

February 27, 1981



SECY-81-133

**POLICY ISSUE**  
**(Commission Meeting)**

For: The Commission

From: Executive Director for Operations

Subject: PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON THE DECONTAMINATION AND DISPOSAL OF RADIOACTIVE WASTES RESULTING FROM THE MARCH 28, 1979 ACCIDENT AT THREE MILE ISLAND NUCLEAR STATION, UNIT 2

Purpose: To provide the Commission with copies of the final Programmatic Environmental Impact Statement on the Decontamination and Disposal of Radioactive Wastes Resulting from the March 28, 1979 accident at Three Mile Island, Unit 2 and to provide a proposed Statement of Policy by the Commission on this Programmatic Statement.

Discussion: In its Statement of Policy and Notice of Intent to Prepare a Programmatic Environmental Impact Statement of November 21, 1979, the Commission directed the staff to prepare such a statement on the decontamination and disposal of radioactive wastes resulting from the March 28, 1979 accident at Three Mile Island, Unit 2. We are forwarding to you, for your information, advance copies of the final Programmatic Environmental Impact Statement (PEIS) (Enclosure 1).

The PEIS is being printed and adequate copies will be made publicly available at the scheduled March 9 briefing for the Commission. Formal notification of the availability of the PEIS will be published in the Federal Register (Enclosure 2). Enclosure 3 is a press release prepared by PA and Enclosure 4 is a proposed Statement of Policy relative to the PEIS for your consideration.

Contact:  
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SECY NOTE: This paper is virtually identical to advance copies which were circulated to Commission offices on February 27, 1981. The only difference is renumbering of the paper from SECY-80-245 to SECY-81-133. The paper is currently scheduled for a briefing at an Open Commission meeting on Monday, March 9, 1981.

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The PEIS was developed by the Three Mile Island Program Office, NRR, with the assistance of Waste Management Division, NMSS. ELD has provided legal review. Argonne National Laboratory, under contract to NRC, was a major participant in preparing the PEIS.

Preparation of this final statement has had the benefit of extensive comments from government agencies and the public on the draft PEIS which was issued in August 1980. During the comment period, which was extended to November 20, 1980, 31 meetings were held with the public, local officials and interested groups on the draft PEIS. Verbatim transcripts were made of many of these meetings and relevant oral comments recorded are responded to in the final PEIS, along with written comments received. The staff also met with representatives of the Environmental Protection Agency and the states of Pennsylvania and Maryland. Comments were not received from the Commission's Advisory Panel on the Decontamination of TMI-2 prior to completion of the PEIS. However, based on our understanding of the Advisory Panel's concerns, the staff believes that most of the panel's comments will have been considered in the changes that have been made in the draft PEIS. Furthermore, the final PEIS is, in the staff's opinion, responsive to the comments provided to the Environmental Protection Agency by a specially constituted independent scientific assessment panel.

The staff's efforts to be responsive to the comments have resulted in a variety of changes, particularly in Chapters 5 through 8 which some persons found confusing. While the organization of those chapters in the draft statement enabled the reader to follow the expected chronological sequence of the cleanup activities, it also had the disadvantage of scattering information on particular subjects, such as processing contaminated water from several plant locations, through various parts of the document. The material in these chapters has been reorganized so that discussions of similar activities are grouped together in this final PEIS.

To further aid the reader, some of the technical descriptions have been simplified, information has been updated, and additional illustrations have been included. As a further aid, a comprehensive summary, written in a less technical manner, has been included at the beginning of the PEIS for those readers who prefer to follow the main themes of the statement without referring to the technical descriptions, calculations, data, and other details that provide the basis for assessing the cleanup alternatives and their impacts.



Relative economic cost estimates of the alternative methods of performing the cleanup of TMI-2 have also been included, as promised when the draft statement was issued. However, the staff does not regard the addition of cost information (or the other modifications mentioned above) as a substantial change in the content of the document. The differential monetary costs among suitable cleanup methods are small compared to the expected total costs of the cleanup and therefore do not constitute sufficient concern to affect a decision as to which alternatives should be chosen to accomplish the cleanup activities.

