION OF REPROCESSING PLANT-RELATED SUBSYSTEMS	7/73	6/74
OPERATION OF PILOT PLANT II	11/73	2/78
COMBINATION COLUMN DESIGN (THIRD PILOT PLANT)	7/77	8/77
CONSTRUCTION OF COMBINATION COLUMN	9/77	1/78
OPERATION OF COMBINATION COLUMN	2/78	present

40

CHART B-3 5/2/80 UNION CARBIDE

APPENDIX C

ORGDP SELECTIVE ABSORPTION PROCESS BIBLIOGRAPHY

ORGDP SELECTIVE ABSORPTION PROCESS BIBLIOGRAPHY

Technical and Progress Reports

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Suite 706, 1755 Riverside Drive, Ottawa, Canada K1G 3T6
Telephone: (613) 731-3461

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May 22nd, 1980

Mr. John Ahearne Chairman
U. S. NUCLEAR REGULATORY COMMISSION
1717 "H" Street NW.
Washington D. C. 20555
U. S. A.

Dear Sir:

With respect to the venting of the radioactive kryton gas at the TMI power plant, allow me to recommend the use of high altitude research balloons for this task.

These giant vessels have been used by NASA, the Air Force and the meterological agencies in their research and they are readily available. One or more of these balloons could easily contain the radioactive kryton gas hampering the clean-up effort at the above installation. The filling and the launching of these balloons could become an affirmative media event proving to the populace that your Commission is deeply concerned with public safety and sentiment.

Considering the expansion of the anti-nuclear attitude within the American society, the implementation of my recommendation could minimize the development of a new "cause" and further confrontations.

Trusting that my recommendation will appeal to your interest, I look forward to your esteemed response.

Respectfully,

Sigmund J. A. de Janos

Sigmund J. A. de Janos
Dipl. Engr. Mech, M. Engr. Econ.,
D. Man. Sc., Research Director

cc Governor Richard Thornburgh

dj/zk

5/30 -- To EDO for Direct Reply. Suspense: June 12. Distribution: Bernie Synder. 80-1125.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
ROCKVILLE MARYLAND 20857

Richard H. Vollmer
Director
Three Mile Island Support, NRR
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Vollmer:

Staff of the Bureau of Radiological Health have reviewed NUREG-0662 (and Addenda 1 and 2) which were announced in 45 FR 20265 and 45 FR 21760.

It is our conclusion that the venting of the Kr-85 in the TMI-2 containment building to the atmosphere under controlled release is the prudent and proper course of action which provides minimal, if not zero, health impact. It is recognized that members of the public in the vicinity of TMI may call for alternatives that do not release the Kr-85 to the environment. It should be noted, however, that the occupational workers are also members of the public and the health impact (if any) best relates to the total population dose in person-rem (both occupational and general public). In this regard, it would be appropriate for NRC to provide estimates of the total population dose (both offsite and occupational). Based on the population dose estimates for the TMI-2 accident, it appears that the cumulative dose (person-rem) to the offsite population from the venting will be less than that due to occupational exposure for the alternatives in Table 1.1.

It is further concluded that the accelerated venting procedure proposed in Addendum 2 provides equal, if not greater, control and protection of the public. Since this procedure will require a smaller resource commitment (particularly for offsite monitoring), the Addendum 2 procedure is preferred.

In addition to the above general conclusions and comments, we would like to provide these specific comments:

1) p. 6-44, middle para. Provide a more specific reference to the limit of 15 mrem per year as it is not evident in those referenced.

2) p. 6-44, middle para. It appears that the value 5.7×10^{-6} sec/m^3 should have been 6.7×10^{-6} sec/m^3, as on the top of page 6-5, the occupancy factor of 0.7 accounting for the reduction from 16 mrem to 10 mrem.

3) p. 6-46, footnote d A reference should be provided for the beta and whole body dose factors, which apparently come from Regulatory Guide 1.109.

Richard H. Vollmer 2

4) p. 6-45 to 6-47 and Table 6.6-1 This material on the maximum allowable X/Q for a one hour period does not place such a maximum limit in proper perspective. If the Kr-85 venting were to continue for only 3-1/3 hours, at these maximum X/Q's out of the 120-hour period, then all of the 10 mrem limit would be exhausted. Thus, it is obvious that the venting must, on the average, be controlled to periods when the meteorology is equal to or better than 6.7×10^{-6} sec/m^3. While some deviation about the average can be accepted, to allow the maximum to go to 3 mrem/hr would not appear to be good practice. Further, no basis for the 3 mrem/hr value has been provided (10 CFR 20, 20.105(b)(1) provides a limit of 2 mrem/hr).

We concur in the proposal to vent the Kr-85 gas from the TMI-2 containment building to the atmosphere within the constraints of existing regulations and guidance, but recommend that NRC provide definitive controls to assure venting only during periods of high meteorological dispersion.

Sincerely yours,

John C. Villforth
Director
Bureau of Radiological Health

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pilcop
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21 April 1980

Dr. Richard H. Vollmer, Director
Three Mile Island Support
Office of Nuclear Regulatory Research
U.S. NUCLEAR REGULATORY COMMISSION
1717 H Street, N. W.
Washington, D.C. 20555

RE: Comment to NRC Environmental Assessment for Venting of TMI-2 Containment Atmosphere, Addendum 2

Dear Dr. Vollmer,

Enclosed you will please find two copies of our comment to the Second Addendum of the NRC Environmental Assessment for the Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere.

If you have any questions concerning this comment, please do not hesitate to contact me.

Yours sincerely,

Bruce Molholt, Ph.D.
for the TMI Legal Fund

Enclosures

Comment to NRC ENVIRONMENTAL ASSESSMENT FOR VENTING OF TMI-2 ATMOSPHERE, Addendum 2

TMI Legal Fund

Introduction

The Environmental Assessment for decontamination of the TMI-2 containment building atmosphere was addended twice. In this comment we address the second NRC Addendum. The first NRC Addendum addressed the fifteen psychological studies of stress induced in the TMI area by the accident and radionuclide leaks in its aftermath. The second NRC Addendum addressed shortening the proposed venting period from 60 to 5 days.

Shortening the Proposed Venting to Five Days

The rationale behind shortening the proposed venting from 60 to 5 days is plain enough. The question comes from the increased health risks which would be suffered by the surrounding communities as a result of higher concentrations of krypton-85 gas in their atmosphere. In this section we address those same health effects, psychological stress, carcinogenesis and mutagenesis, which were addressed in our original commentary, supplementing the previously submitted information.

Increased venting rates according to the amended proposal will be now 5,000 to 50,000 cubic feet per minute as compared to 100 to 1,000 cubic feet per minute of the original proposal.

This fifty-fold increase in purge rate could be accomplished by extra fans outside the hydrogen purge system. Several aspects of this increased purge rate are not clear from the Addendum 2 description and potentially increase the health dangers to the public:

1) How adequately can contaminants of the 2 million feet of air be removed by filtration through HEPA and charcoal filters at 5,000 to 50,000 cubic feet per minute? Under normal conditions, filtration efficiency is inversely proportional to the rate of gas passage over the filter. As we suspect contamination of the atmosphere by strontium-90, cesium-137 and plutonium-239, reduced filtration efficiencies pose serious health threats to the public.

2) A fifty-fold increase in krypton-85 ventilation into the outside air will render it 500 pCi/cc at the land site boundary rather than 10^{-5} µCi/cc of the original Assessment. The chances of significant contamination of low-lying areas surrounding TMI increase proportionally. Small changes in meteorologic conditions become fifty times more significant as do lag times between monitoring krypton-85 concentrations and alterations in venting rates necessary to meet (unstated) maximal concentration levels.

3) Although the reduced venting times have a certain popular appeal in that populations who wish to evacuate during the venting period need to remain away from home and job for a shorter period, it is not clear that people

who move from, for example, within 1 mile on the west (where fear of venting is the strongest) to within 10 miles on the east, are in actuality reducing their krypton-85 exposure due to prevailing westerly winds. It is not clear that families would know where to go during evacuation. A family moving from 1 mile away to 15 miles away might even be in more actual danger due to the vagaries of wind during the 5-day proposed venting period. Evacuation may be little more than a hollow gesture.

