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ASSESSMENT OF OFFSITE RADIATION DOSES FROM
THE THREE MILE ISLAND UNIT 2 ACCIDENT

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Assessment of Offsite Radiation Doses
from the Three Mile Island Unit 2 Accident

EXECUTIVE SUMMARY

Estimates of total, time integrated offsite radiation doses from the accident at Three Mile Island are summarized in the table on page v. The most significant doses are from the release of airborne radioactive noble gases. The best estimate of maximum potential whole body dose from noble gases at any offsite location is 76 millirem. The analogous estimate of cumulative population dose within a 50-mile radius is 3500 person-rem.

Based on techniques used in this analysis, dose estimates are consistent with the release of about seven million curies of noble gases in the first one-and-one-half days of the accident, two million in the next two days and one million in the next three days, and a relatively small amount thereafter.

The estimates were made by Pickard, Lowe and Garrick, Inc. based primarily on radiation measurements made in the plant and in the field by Metropolitan Edison and Porter-Gertz Consultants, Inc., and on meteorological data from the Three Mile Island weather tower.

EXPOSURE FROM NOBLE GASES

Strip chart records from all noble gas radiation monitors in the plant ventilation exhaust show no significant radiation levels during the first three hours of the accident.

Since these monitors are in the most probable pathway for release, it is concluded that no significant releases occurred before 0700 on March 28. Shortly after 0700, however, these monitors, which are designed to read normal low levels, indicated rapidly increasing radiation concentrations. Within a few minutes, they went off scale on the high side. At about the same time, the in-plant building area monitors which measure radiation levels inside the fuel handling and auxiliary buildings began to record increasing levels from about 1 milliroentgen per hour at 0700 to 100 milliroentgen per hour at 0740. At about 0900, the readings began to increase again and reached about 1000 milliroentgen per hour at 1000 hours. They continued to fluctuate at high levels for about four days.

Gamma doses outside plant buildings and offsite were measured by thermoluminescent dosimeters (TLDs) at 20 stations located around the plant at distances from 260 to 24,000 meters. The TLDs were in place as part of the routine environmental monitoring program when the accident started. They were used to measure integrated gamma dose over selected time intervals during the course of the accident.

Measurements from the TLDs and in-plant area monitors were used to estimate offsite doses from the release of radioactive noble gases. First, it is assumed, for reasons discussed in the body of this report, that radiation levels measured by area monitors in the auxiliary and fuel handling buildings are proportional to the rate at which airborne gamma activity was released to the environment. These assumed relative release rates were combined with contemporaneous atmospheric dispersion estimates to calculate gamma doses for the exposure time period and location of each TLD. Then release rates were adjusted so that calculated doses best matched the TLD dose measurements. Once the release rates were defined in this way, they were used along with the same atmospheric dispersion model and weather data to calculate doses at all offsite locations out to 50 miles.

EXPOSURE FROM AIRBORNE IODINES

The best estimates of potential maximum individual thyroid dose from airborne iodine are about 10 millirem from air inhalation, and 1.1 millirem from drinking milk. The best estimates of population exposure within 50 miles of the site due to iodine inhalation and drinking milk are, respectively; 180 and 1100 person-rem to the thyroid.

Air leaving the plant vent was sampled continuously to measure radioactive iodine during the course of the accident. These measurements indicate about 14 curies of iodine-131 were released from the station vent through April 30th. Airborne iodine-131 concentrations were also measured at eight offsite locations. The offsite concentration measurements were compared with concentrations calculated using measured release rates and weather data. Both the measurements and calculations were used to estimate the offsite doses.

Preliminary evaluations of particulate radioisotopes in airborne effluents indicate that these isotopes did not contribute significantly to offsite doses.

EXPOSURE FROM LIQUID RELEASES

The maximum individual dose from radioactive materials in water released from the plant during the course of the accident is estimated to be much less than one millirem. The corresponding population dose from drinking water, eating fish, and recreational uses of the river is less than one person-rem.

Analyses of samples from discharged water and the river indicate that iodine-131 is the only significant accident-generated isotope released from the plant. The best estimate is that 0.24 curies were released from March 28 through April 30.

Samples of river water collected downstream have shown no increase over normal background concentrations of radioactive materials except for four samples. Three of these are from the Columbia Water Treatment plant, about 17 miles downstream. These three samples were taken within the first five days after the accident started. They showed iodine-131 concentrations slightly above detectable levels but far below allowable limits. Iodine-131 was also detected just above minimum detectable limits in one sample collected on April 27 from the Wrightsville Water Treatment Plant about 16 miles downstream.

Summary Table

Summary of Estimated Offsite Radiation Doses from the Accident at TMI Unit 2

Release Mode	Pathway	Organ Affected	Total Estimated Integrated Dose (7) from Accident: Maximum Individual Dose (millirem): from Release & Environmental Dispersion Models	Maximum Individual Dose (millirem): from Environmental Measurements	Population Dose (person-rem)	Reference Section in Report
Liquid	Drinking water	Thyroid	(6)	<0.04 (1)	<1.0	Section 3.3 & Apx E
	Fish ingestion	Thyroid	(6)	<0.02 (1)	<1.0	Section 3.3 & Apx E
	Swimming, boating and shoreline activities	Whole body	(6)	<<0.01 (1)	<1.0	Section 3.3 & Apx E
Gaseous	Noble gases in plume	Whole body	75	76	3500	Section 4.3
	Noble gases in plume	Skin (5)	200	(2)	7170	Section 4.3
	Iodine inhalation	Thyroid(child)	9.8	5.0	180	Section 5.3
	Iodine uptake through cow milk ingestion	Thyroid(infant)	(4)	1.1	1100	Section 5.3
	Particulate isotope inhalation or ingestion	(3)	(3)	(3)	(3)	Section 5.3

(1) Iodine-131 was detected in only a few of the water samples collected and none of the other samples. Concentrations used in dose assessments are assumed to be the minimum detectable level.

(2) No environmental information is available for this pathway.

(3) Preliminary evaluations indicate that particulate isotopes did not contribute significantly to offsite doses.

(4) No estimate from effluent release data is included since environmental samples give more accurate results (Section 5.3).

(5) Includes β and γ dose to skin.

(6) Calculations based on estimated releases and river dilution are consistent with calculations based on environmental measurements.

(7) Doses are computed for varying time periods to include the dose from more than 99% of the estimated released through April 30.

1.0 PURPOSE AND SUMMARY

When a general emergency was declared at 7:24 a.m. on March 28, 1979, Metropolitan Edison in conformance with the emergency plan, sent radiation monitoring teams into the field and initiated an augmented environmental radiation measurement program. The objective was to provide information for those who had to make decisions concerning stabilization of the plant and protection of the public. When this first priority objective was being well served, an organized effort was started within the first two days to assemble all pertinent plant and environmental data as a basis for a more refined estimate of integrated radiation doses in the environment as a function of time and location. These dose estimates have been made and are reported herein. They are based on releases through April 30, 1979.

The report is divided into three parts: the first evaluates offsite doses from radioactive liquids; the second, doses from noble gases; and the third, doses from radioactive iodine and particulates. A compilation of all pertinent data is included in the Appendices.

2.0 REFERENCES

The dose estimates reported herein are based primarily on data from radiation and weather measurements made by and for Metropolitan Edison Company during the full course of the accident. Most of the radioactive releases to the environment occurred before extensive monitoring programs were implemented by other groups. For this reason, only a small portion of the large number of measurements made by other groups has been evaluated. The data used are sufficiently comprehensive to support a reasonably accurate assessment of offsite radiation doses.

Each of the data sources used is discussed in the following sections.

2.1 Measured Releases

Metropolitan Edison Company operates a program to measure the radioactivity in liquids and gases released to the environment from the Three Mile Island plant. The program includes continuous automatic radioactivity measurements and periodic sampling and analysis of all potentially-radioactive liquid and gas effluent streams. Sample analysis results are used where available for quantitative assessments in this report. Measurements made with automated monitoring equipment are, in most cases, less accurate and/or less sensitive than those made by sampling and laboratory analysis.

(7)	Liquid Effluent Radioactivity Concentration (cont'd)	Continuous measurements of radioactivity concentration in flowing liquid effluent streams.
(8)	Liquid Effluent Flow:	Records of operating status, tank volume changes and effluent flow rates.

Data from these sources is summarized in Appendix C.

2.2 Estimated Release Rates

For periods when measurements of the radioactivity concentration in releases were not available, estimates were made using radiation levels measured in the environment along with weather conditions measured at the meteorological tower, and/or radiation levels measured by the area monitors inside the Unit 2 auxiliary and fuel handling buildings.

2.3 Meteorological Data

Metropolitan Edison Company maintains a meteorological tower located at the north end of the island to support normal plant operation and accident control. Data from this tower were continuously available via redundant sensors before, during and after the accident. They were used with atmospheric dispersion models to estimate noble gas releases and to compute radiation doses due to airborne releases. A description of the meteorological program is in Appendix A along with tabulations of data collected during the accident.

2.4 Radiological Environment Monitoring Program (REMP)

For about five years, Metropolitan Edison Company has conducted an operational environmental monitoring program to evaluate the radiological impact of TMI station operations by sampling and analyzing media from the aquatic, terrestrial and atmospheric environments in the vicinity of the station (within 5 to 10 miles). In accordance with emergency response plans, the program was intensified immediately following the accident. A summary of program results for the period from the start of the accident through April 30, 1979 is included in Appendix D, along with a description of the program and a tabulation of all data collected.

2.5 In-Plant Area Radiation Monitors

Strip chart recordings of radiation measurements in many areas in the auxiliary and fuel handling buildings were used. These strip charts are designated HP-UR-1901 and 1902.

2.6 Other References

Many other references were utilized including:

(1) "Mechanical Flow Diagrams, Electrical One Line Diagrams and General Arrangement Drawings, Three Mile Island Nuclear Station - Unit No. 2," by Burns and Roe, Inc., April 1979.

(2) "Population Dose and Health Impact of the Accident at the Three Mile Island Nuclear Station (A Preliminary assessment for the period March 28 through April 7, 1979)," by the Ad Hoc Population Dose Assessment Group, May 10, 1979.

(3) NRC Regulatory Guide 1.111 for dispersion plume models.

(4) NRC Regulatory Guide 1.109 for environmental pathway models.

(5) Three Mile Island Unit 2 Final Safety Analysis Report.

(6) "Preliminary Report on Sources and Pathways of TMI-2 Releases of Radioactive Material", Metropolitan Edison Draft, dated 6/22/79.

(7) "Preliminary Annotated Sequence of Events, March 28, 1979", Metropolitan Edison Draft, dated 6/22/79.

3.0 OFFSITE LIQUID RELEASE AND DOSES

3.1 Releases

3.1.1 Release Quantities

During normal operations, the two nuclear units at Three Mile Island Nuclear Generating Station routinely release small quantities of radioactive isotopes in liquids discharged to the Susquehanna River in accordance with limits specified by the operating license. At the time of the accident at Unit 2, Unit 1 had just been refueled and wastes typical of refueling operations were being treated and released. From March 28, 1979 to April 30, 1979, these releases included 10.7 curies of tritium and about 0.3 curies of other radioisotopes as shown in Table 3-1.

The only significant radionuclide released to the river from Unit 2 as a result of the accident was iodine-131. The best estimate is that .24 curies of iodine-131 were released from March 28 through April 30. Most of this was released from March 31 through April 2 as is shown in Figure 3-1.

Although the release of iodine-131 in liquid effluents exceeded normal levels because of the accident, all liquid releases, including this iodine, were within acceptable release rate limits specified by the operating license. Concentrations in releases were within limits of federal regulations in 10CFR20.106, and 10CFR20.303. They did not exceed values in 10CFR20, Appendix B, Table II, when as the regulation permits, they are averaged over twenty-four hours (10CFR20.303) or one year (10CFR20.106).

3.1.2 Release Paths

The sources of the iodine-131 in liquid discharges were the Industrial Waste Treatment System (IWTS) and the Industrial Waste Filter System (IWFS). These systems which are shown schematically in Figure 3-2 are used to filter and, if necessary, neutralize floor drainage from plant areas having low potential for significant radioactive contamination. Following the accident, small quantities of iodine-131 entered these normally non-radioactive sumps and were pumped to the IWTS and IWFS. A schematic diagram showing details of the streams feeding the IWTS and IWFS is given in Figure 9.3-4 of the Three Mile Island Unit 2 Final Safety Analysis Report.

The secondary neutralization tank (Figure 3-2) was not a source of any radioisotopes in liquid releases. It receives liquid waste from a system in which raw river water is purified for use in the plant. Since the system does not process plant effluents, but only river water, no radioactive iodine would be expected in it. Analyses of tank contents made during the course of the accident has confirmed that no radioactive isotopes from the plant entered this system.