The staff's conclusions regarding the costs and benefits of the cleanup of TMI-2 are set forth with a cost-benefit balance in Section 12 (Enclosure 5) of the PEIS. Although cost-benefit analyses are routinely performed by NRC, the cost-benefit balance for the cleanup of TMI-2 is unique. In contrast to studying whether or not to take a significant action such as issuing a construction permit for a nuclear power plant, the situation at TMI-2, in the staff's view, demands that mitigative actions be taken. Specifically, there is a small possibility (which increases with time) of uncontrolled releases of radioactivity to the environment. This radioactivity (600,000 to 700,000 curies in all) is currently contained in the reactor core and distributed throughout the primary coolant system, the water in the reactor building basement, and on equipment and building surfaces. Additionally, there is also a remote possibility of core recriticality, with the attendant generation of additional fission product activity.

The benefits associated with taking some actions to decontaminate and defuel TMI-2 are straightforward. Of overriding importance is the fact that decontamination of the facility and disposition of the wastes would greatly reduce and perhaps eliminate the existing potential for physical harm to the public and to workers at TMI. Completion of the cleanup activities should also alleviate psychological distress in nearby residents and downstream of the plant. One additional benefit from carrying out the cleanup (and the ongoing studies required for its planning and implementation) would be the resulting data and other information which could prove useful in reducing the risks and consequences of future accidents.

Environmental impacts and other costs associated with alternative methods of performing all of the cleanup have been evaluated in

the PEIS. The potential impacts of taking no action (other than maintaining the reactor in safe-shutdown condition), namely uncontrolled releases of radioactivity to the environment and increased risks to occupational workers, are unacceptable and thus resulted in the staff's discounting this alternative. The effects of an early decision to decommission TMI-2 were also considered and the staff found that the choices of alternatives would be affected very little by such a decision because most of the same tasks must be performed in order to remove and dispose of the damaged fuel.

The analysis of potential decontamination impacts contained in the PEIS indicates that feasible techniques exist and can be employed to complete the cleanup with relatively small resulting environmental impacts. Accordingly, the staff has concluded that on balance the benefits of full decontamination greatly outweigh the environmental costs of the cleanup activities.



William J. Dircks  
Executive Director for Operations

Enclosures:

1. Final Programmatic Environmental Impact Statement on the Cleanup of TMI-2 (PEIS) (Copies to Commissioners, SECY, PE & GC only)
2. Federal Register Notice of Availability of PEIS
3. Press Release on Issuance of PEIS
4. Proposed Statement of Policy Relative to the PEIS
5. PEIS Section 12, Conclusions

DISTRIBUTION

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ENCLOSURE 1

COPIES TO COMMISSIONERS, SECY, OPE AND OGC ONLY

ENCLOSURE 2

UNITED STATES NUCLEAR REGULATORY COMMISSIONDOCKET NO. 50-320METROPOLITAN EDISON COMPANY  
JERSEY CENTRAL POWER AND LIGHT COMPANY  
PENNSYLVANIA ELECTRIC COMPANYNOTICE OF AVAILABILITY OF FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR  
DECONTAMINATION OF THREE MILE ISLAND NUCLEAR STATION, UNIT 2

Pursuant to the National Environmental Policy Act of 1969 and the United States Nuclear Regulatory Commission's regulations in 10 CFR Part 51, notice is hereby given that the Final Programmatic Environmental Impact Statement (PEIS) prepared by the Commission's Office of Nuclear Reactor Regulation, related to the proposed decontamination and disposal of radioactive wastes resulting from the March 28, 1979, accident at Three Mile Island Nuclear Station, Unit 2, located in Dauphin County, Pennsylvania, is available for inspection by the public in the Commission's Public Document Room at 1717 H Street, N.W., Washington, D.C. and in the local public document room at the State Library of Pennsylvania, Government Publications Section, Education Building, Commonwealth and Walnut Streets, Harrisburg, Pennsylvania 17126. The Final PEIS is also being made available at the Pennsylvania State Clearinghouse, Governor's Budget Office, P.O. Box 1323, Harrisburg, Pennsylvania 17120 and at the Tri-County Regional Planning Commission, Shore Drive Office Center, Building No. 2, Suite 221, 2001 North Front Street, Harrisburg, Pennsylvania 17102.

The notice of availability of the Draft PEIS for the decontamination of Three Mile Island Nuclear Station, Unit 2, and request for comments from interested persons was published in the FEDERAL REGISTER on August 15, 1980 (45 F.R. 54494). The comments received from Federal, State, and local agencies and interested members of the public have been included as Appendix A to the Final PEIS.



Copies of the Final Environmental Statement (Document No. NUREG-0583) may be purchased, at current rates, from the National Technical Information Service, Springfield, Va. 22161.

Dated at Bethesda, Maryland, this      day of March 1981.