Any self-selective evacuation procedure which would be facilitated by the 5-day venting is inherently undemocratic. It favors those who can afford to evacuate, possibly causing more stress to those who must remain behind when they can see their neighbors leaving.

Psychological Stress and Reduced Venting Period

Our comments here supplement those of the previously filed comments to the Environmental Assessment body (1). They address facts arising from two of the fifteen studies of psychological stress which have been conducted since the accident and which are relevant to the proposed 5-day krypton-85 venting:

1) the NRC-funded study conducted by the Mountain West Research group(2), and

2) the Pennsylvania State Health Department study directed by Dr. Peter S. Houts of the Hershey Medical Center (3).

We believe that both of these studies indicate that, in addition to the severe psychological trauma which endures from the accident and its aftermath, that venting of krypton-85 into the atmosphere of this same population in 5 days will significantly exacerbate this stress.

Table III-21 of the Mountain West Research study (2) shows that, months after the TMI accident, over 40 percent of the people polled were still concerned about emissions from the stricken reactor. Fifty-six percent of the population within a 5-mile radius to the west were concerned about further TMI emissions as compared to 19 percent who weren't concerned. The fear factor was still prominent for populations between 5 and 10 miles to the west, 47 percent being very concerned, only 13 percent being unconcerned. Not until more than 25 miles from the reactor (in all directions) was the unconcerned population greater than the very concerned.

The State Health Department survey was similarly conducted by telephone and involved two waves of interviews four months and ten months after the accident. By far the most affected group lived within 5 miles of TMI. Among these 37,000 people, 3,800 (13 percent) had been transformed into "antinuclear activists," which statistic Pennsylvania Secretary of Health, Dr. H. Arnold Muller called "very large" and "very significant" (3). The report further revealed that, as of January, 60 percent did not approve of reactivating the TMI plant and that 74 percent would evacuate immediately in the event of any imminent nuclear disaster at the reactor site.

We suggest that these long-lasting, profound changes in psychological stress and antinuclear activism presage definite exacerbation of severe psychological stress and potential civil disobedience in the population surrounding TMI should the proposed venting of krypton-85 be attempted.

In summary, as all tests, including the Kemeny Commission's own findings, have indicated severe psychological stress in the community surrounding TMI as a result of the accident which would be only increased by venting the krypton-85, and that the gas ought not to be vented into the atmosphere of these same afflicted peoples.

Conclusion

In conclusion, we find the proposal to reduce venting time for the removal of krypton-85 gas from the TMI-2 containment building atmosphere to present the public with no lessened degree of overall psychological stress and a worse adverse health potential than the original venting proposal. If venting is to be completed within five days, the average krypton-85 per day levels will exceed 11,000 curies. We find the proposal of the Environmental Assessment, Addendum 2, ineffective for the purposes for which it was designed.

Two additional portions of the second Addendum deserve comment. In describing the health effects which might come from elevating the stack another 140 feet, because the present stack at 160 feet in a valley does not afford much opportunity for proper dilution, the Assessment Addendum dismissed effectiveness even though two- to four-fold increase dilution would be achieved. As this would cause two- to four-fold fewer adverse health effects, we do not feel the advantages inherent in elevated stack height should be taken so lightly.

Secondly, it is proposed in the Addendum that the venting of 57,000 curies be 2/3ds of that allowable this year. This proposal fails to recognize the 20,000,000 curies released 13 months ago and the major releases that could occur after the present year during the future phases of the clean-up operation. This new attempt to

segment releases of radiation re-emphasizes the need for a comprehensive Environmental Impact Statement.

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3. Franklin, B.A. (1980) Long distress found over atom accident, New York Times, April 18, 1980, p. A18 (see attachment).

J. A. Van Vechten
R. J. Gambino
J. J. Cuomo

Encapsulation of Radioactive Noble Gas Waste in Amorphous Alloy

Public demand for the containment and safe storage of radioactive waste materials has caused the U.S. Government to require that, beginning in January 1983, most of the ^{85}Kr, which until now has been vented to the atmosphere during the reprocessing of nuclear fission fuel rods, will have to be captured and retained for several decades. The cost of accomplishing this with present compressed-gas technology is enough to increase the cost of nuclear generated electricity by an estimated 0.3%. However, materials developed for amorphous magnetic bubble memory devices have been found to be capable of storing large quantities of Kr (30 atomic percent) with great stability up to temperatures above 1070 K. The cost of ^{85}Kr storage in the magnetic bubble memory material appears to be less than 1% of that for present compressed-gas technology.

Introduction

The problem of safe disposal of radioactive wastes from nuclear fission power plants is a major obstacle to the continued and expanded use of fission reactors. Perhaps the most difficult radioactive fission product to capture and contain is an isotope of the noble gas Kr. ^{85}Kr, which has a half-life of 10.7 years and emits β-particles at energies up to 0.67 MeV and γ-rays at 0.5 MeV [1, 2]. Unlike most other fission products, it is neither solid (above 121 K) in its elemental form nor can it be reacted to a stable solid compound. Although heavier than air, it mixes thoroughly in the atmosphere: if released even in a deep mine shaft, it would quickly diffuse into the atmosphere. It also diffuses rapidly through water and earth. It is produced in about 0.3% of all ^{235}U fission events. This is about 6% of the Kr and 0.8% of the noble gas produced by fission of ^{235}U. (The other major noble gas produced is Xe.) Almost all processors of nuclear fuel around the world have allowed these radioactive gases to escape to the atmosphere. (It should be noted that essentially all the Kr is released in *reprocessing*; less than 1% is released from the reactor [3].) One exception is the Chemical Processing Plant at the Idaho National Engineering Laboratory, Idaho Falls, which is operated by Allied Chemical Corp. and which has developed several methods [1] to capture ^{85}Kr. The National Engineering Laboratory reprocesses only U.S. Navy nuclear fuels; there are no commercial reprocessing plants at present.

Figure 1 shows the increase in atmospheric ^{85}Kr measured at various geographic locations up to 1968, at which time there were about 56 million curies (56 MCi) or about 10^{27} atoms of ^{85}Kr in the atmosphere worldwide [4]. Almost all ^{85}Kr is introduced by man; of this only 5% is due to nuclear weapons testing. If the rate of expansion of nuclear power along with the concomitant increases in atmospheric ^{85}Kr experienced up to 1968 had continued, there would now be about 0.6 GCi or about 10^{28} atoms of ^{85}Kr in the atmosphere [4]. (The medical consequences of this dose are argued [4] to be slight.) The actual amount is much less due to slowed progress in bringing on nuclear fission power as a replacement for fossil fuels. The rate of release has also been limited by the fact that spent fuel from power reactors is not being reprocessed at present. Spent fuel is stored on-site in deep pools, an unsatisfactory procedure for long-term storage. If nuclear fission power were to provide the projected fraction of our energy needs and if simple venting were to continue, the atmospheric burden would level out at well over 1 GCi. It might also be noted that 1 GCi of ^{85}Kr produces 4 MW of power, which might be put to some practical use if it could be safely handled; admittedly, this is an almost negligible amount compared to the total power that would be produced by the reactors.

To give perspective to the quantities involved, let us note that the fission of ^{235}U produces 200 MeV of thermal energy directly and, depending on design, approximately another 200 MeV of thermal energy by emitting neutrons that produce other fissionable isotopes, principally ^{239}Pu and ^{233}U, by transmutation. Thus, the complete fission of one gram of ^{235}U in a typical reactor would produce about 5.2×10^3 watt-years of heat. As nuclear power plants are about 32% efficient in converting heat to electricity, this one gram of ^{235}U would provide about 1.7 kW of electricity for a year. A typical nuclear power plant generates 1 GW of electricity. To run such a plant continuously for a year requires the complete fissioning of 0.6 Mg of ^{235}U. In a typical fueling cycle, 3% of the initial charge and 1% of the spent fuel is ^{235}U, so that fifty times as much material must be processed as is fissioned. At this rate of production, the alternative of storing spent-fuel bundles on-site is untenable. Thus a typical plant would require 30 Mg of fuel to be reprocessed each year of continuous operation. Of this mass, about 390 g would be ^{85}Kr, about 5×10^{24} atoms or 2.8×10^5 Ci. If we project to the year 2000 and assume that each of 3×10^8 Americans is to be provided electric energy totally supplied by nuclear fission at the present average consumption rate of 2 kW, *i.e.*, 600 GW for the nation, then 600 standard 1-GW plants would be required for the U.S. alone. These would produce 2.3 Mg or 1.7×10^8 Ci of ^{85}Kr annually. If nuclear power were to provide only a fraction of this energy need or if the average electric consumption were to decrease, the ^{85}Kr release would be correspondingly reduced. World production of ^{85}Kr would be at least three times this figure.