Analyses indicate that the Waste Evaporator Condensate Storage Tanks (WECST) were the source of essentially all of the radionuclides from normal refueling operations which were released to the river including a trace of iodine-131 (about 1% of that discharged from IWTS and IWFS). They were not the source of accident generated radionuclide discharges. These tanks are used for hold-up of radioactive liquid waste in normal operation. They are located in Unit 1, but receive liquid wastes from both units. They are used to control batch releases of radioactive liquid wastes to the Susquehanna River in accordance with plant procedures and Technical Specifications and governmental regulations. Each batch is sampled and analyzed prior to release. After release, contents are diluted in the mechanical draft cooling tower blowdown before discharge to the river. Releases from these tanks are controlled so that calculated concentrations at the point of discharge to the river do not exceed ten percent of maximum permissible concentrations in 10CFR20, Appendix B, Table II.

3.1.3 IWTS and IWFS Release Measurements

Prior to the accident, effluents from the IWTS and IWFS were not routinely sampled and analyzed because the potential for significant contamination of these systems was low. After the accident, a program for regular sampling and analysis was instituted. From March 28, at 0700, through April 30, all but one of 17 releases from the IWTS and four of 12 from the IWFS systems were sampled.

The five discharges that were not sampled are shown below:

Source	Date	Start	Stop
IWTS	3/28	0400	0900
IWFS	3/31	0140	0430
IWFS	4/01	0130	0534
IWFS	4/01	1521	1915
IWFS	4/02	0515	1110

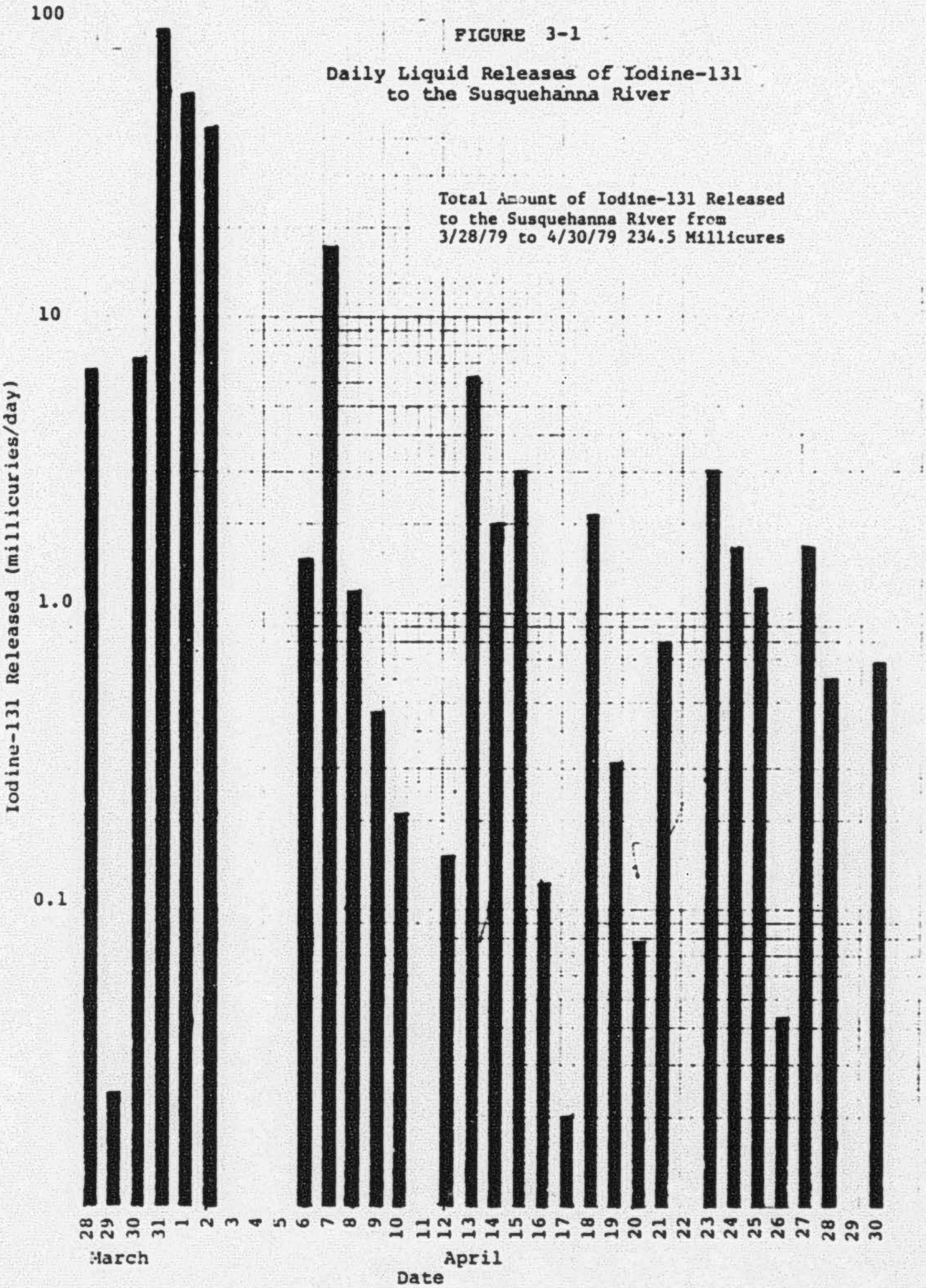
Concentrations and quantities of iodine-131 released in these discharges have been estimated from data for subsequent discharges for which measurements were available. Measurement of iodine-131 in water samples collected from the Susquehanna River downstream of the point of discharge (see Section 3.2 below) indicate these estimates are reasonable. Data from a liquid effluent monitor which operated continuously at the point of discharge to the river have been used to make upper limit estimates of concentrations and quantities released in these discharges. The best estimates and upper limit estimates are described below.

It is unlikely that any iodine-131 was released in the unsampled March 28 discharge from the IWTS. Routine sampling (grab samples about every two hours) and analysis of contents of the IWTS and IWFS began on March 29. Samples from the IWTS on March 29 and 30 indicate no detectable iodine-131 in the IWTS. In addition, the unsampled March 28 IWTS release was terminated at 0900, just a short time after release of radioactive materials to plant areas other than the containment building. Because of hold-up times in feed stream sumps, and in the IWTS sump, and because no iodine-131 was detected in two subsequent samples, it is unlikely that significant quantities of iodine-131 were released during the March 28 IWTS discharge. For purposes of estimation, however, the concentration of iodine-131 in that release is assumed to be the average concentration of IWTS discharges for the period March 28 to April 2.

A best estimate of the quantities of iodine-131 in the four unsampled IWFS releases was developed from concentrations measured subsequently in IWFS discharges. A sample from the first post-accident IWFS discharge was collected on March 30 but it was misplaced in the sample storage area for several weeks. When it was analyzed after it was located on April 24 there was no detectable iodine-131 in the sample. After adjustment of the minimum detectable concentration for radioactive decay of iodine-131, it was concluded that the concentration in the IWFS sump on March 30 was at most 5.6×10^{-7} μCi/cc. When the IWFS sump was next sampled on April 7 (for the discharge starting April 6) the concentration was 3.4×10^{-6} μCi/cc. Measured concentrations in the next three discharges from April 10 through April 16 varied over the range from 3.8×10^{-7} μCi/cc to 7.9×10^{-6} μCi/cc. It is assumed that the IWFS sump concentration during the four unsampled discharges from March 31 to April 2 was 2.5×10^{-6} μCi/cc, the average of concentrations measured in the IWFS sump from April 6 to April 6. On this basis the four unsampled releases contained a total of 1377 μCi of iodine-131.

FIGURE 3-1

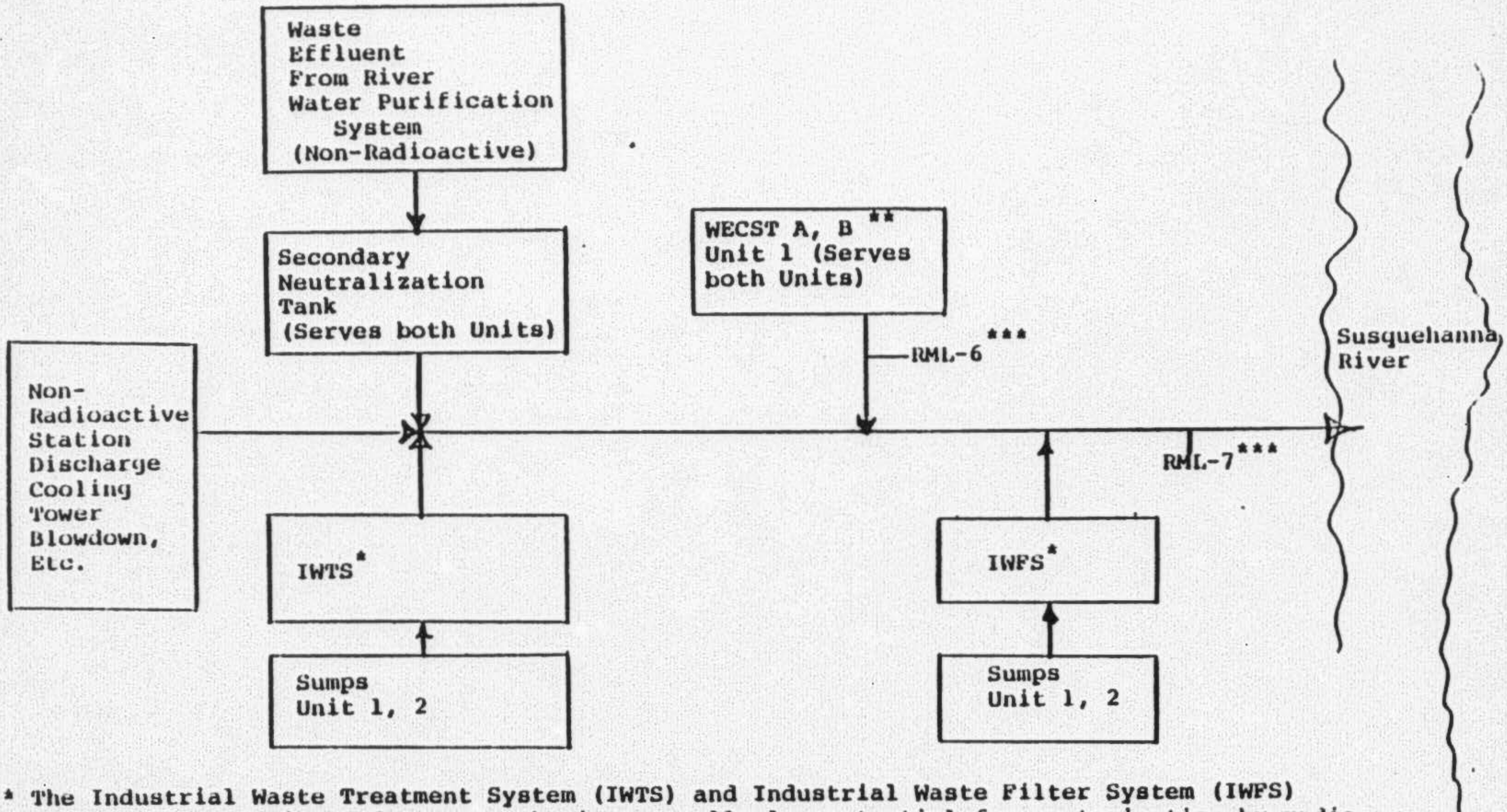
Daily Liquid Releases of Iodine-131 to the Susquehanna River



No releases were made on April 3,4,5,11,22 and 29

FIGURE 3-2

LIQUID RELEASE FLOW PATHS FROM TMI UNITS 1 & 2



* The Industrial Waste Treatment System (IWTS) and Industrial Waste Filter System (IWFS) collect floor drainage form areas having normally low potential for contamination by radioactive materials, but small quantities of iodine-131 entered these systems after the accident.

** WECST-Waste Evaporator Condensate Storage Tank

These tanks are the only sources of radioactive isotopes in liquid discharges during normal operations.

*** Continuous radiation monitors in liquid discharge lines which record and alarm in both control rooms. RML-6 closes WECST discharge valve on alarm.

4.0 OFFSITE NOBLE GAS RELEASES AND DOSES

The analyses made to estimate offsite doses from radioactive noble gases are discussed below in three sections. Section 4.1 deals with releases of radioactive materials from the plant; Section 4.2 with radiation dose measurements outside the plant and offsite; and Section 4.3 with offsite dose calculations.

4.1 Releases from the Plant

Radioactive noble gases could have been released to the atmosphere in leakage from the reactor building, in steam released from the atmospheric steam dump valves or in ventilation air from the auxiliary and fuel handling buildings which is exhausted through the plant vent. Evaluations of these and other potential sources indicate that the only significant releases occurred from the plant vent. These evaluations are summarized in the "Preliminary Report on Sources and Pathways of TMI Releases of Radioactive Materials", dated July 16, 1979 (Rev. 0).