FOR THE NUCLEAR REGULATORY COMMISSION



Bernard J. Snyder, Program Director  
Three Mile Island Program Office  
Office of Nuclear Reactor Regulation .



ENCLOSURE 3

NRC STAFF ISSUES FINAL ENVIRONMENTAL STATEMENT  
ON TMI-2 CLEANUP

The Nuclear Regulatory Commission staff has issued a final environmental impact statement related to the proposed decontamination and disposal of radioactive wastes resulting from the accident at Unit 2 of the Three Mile Island Nuclear Power Station in Pennsylvania.

In a November 1979 policy statement, the Commission directed the staff to prepare a programmatic statement on environmental issues and alternatives as a means of involving the public in its decision-making process before deciding on specific cleanup choices.

The final statement reflects comments on a draft statement--issued in August 1980--which were received from private organizations and citizens as well as Federal, State and local agencies. These comments are included as an Appendix A to the final document.

In the final statement, the staff has evaluated the environmental impacts of alternative methods for complete decontamination of TMI-2 including removal of the fuel, decontamination of the reactor coolant system and disposal of the resulting radioactive wastes.

The staff has concluded that existing methods are adequate, or can be modified, to perform all necessary cleanup operations without incurring significant environmental impacts. The staff also has concluded that:

"...the...benefits and other considerations relative to the full decontamination, core removal and disposal of the radioactive wastes from the...accident at TMI-2 greatly outweigh the environmental costs of the cleanup activities. Until TMI-2 is largely decontaminated, there is a small possibility (which increases with time) of uncontrolled releases of radioactivity to the environment. Decontamination of the plant and disposal of the wastes will eliminate this possibility for potential harm to the public and workers at TMI, and will alleviate the attendant anxiety concerning radioactive releases from the plant...therefore...full cleanup of the facility must proceed as expeditiously as is reasonably feasible, consistent with ensuring public health and safety and protecting the environment."

The staff's detailed conclusions on environmental impacts and other costs are attached.

Copies of the Final Programmatic Environmental Statement (NUREG-0683) are being made available for inspection at three locations near the TMI site: the State Library of



Pennsylvania, Government Publications Section, Education Building, Commonwealth and Walnut Streets, Harrisburg; the Pennsylvania State Clearinghouse, Governor's Budget Office, Harrisburg; and at the Tri-County Regional Planning Commission, Shore Drive Office Center, Building No. 2, Suite 221, 2001 North Front Street, Harrisburg. It also will be available for inspection in the Commisison's Public Document Room, 1717 H Street, NW, Washington, D.C.

Individual copies may be purchased at current rates from the National Technical Information Service, Springfield, Virginia 22161.

Attachments

## 12. CONCLUSIONS

In this programmatic environmental impact statement, the NRC staff has evaluated the environmental impacts and other costs and benefits associated with the proposed cleanup of Three Mile Island Unit 2. As a result of its evaluation, the staff has made the following findings and conclusions:

### 12.1 Conclusions on Environmental Impacts and Other Costs

1. The cumulative radiation dose received by the entire work force would be in the range of 2000 to 8000 person-rem for the whole cleanup program. It is predicted that less than one additional cancer death attributable to exposure to radiation will occur among the work force (the death rate from cancer due to other causes among the U.S. population averages approximately 200 deaths per 1000 people). Not more than two additional genetic effects in descendants of the workers are expected to occur (among the U.S. population, approximately 60 genetic defects can be expected per 1000 people). This is the most significant radiological impact expected from the cleanup activities.

The occupational dose to an individual worker will be limited to 3 rem/quarter in accordance with 10 CFR Part 20; however, the exact dose below 3 rem/quarter to any one individual cannot be determined due to lack of information about specific work assignments.

2. Throughout the cleanup, any anticipated releases to the environment must be controlled by the licensee in accordance with the staff's proposed effluent criteria to conform to the individual dose design objectives listed in 10 CFR Part 50, Appendix I, as mandatory limits. The total-body dose design objectives are 15 mrem/year from airborne particulate releases and 3 mrem/year from liquid releases.

Decontamination methods and technology are available which can be used to complete the cleanup in accordance with the offsite dose limits stated above. If the cleanup is conducted in accordance with the staff's proposed effluent criteria, the staff estimates that, for the entire cleanup, the total body dose to the maximum exposed individual offsite will range from 0.8 to 2.3 mrem for gaseous effluents and from 0.0015 to 1.1 for liquid effluents. The cleanup is expected to take from 5 to 9 years to complete.