U.S. Federal regulations to take effect January 1983 [5] will limit the amount of ^{85}Kr that may be vented to 5×10^4 Ci/GW of electricity generated for one year, for fuel irradiated in 1983 or thereafter. [*Editor's note*: The global body dose rate per capita from the release of all of the ^{85}Kr generated in continuous operation of a 1-GW (electricity) reactor is $\approx 2 \times 10^{-5}$ mrem/year (rem = roentgen equivalent man). This dose rate is about 2×10^{-7} times the average background dose rate; see Reference [3].] Reprocessing with unrestricted venting would result in a release rate about seven times higher than this. The fuel reprocessing plants would be responsible for keeping the ^{85}Kr release down to this level. (A standard reprocessing plant handles about 2 Gg of spent fuel per year, which is the amount produced by 67 standard nuclear power plants, each producing 1 GW of electricity [2].)

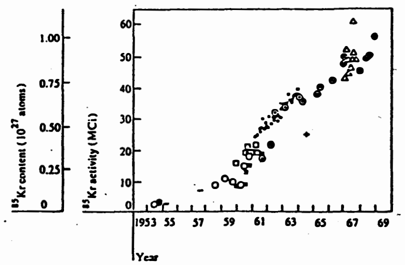

Figure 1 Atmospheric ^{85}Kr as a function of time up to 1968. Data taken from Ref. [3].

Where the Kr has been captured, the only technology available for storing it is to compress it into cylinders [2]; 133 cylinders 23 cm in diameter would be required to contain the noble gas released each year at each fuel reprocessing plant. There are several problems with this method of containment. Rubidium, the decay product of ^{85}Kr, causes a deterioration of ferrous alloys; so there is doubt about the long-term integrity of the cylinders. There is also the danger that the cylinders might burst due to some accident in handling and transport or due to corrosion- and radiation-induced damage over long periods of time. Because the radioactive gas is present in large quantity and under pressure, such an accident could easily be fatal to those nearby unless some means of secondary confinement of the gas is provided. The cost of meeting federally imposed safety standards with the compressed gas technology is rather high [2]. The estimated cost of a facility to contain on a 40-year cycle the compressed gas produced by a single reprocessing plant is \$208.5 million. For a 30-year loan at an 11.5% interest rate, this would require an annual payment of more than \$24 million. The cost of compressing the gas, of purchasing and transporting the cylinders, and of salaries and energy would be additional. The warehouse cost alone would run to more than \$200 million per year for the U.S. by the year 2000. In other terms, this would add \$0.00006 to the cost of generating a kWh of electricity, which would be an increase of about 0.3%.

Proposed alternate methods of storage have included incorporation into zeolite lattice pores by high temperature-pressure diffusion and by incorporation into crystalline [2a] and amorphous [2b] metals. The zeolite method

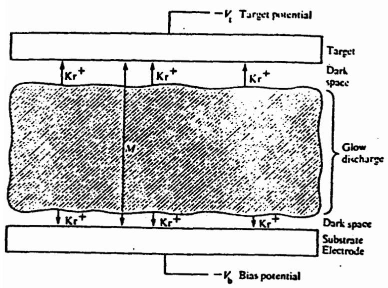

Figure 2 Schematic representation of the bias sputtering process.

suffers from the fact that if water gets to the material, it reacts and rapidly releases the gas. In crystalline metals the Kr forms small bubbles. At high concentration the pressure in these bubbles is sufficient to cause mechanical failure, a phenomenon known as blistering, in which the gas escapes. Furthermore, these bubbles tend to collect at grain boundaries and microcracks along which they diffuse at significant rates even at room temperature. Moreover, due to the power produced by the decay of the ^{85}Kr, the containment material will be self-heated to a temperature dependent on the size of the individual container; the larger the container, the larger the maximal temperature and the more severe the thermal diffusion and degradation. For most storage schemes the volumes of containment material required are substantial. Each reprocessing plant would require [2] the following volumes per year for the various proposed methods: compressed gas cylinders, 6.5 m^3; zeolite, 7.3 m^3; Ni, 1.3 m^3; Al, 1.6 m^3; glass, >190 m^3.

Storage in bias-sputtered amorphous metallic alloy

In the course of development of amorphous materials for magnetic bubble memory devices [6], we have come upon a method for the storage of Kr, Xe and other noble gases, whether or not radioactive, which seems capable of containing the radioactive waste from one of these reprocessing plants in just 0.2 m^3 of material, and of retaining it stably up to temperatures as high as 1070 K. We estimate the cost of storing the ^{85}Kr by this method as well under 1% that of storage in the compressed-gas cylinders, *i.e.*, less than $0.24 million per reprocessing plant.

The containment materials in question are formed by bias-sputter deposition [7]. This process is illustrated in Fig. 2. A low-pressure discharge is established in a sputtering gas between two electrodes, one of which is known as the target and the other as the substrate electrode. The sputtering gas is normally chosen to be one of the noble gases, He, Ne, Ar, Kr, or Xe, to avoid chemical reactions with the target and substrate materials. In practice, Ar is usually chosen on the basis of cost and sputtering rate. The Kr and Xe sputter as rapidly in most applications but are more expensive. The discharge converts the noble gas to a positive ionization state, *e.g.*, Kr$^+$. These ions are accelerated toward the target electrode, which is biased negative with respect to the plasma by the *target potential*. The plasma is in turn biased from ground by a small *plasma potential*. When the noble gas ions reach the target surface they penetrate several atomic layers, producing a process known as a collision cascade in which the energy of an incident ion is transferred to many atoms of the target material. Several of these atoms are subsequently emitted from the target surface in a manner similar to the "break" at the start of a game of billiards. The target atoms are generally neutral and travel by virtue of their kinetic energy through the intervening space between the target and the substrate, perhaps suffering a few collisions with the sputtering gas on the way. For normal choices of substrate temperature and materials, virtually all of the target atoms reaching the substrate stick there. As normally practiced, this results in the growth of a polycrystalline film on the substrate. However, Nowick and Mader [8] discovered that when two or more elements are deposited simultaneously and the radii of their atoms are sufficiently different, the resultant films are not polycrystalline but amorphous. (This means that they are microscopically disordered but macroscopically homogeneous as contrasted to the polycrystalline films, which are microscopically ordered but macroscopically disordered.) It is also possible to obtain amorphous films with atoms all the same size if one deposits faster than a critical rate, this rate being a function of substrate temperature [9].

In bias sputtering, a *substrate bias* is also applied between the plasma and the substrate. This has the effect of accelerating noble gas ions toward the surface of the growing film as well as toward the target. The ion bombardment of the film during growth has a number of useful effects. In the first place, it introduces anisotropies in the properties of the film. In the development of amorphous magnetic bubble materials, it was necessary to use this effect to induce a perpendicular easy axis of magnetization. In the second place, it allows one to eliminate many types of impurities that are not as well bound as host atoms. This is done by inducing a collision cascade in the substrate that is not sufficiently violent to remove host atoms. A third effect, which was discovered by

990 K. The authors associate these peaks with mechanisms having activation energies of 1.31, 1.74, 2.21, and 2.78 eV, respectively.

Rantanen *et al.* [13a] also studied the thermal re-emission spectra of Kr from polycrystalline Ni. They reported activation energies of 1.18, 1.36, 1.50, and 1.71 eV for this case. They also pointed out that these activation energies are probably associated with interstitial migration (1.03–1.09 eV), vacancy formation (1.35 eV), vacancy migration (1.55 eV), and surface diffusion (1.68 eV).