4.1.1 Plant Vent Monitors

Strip chart records from all noble gas radiation monitors located in the plant ventilation system exhaust have been examined in detail. They show no significant radiation levels during the first three hours following the reactor trip at 0400 on March 28. Since the plant vent was the pathway for release of noble gases, it is concluded that no significant releases occurred from 0400 to 0700 hours. About 0700, however, the plant vent monitors increased rapidly to full scale indicating that releases had started.

The plant vent monitors are designed to measure very low levels of radiation during normal operation, and to give plant operators rapid indication when these levels increase. They are not designed to provide information about releases of the magnitude experienced during the accident. While they did show when significant increases started, they went off-scale at too low a level to be useful in making quantitative measurements. Furthermore, because of their sensitivity, they stayed off-scale for a number of days, being affected not only by radiation in vent gases, but also by radiation from liquids, gases and/or deposited solids in the rooms in which the monitors are located and by radioactive materials deposited in the monitoring systems themselves.

4.1.2 In Plant Area Radiation Monitors

At about 0700, the same time the plant vent monitors went off-scale, the inplant area monitors inside the fuel handling and auxiliary buildings began to record increasing levels from 1 milliroentgen per hour at 0700 to 100 milliroentgen per hour at 0740. At about 0900, the readings began to increase again and by 1000 hours read about 1000 milliroentgen per hour. They continued to fluctuate at high levels for about four days, as is indicated on Figure 4-1. One or more of these area monitors continued to read on-scale during the course of the accident.

Strip chart recordings from these monitors provide information which was used to estimate the relative magnitude of releases from the plant as a function of time. Although these monitors respond to airborne radioactivity, they also could measure radiation from nearby local sources such as liquids and gases in tanks and pipes, as well as radioactive materials on filter banks. However, area monitors in several different locations responded together (but at different magnitudes), periodically rising as much as an order of magnitude to a peak, then returning to an elevated baseline. This suggests that they were responding primarily to fluctuations in airborne radioactivity which affected all of them in about the same way, rather than to local sources which would affect each one differently. After the first day of the accident, upward fluctuations occurred when the makeup tank was vented, further demonstrating that the monitors responded to events which released radioactivity to the building atmosphere. Additionally, grab samples from the plant vent on March 31 shown on Figure 4-3, agree well with the assumed noble gas release rates. Thus, it is inferred that the recorded levels are primarily related to the concentration of radioactivity in the building air.

The assumption that area monitor levels are proportional to release rates also depends on the subsidiary assumption that the ventilation system exhaust was operated at a constant flow rate throughout the course of the accident. This appears to be true with minor exceptions. Review of ventilation system operations indicates that either the auxiliary building fans or the fuel handling building fans were on at all times after 0900 on March 28, when significant releases began. The fuel handling building fans were only off for a one-hour period starting at 0100 on March 29. Therefore, it is judged that area radiation monitor readings, as summarized in Figure 4-1, adequately characterize relative release rates.

The fuel handling and auxiliary building ventilation systems each have charcoal filter beds for iodine removal. Evaluations of iodine inventories on charcoal samples from these filter banks indicate about four times as much iodine was collected on charcoal in the fuel handling building ventilation system as on the auxiliary building charcoal (see the report entitled "Analysis of the Adsorbers and Adsorbents from Three Mile Island Unit #2" by Nuclear Consulting Services, Inc.). Assuming the noble gases were released in proportion to the iodines, and considering that the fuel handling building ventilation system operated almost continuously, it can be inferred that a greater portion of the noble gases were released through the fuel handling building to the plant vent. The principal area monitor (HP-R-3240) used to define the release trend on Figure 4-1 is located near the filter banks which service the fuel handling building and, thus, was in a good location to have responded to the bulk of the releases.

There are openings between the fuel handling and auxiliary building air spaces and the pressure balance is such that flow occurs from the auxiliary building to the fuel handling building. Therefore, measurements indicating that a greater proportion of the releases may have been from the fuel handling building exhaust system while the source of leakage was probably in the auxiliary building are not necessarily contrary to expectations.

The wide fluctuations in area monitor readings suggest that the sources of noble gas releases were intermittent and associated with the paths of liquids and gases following their letdown from the primary system. It does not seem plausible, based on the available data, that a release of liquids from the reactor building sump into the auxiliary building could have caused the observed area monitor responses since changes in area monitor readings continued long after the reactor building sump discharge line was isolated and the reactor building was at subatmospheric pressure.

4.1.3 Noble Gas Mix

It is assumed for purposes of this analysis that the "mix" of noble gas fission products released is, with one exception, the same as that calculated to be in the nuclear fuel by the ORIGEN computer program. This program computes the quantities of fission products as a function of time following reactor trip based on the Unit 2 operating history prior to March 28, 1979.

Comparisons of the ORIGEN results with measurements of isotopic mix in samples of gaseous effluent show good agreement except that measured values of Xe-133m were about a factor of 6 lower than ORIGEN predictions. Following an evaluation of assumptions in the ORIGEN program, it was decided that the measured Xe-133m fraction was more appropriate and ORIGEN results were modified accordingly. The resulting noble gas mix versus time is shown in Figure 4-2. Dose calculations which follow are not sensitive to the relative quantities of Xe-133m which comprises only a small portion of the mix.

Isotopic analyses of noble gases found in the plume by DOE helicopter monitoring teams have also been made. A preliminary analysis made by DOE of a plume sample taken about 12 hours after the accident showed the presence of Xe-133, Xe-135 and Kr-88 in proportion to ORIGEN predictions. Krypton would not have been expected if the only major source of noble gas releases had been iodine decay in the auxiliary building sump.

The released mix is complicated by the separation of the noble gas and iodine isotopes during the changes in the steam-water-air environment in which the isotopes were transported for days after the accident. Iodines tend to remain with the liquid phase whereas noble gases remain with the gaseous phase. Additionally, iodine isotopes decay to produce many of the noble gas isotopes. Thus, it is not obvious that the mix in released gases would be like that in the fuel had there been no fuel failure. Nonetheless, it is judged that the ORIGEN results represent a best estimate of the mix.

4.1.4 Procedure for Estimating Noble Gas Releases

Assuming the radioactivity levels recorded by the area monitors provide a relative indication of the release rate of noble gases, and are not sufficient to establish the actual quantities released, an iterative procedure was developed as described below to estimate noble gas releases:

: Define area monitor indications (R) as a function of time as shown in Figure 4-1.

: Determine the relative quantities of each isotope with respect to the predominant isotope, Xe-133 using results from the ORIGEN computer program with corrected values for Xe-133m (Figure 4-2).

: Determine the dose equivalence factor using the following procedure, assuming area monitors respond in direct proportion to noble gas energy levels as follows:

$$\sum_i Q_i \bar{E}_i \cong R \qquad (1)$$

where:

Q_i = release rate (μCi/sec) of isotope i

$\bar{E}_i$ = gamma energy per disintegration (Mev) of isotope i

R = area radiation monitor indication (roentgen/hr).

This expression can be expanded for any given time as follows:

$$Q_1\bar{E}_1 + Q_2\bar{E}_2 + Q_3\bar{E}_3 \; . \; . \; . \; . \; . \cong R \qquad (2)$$

and, using the relationship of each isotope to Xe-133 from Figure 4-2:

$$f_i = \frac{Q_i}{Q_1} \quad (3)$$

Values of Q_1, the release rate for Xe-133, as a function of time can be written as:

$$Q_1(t) \cong \frac{R(t)}{F(t)} \quad (4)$$

where the dose equivalence factor F(t) is:

$$F(t) = \bar{E}_1 + f_2(t)\bar{E}_2 + f_3(t)\bar{E}_3 \ldots f_n(t)\bar{E}_n \quad (5)$$

Release rates $Q_i(t)$ for other isotopes are then obtained using Equation (3).

Step 4: Establish a set of trial release rates for each isotope proportional to $Q_1(t)$ computed above and use them along with the diffusion model to compute gamma doses around the site perimeter based on measured onsite meteorological data. These data include quarter-hourly wind speed, wind direction and vertical temperature difference from which atmospheric dispersion estimates are made as a function of time. A dose calculation is made for each quarter-hour and results are summed over the exposure time for each TLD monitoring station. Input meteorological data are discussed in Appendix A.

The dispersion model utilizes a finite plume model to compute gamma dose to a ground level receptor in accordance with procedures outlined in NRC Regulatory

Guides 1.109 and 1.111. Downwash in the wake of a large plant structure is accounted for by using a "mixed-mode" model which accounts for building wake effects on the plume when the wind speed is above certain levels. Atmospheric dispersion models and input assumptions are described in more detail in Appendix B.

Step 5: Having computed gamma dose at each TLD monitor site using the trial set of release rates, the results are compared with TLD data and the trial release rates are adjusted according to wind direction to provide the best match at each TLD location which had readings substantially higher than background. This was done for each of the first four TLD measurement intervals. Table 4-1 gives the final release rates after adjustment.

The above procedure was used for the period of most significant releases during which plant vent noble gas monitors were unavailable and environmental TLD doses were measurable, starting on March 28, 1979 and continuing through April 6, 1979.

The initial trial release rates for Step 4 arbitrarily assumed releases in units of μCi/sec for each isotope proportional to area monitor readings in roentgens per hour and inversely proportional to the dose equivalence factor in accordance with Equations (3), (4) and (5). This gave good correlation between calculated doses and corresponding TLD measurements except for releases during the afternoon and evening of March 28, during which time winds were blowing toward the NNW (see direction arrows on Figure 4-1). Computed doses at the NNW TLD were a factor of 2 lower than measurements. Consequently, isotope release rates for March 28 from

1600 through 2400 were increased by a factor of two. Doses calculated to the ENE were too high. So Q_i values were reduced by a factor of 1.5 on March 29 at 0300 and by a factor of 2.0 on March 29 at 0600. With these adjustments, the agreement between calculated and meaasured doses was satisfactory for those locations with relatively high measured doses. During portions of the 9-hour period of adjustment in the evening of March 28, some of the area monitors were reading off-scale. This suggests that the upward adjustment in release rate made for this time period might have been supported by the area monitor data had these data been available.

Table 4-2 summarizes results and shows comparisons of calculated and measured gamma doses for each TLD location and measurement interval prior to April 6. The ratio of predicted to measured doses was chosen as a simple indicator for comparing results. In determining release rates, more importance was placed on matching TLDs with high readings. As a result, for the TLDs with highest exposure, the ratios are close to 1.0. Average ratios for each period are greater than 1.0, which would indicate that average estimates of noble gas release rates are high. There is considerable scatter in the ratios for TLDs which measured very low doses.

Table 4-3 summarizes predicted versus measured doses for each TLD location over the total period of exposure through April 6, 1979. The ratios of predicted to measured dose are not as widely scattered for this longer period as they are for the shorter periods in Table 4-2. The accuracy of calculated doses is discussed in Section 4.1.6 below.

4.1.5 Estimated Noble Gas Releases

Using the procedure outlined above for estimating release rates, the total number of curies of each significant noble gas isotope released was calculated for each of the four time periods corresponding to TLD measurement intervals. The results are shown in Table 4-4. They indicate about 10 million curies of noble gases were released through April 30. About 81% of the total was Xe-133. About 66% of the total was released during the first day and a half after the accident started. Another 22% of the total was released in the next two days from March 29 at 1700 to March 31 at 1600. On Friday morning, March 30, a short-term radiation measurement of 1200 millirem per hour was made by a helicopter stationed above the plant vent. Although it received considerable attention, the release rate associated with this measurement did not result in significant ground level doses as compared with those which had already occurred.

Figure 4-3 shows the estimated noble gas release rates through April 30, 1979 versus those derived from laboratory analysis of grab samples and, after April 22, from continuous noble gas effluent monitors.

4.1.6 Accuracy of Calculated Doses

For the time period when all significant noble gas releases occurred, doses calculated by the procedure described in the previous section are within a factor of 2 of those measured for 13 of the 16 TLD stations which are 600 meters or more from plant buildings (Table 4-3). At the other three of these 16 locations, the calculated doses were 3 to 4 times those measured. For the time period when exposures were highest, calculated doses at 11 of these 16 stations are above one millirem. At 8 of the 11 calculated doses are within a factor of two of those measured. At the other 3, they are a factor of 2 to 6 higher.

The most significant uncertainties in calculated versus actual doses are probably due to the difficulty of accurately accounting for the large influence that turbulent wakes from adjacent structures may have on dispersion of the plume. This is especially true since the TLDs with high readings which were used to calibrate the atmospheric dispersion model are also the ones at locations most influenced by this turbulence. Some uncertainties are due to the difficulty of modeling meteorological conditions conducive to "puddling."