3. An individual offsite receiving the maximum estimated dose resulting from atmospheric releases during the entire cleanup (0.8 to 2.3 mrem) would incur an estimated increased risk of dying from cancer of between 1 in 2 million and 1 in 700,000, and an increased risk of a genetic effect to offspring over the next 5 generations of between 1 in 300,000 and 1 in 100,000. As a result of liquid releases which may occur over the entire cleanup period, an individual receiving the maximum estimated dose (0.0015 to 1.1 mrem) would incur an estimated increased risk of dying from cancer of between 1 in 1 billion and 1 in 1 million, and an increased risk of genetic effect to offspring over the next 5 generations of between 1 in 200 million and 1 in 200,000.

If an offsite dose equal to the staff's proposed (10 CFR Part 50, Appendix I) atmospheric annual limit (15 mrem/yr., total body) were received, that individual would incur an estimated increased risk of dying from cancer of 1 in 100,000 and an increased risk of a genetic effect to offspring over the next 5 generations of about 1 in 20,000. An offsite dose equal to the staff's proposed liquid annual limit (3 mrem/yr., total body) would result in an individual incurring an estimated increased risk of dying from cancer of 1 in 500,000 and an increased risk of a genetic effect to offspring over the next 5 generations of about 1 in 80,000. (The average risk to members of the U.S. population of dying from cancer is approximately 1 in 5 and the risk of genetic effects is about 1 in 17.)

4. If the cleanup is conducted in accordance with the staff's proposed effluent criteria, the total cumulative dose received by the entire population within a 50-mile radius of TMI-2 due to both gaseous and liquid releases would range from 10 to 10 person-rem for the entire cleanup. This is a small fraction (about .01%) of the background radiation dose received by the population from causes other than releases from TMI (population background radiation dose = 115 mrem/yr x  $2.2 \times 10^6$  people = 250,000 person-rem).



5. Although the number of truck shipments necessary to carry solid radioactive wastes to disposal sites will be large (ranging from about 350 to 1000), the shipments will be made over a long period and should cause little traffic congestion. Adherence to Federal packaging and shipping regulations will result in small radiation doses to those along the shipping route. If all TMI wastes are shipped to the furthest potential storage site, the estimated 700,000 persons who reside along the 2750-mile route might receive a cumulative population dose within the range of 20 to 50 person-rem.
6. An individual onlooker who spends three minutes at an average distance of 3 ft from a truck loaded with radioactive waste might receive a dose of up to 1.3 mrem. This dose would increase the individual risk of dying from cancer by 1 in 1 million. The increased risk of genetic effects from the dose to offspring of the exposed individual is about 1 in 200,000.
7. Radioactive fuel and other high-specific-activity wastes from TMI-2 must be packaged and will have to be stored at the site temporarily until a suitable disposal site is established elsewhere. No significant environmental effects are expected from these activities.
8. From 1/2 to 1 acre of land at authorized disposal sites will be required for the low-level wastes from TMI-2.
9. The expected consequences of credible accidents are small (below the requirement of 10 CFR Part 20 for normal operation).
10. Resources that will necessarily be committed to the cleanup are materials of construction such as steel and cement, chemicals, organic resins, and other materials, none of which is in short supply in comparison to the annual U.S. production.
11. Psychological distress caused by the accident and operations necessary to proceed with the cleanup has declined but there is a potential for temporary increases in distress as various cleanup activities are undertaken.
12. Social economic impacts include potential consumer avoidance of Chesapeake Bay seafood products that the public may believe are contaminated if processed water is released to the Susquehanna River, potential consumer avoidance of milk products sold directly to consumers following airborne releases of radioactivity, and the potential adverse market effect on residential property close to the transport route through Middletown, Pennsylvania, during the period of waste shipments from TMI.
13. The differential monetary costs among suitable cleanup methods are small compared to the expected total costs of the entire cleanup and therefore do not constitute sufficient concern to affect a decision as to which alternatives should be chosen to accomplish the cleanup activities. The overriding considerations should be ensuring the public's health and safety and protection of the environment.