The above results for Kr in polycrystalline Ni should be compared with the thermal release of Kr from amorphous GdCo and GdCoMo alloy films by Frisch and Reuter [14]: see Fig. 3(b). The method used to study the amorphous film was similar to that of Rantanen *et al.*, except that the heating rate was 10 K/min and a high-sensitivity mass spectrometer was used. Extensive measurements have been made on a large number of these bias-sputtered amorphous GdCo and GdCoMo alloy films. All of the thermal re-emission spectra for *unoxidized* films have the character shown in Fig. 3(b). Oxidation lowers the temperature at which Kr release occurs [14b]. In the amorphous alloy films no detectable rate of noble gas evolution was observed until the film began to crystallize [14a]. At the crystallization temperature the gas was evolved very rapidly. In this case the kinetics of gas liberation are determined by the kinetics of the crystallization, which is a nucleation-and-growth process. An activation energy of 4 eV has been estimated for the migration of Kr in amorphous GdCo alloy [14a]. This implies that the mean time to diffuse one atomic site would be about 10^{14} years at 570 K; at 1070 K, the Kr would diffuse about 10 nm in the 40 years required for the radioactivity to decay to 3% of its original value.

A further benefit of an amorphous structure for a material to contain ^{85}Kr is that the disorder improves the ability of the material to tolerate radiation damage and impurities. Even if the containment material were pure to begin with, it would not remain so because the ^{85}Kr transmutes to Rb by radioactive decay. The stability of a crystalline host material would be adversely affected by the simultaneous effects of irradiation, which generally enhances atomic diffusion, and of the incorporation of the daughter isotope, which is chemically incompatible with the crystal lattice of the proposed host materials. This would cause embrittlement of a crystalline host material and would accelerate mechanical failure by such mechanisms as blistering. However, those amorphous alloys which are stabilized by atomic size mismatch and a highly disordered drphs structure are much less sensitive to the chemical nature of minor impurity constituents and can exist over a broad range of composition. The amorphous alloys in question will contain about 30 at% Kr or Xe, but, as noted above, only 6% of the total Kr released at the reprocessing plant would be radioactive ^{85}Kr. Let us assume that the Xe is separated out by distillation so that only Kr is stored. This would seem to be economically desirable, although one could also easily store the Xe by expanding the size of the sputtering unit. Eventually, 1.8 at% Rb will be contained in the storage material. This would be enough to affect many crystalline hosts substantially but would have a negligible effect on a drphs-amorphous host. Such host materials are also less susceptible to radiation damage because the currents produced by ionizing radiation do not persist as long and because the resultant atomic diffusion does not have as much effect on a structure that is already disordered.

The selection of the most practical composition from which to form the encapsulating host material requires the consideration of four factors: gas-incorporation capacity, thermal stability, chemical stability, and cost. Let us start with the amorphous magnetic bubble memory material, GdCoMo, for which the incorporation of large quantities of noble gas was first discovered. This material can incorporate more than 50 at% Ar and more than 30 at% Kr and Xe when the three bias voltages of the system are adjusted properly. This large noble gas incorporation capacity occurs because the rare earth element Gd has an atomic radius much larger than the first-series transition element Co. The second-series transition element Mo is intermediate in size and serves to further disorder the drphs structure so that these mixtures will condense in an amorphous phase over a wide range of compositions and will have a relatively large number of interstitial spaces large enough to accommodate a Kr or Xe atom. However, the GdCoMo composition of the magnetic bubble memory would not be an attractive choice from the point of view of cost. Because the rare-earth elements (which in fact are not that rare) are all very similar in their chemical behavior, they are expensive in their pure elemental form. A typical price for pure Gd would be $500/kg. If one instead purchases the rare earth elements in an unseparated form, called mischmetal or RMM [15], the price is much less, typically $10/kg, and the chemical behavior as it affects Kr storage in amorphous alloys is no worse. One can also replace Co with Fe without affecting the containment properties significantly. With respect to thermal stability, it has been shown that GdCoMo and GdCoCr ternary alloys are much more stable than binary alloys like GdCo or even ternary alloys containing Au or Cu, *e.g.*, GdCoAu or GdCoCu. For example, 15 to 20 at% Mo increases the crystallization temperature from 770 K for GdCo to more

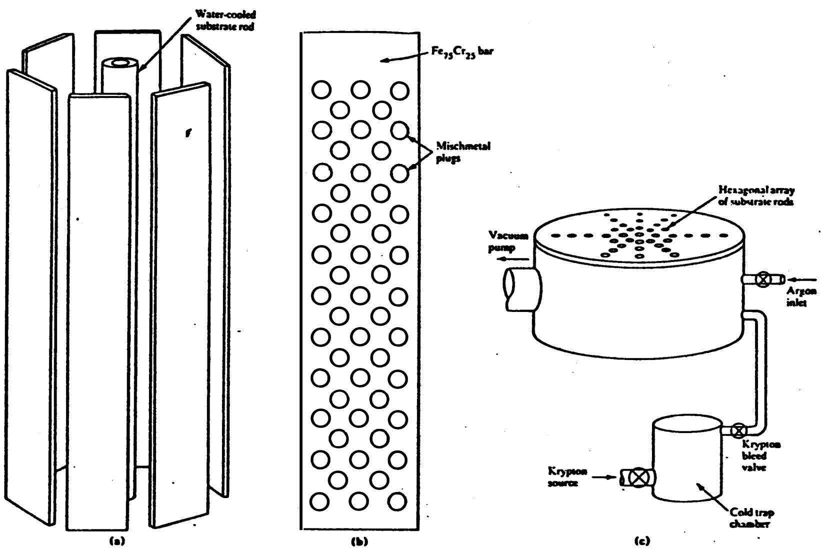

Figure 4 Proposed sputtering apparatus for incorporation of Kr into the amorphous alloy on a production scale. (a) Modular sputtering unit, (b) target bar assembly, and (c) sputtering chamber.

than 1070 K for the ternary alloys. From the point of view of chemical stability, the rare earth concentrations should be kept low because these materials oxidize (as well as cost more than the other constituents). Chromium, on the other hand, significantly improves the oxidation resistance and should be added at a concentration consistent with its cost. Therefore, an appropriate composition for the containment application would be (in atomic percent): RMM 20%, Fe 60%, and Cr 20%. The 2.1 Mg, or about 0.2 m^3, of this composition that would be required to store the Kr retrieved at each 2-Gg/year reprocessing plant would cost about $10 thousand. Of course, this material could be recovered and recycled every century or so as the level of Kr radioactivity from each charge decreases.

The process

At the reprocessing plant, spent fuel elements containing UO_2 ceramic pellets encased in metal are dissolved in nitric acid. At this point the Kr and Xe are released and bubble out of solution together with several other volatile species. The various volatile species can be separated and trapped in a cryogenic distillation tower [1]. The Kr and Xe would be trapped at the end of the distillation sequence in cold traps or on charcoal cooled to 77 K with liquid nitrogen.

The liquified noble gas is maintained at 77 K and transferred to the sputtering station for incorporation into the amorphous alloy; see Fig. 4. The vapor pressure of the Kr at this temperature is about 10^2 Pa (10^{-3} atm), which is enough to bleed through valving into the sputtering chamber but low enough that the danger of excessive leaks would be easily managed. The gas pressure in the sputtering chamber is about 10^{-2} Pa (10^{-7} atm). [Compare this situation with that of the compressed gas cylinders, which handle the gas at a pressure of about 10^7 Pa (10^2 atm).]

The rate at which material may be deposited by bias-sputter deposition varies from 1 μm/h for very simple diode systems to 30 μm/h for systems that use electron-injection or magnetic-field confinement of the plasma. We feel that the most practical arrangement would be modular and would consist of a hexagonal array of water-

cooled substrate rods surrounded by bar-shaped target electrodes. With this arrangement a continuous deposition rate of 10 μm/h would be practical. In order to deposit the 0.2 m^3 of material per year required to contain the Kr retrieved at each 2-Gg/year reprocessing plant, the volume deposition rate will have to be 2.3×10^{-5} m^3/h, so that 2.3 m^2 of deposition area are needed. This can be accommodated with a system of 232 rods 2 cm in diameter and 30 cm long arrayed honeycomb fashion in a cylindrical vacuum chamber 1.5 m in diameter and 0.5 m high. Such sputtering systems sell commercially for about $80 thousand [16].