A study was made to compare doses computed using the chosen dispersion model with those computed using two other dispersion models which bound it. The resulting comparisons are shown in Figure 4-4. One bounding model assumes the plume released from the plant vent remains elevated, unperturbed by turbulent building wake effects. The other assumes all releases are trapped in turbulent wakes behind plant structures so that the releases are effectively at ground level. The chosen model, on the other hand, is a mixed mode model which combines both elevated and ground level releases depending on wind speed. Winds from each direction travel over a different set of building configurations. These differences are not accounted for in any of the models used. However, the bounding calculations probably encompass these differences. Appendix F illustrates the estimated effect that the building wakes have on plume geometry.

In developing the isotopic release rates following the procedure in Section 4.1.4, emphasis was placed on matching calculated doses with TLD measured doses in the NNW direction sector since TLD measurements were highest and the wind was relatively steady in this direction. Inspection of Figure 4-4 shows that results from the chosen mixed mode model were well matched with measured doses in this direction.

Ideally, all measured doses would be within the values computed by the bounding models. However, as shown in Figure 4-4, some measured values are within the bounds and some are not. For several directions all three models predict higher than measured results. Significant mismatches may be due to low wind speeds and meandering plumes after the first day. However, offsite doses were relatively low when these conditions existed and significant errors during these times have a relatively small effect on total time-integrated doses.

The sensors used in the area monitors are G-M tubes which may under-respond to the predominant isotope, Xe-133. Additionally, the geometry of the source in the room in which the area monitors are located may affect the relative dose readings of these instruments. This response may change with time as the isotopic mix changes. However, these effects are not expected to introduce substantial uncertainties in the estimates of the relative releases.

Uncertainties in TLD dosimetry for relatively high doses compared to expected background are less than dispersion model uncertainties and should be considerably less important by comparison. There is some evidence that the TLDs may have over-responded to Xe-133 (see Section 4.2 and Appendix G), however, for the first few days following the accident, other isotopes for which the TLDs do not over-respond contributed significantly to the total dose making any correction for Xe-133 of less importance.

Additional uncertainties may have been introduced into the analysis by assuming that release rates corresponded to area monitor fluctuations. However, during the period of expected highest release rates, starting on the afternoon of the first day, winds were fairly steady and it would be unlikely that combinations of changes in dispersion and release rates that would maximize dose would coincide in such a manner as to cause an unrealistic assessment of dose.

It is conceivable that plume meander during periods of low wind speeds may have caused "puddling" in such a way that a volume of the plume passed over a given TLD more than once. Since the plume model does not account for this behavior, such conditions could cause errors in the calculated dose. However, for most of the time during the period of highest area monitor readings before 0600 on March 29 (see Figure 4-1), a fairly well established plume in the NNW and WNW directions existed. This is illustrated in Figure 4-5 which shows plume centerline trajectories starting every 15 minutes during the periods of highest releases on March 28. These trajectories are developed from weather data measured at the site. They show the existence of a steady (non-meandering) plume in the northwestern sectors and do not show any puddling. Further verification that puddling did not exist during this period has been sought by studying DOE helicopter data. However, no flights were conducted during the evening of March 28 when major releases occurred. Data from ground observation teams are of value only beyond three miles because during this time the plume was tracking up the river in areas which were inaccessible to the ground teams.

4.2 Environmental TLD Measurements

Metropolitan Edison Company conducts a routine environmental radiation monitoring program including use of stationary thermoluminescent dosimeters (TLD's) which measure integrated gamma dose. They are in place at all times at 20 locations as shown on the map in Appendix D. Most are within several miles of the plant, but a few are located up to 15 miles away. These dosimeters were in place in the field at the time the accident occurred. Dosimeters in the field were replaced with fresh dosimeters every one to three days following the accident, and the collected dosimeters were evaluated to determine trends for dose rate as well as the dose accumulated since the beginning of the accident. These data represent a comprehensive measurement of doses due to noble gas releases at the locations monitored. Table 4-5 provides a summary of significant TLD mesurements through April 30, 1979. Background has been subtracted as described in the footnotes. No other adjustments have been made. Additional information concerning the dosimeter monitoring program is contained in Appendix D.

Shortly after the declaration of an emergency, mobile monitoring teams were dispatched by Metropolitan Edison Company. A police helicopter was used during the early hours of the response to assist the monitoring teams since the onsite meteorological tower indicated winds toward the west over the river. These teams were equipped with instruments which measured dose rates from airborne radioactive material (primarily noble gases with Xe-133 dominant) and with air samplers which were capable of collecting airborne radioactive materials other than noble gases for later laboratory analysis.

From the second day on following the accident, release rates varied over a wide range and frequent wind shifts occurred. This combination of events caused radiation levels to fluctuate rapidly with time at any single location. The emergency response survey teams had to move from place to place following the transport of airborne radioactivity. Because of the fluctuations in radiation levels and the short monitoring periods at any one location, data collected by survey teams are not the best available for the determination of cumulative doses and they were not used in this assessment except in attempts to determine when noble gas releases were significantly higher than baseline values.

Thermoluminescent dosimetry measurements used in this report are from dysprosium doped calcium sulfate dosimeters supplied by Teledyne Isotopes. An evaluation of the response of these dosimeters to the low-energy photons from Xe-133 is provided in Appendix G. The conclusion of the evaluation is that the dosimeters did not under-respond to Xenon-133 in field exposure conditions, and that over-response in the field was probably no greater than a factor of 1.5.

Results of a study made for several directions with highest exposures to estimate the fraction of the dose contributed by Xe-133 for the first two TLD exposure periods are shown in Table 4-6. As noted on the table, the total dose contributed by Xe-133 is not the same in each direction. This occurs because the wind direction and relative amount of each isotope change with time. Relative contributions to the dose from each isotope also change with distance due to the height of the plume above terrain as well as changes in plume dimensions. No corrections were made in this assessment for possible TLD over-response to Xe-133.

4.3 Estimated Offsite Doses

Mathematical models for estimating doses to individuals and populations normally use known isotope release rates along with atmospheric dispersion models and meteorological parameters. However, since atmospheric releases of noble gases were not monitored, release rates estimated using the procedure in Section 4.1.4 above were used to estimate doses to individuals at locations not monitored by TLD's and to the population within 50 miles of the plant. For these calculations, the atmospheric dispersion model described in Appendix B which had been previously used only for estimates at TLD locations close to the plant was extended to a distance of 50 miles in each of 16 direction sectors. Figures 4-6 through 4-9 are isopleths showing estimated whole body gamma doses to distances of 1, 2, 5 and 50 miles, respectively. These estimates are based on estimated noble gas release data as well as the atmospheric dispersion and dose models in Appendix B. Figure 4-10 represents an isopleth of the beta portion of the skin dose.

4.3.1 Population Dose Estimates

Population dose estimates were computed using the straight-line dispersion model and site meteorological data to compute the whole body dose each hour at 10 locations downwind out to 50 miles in the sector in which the wind was blowing. These hourly doses were added for all hours in the period after the accident extending to April 30, 1979 and multiplied by the population in each of these 10 distances. The estimated 1980 population given in Appendix B was used. Results of this analysis indicate that the aggregate whole body dose to the population within 50 miles (about two million people) was about 3500 person-rems from noble gases released through April 30, 1979. This estimate does not consider the effect of occupancy and shielding due to housing or other structures which could reduce dose estimates. Figure 4-11 shows the estimated population doses as a function of time following the accident.

A similar calculation was made to determine the population skin dose. For this case the beta contribution was computed and summed over the population grid and then added to the whole body population dose. The beta contribution was 3670 person-rems which when added to the gamma dose of 3500 person-rems gives 7170 person-rems to the skin.

Uncertainties in the population dose calculation are estimated as follows. First, the population doses were computed using the bounding dispersion models for ground and elevated releases discussed in Section 4.1.6 along with the estimated noble gas releases to obtain 4197 and 3418 person-rems for the ground and elevated cases, respectively. If the source term had been overestimated by a factor of 2 using the ground level release model as discussed in Section 4.1.6, the population dose would be 4197 ÷ 2 or 2098 person-rems. On the other hand, if the plume had been elevated resulting in a factor of 2 underestimate, the population dose would be 3418 x 2 or 6836 person-rems. Thus, the uncertainty estimated in the 3500 person-rem population dose is considered to be within a factor of ±2 based on the atmospheric dispersion model.

There is some evidence that channeling of the plume within the river and "puddling" due to wind meander at certain locations may have occurred, however, this is not expected to have a significant affect on overall population dose calculations. Restrictions in plume growth in the river valley could result in less dilution than calculated at ground level at certain locations over the river at distances beyond several miles.

However, this effect should not result in significant increases in population dose because there are generally fewer receptors in the river valley. Concentrations in a plume cannot increase, thus if plume reversals or puddling occur within the hour for which the dose increment is computed, the additional dose would be less than that assumed to have been delivered in the hour. If puddling persists for more than one hour, and one population group is being affected by such a "puddle", the radioactive materials in the puddle could not affect any other group at the same time. Thus, no significant increase in population would be expected. Effects of any puddling that occurred near the site would have been measured by the TLD's.

4.3.2 Maximum Measured Offsite Doses

Table 4-5 summarizes net gamma doses based on measurements from the TLD monitoring program. The highest offsite integrated whole body dose measured at any TLD location through April 28 was 75.8 millirems above background at Station 4A1 located about 800m ENE from the plant. For purposes of this discussion "offsite" is assumed to be locations greater than 600 meters from the plant that were known to be occupied following the accident. The accumulated doses measured at the Goldsboro (Station 12B1) and Middletown (Station 1G1) TLD monitoring stations over the same period were 11.9 and 9.1 millirem above background, respectively. There are some uncertainties inherent in measurements of doses of this low magnitude due to normal fluctuations in background dose. This uncertainty does not affect the maximum dose of 76 millirems for which the accident contribution was substantially greater than fluctuations in natural background.

4.3.3 Maximum Calculated Offsite Doses

By contrast, as shown in Table 4-3, whole body dose calculations at these same TLD monitor locations using the estimated noble gas releases resulted in doses of 43.3 mrem 800m ENE; 21.5 mrem near Goldsboro on the west river bank; and 29.9 mrem at Middletown. Inspection of Figures 4-7 and 4-8 shows that the maximum estimated offsite dose was about 75 mrem at several locations in the WNW, NNW and NNE directions. These estimates are about a factor of two higher than doses measured by the TLDs in the same general areas reported in Section 4.3.2 above and are likely to be overestimates.

Since beta radiation from noble gases cannot be reliably measured in the environment, skin dose due to beta radiation was calculated based on the noble gas source term developed using the procedure in Section 4.1.4. The dose mode used is described in Appendix B. Figure 4-10 shows an isopleth of estimated skin dose due to beta radiation in the site vicinity. These values must be added to the gamma dose to obtain total skin dose. The combined beta plus gamma maximum skin dose is estimated to be less than 200 millirem at occupied locations near the site. About 125 millirem of this amount is due to beta radiation. No reduction in beta dose is assumed for the protective effect of clothing or for occupancy factors.

The above calculations of maximum dose were made for locations near the site that were known to be occupied after the accident. Subsequently, the "Ad Hoc Committee for Dose and Health Impact of the Accident at the Three Mile Island

Nuclear Station" reported that an individual had been working on Hill Island to the NNW for about 9-1/2 hours (from 1000 to 1630 on March 28 and from 1100 to 1500 on March 29).

An additional dose calculation specifically for this location was made using methodology described herein and the estimated noble gas releases from Table 4-1 for this period. Meteorological conditions and dose calculations were updated every quarter of an hour during the occupancy period. The total whole body dose was determined to be 23 millirem, which is considerably below the highest offsite exposures of 75 millirem.

4.3.4 Time Distribution of Offsite Dose

Figure 4-12 shows the whole body dose rates estimated to have occurred as a function of time after the accident at the TLD locations near the site. Doses are given for each quarter of an hour as indicated by the vertical lines for the representative TLD location in each direction sector. Each line represents the dose in millirems that occurred during the given quarter-hour period. As shown, the major portion of the release travelled to the NNW between 1600 and 2400 on March 28.

4.3.5 Fraction of 10CFR20.106 Maximum Permissible Concentrations (MPC) for Noble Gas Isotopes

Using the estimated noble gas source term in Table 4-1, a computer run was made using the best-estimate atmospheric dispersion model (see Appendix B) to determine the annualized fraction of MPC limits in offsite areas occupied after the accident. The relationship used for this determination is as follows:

$$\text{Fraction of annual MPC} = \frac{\sum_{t=1}^{R} (X/Q)_t \sum_{i=1}^{n} \frac{Q_{i,t}}{MPC_i}}{8760}$$

where:

X/Q_t = atmospheric dispersion coefficient applicable for hour t (sec/m^3)

$Q_{i,t}$ = release rate of each isotope i for hour t (μCi/sec)

MPC_i = maximum permissible concentration of isotope i ($\mu Ci/m^3$)

t = hour of release

R = total hours of release

n = total number of isotopes

Figure 4-13 shows an isopleth of results for noble gases. The concentrations were averaged over a one-year period as allowed by 10CFR Part 20. Results show that MPC concentrations would have been exceeded in only a few locations offsite for noble gases and most of these would have occurred in areas not occupied after the accident started.