#### 12.2 Additional Conclusions

1. Existing methods are adequate, or can be suitably modified, to perform virtually all of the necessary operations without incurring significant environmental impacts. Where special tools or methods are found necessary for operations such as defueling, engineering expertise is available to cope with such requirements.
2. An early decision to decommission TMI-2 would have very little effect on the choices of alternatives for the cleanup tasks because most of the same tasks must be performed in order to remove and dispose of the damaged fuel.
3. If the damaged fuel and radioactive wastes are not removed, the island would, in effect, become a permanent waste disposal site. The location, geology, and hydrology of Three Mile Island are among the factors that do not meet current criteria for a safe long-term waste disposal facility. Removing the damaged fuel and radioactive waste to storage sites that do meet all of the relevant criteria is the only reliable means for eliminating the risk of widespread uncontrolled contamination of the environment by the accident wastes. The staff has concluded that TMI should not become a permanent waste disposal site.

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4. Procedures have not yet been established for processing and disposal of high-specific-activity waste. Therefore, the staff regards the transfer of damaged fuel and other high-specific-activity waste to facilities operated by the Department of Energy (where the national expertise exists) to be the most appropriate course of action for processing and final disposal of this material.
5. The contaminated accident-generated water in the reactor building basement (sump) and in the reactor primary system cannot be left in its present condition and location if the cleanup effort is to proceed. Removal of this contaminated accident water will reduce the airborne and direct radiation levels in the building sufficiently to permit other cleanup operations to be accomplished with greater safety.
6. Treatment of the contaminated accident water will transform the entrained radioactivity from its current mobile state to a more manageable form by concentrating and immobilizing the activity by an appropriate process. The cleanup activity will eliminate the risks associated with leaving the contaminated accident water radionuclide inventory in the mobile unprocessed state.
7. A decision on the ultimate disposal of the processed water can be deferred until after the water has been processed. Then, the concentration of radionuclides remaining in the water will be low enough for the water to be stored safely onsite until the disposal decision is made. Processing the water to immobilize most of the radionuclides and storage of the processed water will not foreclose any reasonable options for disposition of the water or concentrated wastes.
8. The alternatives adopted for the various cleanup tasks will be those that keep the occupational doses as low as reasonably achievable. Delaying full cleanup will not appreciably lower the radiation fields (as a result of radioactive decay) or occupational doses. However, full and prompt cleanup would reduce the risks of uncontrolled radiation releases and would keep the doses to workers involved in cleanup tasks and to the public at a minimum.

### 12.3 Benefits

1. The major benefit of the cleanup will be the elimination of the continuing risk of potential uncontrolled releases of radioactivity to the environment from damaged fuel or from the radioactive materials which are distributed throughout the primary system, the reactor containment building, and the auxiliary and fuel handling buildings. The radionuclides are also in the contaminated accident water in the reactor building basement and in the radioactive waste in temporary storage on the Island. These sources are a hazard because of the potential for uncontrolled radiation exposure to workers on the Island and to the local population. Removal of this hazard will relieve anxiety in some members of the local population and those dependent on the Susquehanna River and the Chesapeake Bay for a livelihood, for drinking water, or for recreation. The only way to eliminate this continuing hazard and anxiety is to clean up the facilities and remove the radioactive waste and damaged fuel to suitable storage sites.
2. An incidental benefit that would accrue from the cleanup (and the ongoing studies that will be needed for planning and implementation) is additional knowledge that would be useful for reducing the risks and consequences of possible future accidents at nuclear power plants.

### 12.4 Cost-Benefit Balance

The staff concludes that on balance the above benefits and other considerations relative to the full decontamination, core removal, and disposal of the radioactive wastes from the March 28, 1979 accident at TMI-2 greatly outweigh the environmental costs of the cleanup activities. Until TMI-2 is largely decontaminated, there is a small possibility (which increases with time) of uncontrolled releases of radioactivity to the environment. Decontamination of the plant and disposal of the wastes will eliminate this possibility for potential harm to the public and workers at TMI, and will alleviate the attendant anxiety concerning radioactive releases from the plant. The staff therefore concludes that the full cleanup of the facility must proceed as expeditiously as is reasonably feasible, consistent with ensuring public health and safety and protecting the environment.

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ENCLOSURE 4



Statement of Policy Relative to the NRC Programmatic Environmental Impact  
Statement on the Cleanup of Three Mile Island Unit 2.