About 200 kW/m^2 input power would be required to sputter at the proposed rate of 10 μm/h [17]. Therefore, the sputtering station would consume about 460 kW of electrical power in order to capture the Kr retrieved at a 2-Gg/year fuel reprocessing plant. At $0.04/kWh the cost of this power would be $160 thousand per year. Perhaps another $10 thousand per year of electricity would be consumed running the vacuum, cooling and control systems.

Due to the inherent simplicity of the sputtering process itself, this could easily be automated or remotely controlled. The cost of special control equipment for the radioactive environment automated operation should not exceed $100 thousand. However, the deposited rods would have to be removed and replaced periodically. This could be accomplished by valving off the source of ^{85}Kr and of the cooling water, breaking the vacuum of the system, and pulling the top flange of the vacuum chamber with all the rods and the remains of the target electrodes attached to it out of the body of the vacuum chamber and removing it from the sputtering station. Operators could then attach a new top flange with substrate-rod assembly and target electrodes to the vacuum and cooling systems. This should be done about once a month after about 7 mm of material has been deposited on the rods.

The configuration of the target electrodes shown in Fig. 4 indicates that these consist of $Fe_{75}Cr_{25}$ bars with mischmetal plugs inserted into drilled holes. This configuration is recommended for easy handling of the mischmetal, which is hard and brittle. With this configuration one could also arrange to coat the deposited layer of amorphous metal with crystalline stainless steel in order to provide further protection from corrosion and abrasion, and to contain the beta particles emitted by the Kr. This would be done by continuing to sputter after the Kr source had been turned off and the mischmetal plugs nearly consumed, and the bias voltage would be increased to 250 V in order to increase the fraction of Fe and Cr in the deposited mixture.

For final storage one might wish to pot the entire top flange, rod and target remains assembly in cement and wrap it in lead. However, we feel that the amorphous alloy is so stable a method of storage that the material could be released for several practical applications (ranging from nuclear batteries to fire detectors, cold-cathode stabilizers, thickness monitors, and simple sources of heat) rather than simply putting it away in a deep salt mine.

Conclusion

The materials developed for the amorphous magnetic bubble memory system have been shown to provide a very stable medium for the long-term/high-temperature storage of the noble gases Kr and Xe. The radioactive isotope ^{85}Kr, produced in ^{235}U fission reactors, is difficult and expensive to contain by other means. Compared to the present technology of compressed-gas cylinder storage, which is estimated to cost $24 million per year per reprocessing plant for warehouse amortization alone, our process would cost approximately $180 thousand for capital equipment, which would be amortized at less than $40 thousand per year, plus $10 thousand per year for materials and $170 thousand per year for electricity. In our economic analysis we have not considered the cost of the building to contain the process; but since the process runs at high vacuum instead of at high pressure and since the product is quite stable to high temperatures, we feel the cost of this building should be minimal. In the high-pressure cylinder technology the cost of the building is a major part of the total expense. With our process the radioactive material is present only in small quantities before it is incorporated into the solid, and because of the stability of that solid, can be dispersed in practical applications afterwards.

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The authors are located at the IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598.

(914) 945-3000

617 Briarcliff Road
Middletown, PA 17057
April 11, 1980

Chairman John Ahearne
U. S. N. R. C.
Washington, D. C. 20555

Commissioner Ahearne:

I have read NUREG-0662 and analyzed it as carefully as my capabilities permit. I am not technically oriented and, therefore, may fail to comprehend some of the material presented. However, I am sure most of the other residents of this area who respond to this assessment will find themselves in the same uncomfortable position. Therefore, the questions I pose may seem trivial to the scientist, but they represent my best effort to better understand the decontamination of the reactor building atmosphere at TMI Unit #2. I will begin with several comments and follow with my questions.

I have attended numerous meetings held by the NRC, Met Ed and the PA Department of Environmental Resources to discuss the cleanup. Continuous assurances that the proposed venting of the Kr-85 will have no adverse health impact on the people have been made. I asked Mr. Robert Arnold, senior vice-president of GPU, if 57,000 Ci of Kr-85 had ever been vented from a facility of any type that has in excess of 150,000 people residing in a ten-mile radius? His answer was"no."

Mr. John Collins of the NRC has stated that a nuclear plant routinely releases 1,000 Ci of radioactive gases per month. His point seems to be that "we've been doing it all along, so why be so upset now?" When questioned further about the routine releases under normal operating conditions, Collins stated that Kr-85 constitutes approximately 50 Ci of the 1,000 Ci/month. Therefore, normal operations release approximately 600 Ci of Kr-85/year, and the 57,000 Ci in the containment building would equate to 95 years of routine releases. Depending upon the time period chosen for the venting - if venting is chosen - the people of this area would be subjected to 95 years of Kr-85 exposure in anywhere from 5 to 60 days, or thereabouts. Is this acceptable? What assurances can you give me, based on collected health data over a period of years, that even the routine releases from nuclear power plants are safe? It seems to me that assumptions are made about health effects based on calculations and models that very well may have no proven bases as acceptable measurements of health impact. My preference in determining health impacts of operating nuclear power plants is to deal in objective, independent data collected and analyzed over a substantial period of time. Please direct me to this type of information so that I can see what you use in making your evaluations.

My suspicions about the lack of hard data that should be the basis for making a decision of this magnitude are further heightened by the following statement excerpted from page 7-4 of NUREG-0662. It states, "Another objective of the program will be the development of information on the atmospheric transport of radionuclides under well documented meteorological conditions in order to test and/or validate transport models; and to determine the adequacy of models and assumptions used in current regulatory guides, including an assessment of their margin of conservatism." (Emphasis added) That statement means the nuclear industry has been operating on a lot of assumptions for a long time and now is an excellent opportunity to see if those assumptions have any relationship to reality.

Throughout the long cleanup of Three Mile Island, there will undoubtedly be innumerable occasions to carry out unprecedented experimentation. The temptation to the scientist will be overwhelming. Some of those experiments can probably be performed with little or no risk to the health and safety of area residents. Is the Kr-85 venting experiment worth the risks? I think not!

As a resident of the TMI area, I continue to experience, as do my family, friends and neighbors, the psychological stress of the continuing accident. Although this is generally perceived as intangible, and by some unmeasurable, the presence cannot be denied. I enclose a copy of an article from the Catholic Witness, a weekly paper in this area. The article was written by Fr. Thomas R. Haney, Pastor of a Catholic Parish in Palmyra, PA, approximately 15 miles from TMI. He states, ".... the psychological and emotional state of many of us is at the breaking point. This state is aggravated by the distinct possibility that no one in charge really cares." He concludes by asking a question, that I will ask of you, "Who is morally responsible?"

My questions with page references to the NUREG-0662.

p. 1-4 In reference to fission products and particulates. How sure can you be that these other products will not be released? I realize filtering will be done, but no filter is 100% effective. Some of these particulates are apt to be very dangerous isotopes.

p. 4-2 Is reactor coolant sampling considerably less effective than neutron flux monitors in providing assurance that the core is not going critical? If this sampling provides adequate information, does the licensee have a real necessity to repair or replace any of the damaged nuclear instruments? If fans that maintain containment at negative pressure stop operating, what likelihood is there of Kr-85 leaking? Is it greatly increased since the pressure within containment will not increase that much?

p. 4-2 The Kr-85 contributes approximately 75% of the total body gamma field on the operating floor. The Governor's Commission Report done by the state of PA states that the level of radiation above the water was 200 R per hour in October. How much work can be done inside containment even if the Kr-85 is removed? Won't maintenance and any further cleanup be seriously hampered by the 7 feet of water?

p. 6-2 ".... good dispersion due to high winds." What are high winds? How predictable are winds?

p. 6-3 ".... the filters will be changed only once at the end of the purge operations." Only once for the entire operation?

p. 6-4 "the primary isotope .... released during a purge operation would be Kr-85." What would the secondary isotopes be?

p. 6-6 ".... we assumed that 30 minutes were required for the operator to detect the leak and isolate the system." In early February during sampling of the containment atmosphere, the system ran for 18 hours despite radiation readings three times higher than permitted. Why do you assume operators will be so much efficient during purging?

p. 6-7 "controlled releases can be maintained within applicable federal regulations." Is this for each purge seperately, or for the entire 57,000 Ci?

p. 6-14 "..... that does not ordinarily react chemically." (referring to Kr-85) When does it react chemically?

p. 6-18 Who is MPR Associates?

p. 6-18 ".... 20% of the piping and would contain 90% of the Kr-85." Does that imply that with purging during the first 20% of the Purge (the first 4,600,000 ft^3) that 90% of the Kr-85 (51,300 Ci) will be released?