Table 4-1

Estimated Noble Gas Release Rates

HR NO	TIME	AREA*	FRACTION OF XE133: XE133	XE133M	XE135	XE135M	KR88	DOSE FRACTION (OXE) REL TO XE133: XE133	XE133M	XE135	XE135M	KR88	DOSE EQUIV** FACTOR	AVG RELEASE RATE UCI/SEC***: XE133	XE133M	XE135	XE135M	KR88
1	400	0.00	1.00	.02	.23	.18	.49	.04600	.00107	.05827	.07873	.94054	1.1246					
2	500	0.00	1.00	.02	.24	.16	.38	.04600	.00106	.05993	.07039	.73517	.9126					
3	600	0.00	1.00	.02	.25	.15	.30	.04600	.00106	.06177	.06294	.57465	.7464	0.	0.	0.	0.	0.
4	700	.05	1.00	.02	.25	.13	.23	.04600	.00106	.06361	.05627	.44918	.6161					
5	800	.05	1.00	.02	.26	.12	.18	.04600	.00106	.06545	.05031	.35111	.5139					
6	900	.05	1.00	.02	.27	.10	.14	.04600	.00105	.06730	.04498	.27444	.4338	.98E+05	.94E+03	.10E+05	.40E+04	.55E+04
7	1000	2.00	1.00	.02	.28	.09	.11	.04600	.00105	.06915	.04022	.21452	.3709					
8	1100	2.00	1.00	.02	.29	.08	.09	.04600	.00105	.07279	.03596	.16768	.3235	.58E+07	.75E+05	.90E+06	.26E+06	.27E+06
9	1200	2.00	1.00	.02	.31	.07	.07	.04600	.00105	.07443	.03215	.13107	.2867					
10	1300	2.00	1.00	.02	.32	.07	.05	.04600	.00104	.08008	.02874	.10245	.2581	.74E+07	.94E+05	.12E+07	.26E+06	.21E+06
11	1400	18.00	1.00	.02	.33	.06	.04	.04600	.00104	.08374	.02570	.08008	.2366					
12	1500	18.00	1.00	.02	.36	.05	.03	.04600	.00104	.08919	.02298	.06260	.2218	.79E+08	.98E+06	.14E+08	.22E+07	.13E+07
13	1600	18.00	1.00	.02	.36	.05	.03	.04600	.00104	.08929	.02054	.04893	.2058					
14	1700	18.00	1.00	.02	.36	.04	.02	.04600	.00103	.08940	.01837	.03825	.1930					
15	1800	18.00	1.00	.02	.35	.04	.02	.04600	.00103	.08772	.01642	.02989	.1811	.93E+08	.79E+06	.12E+08	.13E+07	.51E+06
16	1900	8.00	1.00	.02	.34	.03	.01	.04600	.00103	.08603	.01468	.02337	.1711	.47E+08	.11E+07	.16E+08	.16E+07	.57E+06
17	2000	2.60	1.00	.02	.34	.03	.01	.04600	.00103	.08434	.01313	.01827	.1628	.16E+08	.38E+06	.54E+07	.49E+06	.15E+06
18	2100	8.00	1.00	.02	.32	.03	.01	.04600	.00102	.08085	.01174	.01428	.1539	.52E+08	.12E+07	.17E+08	.14E+07	.38E+06
19	2200	16.00	1.00	.02	.31	.02	.01	.04600	.00102	.07734	.01049	.01116	.1460	.11E+09	.26E+07	.34E+08	.27E+07	.63E+06
20	2300	24.00	1.00	.02	.30	.02	.00	.04600	.00102	.07383	.00938	.00872	.1390					
21	2400	24.00	1.00	.02	.28	.02	.00	.04600	.00102	.07032	.00839	.00682	.1325	.18E+09	.21E+07	.25E+08	.18E+07	.32E+06
22	100	4.00	1.00	.02	.27	.02	.00	.04600	.00101	.06860	.00750	.00533	.1284					
23	200	4.00	1.00	.02	.27	.02	.00	.04600	.00101	.06687	.00670	.00417	.1248	.32E+08	.38E+06	.43E+07	.25E+06	.35E+05
24	300	6.00	1.00	.02	.26	.01	.00	.04600	.00101	.06514	.00599	.00326	.1214	.49E+08	.12E+07	.13E+08	.69E+06	.83E+05
25	400	1.50	1.00	.02	.26	.01	.00	.04600	.00101	.06377	.00536	.00255	.1187					
26	500	1.50	1.00	.02	.24	.01	.00	.04600	.00100	.06017	.00484	.00199	.1140	.13E+08	.15E+06	.16E+07	.74E+05	.68E+04
27	600	7.50	1.00	.02	.23	.01	.00	.04600	.00100	.05678	.00437	.00156	.1097	.68E+08	.16E+07	.16E+08	.69E+06	.55E+05
28	700	1.00	1.00	.02	.21	.01	.00	.04600	.00099	.05358	.00394	.00122	.1057					
29	800	1.00	1.00	.02	.20	.01	.00	.04600	.00099	.05056	.00356	.00096	.1021	.96E+07	.11E+06	.99E+06	.41E+05	.24E+04
30	900	.50	1.00	.02	.19	.01	.00	.04600	.00098	.04771	.00321	.00075	.0987					
31	1000	.50	1.00	.02	.18	.01	.00	.04600	.00098	.04502	.00290	.00059	.0955					
32	1100	.50	1.00	.02	.17	.01	.00	.04600	.00097	.04248	.00262	.00046	.0925	.52E+07	.41E+05	.31E+06	.11E+05	.43E+03
33	1200	1.00	1.00	.02	.16	.01	.00	.04600	.00097	.04009	.00236	.00036	.0898					
34	1300	1.00	1.00	.02	.15	.00	.00	.04600	.00096	.03783	.00213	.00028	.0872	.11E+08	.13E+06	.87E+06	.28E+05	.84E+03
35	1400	1.50	1.00	.02	.14	.00	.00	.04600	.00096	.03569	.00193	.00022	.0848					
36	1500	1.50	1.00	.02	.13	.00	.00	.04600	.00095	.03368	.00174	.00017	.0825	.18E+08	.20E+06	.12E+07	.37E+05	.82E+03
37	1600	.90	1.00	.02	.13	.00	.00	.04600	.00095	.03178	.00157	.00014	.0804	.11E+08	.25E+06	.14E+07	.41E+05	.79E+03
38	1700	1.30	1.00	.02	.12	.00	.00	.04600	.00094	.02999	.00142	.00011	.0785	.17E+08	.36E+06	.20E+07	.55E+05	.91E+03
39	1800	1.30	1.00	.02	.11	.00	.00	.04600	.00094	.02830	.00128	.00008	.0766	.17E+08	.37E+06	.19E+07	.51E+05	.73E+03
40	1900	.50	1.00	.02	.11	.00	.00	.04600	.00093	.02670	.00116	.00007	.0749					
41	2000	.50	1.00	.02	.10	.00	.00	.04600	.00093	.02520	.00104	.00005	.0732	.68E+07	.74E+05	.34E+06	.83E+04	.90E+02
42	2100	.90	1.00	.02	.10	.00	.00	.04600	.00092	.02378	.00094	.00004	.0717	.13E+08	.27E+06	.12E+07	.27E+05	.26E+03
43	2200	.40	1.00	.02	.09	.00	.00	.04600	.00092	.02244	.00085	.00003	.0702	.57E+07	.12E+06	.51E+06	.11E+05	.92E+02
44	2300	.20	1.00	.02	.08	.00	.00	.04600	.00091	.02117	.00077	.00002	.0689	.29E+07	.62E+05	.25E+06	.52E+04	.37E+02
45	2400	1.00	1.00	.02	.08	.00	.00	.04600	.00091	.01998	.00069	.00002	.0676	.15E+08	.31E+06	.12E+07	.24E+05	.15E+03
46	100	.20	1.00	.02	.08	.00	.00	.04600	.00090	.01885	.00063	.00002	.0664					
47	200	.20	1.00	.02	.07	.00	.00	.04600	.00090	.01779	.00056	.00001	.0653	.30E+07	.32E+05	.11E+06	.20E+04	.93E+01
48	300	1.50	1.00	.02	.07	.00	.00	.04600	.00089	.01679	.00051	.00001	.0642	.23E+08	.49E+06	.16E+07	.28E+05	.11E+03

* Adjusted area monitor trend in R/hr.

** Factor F(t) from equation (5).

*** Release rates are averages for the corresponding hour and previous hours of assumed constant R(t).

Table 4-1 (continued)

NR NO	TIME	AREA*	FRACTION OF XE133 XE133	XE133M	XE135	XE135M	KR88	DOSE FRACTION (DXE) REL TO XE133 XE133	XE133M	XE135	XE135M	KR88	DOSE EQUIV** FACTOR	AVG RELEASE RATE UCI/SEC*** XE133	XE133M	XE135	XE135M	KR88
49	400	.20	1.00	.02	.06	.00	.00	.04600	.00089	.01584	.00046	.00001	.0632	.32E+07	.66E+05	.20E+06	.34E+04	.12E+02
50	500	.60	1.00	.02	.06	.00	.00	.04600	.00088	.01483	.00042	.00001	.0621	.97E+07	.20E+06	.57E+06	.93E+04	.28E+02
51	600	.15	1.00	.02	.06	.00	.00	.04600	.00088	.01388	.00038	.00000	.0611	.25E+07	.50E+05	.14E+06	.21E+04	.56E+01
52	700	1.20	1.00	.02	.05	.00	.00	.04600	.00087	.01300	.00034	.00000	.0602	.20E+08	.41E+06	.10E+07	.16E+05	.36E+02
53	800	.50	1.00	.02	.05	.00	.00	.04600	.00087	.01217	.00031	.00000	.0591	.84E+07	.17E+06	.41E+06	.60E+04	.12E+02
54	900	1.10	1.00	.02	.05	.00	.00	.04600	.00086	.01139	.00028	.00000	.0585					
55	1000	1.10	1.00	.02	.04	.00	.00	.04600	.00086	.01066	.00025	.00000	.0578	.19E+08	.19E+06	.41E+06	.56E+04	.83E+01
56	1100	.50	1.00	.02	.04	.00	.00	.04600	.00085	.00998	.00023	.00000	.0571					
57	1200	.50	1.00	.02	.04	.00	.00	.04600	.00085	.00935	.00021	.00000	.0564					
58	1300	.50	1.00	.02	.04	.00	.00	.04600	.00084	.00875	.00019	.00000	.0558					
59	1400	.50	1.00	.02	.03	.00	.00	.04600	.00084	.00819	.00017	.00000	.0552	.89E+07	.44E+05	.74E+05	.88E+03	.74E+00
60	1500	.90	1.00	.02	.03	.00	.00	.04600	.00083	.00767	.00015	.00000	.0547					
61	1600	.90	1.00	.02	.03	.00	.00	.04600	.00083	.00718	.00014	.00000	.0541					
62	1700	.90	1.00	.02	.03	.00	.00	.04600	.00082	.00672	.00012	.00000	.0537					
63	1800	.90	1.00	.02	.03	.00	.00	.04600	.00082	.00629	.00011	.00000	.0532					
64	1900	.90	1.00	.02	.02	.00	.00	.04600	.00081	.00589	.00010	.00000	.0528					
65	2000	.90	1.00	.02	.02	.00	.00	.04600	.00081	.00552	.00009	.00000	.0524	.17E+08	.54E+05	.63E+05	.61E+03	.22E+0
66	2100	.80	1.00	.02	.02	.00	.00	.04600	.00080	.00516	.00008	.00000	.0520					
67	2200	.80	1.00	.02	.02	.00	.00	.04600	.00080	.00483	.00007	.00000	.0517					
68	2300	.80	1.00	.02	.02	.00	.00	.04600	.00079	.00453	.00007	.00000	.0514					
69	2400	.80	1.00	.02	.02	.00	.00	.04600	.00079	.00424	.00006	.00000	.0511					
70	100	.80	1.00	.02	.02	.00	.00	.04600	.00078	.00397	.00006	.00000	.0508					
71	200	.80	1.00	.02	.01	.00	.00	.04600	.00078	.00371	.00005	.00000	.0505	.16E+08	.48E+05	.39E+05	.31E+03	.47E-0
72	300	.60	1.00	.02	.01	.00	.00	.04600	.00078	.00348	.00005	.00000	.0503					
73	400	.60	1.00	.02	.01	.00	.00	.04600	.00077	.00325	.00004	.00000	.0501					
74	500	.60	1.00	.02	.01	.00	0.00	.04600	.00077	.00304	.00004	0.00000	.0498					
75	600	.60	1.00	.02	.01	.00	0.00	.04600	.00076	.00284	.00003	0.00000	.0496					
76	700	.60	1.00	.02	.01	.00	0.00	.04600	.00075	.00265	.00003	0.00000	.0494					
77	800	.60	1.00	.02	.01	.00	0.00	.04600	.00075	.00247	.00003	0.00000	.0493					
78	900	.60	1.00	.02	.01	.00	0.00	.04600	.00074	.00231	.00002	0.00000	.0491					
79	1000	.60	1.00	.02	.01	.00	0.00	.04600	.00074	.00216	.00002	0.00000	.0489	.12E+08	.26E+05	.13E+05	.79E+02	0.
80	1100	.40	1.00	.02	.01	.00	0.00	.04600	.00073	.00201	.00002	0.00000	.0488					
81	1200	.40	1.00	.02	.01	.00	0.00	.04600	.00073	.00188	.00002	0.00000	.0486					
82	1300	.40	1.00	.02	.01	.00	0.00	.04600	.00072	.00176	.00002	0.00000	.0485					
83	1400	.40	1.00	.02	.01	.00	0.00	.04600	.00072	.00164	.00001	0.00000	.0484					
84	1500	.40	1.00	.02	.01	.00	0.00	.04600	.00071	.00153	.00001	0.00000	.0483					
85	1600	.40	1.00	.02	.01	.00	0.00	.04600	.00071	.00143	.00001	0.00000	.0482					
86	1700	.40	1.00	.02	.01	.00	0.00	.04600	.00070	.00133	.00001	0.00000	.0481	.83E+07	.19E+05	.63E+04	.30E+02	0.
87	1800	.20	1.00	.02	.00	.00	0.00	.04600	.00070	.00125	.00001	0.00000	.0480					
88	1900	.20	1.00	.02	.00	.00	0.00	.04600	.00070	.00116	.00001	0.00000	.0479					
89	2000	.20	1.00	.02	.00	.00	0.00	.04600	.00069	.00109	.00001	0.00000	.0478					
90	2100	.20	1.00	.02	.00	.00	0.00	.04600	.00069	.00101	.00001	0.00000	.0477					
91	2200	.20	1.00	.02	.00	.00	0.00	.04600	.00068	.00095	.00001	0.00000	.0476					
92	2300	.20	1.00	.02	.00	.00	0.00	.04600	.00068	.00088	.00001	0.00000	.0476					
93	2400	.20	1.00	.02	.00	.00	0.00	.04600	.00067	.00083	.00001	0.00000	.0475					
94	100	.20	1.00	.02	.00	.00	0.00	.04600	.00067	.00077	.00000	0.00000	.0474					
95	200	.20	1.00	.02	.00	.00	0.00	.04600	.00066	.00072	.00000	0.00000	.0474					
96	300	.20	1.00	.02	.00	.00	0.00	.04600	.00066	.00067	.00000	0.00000	.0473					
97	400	.20	1.00	.02	.00	.00	0.00	.04600	.00065	.00063	.00000	0.00000	.0473					
98	500	.20	1.00	.02	.00	.00	0.00	.04600	.00065	.00059	.00000	0.00000	.0472					
99	600	.20	1.00	.01	.00	.00	0.00	.04600	.00064	.00055	.00000	0.00000	.0472					