Agency: U.S. Nuclear Regulatory Commission

Action: Statement of Policy

On November 21, 1979, the Nuclear Regulatory Commission directed the staff to prepare a Programmatic Environmental Impact Statement (PEIS) on the decontamination and disposal of radioactive wastes resulting from the March 28, 1979 accident at Three Mile Island, Unit 2. A Statement of Policy and Notice of Intent regarding that decision was published in the Federal Register on November 27, 1979 (page 67738). As stated at that time: "In the Commission's judgment, an overall study of the decontamination and disposal process will assist the Commission in carrying out its regulatory responsibilities under the Atomic Energy Act to protect the public health and safety as decontamination progresses. It will also be in keeping with the purposes of the National Environmental Policy Act to engage the public in the Commission's decisionmaking process, and to focus on the environmental issues and alternatives before commitments to specific cleanup choices are made." As directed, the Commission's staff has now completed a final programmatic environmental impact statement on all phases of the cleanup of TMI Unit 2 to meet the foregoing objectives.

Preparation of this final statement has had the benefit of extensive comments from government agencies and the public. Comments on the draft PEIS from the Advisory Panel for the Decontamination of TMI-2 (a panel which the Commission



established to receive independent advice from local officials, scientists, and individuals in the area) had not been received prior to finalization of the PEIS. However, the Commission has now received the Panel's comments and finds that the staff's final PEIS is responsive to those comments. The Commission concludes that this statement is sufficiently comprehensive and thorough and therefore, satisfies our obligations under NEPA.

The environmental impacts of all the cleanup activities at TMI-2 are expected to be within the scope of the impacts assessed in the statement for the alternative methods of conducting each of these activities, and the benefits to be realized from prompt cleanup clearly outweigh these impacts. However, it is recognized that there may be uncertainties about the cleanup which may result in the need for additional consideration as more information becomes known.

As the licensee proposes specific decontamination alternatives for each major cleanup activity, the staff will determine whether these proposals and their predicted impacts fall within the scope of those already assessed in the PEIS. If they do not, appropriate reviews will be undertaken in accordance with NEPA. In addition, reviews of each proposed major cleanup activity will normally be necessary to assure that all applicable NRC requirements are met to protect the health and safety of the public. To the extent that a specific proposal requires an amendment to the facility operating license, an appropriate public notice will be provided.

On September 26, 1980, this Commission issued a Statement of Policy relative to the Pennsylvania Public Utility Commission's order to the licensee to cease

and desist from using any operating revenues for cleanup and restoration costs at TMI-2 which are not covered by insurance. We reiterate here our previous position that we will not excuse the licensee from compliance with any order, regulation or other requirement imposed by this Commission for purposes of protecting public health and safety and the environment. With finalization of the environmental impact statement for TMI-2, the Commission's position is that the licensee should accelerate the pace of the cleanup to expeditiously complete all decontamination activities consistent with ensuring protection of public health and safety and the environment.

We further take the position that the cleanup should be carried out in accordance with the requirements of the existing operating license (DPR-73) and the staff's proposed criteria as delineated in Appendix R of the final PEIS. Implementation of these criteria in this manner is more stringent than for normally operating plants, in recognition of the condition of TMI-2. Accordingly, the Commission directs the Director of NRR to promptly initiate appropriate action to modify the TMI-2 operating license to add the criteria proposed in Appendix R of the final PEIS to the existing technical specifications.

The Commission expects to receive continuing advice from the TMI-2 Advisory Panel on major activities required to accomplish expeditious and safe cleanup of the TMI-2 facility. This advice is expected to provide important input for future NRC decisions throughout the progress of the cleanup.

Dated at Washington, DC this \_\_\_\_\_ day of March 1981.

For the Commission.

Samuel J. Chilk

Secretary of the Commission



ENCLOSURE 5

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## 12. CONCLUSIONS

In this programmatic environmental impact statement, the NRC staff has evaluated the environmental impacts and other costs and benefits associated with the proposed cleanup of Three Mile Island Unit 2. As a result of its evaluation, the staff has made the following findings and conclusions:

### 12.1 Conclusions on Environmental Impacts and Other Costs

1. The cumulative radiation dose received by the entire work force would be in the range of 2000 to 8000 person-rem for the whole cleanup program. It is predicted that less than one additional cancer death attributable to exposure to radiation will occur among the work force (the death rate from cancer due to other causes among the U.S. population averages approximately 200 deaths per 1000 people). Not more than two additional genetic effects in descendants of the workers are expected to occur (among the U.S. population, approximately 60 genetic defects can be expected per 1000 people). This is the most significant radiological impact expected from the cleanup activities.

The occupational dose to an individual worker will be limited to 3 rem/quarter in accordance with 10 CFR Part 20; however, the exact dose below 3 rem/quarter to any one individual cannot be determined due to lack of information about specific work assignments.