Have you read the report on alternative methods for removing Kr-85 prepared by Gerald L. Pollack, Professor of Physics at Michigan State University, for Commissioner Gilinsky on March 24, 1980? Please comment on his conclusions.

Respectfully submitted,

James B. Hurst

James B. Hurst

March 28, 1980

Don't unleash TMI krypton on a terrified populace

Viewpoint

FR. THOMAS R. HANEY

Here it is exactly one year later and we who endured the agony of the TMI accident, the confusion of the reassurances and the heartbreak of ignorance are now being subjected to the dread of venting; the fear of its ramifications and the tension of knowing there are other ways to clean up the plant.

We're told that the doses of released krypton will not harm us because they'll be so small.

But a little plus a little plus a little equals a lot. The effects of the venting are cumulative. Just as cumulative is our doubt, disbelief and distrust of those in charge.

As a result, the psychological and emotional state of many of us is at the breaking point. This state is aggravated by the distinct possibility that no one in charge really cares.

The whole TMI ordeal has been like a dull knife cutting a rope -- and we're looking at what might now be the last strand of that rope!

The cleanup is needed, but is the terror that's caused by venting?

Even if everything were secure and safe, that does not alleviate the disintegrating psychological state of the people. A little child in a dark room may go into convulsions out of fear.

We know there's no danger, but the child's fear is as real as if there were.

The point here, however, is that in the dark room of venting there is indeed a real danger. Who is morally responsible?

[illegible] E. ERTEL
[illegible], PENNSYLVANIA

[illegible] HOUSE OFFICE BUILDING
[illegible], D.C. 20515
[illegible]

[illegible] ON PUBLIC WORKS [illegible] TRANSPORTATION

[illegible] ON SCIENCE [illegible] TECHNOLOGY

Congress of the United States
House of Representatives
Washington, D.C. 20515

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HARRISBURG EAST MALL
PAXTON STREET
HARRISBURG, PENNSYLVANIA [illegible]
(717) [illegible]

ROOM 230
FEDERAL BUILDING
WILLIAMSPORT, PENNSYLVANIA [illegible]
(717) [illegible]

MUNICIPAL BUILDING
SUNBURY, PENNSYLVANIA [illegible]
(717) [illegible]

April 21, 1980

Hon. John F. Ahearne
Chairman
Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20555

Dear Chairman Ahearne:

Having had the opportunity to review the various cleanup options presented to the Nuclear Regulatory Commission and having studied the reports on the Selective Absorbtion System prepared by Dr. Gerald Pollack at the request of Commissioner Gilinsky, I felt the Selective Absorbtion System required more consideration.

On Saturday, April 19, NRC Commissioner Victor Gilinsky and I flew to the Oak Ridge Gaseous Diffusion Plant, in Oak Ridge, Tennessee, to examine the pilot plant designed to remove Krypton-85 (Kr-85) from a contained atmosphere through the Selective Absorbtion process. This process is described on pages 6-32 through 6-38 of the NRC Environmental Assessment for Decontamination of the Three Mile Island Unit 2 Reactor Building Atmosphere (NUREG-0662). Commissioner Gilinsky and I also had the opportunity to discuss this process with the engineers who have designed and operated this pilot plant, and officials from Union Carbide which has conducted the program under contract with the Department of Energy.

The Selective Absorbtion System has been worked on at the Oak Ridge Gaseous Diffusion Plant since 1967. The system today is a third-generation process which has been operating successfully for one and one-half years. Its flow rate is 15 cubic feet per minute. With the obvious exception of venting, the Selective Absorbtion process is the least expensive of the options presented in NUREG-0662 and could be placed in operation at TMI 2 in less time than the other options. According to the engineers at Oak Ridge, assuming the availability of materials and the necessary approvals, this system can be built and tested in about three months. This contrasts with the time requirement discussed in NUREG-0662.

Because I believe that the Nuclear Regulatory Commission, and all other active parties, are moving toward approving the venting of the radioactive gases in the damaged reactor, I am concerned that adequate consideration has not been given to the Selective Absorbtion System. The Selective Absorbtion System has already been proven to be effective, and it can be put into place quickly. Passing the gases in TMI Unit 2 through the system only once would reduce the Kr-85 in containment by a factor of 100 to 1000 times. Scaling the pilot plant up from a 15 cubic feet/minute flow rate to a rate of

Page 2
Hon. John F. Ahearne
April 21, 1980

200 cubic feet/minute does not represent any significant problems. The system is not a complex one and its components are all "off-the-shelf" items which should be readily available.

We must remember in assessing this option that: the Kr-85 is already in the reactor at TMI; unless we implement the Selective Absorbtion System, the Kr-85 will be vented into the atmosphere; the worst that could happen with the Selective Absorbtion System is a failure requiring venting (an option which will be otherwise approved). In addition, it is not necessary to require that the Selective Absorbtion System be built to nuclear code construction standards. This will only delay the process and, because of the small volume of gases in the system at any one time, even a total failure would not result in any major detrimental release.

I believe that venting is unacceptable for a number of reasons. The Selective Absorbtion System is a viable alternative. The longer we spend debating the various options, the more we force ourselves into a situation where venting in the only alternative because of time constraints. In accordance with our converation, it is my understanding that a detailed analysis on this system will be prepared by Oak Ridge by this Friday. I am sure that this detailed analysis will confirm the initial conclusion that this system should be utilized.

I am anxious to work with you in moving forward with this process and will do everything in my power to expedite its installation and operation.

Sincerely,

Allen E. Ertel
Allen E. Ertel
MEMBER OF CONGRESS

AEE/bh

cc: Hon. Victor Gilinsky, Commissioner, Nuclear Regulatory Commission
Hon. Peter Bradford, Commissioner, Nuclear Regulatory Commission
Hon. Joseph M. Hendrie, Commissioner, Nuclear Regulatory Commission
Hon. Richard T. Kennedy, Commissioner, Nuclear Regulatory Commission
Hon. Charles Duncan, Secretary, Department of Energy
Mr. George W. Cunningham, Assistant Secretary for Nuclear Energy, DOE
Mr. Jack H. Watson, Jr., Assistant to the President for Intergovernmental Affairs
Hon. Richard Thornburgh, Governor, Commonwealth of Pennsylvania
Mr. Herman Dieckamp, President, General Public Utilities
Mr. Robert Arnold, President, Metropolitan Edison
Mr. Walter Vannoy, President, Babcock and Wilcox
Mr. R. J. Hart, Union Carbide

Technicians Tell Ertel & Galinsky PEJ 4/23/80

Selective Absorption Start Possible Within 60-90 Days

By Joe Sukle
Associate Editor

17th District Congressman Allen E. Ertel has reported to the Press And Journal that he is "heartily backing" the Selective Absorption process as a means of ridding the containment building of the Unit II reactor on Three Mile Island of the radioactive krypton-85 gas. Furthermore Ertel stated that technical experts assured him that assuming the availability of materials and the necessary approvals, this system could be built and tested for full-scale operation in a period of 60 to 90 days.

According to Ertel's District aid Daniel Tunnell, the Congressman and two of his aides visited the Oak Ridge Gaseous Diffusion Plant in Tennessee over the weekend. Ertel viewed a Selective Absorption system presently in operation at Oak Ridge. The system is a third generation model that had been originally designed and operated since 1967. Also with the congressman at Oak Ridge was Nuclear Regulatory Commission Commissioner Victor Galinsky.

As a result of the visit to Oak Ridge, Congressman Ertel has drafted a formal letter to NRC Chairman John Ahearne and to the rest of the NRC Commissioners stating his confidence and backing of the Selective Absorption System and asking them to seriously consider it a viable alternative to venting. Ertel maintained in the letter that the previously outlined venting of radioactive krypton-85 gas into the atmosphere is an "unacceptable scheme."