Table 4-1 (continued)

HR NO	TIME	AREA*	XE131	FRACTION OF XE131 XE133M	XE135	XE135M	KR88	DOSE FRACTION (OXE) REL TO XE133 XE133	XE133M	XE135	XE135M KR88	DOSE EQUIV** FACTOR	AVG RELEASE RATE UCI/SEC*** XE133	XE133M	XE135	XE135M KR88
100	700	.20	1.00	.01	.00	.00	0.00	.04600	.00064	.00051	.000000.00000	.0472				
101	800	.20	1.00	.01	.00	.00	0.00	.04600	.00063	.00047	.000000.00000	.0471				
102	900	.20	1.00	.01	.00	.00	0.00	.04600	.00063	.00044	.000000.00000	.0471				
103	1000	.20	1.00	.01	.00	.00	0.00	.04600	.00063	.00041	.000000.00000	.0470				
104	1100	.20	1.00	.01	.00	.00	0.00	.04600	.00062	.00039	.000000.00000	.0470				
105	1200	.20	1.00	.01	.00	.00	0.00	.04600	.00062	.00036	.000000.00000	.0470				
106	1300	.20	1.00	.01	.00	.00	0.00	.04600	.00061	.00034	.000000.00000	.0469				
107	1400	.20	1.00	.01	.00	.00	0.00	.04600	.00061	.00031	.000000.00000	.0469				
108	1500	.20	1.00	.01	.00	.00	0.00	.04600	.00060	.00029	.000000.00000	.0469				
109	1600	.20	1.00	.01	.00	.00	0.00	.04600	.00060	.00027	.000000.00000	.0469				
110	1700	.20	1.00	.01	.00	.00	0.00	.04600	.00059	.00025	.000000.00000	.0468				
111	1800	.20	1.00	.01	.00	.00	0.00	.04600	.00059	.00024	.000000.00000	.0468				
112	1900	.20	1.00	.01	.00	.00	0.00	.04600	.00059	.00022	.000000.00000	.0468				
113	2000	.20	1.00	.01	.00	.00	0.00	.04600	.00058	.00021	.000000.00000	.0468	.42E+07	.21E+04	.13E+03	.27E+000.
114	2100	.40	1.00	.01	.00	.00	0.00	.04600	.00058	.00019	.000000.00000	.0468				
115	2200	.40	1.00	.01	.00	.00	0.00	.04600	.00057	.00018	.000000.00000	.0468				
116	2300	.40	1.00	.01	.00	.00	0.00	.04600	.00057	.00017	.000000.00000	.0467				
117	2400	.40	1.00	.01	.00	.00	0.00	.04600	.00056	.00016	.000000.00000	.0467				
118	100	.40	1.00	.01	.00	.00	0.00	.04600	.00056	.00015	.000000.00000	.0467				
119	200	.40	1.00	.01	.00	.00	0.00	.04600	.00056	.00014	.000000.00000	.0467				
120	300	.40	1.00	.01	.00	.00	0.00	.04600	.00055	.00013	.000000.00000	.0467				
121	400	.40	1.00	.01	.00	.00	0.00	.04600	.00055	.00012	.000000.00000	.0467				
122	500	.40	1.00	.01	.00	.00	0.00	.04600	.00054	.00011	.000000.00000	.0467				
123	600	.40	1.00	.01	.00	.00	0.00	.04600	.00054	.00010	.000000.00000	.0466				
124	700	.40	1.00	.01	.00	.00	0.00	.04600	.00054	.00010	.000000.00000	.0466				
125	800	.40	1.00	.01	.00	.00	0.00	.04600	.00053	.00009	.000000.00000	.0466				
126	900	.40	1.00	.01	.00	.00	0.00	.04600	.00053	.00009	.000000.00000	.0466				
127	1000	.40	1.00	.01	.00	.00	0.00	.04600	.00052	.00008	.000000.00000	.0466	.86E+07	.75E+04	.19E+03	.25E+000.
128	1100	.10	1.00	.01	.00	.00	0.00	.04600	.00052	.00007	.000000.00000	.0466				
129	1200	.10	1.00	.01	.00	.00	0.00	.04600	.00052	.00007	.000000.00000	.0466				
130	1300	.10	1.00	.01	.00	.00	0.00	.04600	.00051	.00006	.000000.00000	.0466				
131	1400	.10	1.00	.01	.00	.00	0.00	.04600	.00051	.00006	.000000.00000	.0466				
132	1500	.10	1.00	.01	.00	.00	0.00	.04600	.00050	.00005	.000000.00000	.0466				
133	1600	.10	1.00	.01	.00	.00	0.00	.04600	.00050	.00005	.000000.00000	.0466				
134	1700	.10	1.00	.01	.00	.00	0.00	.04600	.00050	.00005	.000000.00000	.0465				
135	1800	.10	1.00	.01	.00	.00	0.00	.04600	.00049	.00004	.000000.00000	.0465				
136	1900	.10	1.00	.01	.00	.00	0.00	.04600	.00049	.00004	.000000.00000	.0465				
137	2000	.10	1.00	.01	.00	.00	0.00	.04600	.00049	.00004	.000000.00000	.0465				
138	2100	.10	1.00	.01	.00	.00	0.00	.04600	.00048	.00004	.000000.00000	.0465				
139	2200	.10	1.00	.01	.00	.00	0.00	.04600	.00048	.00003	.000000.00000	.0465				
140	2300	.10	1.00	.01	.00	.00	0.00	.04600	.00048	.00003	.000000.00000	.0465				
141	2400	.10	1.00	.01	.00	.00	0.00	.04600	.00047	.00003	.000000.00000	.0465				
142	100	.10	1.00	.01	.00	.00	0.00	.04600	.00047	.00003	.000000.00000	.0465				
143	200	.10	1.00	.01	.00	.00	0.00	.04600	.00047	.00003	.000000.00000	.0465				
144	300	.10	1.00	.01	.00	.00	0.00	.04600	.00046	.00002	.000000.00000	.0465				
145	400	.10	1.00	.01	.00	.00	0.00	.04600	.00046	.00002	.000000.00000	.0465				
146	500	.10	1.00	.01	.00	.00	0.00	.04600	.00045	.00002	.000000.00000	.0465				
147	600	.10	1.00	.01	.00	.00	0.00	.04600	.00045	.00002	.000000.00000	.0465				
148	700	.10	1.00	.01	.00	.00	0.00	.04600	.00045	.00002	.000400.00000	.0465				
149	800	.10	1.00	.01	.00	.00	0.00	.04600	.00044	.00002	.000000.00000	.0465				
150	900	.10	1.00	.01	.00	.00	0.00	.04600	.00044	.00002	.000000.00000	.0465				

Table 4-1 (continued)