2. Throughout the cleanup, any anticipated releases to the environment must be controlled by the licensee in accordance with the staff's proposed effluent criteria to conform to the individual dose design objectives listed in 10 CFR Part 50, Appendix I, as mandatory limits. The total-body dose design objectives are 15 mrem/year from airborne particulate releases and 3 mrem/year from liquid releases.

Decontamination methods and technology are available which can be used to complete the cleanup in accordance with the offsite dose limits stated above. If the cleanup is conducted in accordance with the staff's proposed effluent criteria, the staff estimates that, for the entire cleanup, the total body dose to the maximum exposed individual offsite will range from 0.8 to 2.3 mrem for gaseous effluents and from 0.0015 to 1.1 for liquid effluents. The cleanup is expected to take from 5 to 9 years to complete.

3. An individual offsite receiving the maximum estimated dose resulting from atmospheric releases during the entire cleanup (0.8 to 2.3 mrem) would incur an estimated increased risk of dying from cancer of between 1 in 2 million and 1 in 700,000, and an increased risk of a genetic effect to offspring over the next 5 generations of between 1 in 300,000 and 1 in 100,000. As a result of liquid releases which may occur over the entire cleanup period, an individual receiving the maximum estimated dose (0.0015 to 1.1 mrem) would incur an estimated increased risk of dying from cancer of between 1 in 1 billion and 1 in 1 million, and an increased risk of genetic effect to offspring over the next 5 generations of between 1 in 200 million and 1 in 200,000.

If an offsite dose equal to the staff's proposed (10 CFR Part 50, Appendix I) atmospheric annual limit (15 mrem/yr., total body) were received, that individual would incur an estimated increased risk of dying from cancer of 1 in 100,000 and an increased risk of a genetic effect to offspring over the next 5 generations of about 1 in 20,000. An offsite dose equal to the staff's proposed liquid annual limit (3 mrem/yr., total body) would result in an individual incurring an estimated increased risk of dying from cancer of 1 in 500,000 and an increased risk of a genetic effect to offspring over the next 5 generations of about 1 in 80,000. (The average risk to members of the U.S. population of dying from cancer is approximately 1 in 5 and the risk of genetic effects is about 1 in 17.)

4. If the cleanup is conducted in accordance with the staff's proposed effluent criteria, the total cumulative dose received by the entire population within a 50-mile radius of TMI-2 due to both gaseous and liquid releases would range from 10 to 30 person-rem for the entire cleanup. This is a small fraction (about .01%) of the background radiation dose received by the population from causes other than releases from TMI (population background radiation dose = 115 mrem/yr x 2.2 x 10<sup>6</sup> people = 250,000 person-rem).



5. Although the number of truck shipments necessary to carry solid radioactive wastes to disposal sites will be large (ranging from about 350 to 1000), the shipments will be made over a long period and should cause little traffic congestion. Adherence to Federal packaging and shipping regulations will result in small radiation doses to those along the shipping route. If all TMI wastes are shipped to the furthest potential storage site, the estimated 700,000 persons who reside along the 2750-mile route might receive a cumulative population dose within the range of 20 to 50 person-rem.
6. An individual onlooker who spends three minutes at an average distance of 3 ft from a truck loaded with radioactive waste might receive a dose of up to 1.3 mrem. This dose would increase the individual risk of dying from cancer by 1 in 1 million. The increased risk of genetic effects from the dose to offspring of the exposed individual is about 1 in 200,000.
7. Radioactive fuel and other high-specific-activity wastes from TMI-2 must be packaged and will have to be stored at the site temporarily until a suitable disposal site is established elsewhere. No significant environmental effects are expected from these activities.
8. From 1/2 to 1 acre of land at authorized disposal sites will be required for the low-level wastes from TMI-2.
9. The expected consequences of credible accidents are small (below the requirement of 10 CFR Part 20 for normal operation).
10. Resources that will necessarily be committed to the cleanup are materials of construction such as steel and cement, chemicals, organic resins, and other materials, none of which is in short supply in comparison to the annual U.S. production.
11. Psychological distress caused by the accident and operations necessary to proceed with the cleanup has declined but there is a potential for temporary increases in distress as various cleanup activities are undertaken.
12. Social economic impacts include potential consumer avoidance of Chesapeake Bay seafood products that the public may believe are contaminated if processed water is released to the Susquehanna River, potential consumer avoidance of milk products sold directly to consumers following airborne releases of radioactivity, and the potential adverse market effect on residential property close to the transport route through Middletown, Pennsylvania, during the period of waste shipments from TMI.
13. The differential monetary costs among suitable cleanup methods are small compared to the expected total costs of the entire cleanup and therefore do not constitute sufficient concern to affect a decision as to which alternatives should be chosen to accomplish the cleanup activities. The overriding considerations should be ensuring the public's health and safety and protection of the environment.