Ertel also said that he would do as much as possible to see that the Selective Absorption Process would be implemented at the Three Mile Island nuclear power generating station as soon as possible, pending the approval by the NRC Commissioners to follow this means of cleanup of the crippled Unit II reactor. "The longer we spend debating the various options, the more we force ourselves into a situation where venting is the only alternative because of time constraints," Ertel wrote.

As reported in last weeks Press And Journal, according to Michigan State University physicist Dr. Gerald Pollack, the Selective Absorption Process would result in miniscule, if any, threat of an offsite radiation release. "Even with a total malfunction of the treatment system the maximum exposure would be insignificant. The amount of krypton that is being processed at any one time is small," Tunnell said.

Dr. Pollack stressed that the

(Continued On Sec. 1, Page 9)

Selective Absorption Start Possible

(Continued)

Selective Absorption Process would be his first recommendation in dealing witht he estimated 57,000 curies of radioactive krypton-85 gas in the containment building atmosphere of Unit II at TMI.

The Metropolitan Edison Company and the NRC Staff had previously recommended to the commissioners of the NRC in an Environmental Assessment that the purging of the krypton-85 gas to the atmosphere would be the best avenue to follow in plant cleanup. They stated that the cleanup process at TMI should be done quickly and that the gas purging scheme would accomplish a needed segment of cleanup at TMI as quickly as possible.

The original outline by Dr. Pollack was from 1.5 to 4 years would be required to set up the Selective Absorption Process. But Ertel maintains that following his visit and conversation with officials and the system's designers at Oak Ridge the entire Selective Absorption process could be operating within 90 days.

Technicians at Oak Ridge described the items needed for constructing the Selective Absorption Process as being "off-the-shelf" materials that would not be difficult to attain. "They would be readily available according to the technicians at Oak Ridge," Ertel's spokesman said. "Now that is drastically different from what was given in the NRC's Environmental Assessment."

The Selective Absorption Process presently in operation at Oak Ridge is processing at a flow rate of 15 cubic feet per minute. To be employed at TMI, this would have to be increased to approximately 200 cubic feet per minute. "This does not represent any significant problems," Ertel wrote in his letter. "Passing the gases in TMI Unit-II through the system only once would reduce the Kr-85 in containment by a factor of 100 to 1,000 times."

The NRC environmental assessment agrees that "all indications are that the absorption system would perform satisfactorily" when the system is enlarged. But Robert Arnold, GPU's head of cleanup, is concerned that the engineering problems that would be encountered during scale-up could present problems.

"One of the major criticism of nuclear power plants is that they were scaled up too fast," Arnold said. In his view the absorption system was "not at a point of development" where it would be practical as an alternative to venting.

Ertel's aid defended the system by saying, "We're not convinced that this is the cure-all." "We think it presents a very clear alternative to what the people have been led to believe in the past. The process not only holds out a hope but it's something the congressman has asked to have immediately implemented. He hopes to be in a position to push very hard with the NRC and to get the confidence of two other NRC Commissioners."

Ertel stated, "we must remember in assessing this option that: the Kr-85 is already in the reactor; unless we implement the Selective Absorption System, the Kr-85 will be vented into the atmosphere; the worst that could happen with the failure of the Selective Absorption System is venting."

The letter Ertel has sent to the NRC Commissioners has culminated several weeks of work he and Commissioner Galinsky have been doing in investigating the Selective Absorption Process.

"They felt that because of the public anxiety and the stress that was evident among the populus in the immediate area that it would be well advised for those in public office to get an additional opinion," Tunnell said. He continued by saying that both Ertel and Galinsky felt that the Selective Absorption Process did not receive proper consideration in the NRC staff's Environmental Assessment.

A detailed analysis of the entire system is expected to be received by Ertel from Oak Ridge sometime this week. "This analysis should confirm the initial conclusion that this system should be utilized," he stated.

The pricetag on the Selective Absorption Process had been originally set at from $4 to $20 million with the cleanup process taking approximately 60 to 70 days. The gas purging method of ridding the containment building of the krypton-85 gas would cost from $75,000 to $120,000 and would take anywhere from five to 60 days to complete according to NRC staff members and Metropolitan Edison Company officials.

The Patriot, Harrisburg, Pa., Saturday, April 26, 1980

Krypton-Absorbing Plan Reportedly Needs I

By MICK ROOD
Washington Bureau

'ASHINGTON — Managers of sorption system they say could ve the more than 50,000 curies ypton 85 gas in the Three Mile 1 Unit 2 containment without ng radioactive releases claimed y that it would take at least 18 hs to get the system in place vorking.

'ith three of five Nuclear Regu- Commission members listen- t the briefing, Department of y and Union Carbide officials bed how regulatory restric- bidding requirements, krypton storage problems and other potential delays could drag out installation. Union Carbide has been developing the Selective Absorption System under contract with DOE for 13 years at the government's Oak Ridge, Tenn., nuclear research facility.

When it strongly recommended venting the krypton 85 into the atmosphere March 11, the NRC staff dismissed the absorption system as too time-consuming and expensive. Rep. Allen Ertel, D-Montoursville, and NRC member Victor Gilinsky had visited Oak Ridge a week ago in the hopes that a presentation describing the absorption process might be considered as an option to venting.

Although NRC Chairman John F. Ahearne said the method of removing the radioactive gas from the containment so Unit 2 can be cleaned up is still an open question, prospects for a genuine venting alternative were not enhanced at the briefing.

Bob Merriman, head of Union Carbide's gaseous diffusion division at Oak Ridge, did tell the commission that the selective absorption technology is "well established and I have no reservations about that." But rather than advocate his technology, Merriman dwelled on time-consuming bureaucratic barriers that would bog down a construction timetable. Merriman also apparently upped estimates of how much the system would cost. The NRC staff projected less than two months ago that the price tag would be from $4 to 10 million. Four price ranges presented to the NRC Friday started at $10 million and went as high as $20 million.

Gilinsky and Ertel left the briefing shaking their heads.

"These people came in here with a very negative frame of mind," Gilinsky said.

"They're trying to dis-sell system," Ertel said.

"My graduate students ar could do a better job than that," Richard L. Pollack, a Michigan S University physics professor w Gilinsky has hired as a special sultant on the TMI decontamina problem.

Merriman denied trying downplay his own system and sisted that the NRC should be av that practical problems in buil anything for the government take considerable time. He also c plained his estimates were sh

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THOMAS K. GILHOOL

CHIEF COUNSEL
ERIC I. B. BELLER
MICHAEL CHURCHILL
ELIAS S. COHEN
FRANK FINCH III
ANTHONY E. JACKSON
DEBORAH KAPLAN*
HARRIET N. KATZ
FRANK J. LASKI
LYNN C. MALMGREN
PRATHER RANDLE
JAMES J. RAGGIO
ALBERT J. SLAP
EDWARD A. STUTMAN

DAVID G. DAVIS
ADMINISTRATIVE OFFICER
* Admitted in District of Columbia only.

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1315 WALNUT ST., 16th FL., PHILA. 19107 215 · PE 5-7200
F. JOHN HAGELE
CHAIRMAN OF THE BOARD
EDWIN D. WOLF
EXECUTIVE DIRECTOR
1974-1976

May 14, 1980

Dr. Richard H. Vollmer
Director, Three Mile Island Support
NRR, U.S. Nuclear Regulatory Commission
1717 "H" Street, N.W.
Washington, D.C. 20555

Re: COMMENT TO ENVIRONMENTAL ASSESSMENT FOR THE DECONTAMINATION OF THE THREE MILE ISLAND UNIT 2 REACTOR BUILDING ATMOSPHERE

Dear Mr. Vollmer:

Please be advised that the TMI Legal Fund, on whose behalf we recently submitted comments to the krypton venting Environmental Assessment, consists of the following six groups:

(1) Susquehanna Valley Alliance (SVA)
(2) Environmental Coalition on Nuclear Power (ECNP)
(3) Anti-Nuclear Group Representing York (ANGRY)
(4) TMI Alert
(5) Newberry Township
(6) People Against Nuclear Energy (PANE)

Please ensure that this information appears in the record of the comments.