HR NO	TIME	AREA*	FRACTION OF XE133: XE133	XE133M	XE135	XE135M	KR88	DOSE FRACTION (OXE) REL TO XE133: XE133	XE133M	XE135	XE135M KR88	DOSE EQUIV** FACTOR	AVG RELEASE RATE UCI/SEC***: XE133	XE133M	XE135	XE135M	KR88
151	1000	.10	1.00	.01	.00	.00	0.00	.04600	.00044	.00001	.000000.00000	.0465					
152	1100	.10	1.00	.01	.00	.00	0.00	.04600	.00043	.00001	.000000.00000	.0464					
153	1200	.10	1.00	.01	.00	.00	0.00	.04600	.00043	.00001	.000000.00000	.0464					
154	1300	.10	1.00	.01	.00	.00	0.00	.04600	.00043	.00001	.000000.00000	.0464					
155	1400	.10	1.00	.01	.00	.00	0.00	.04600	.00043	.00001	.000000.00000	.0464					
156	1500	.10	1.00	.01	.00	.00	0.00	.04600	.00042	.00001	.000000.00000	.0464	.22E+07	.73E+03	.30E+01	.17E-02	0.
157	1600	.05	1.00	.01	.00	.00	0.00	.04600	.00042	.00001	.000000.00000	.0464					
158	1700	.05	1.00	.01	.00	.00	0.00	.04600	.00042	.00001	.000000.00000	.0464					
159	1800	.05	1.00	.01	.00	.00	0.00	.04600	.00041	.00001	.000000.00000	.0464					
160	1900	.05	1.00	.01	.00	.00	0.00	.04600	.00041	.00001	.000000.00000	.0464					
161	2000	.05	1.00	.01	.00	.00	0.00	.04600	.00041	.00001	.000000.00000	.0464					
162	2100	.05	1.00	.01	.00	.00	0.00	.04600	.00040	.00001	.000000.00000	.0464					
163	2200	.05	1.00	.01	.00	.00	0.00	.04600	.00040	.00001	.000000.00000	.0464					
164	2300	.05	1.00	.01	.00	.00	0.00	.04600	.00040	.00001	.000000.00000	.0464					
165	2400	.05	1.00	.01	.00	.00	0.00	.04600	.00039	.00001	.000000.00000	.0464					
166	100	.05	1.00	.01	.00	.00	0.00	.04600	.00039	.00001	.000000.00000	.0464					
167	200	.05	1.00	.01	.00	.00	0.00	.04600	.00039	.00000	.000000.00000	.0464					
168	300	.05	1.00	.01	.00	.00	0.00	.04600	.00039	.00000	.000000.00000	.0464					
169	400	.05	1.00	.01	.00	.00	0.00	.04600	.00038	.00000	.000000.00000	.0464					
170	500	.05	1.90	.01	.00	.00	0.00	.04600	.00038	.00000	.000000.00000	.0464					
171	600	.05	1.00	.01	.00	.00	0.00	.04600	.00038	.00000	.000000.00000	.0464					
172	700	.05	1.00	.01	.00	.00	0.00	.04600	.00037	.00000	.000000.00000	.0464					
173	800	.05	1.00	.01	.00	.00	0.00	.04600	.00037	.00000	.000000.00000	.0464					
174	900	.05	1.00	.01	.00	.00	0.00	.04600	.00037	.00000	.000000.00000	.0464					
175	1000	.05	1.00	.01	.00	.00	0.00	.04600	.00037	.00000	.000000.00000	.0464					
176	1100	.05	1.00	.01	.00	.00	0.00	.04600	.00036	.00000	.000000.00000	.0464					
177	1200	.05	1.00	.01	.00	.00	0.00	.04600	.00036	.00000	.000000.00000	.0464					
178	1300	.05	1.00	.01	.00	.00	0.00	.04600	.00036	.00000	.000000.00000	.0464					
179	1400	.05	1.00	.01	.00	.00	0.00	.04600	.00035	.00000	.000000.00000	.0464					
180	1500	.05	1.00	.01	.00	.00	0.00	.04600	.00035	.00000	.000000.00000	.0464					
181	1600	.05	1.00	.01	.00	.00	0.00	.04600	.00035	.00000	.000000.00000	.0464					
182	1700	.05	1.00	.01	.00	.00	0.00	.04600	.00035	.00000	.000000.00000	.0463					
183	1800	.05	1.00	.01	.00	.00	0.00	.04600	.00034	.00000	.000000.00000	.0463					
184	1900	.05	1.00	.01	.00	.00	0.00	.04600	.00034	.00000	.000000.00000	.0463					
185	2000	.05	1.00	.01	.00	.00	0.00	.04600	.00034	.00000	.000000.00000	.0463					
186	2100	.05	1.00	.01	.00	.00	0.00	.04600	.00034	.00000	.000000.00000	.0463					
187	2200	.05	1.00	.01	.00	.00	0.00	.04600	.00033	.00000	.000000.00000	.0463					
188	2300	.05	1.00	.01	.00	.00	0.00	.04600	.00033	.00000	.000000.00000	.0463					
189	2400	.05	1.00	.01	.00	.00	0.00	.04600	.00033	.00000	.000000.00000	.0463					
190	100	.05	1.00	.01	.00	.00	0.00	.04600	.00033	.00000	.000000.00000	.0463					
191	200	.05	1.00	.01	.00	.00	0.00	.04600	.00032	.00000	.000000.00000	.0463					
192	300	.05	1.00	.01	.00	.00	0.00	.04600	.00032	.00000	.000000.00000	.0463					
193	400	.05	1.00	.01	.00	.00	0.00	.04600	.00032	.00000	.000000.00000	.0463					
194	500	.05	1.00	.01	0.00	0.00	0.00	.04600	.000320.000000.000000.00000			.0463					
195	600	.05	1.00	.01	0.00	0.00	0.00	.04600	.000320.000000.000000.00000			.0463					
196	700	.05	1.00	.01	0.00	0.00	0.00	.04600	.000310.000000.000000.00000			.0463					
197	800	.05	1.00	.01	0.00	0.00	0.00	.04600	.000310.000000.000000.00000			.0463					
198	900	.05	1.00	.01	0.00	0.00	0.00	.04600	.000310.000000.000000.00000			.0463					
199	1000	.05	1.00	.01	0.00	0.00	0.00	.04600	.000310.000000.000000.00000			.0463					
200	1100	.05	1.00	.01	0.00	0.00	0.00	.04600	.000310.000000.000000.00000			.0463					

Table 4-1 (continued)

HR NO	TIME	AREA*	FRACTION OF XE133 XE133	XE133M	XE135	XE135M	KR88	DOSE FRACTION (DxE) REL TO XE133 XE133	XE133M	XE135	XE135M	KR88	DOSE EQUIV** FACTOR	AVG RELEASE RATE UCI/SEC*** XE133	XE133M	XE135	XE135M	KR88
201	1200	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
202	1300	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
203	1400	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
204	1500	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
205	1600	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
206	1700	.05	1.00	.01	0.00	0.00	0.00	.04600	.000300	.000000	.000000	.00000	.0463					
207	1800	.05	1.00	.01	0.00	0.00	0.00	.04600	.000290	.000000	.000000	.00000	.0463					
208	1900	.05	1.00	.01	0.00	0.00	0.00	.04600	.000290	.000000	.000000	.00000	.0463					
209	2000	.05	1.00	.01	0.00	0.00	0.00	.04600	.000290	.000000	.000000	.00000	.0463					
210	2100	.05	1.00	.01	0.00	0.00	0.00	.04600	.000290	.000000	.000000	.00000	.0463					
211	2200	.05	1.00	.01	0.00	0.00	0.00	.04600	.000290	.000000	.000000	.00000	.0463					
212	2300	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
213	2400	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
214	100	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
215	200	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
216	300	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
217	400	.05	1.00	.01	0.00	0.00	0.00	.04600	.000280	.000000	.000000	.00000	.0463					
218	500	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
219	600	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
220	700	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
221	800	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
222	900	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
223	1000	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
224	1100	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
225	1200	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460					
226	1300	.05	1.00	0.00	0.00	0.00	0.00	.046000	.000000	.000000	.000000	.00000	.0460	.11E+070.	0.	0.	0.	

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Table 4-2

Radiological Environmental Program TLD Data from Three Mile Island
(Approximate Period of Exposure 3/28 @ 0700 to 3/29 @ 1600)

Map No.	Station	Distance (meters)	Direction[1]	Quarter Hours in this Direction	Time Removed	Measured Dose-Background Subtracted (millirem)	Calculated Gamma Dose (millirem)	Weighted Ratio of Predicted to Measured Dose
2	1S2	640	N	13	1640	76.96	135.5	1.76
26	1C1	4180	N	13	1445	5.51[2]	17.5	3.18
3	2S2	1130	NNE	14	1715	27.90	60.0	2.15
5	4S2	480	ENE	2	1705	17.74	6.0	0.34
13	4A1	800	ENE	2	0920	3.23[2]	2.0	0.62
37	4G1	16100	ENE	2	1810	0.00[2]	0.04	-
6	5S2	320	E	3	1705	13.56	25.0	1.85
14	5A1	640	E	3	0900	2.46[2]	7.0	2.84
34	7F1	14500	SE	1	0955	0.00[2]	0.03	-
38	7G1	24100	SE	1	1020	0.00	0.02	-
28	8C1	3700	SSE	8	0930	0.43[2]	2.5	5.8
8	9S2	640	S	5	1655	6.28[2]	8.0	1.26
39	9G1	20900	S	5	1050	0.91[2]	0.02	0.02
23	10B1	1770	SSW	4	1225	2.95[2,3]	5.0	1.70
9	11S1	160	SW	2	1650	180.78	(4)	-
24	12B1	1270	WSW	5	1150	2.53[2]	3.0	1.20
10	14S2	640	WNW	16	1215	95.02[3]	140.0	1.47
40	15G1	24100	NW	9	1330	0.00[2]	0.0	-
11	16S1	320	NNW	36	1645	964.60	1050.0	1.09
17	16A1	640	NNW	36	1210	618.40[3]	500.0	0.81
							Average Ratio	1.73

(1) Direction from plant toward monitoring location

(2) Gross values for these estimates are only slightly greater than background

(3) Average of duplicate measurements

(4) Not evaluated - too close to source and plant structures

Table 4-2 (continued)

Radiological Environmental Program TLD Data from Three Mile Island
(Approximate Period of Exposure 3/29 @ 1700 to 3/31 @ 1600)

Map No.	Station	Distance (meters)	Direction [1]	Quarter Hours in this Direction	Time Removed	Measured Dose-Background Subtracted (millirem)	Calculated Gamma Dose (millirem)	Weighted Ratio of Predicted to Measured Dose
2	1S2	640	N	8	1335	18.67	23.0	1.23
26	1C1	4180	N	8	1250	2.76	9.0	3.26
3	2S2	1130	NNE	19	1415	30.60	25.0	0.82
5	4S2	480	ENE	16	1405	117.76	45.0	0.38
13	4A1	800	ENE	16	0640	32.26	30.0	0.93
37	4G1	16100	ENE	16	1535	0.76 (2)	1.5	1.97
6	5S2	320	E	4	1400	46.52	24.0	0.51
14	5A1	640	E	4	0655	7.57	14.0	1.85
34	7F1	14500	SE	7	0735	0.55 (2)	1.5	2.73
38	7G1	24100	SE	7	0800	0.51 (2)	0.8	1.56
28	8C1	3700	SSE	14	0715	9.92	7.0	0.70
8	9S2	640	S	12	1355	23.68	25.0	1.06
39	9G1	20900	S	12	0855	0.92	1.1	1.20
23	10B1	1770	SSW	12	1100	13.79	22.0	1.60
9	11S1	160	SW	2	1350	101.26	(4)	-
24	12B1	1270	WSW	3	0945	8.66	13.0	1.50
10	14S2	640	WNW	13	1050	45.95	34.0	0.74
40	15G1	24100	NW	19	1135	1.43	1.2	0.34
11	16S1	320	NNW	9	1345	78.97	40.0	0.50
17	16A1	640	NNW	9	1045	42.54	23.0	0.54
							Average Ratio	1.26

(1) Direction from plant toward monitoring location
(2) Gross values for these estimates are only slightly greater than background
(3) Average of duplicate measurements
(4) Not evaluated - too close to source and plant structures

Table 4-2 (continued)

Radiological Environmental Program TLD Data from Three Mile Island
(Approximate Period of Exposure 3/31 @ 1700 to 4/3 @ 1500)

Map No.	Station	Distance (meters)	Direction[1]	Quarter Hours in this Direction	Time Removed	Measured Dose-Background Subtracted (millirem)	Calculated Gamma Dose (millirem)	Weighted Ratio of Predicted to Measured Dose
2	1S2	640	N	6	1513	0.00[2]	7.0	-
26	1C1	4180	N	6	1325	0.88[2]	3.0	3.41
3	2S2	1130	NNE	11	1552	2.77	7.5	2.71
5	4S2	480	ENE	10	1550	26.06	13.0	0.50
13	4A1	800	ENE	10	0650	38.81	10.0	0.26
37	4G1	16100	ENE	10	1640	0.00[2]	1.0	-
6	5S2	320	E	4	1545	24.85	11.0	0.44
14	5A1	640	E	4	0700	6.82	6.0	0.68
34	7F1	14500	SE	26	0735	0.00[2]	1.0	-
38	7G1	24100	SE	26	0808	0.00[2]	0.07	-
28	8C1	3700	SSE	45	0720	1.22[2]	5.0	4.10
8	9S2	640	S	32	1530	3.78	11.0	2.91
39	9G1	20900	S	32	0920	0.00[2]	0.02	-
23	10B1	1770	SSW	6	1107	0.00[2]	1.4	-
9	11S1	160	SW	13	1522	41.93	(4)	-
24	12B1	1270	WSW	15	1030	0.00[2]	4.0	-
10	14S2	640	WNW	55	1100	8.39	32.0	3.81
40	15G1	24100	NW	19	1205	0.00[2]	0.01	-
11	16S1	320	NNW	1	1520	5.73	2.0	0.35
17	16A1	640	NNW	1	1055	1.15[2]	1.0	0.87
							Average Ratio	1.84

(1) Direction from plant toward monitoring location

(2) Gross values for these estimates are only slightly greater than background

(3) Average of duplicate measurements

(4) Not evaluated - too close to source and plant structures

Table 4-2 (continued)

Radiological Environmental Program TLD Data from Three Mile Island
(Approximate Period of Exposure 4/3 @ 1600 to 4/6 @ 1300)

Map No.	Station	Distance (meters)	Direction[1]	Quarter Hours in this Direction	Time Removed	Measured Dose-Background Subtracted (millirem)	Calculated Gamma Dose (millirem)	Weighted Ratio of Predicted to Measured Dose
2	1S2	640	N	13	1613	0.04[2]	1.5	37.5
26	1C1	4180	N	13	1545	0.02[2]	0.4	2.5
3	2S2	1130	NNE	21	1700	0.40[2]	1.5	3.7
5	4S2	490	ENE	12	1650	6.97	2.0	0.3
13	4A1	800	ENE	12	0715	1.56	1.3	0.8
37	4G1	16100	ENE	12	1805	0.00[2]	0.0	-
6	5S2	320	E	30	1653	14.21	6.5	0.5
14	5A1	640	E	30	0730	2.35[2]	3.0	1.3
34	7F1	14500	SE	9	0800	0.07[2]	0.03	0.4
38	7G1	24100	SE	9	0800	0.00[2]	0.02	-
28	8C1	3700	SSE	21	0740	0.84	1.2	1.4
8	9S2	640	S	12	1630	1.13	1.7	1.5
39	9G1	20900	S	12	0935	0.00[2]	0.05	-
23	10B1	1770	SSW	9	1230	0.47[2]	0.6	1.3
9	11S1	160	SW	11	1625	19.90	(4)	-
24	12B1	1270	WSW	12	1100	0.71	1.5	2.1
10	14S2	640	WNW	24	1150	0.79[2]	3.0	3.8
40	15G1	24100	NW	3	1420	0.00[2]	0.0	-
11	16S1	320	NNW	8	1620	0.51[2]	3.0	5.9
17	16A1	640	NNW	8	1125	0.38[2]	1.8	4.7
							Average Ratio	4.5