## 12.2 Additional Conclusions

1. Existing methods are adequate, or can be suitably modified, to perform virtually all of the necessary operations without incurring significant environmental impacts. Where special tools or methods are found necessary for operations such as defueling, engineering expertise is available to cope with such requirements.
2. An early decision to decommission TMI-2 would have very little effect on the choices of alternatives for the cleanup tasks because most of the same tasks must be performed in order to remove and dispose of the damaged fuel.
3. If the damaged fuel and radioactive wastes are not removed, the Island would, in effect, become a permanent waste disposal site. The location, geology, and hydrology of Three Mile Island are among the factors that do not meet current criteria for a safe long-term waste disposal facility. Removing the damaged fuel and radioactive waste to storage sites that do meet all of the relevant criteria is the only reliable means for eliminating the risk of widespread uncontrolled contamination of the environment by the accident wastes. The staff has concluded that TMI should not become a permanent waste disposal site.



4. Procedures have not yet been established for processing and disposal of high-specific-activity waste. Therefore, the staff regards the transfer of damaged fuel and other high-specific-activity waste to facilities operated by the Department of Energy (where the national expertise exists) to be the most appropriate course of action for processing and final disposal of this material.
5. The contaminated accident-generated water in the reactor building basement (sump) and in the reactor primary system cannot be left in its present condition and location if the cleanup effort is to proceed. Removal of this contaminated accident water will reduce the airborne and direct radiation levels in the building sufficiently to permit other cleanup operations to be accomplished with greater safety.
6. Treatment of the contaminated accident water will transform the entrained radioactivity from its current mobile state to a more manageable form by concentrating and immobilizing the activity by an appropriate process. The cleanup activity will eliminate the risks associated with leaving the contaminated accident water radionuclide inventory in the mobile unprocessed state.
7. A decision on the ultimate disposal of the processed water can be deferred until after the water has been processed. Then, the concentration of radionuclides remaining in the water will be low enough for the water to be stored safely onsite until the disposal decision is made. Processing the water to immobilize most of the radionuclides and storage of the processed water will not foreclose any reasonable options for disposition of the water or concentrated wastes.
8. The alternatives adopted for the various cleanup tasks will be those that keep the occupational doses as low as reasonably achievable. Delaying full cleanup will not appreciably lower the radiation fields (as a result of radioactive decay) or occupational doses. However, full and prompt cleanup would reduce the risks of uncontrolled radiation releases and would keep the doses to workers involved in cleanup tasks and to the public at a minimum.

## 12.3 Benefits

1. The major benefit of the cleanup will be the elimination of the continuing risk of potential uncontrolled releases of radioactivity to the environment from damaged fuel or from the radioactive materials which are distributed throughout the primary system, the reactor containment building, and the auxiliary and fuel handling buildings. The radionuclides are also in the contaminated accident water in the reactor building basement and in the radioactive waste in temporary storage on the Island. These sources are a hazard because of the potential for uncontrolled radiation exposure to workers on the Island and to the local population. Removal of this hazard will relieve anxiety in some members of the local population and those dependent on the Susquehanna River and the Chesapeake Bay for a livelihood, for drinking water, or for recreation. The only way to eliminate this continuing hazard and anxiety is to clean up the facilities and remove the radioactive waste and damaged fuel to suitable storage sites.
2. An incidental benefit that would accrue from the cleanup (and the ongoing studies that will be needed for planning and implementation) is additional knowledge that would be useful for reducing the risks and consequences of possible future accidents at nuclear power plants.

## 12.4 Cost-Benefit Balance

The staff concludes that on balance the above benefits and other considerations relative to the full decontamination, core removal, and disposal of the radioactive wastes from the March 28, 1979 accident at TMI-2 greatly outweigh the environmental costs of the cleanup activities. Until TMI-2 is largely decontaminated, there is a small possibility (which increases with time) of uncontrolled releases of radioactivity to the environment. Decontamination of the plant and disposal of the wastes will eliminate this possibility for potential harm to the public and workers at TMI, and will alleviate the attendant anxiety concerning radioactive releases from the plant. The staff therefore concludes that the full cleanup of the facility must proceed as expeditiously as is reasonably feasible, consistent with ensuring public health and safety and protecting the environment.