Sincerely,
Judith A. Dorsey
Judith A. Dorsey, Esq.

Bruce Molholt, Ph.D.

Jean Royer Kohr, Esq.

JAD/BM/JRK/at

1980

Absorbing Plan Reportedly Needs 18 Months

rage problems and other po- delays could drag out instal- Union Carbide has been ping the Selective Absorption under contract with DOE years at the government's ldge, Tenn., nuclear research

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But rather than advocate his technology, Merriman dwelled on time consuming bureaucratic barriers that would bog down a construction timetable. Merriman also apparently upped estimates of how much the system would cost. The NRC staff projected less than two months ago that the price tag would be from $4 to 10 million. Four price ranges presented to the NRC Friday started at $10 million and went as high as $20 million.

Gilinsky and Ertel left the briefing shaking their heads.

"These people came in here with a very negative frame of mind," Gilinsky said.

"They're trying to dis-sell this system," Ertel said.

"My graduate students and I could do a better job than that," said Richard L. Pollack, a Michigan State University physics professor whom Gilinsky has hired as a special consultant on the TMI decontamination problem.

Merriman denied trying to downplay his own system and insisted that the NRC should be aware that practical problems in building anything for the government will take considerable time. He also complained his estimates were shaky because Ertel and Gilinsky allo only a week's time to study estimates.

Ertel said he was also distur that Merriman didn't bring al Michael Stevenson, a Union Car engineer at Oak Ridge who oper a pilot model absorption system which any full scale TMI model be patterned. Stevenson had enthusiastic about adapting the tem to TMI needs when Ertel Gilinsky visited Oak Ridge last urday.

Merriman said there had bee ulterior motives in leaving Ste son behind.

25 Harvey Lane
Malvern Pa, 19355
3/31/80

Mr Jimmy Carter
President of the United States
The White House
Washington D.C.

Dear Mr President

I have conceived a method whereby the krypton gas in the cooling towers at TMI could be vented without any possibility of contaminating the local area around TMI.

The method involves bleeding the gas into a suitable container that would be supported by a helium balloon. Once the container was full, the ground support lines for the helium balloon would be cut & the helium balloon would carry the container of the krypton gas into the upper atmosphere. At the appropriate height a timing device would puncture the krypton container & bleed it to the upper atmosphere, far away from human life.

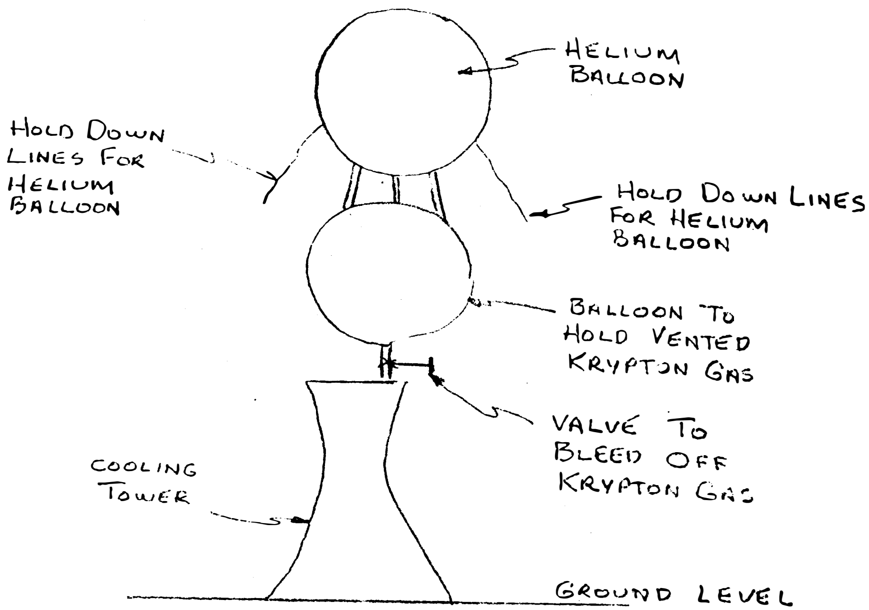
It is realized that a good number of balloons & krypton containers would be required.

It is believed that this is the only safe way that disposal of this gas can be achieved without any possible injury to human life.

A sketch of my method is enclosed. I can supply further details to anyone that wishes to see them.

Very truly yours,
Raymond A Geyer Jr.

Governor Richard Thornburgh.



T.M.I. BLEED OFF SYSTEM

R.A. GUYER JR.
25 HARVEY LANE
MALVERN PA
3/31/80

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE
HARRISBURG

THE GOVERNOR

May 16, 1980

Honorable John F. Ahearne
Acting Chairman
Nuclear Regulatory Commission
Washington, D.C. 20005

Dear Mr. Chairman:

This is to notify you of my views, on behalf of the Commonwealth of Pennsylvania, regarding the proposal now before you to remove radioactive krypton 85 from the Three Mile Island Unit 2 containment building by the process of venting it into the atmosphere.

I have sought and received assessments from the broadest range of knowledgeable sources available regarding potential health effects of that proposal. These sources have included:

*Members of your own staff, and especially Mr. Harold Denton, your director of nuclear reactor regulation.

*The Union of Concerned Scientists (UCS), the nation's foremost critic, I believe, of existing nuclear power safety levels.

*The National Council on Radiation Protection and Measurements (NCRP), an organization of distinguished scientists and physicians which has been instrumental in setting radiation health standards in this country for nearly 20 years.

*Representatives of the electric utility and nuclear industries.

*The U.S. Department of Health, Education and Welfare.

*The Governor's Commission on Three Mile Island.

*The Pennsylvania Departments of Health and Public Welfare, the latter of which has jurisdiction in the area of mental health in our state.

*The Pennsylvania Department of Environmental Resources (DER), including its Bureau of Radiation Protection.

The assessments of these various groups and institutions are being forwarded to you under separate cover, and I respectfully request that you enter them into your official record on this matter.

There is, I have found, a broad-based consensus among these sources that the venting proposal now before you would have, in the words of the Concerned Scientists, "no direct radiation-induced health effects on the residents of this area." Similarly, the NCRP concludes: "the exposures likely to be received as a result of venting are not a valid basis for concern with respect to health effects."

There is a consensus on the accuracy of the radiation dose rate calculations made by your staff, in conjunction with the utility, and there is a consensus that those dose rates are "insignificant."

I should point out that the Union of Concerned Scientists feels that the psychological stress already experienced by many residents of this area since March 28, 1979 should seriously be considered in any decision you make with regard to the cleanup operation on Three Mile Island, and I agree with that. As you know, I previously instructed attorneys for the Commonwealth to introduce stress as a legitimate factor for you to consider in other decisions growing out of this incident.

I am advised and I believe, however, that the question of stress, as related to the venting plan, is directly linked to the question of its safety, and that the consensus finding that the plan poses no radiation threat to public health should, in itself, substantially reduce any stress that might have accompanied it.

UCS also recommends that you consider two alternative venting plans described in its report, and that you reconsider two non-venting plans previously rejected by your staff. I am sure you will give due consideration to those recommendations. I do urge that any new assessments be completed as promptly as possible. I am advised and believe that the sooner this matter is resolved, the sooner any stress related to it will be dissipated.

I recognize that part of the delay already experienced has been due to my effort to be assured of the safety of venting. I now have that assurance, and I feel that a safe cleanup plan should be implimented as quickly as possible.

Should you proceed with the venting proposal advanced by your staff, be assured that I am prepared to support that decision. To minimize stress, I also am prepared to commit all of the resources at my disposal to assure the residents of the area, as I am now persuaded, that this plan is, indeed, a safe one.

It has been said that some of the alternatives should have been considered as soon as the immediate crisis on Three Mile Island had ended. Recognizing that hindsight is an easy thing to employ, I do recommend that you begin now to identify all of the future problems and every possible solution to those problems that we may confront in other phases of the cleanup operation. I also recommend that you arrange to tap all potential sources of technical and scientific advice regarding those problems. Be assured that I stand ready to work with your staff in that regard.

Thank you for the opportunity to express my views on this important matter.

Sincerely,

Dick Thornburgh
Governor

NRC FORM 335 (7-77)

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