(1) Direction from plant toward monitoring location
(2) Gross values for these estimates are only slightly greater than background
(3) Average of duplicate measurements
(4) Not evaluated - too close to source and plant structures

Table 4-3

Radiological Environmental Program TLD Data from Three Mile Island
(Total Period of Significant Exposure 3/28 @ 0700 to 4/6 @ 1300)

Map No.	Station	Distance (meters)	Direction (1)	Hours of Wind in this Direction	Measured Dose-Background Subtracted (millirem)	Calculated Gamma Dose (millirem)	Weighted Ratio of Predicted to Measured Dose
2	1S2	640	N	40	95.6	167.0	1.75
26	1C1	4180	N	40	9.1	29.9	3.28
3	2S2	1130	NNE	65	61.7	94.0	1.52
5	4S2	480	ENE	40	168.5	66.0	0.39
13	4A1	800	ENE	40	75.8	43.3	0.57
37	4G1	16100	ENE	40	0.7	2.5	3.57
6	5S2	320	E	41	99.1	66.5	0.67
14	5A1	640	E	41	19.2	30.0	1.56
34	7F1	14500	SE	43	0.6	2.5	4.17
38	7G1	24100	SE	43	0.5	0.9	1.80
28	8C1	3700	SSE	88	12.4	15.7	1.26
8	9S2	640	S	61	34.9	45.7	1.31
39	9G1	20900	S	61	1.8	1.2	0.67
23	10B1	1770	SSW	31	17.2	29.0	1.68
9	11S1	160	SW	28	343.9	(1)	-
24	12B1	1270	WSW	45	11.9	21.5	1.81
10	14S2	640	WNW	108	150.1	199.0	1.32
40	15G1	24100	NW	50	1.4	1.2	0.86
11	16S1	320	NNW	54	1049.8	1095.0	1.04
17	16A1	640	NNW	54	662.47	525.8	0.79
						Average Ratio	1.58

(1) Not evaluated - too close to source and plant structures

Table 4-4

Estimated Quantities (Ci) of Each Noble Gas Isotope for Release Periods Corresponding to TLD Measurements 3/28/79-4/30/79

Isotope	3/28 @ 0700-3/29 @ 1600	3/29 @ 1700-3/31 @ 1600	3/31 @ 1700-4/3 @ 1500	4/3 @ 1600-4/6 @ 1300	4/6 @ 1400-4/30 @ 2400*	Total
Xe-133	4.9E6	2.1E6	1.1E6	2.7E5	1.5E4	8.3E6
Xe-133m	1.2E5	3.9E4	1.5E4	1.9E3	0	1.7E5
Xe-135	1.5E6	7.7E4	1.4E3	0	0	1.5E6
Xe-135m	1.4E5	1.3E3	0	0	0	1.4E5
Kr-88	6.1E4	0	0	0	0	6.1E4
	6.6E6	2.2E6	1.1E6	2.7E5	1.5E4	1.0E7

*The last three weeks of the month are combined into one group since the contribution is less than 1% of the total. The estimated quantity released during this period is based on effluent measurements.

Table 4-5

Three Mile Island REMP Thermoluminescent Dosimeter (TLD) Results 3/28/79-4/12/79[3]

Natural Background Subtracted

mrad[1]

Station[4]	3/28 3/29	3/29 3/31	3/31 4/03	4/03 4/06	4/06 4/09	4/09 4/12	TOTAL
1S2	76.96	18.67	0.00	.04	.79	0.00	96.46
1S2Q	79.66	14.92	.74	.28	.31	.28	96.18
2S2	27.90	30.60	2.77	.40	.11	0.00	61.78
4S2	17.74	117.76	26.06	6.97	.98	.04	169.55
4S2Q	15.42	71.02	20.73	4.15	.50	.43	112.25
5S2	13.56	46.52	24.85	14.21	5.18	2.06	106.37
5S2Q	12.29	36.33	20.64	11.03	4.22	1.69	86.20
8C1	.43	9.92	1.22	.84	.54	.01	12.96
8C1Q	.68	8.11	2.24	.72	.24	.28	12.26
9S2	6.28	23.68	3.78	1.13	.64	0.00	35.52
11S1	180.78	101.26	41.93	19.90	7.25	.24	351.35
11S1Q	144.08	75.22	34.40	13.39	4.64	.18	271.91
16S1	964.60	78.97	5.73	.51	.02	0.00	1049.83
16S1Q	902.01	61.05	4.67	.35	0.00	0.00	968.08
14S2	86.90	45.95	8.39	.79	.09	0.00	142.12
14S2D[2]	103.14	0.00	0.00	0.00	0.00	0.00	103.14
4A1	3.23	32.26	38.81	1.56	.14	.05	76.05
5A1	2.46	7.57	6.82	2.35	.65	1.59	21.42
5A1Q	.89	5.13	4.74	1.50	.79	1.26	14.30
16A1	834.19	42.54	1.15	.38	.17	0.00	878.43
16A1D[2]	402.61	0.00	0.00	0.00	0.00	0.00	402.61
10B1	4.88	13.79	0.00	.47	.17	.05	19.35

Table 4-5 (continued)

Station	3/28 3/29	3/29 3/31	3/31 4/03	4/03 4/06	4/06 4/09	4/09 4/12	TOTAL
10B1D (2)	1.08	0.00	0.00	0.00	0.00	0.00	1.08
12B1	2.53	8.66	0.00	.71	.78	0.00	12.69
1C1	5.51	2.76	.88	.02	.07	.07	9.31
7F1	0.00	.55	0.00	.07	.12	0.00	.74
7F1Q	0.00	.31	.74	.12	.14	.13	1.42
4G1	0.00	.76	0.00	0.00	.11	0.00	.88
4G1Q	0.00	.26	.82	.08	.20	.16	1.52
9G1	.91	.92	0.00	0.00	.18	0.00	2.01
15G1	0.00	1.43	0.00	0.00	.15	0.00	1.58
15G1Q	0.00	.76	.18	.07	0.00	.10	1.12
7G1	0.00	.51	0.00	0.00	.03	0.00	.54

Table 4-5 (continued)

(1) Accuracy is limited to two significant figures. Greater indicated accuracy is maintained only to minimize cumulative rounding errors. Dose presented represents gamma dose in tissue near the surface of the body. Natural background contributions, from Appendix D, Table D-9, have been subtracted from values listed in Appendix D, Table D-4, which includes natural background. There is some uncertainty associated with the estimate of the natural background radiation contribution to dose because natural background radiation dose rates fluctuate to some extent. These uncertainties may affect uncertainties associated with the doses presented above, which are estimates of increments above the natural background radiation dose. If the increment is large, the relative uncertainty is small. But if the increment is comparable to or less than the natural background dose, the relative uncertainty in the increment estimate is large. Most of the dosimeters used for the 3/28-3/29 estimates had been exposed for three months. (Dosimeters at stations 14S2, 16A1, and 10B1 had been exposed for six months). The natural background contribution to the total dose over the three-month period was in the range of 10-20 mrad. Thus, increments of less than about 15 mrads must be considered somewhat uncertain. That is, an incremental dose estimated as 5 mrad could actually have been as low as zero. It could also have been somewhat greater than 5 mrad, but probably not greater than about 10 mrad. The background contribution during the three-day exposure periods subsequent to 3/29 was low, in the range 0.25 to 1. mrad. An incremental dose estimated as 0.5 mrad could have been as low as 0. or as high as about 1.0 mrad. No correction for over-response to low-energy photons has been applied.

(2) Duplicate value for first period. Values used in this analysis are averages of the two measurements.

(3) No significant exposure from noble gas isotopes was measurable after April 12.

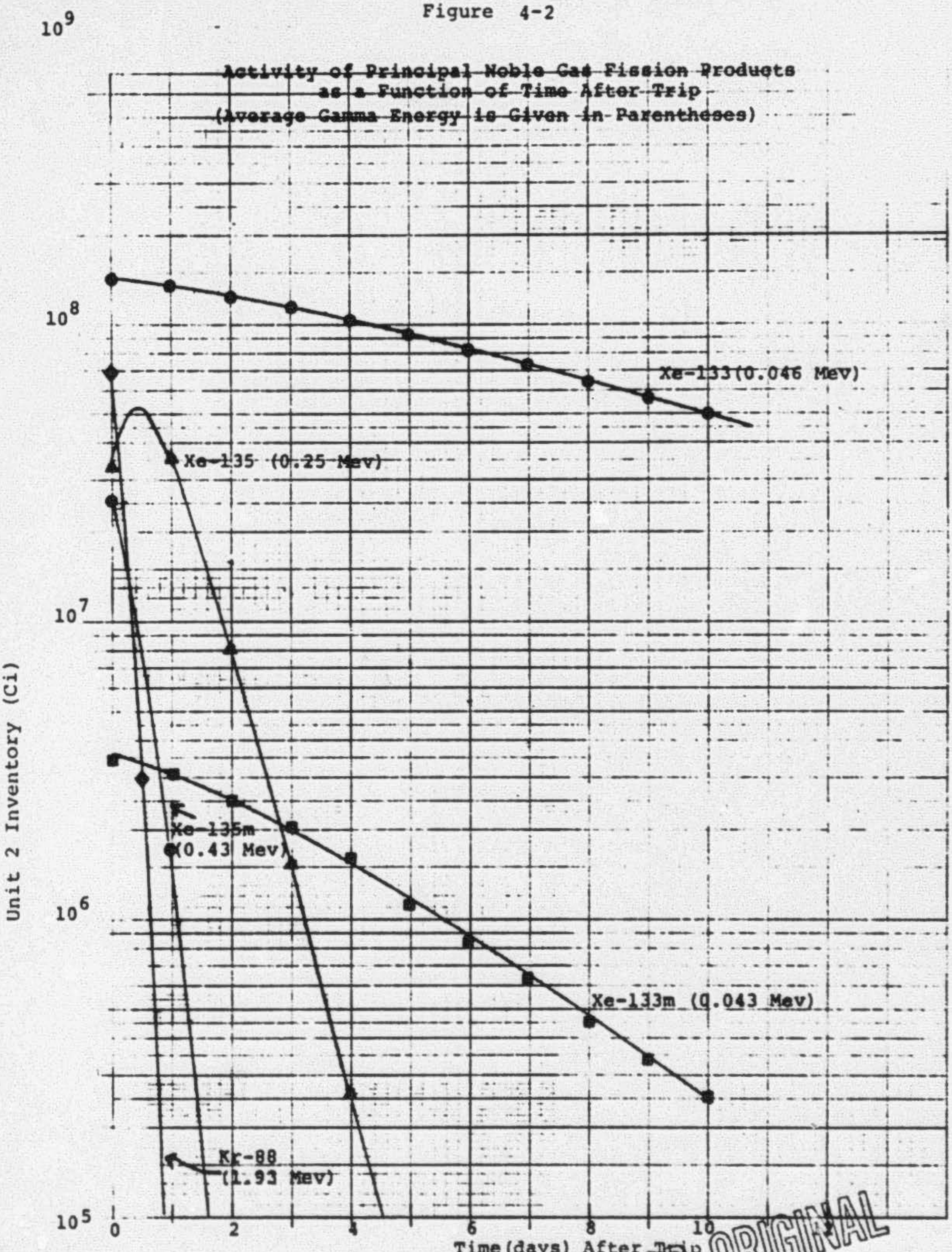
(4) Refer to Appendix D for site maps showing monitor locations.

Table 4-6

Percent of Total Gamma Dose
Attributable to Xe-133

Direction	Distance (meters)	Percent of the Total Dose Over Given Time Period 3-28 @ 0700 – 3-29 @ 1600	3-29 @ 1700 – 3-31 @ 1600
WNW	600	28	94
NW	600	36	95
NNW	300	51	95
N	300	74	90
NNE	600	65	94
NE	600	30	94
ENE	600	26	94

Figure 4-2



Activity of Principal Noble Gas Fission Products
as a Function of Time After Trip
(Average Gamma Energy is Given in Parentheses)
10^9
10^8
10^7
10^6
10^5
Unit 2 Inventory (Ci)
Xe-133(0.046 Mev)
Xe-135 (0.25 Mev)
Xe-135m
(0.43 Mev)
Xe-133m (0.043 Mev)
Kr-88
(1.93 Mev)
0
2
4
6
8
10
Time (days) After Trip

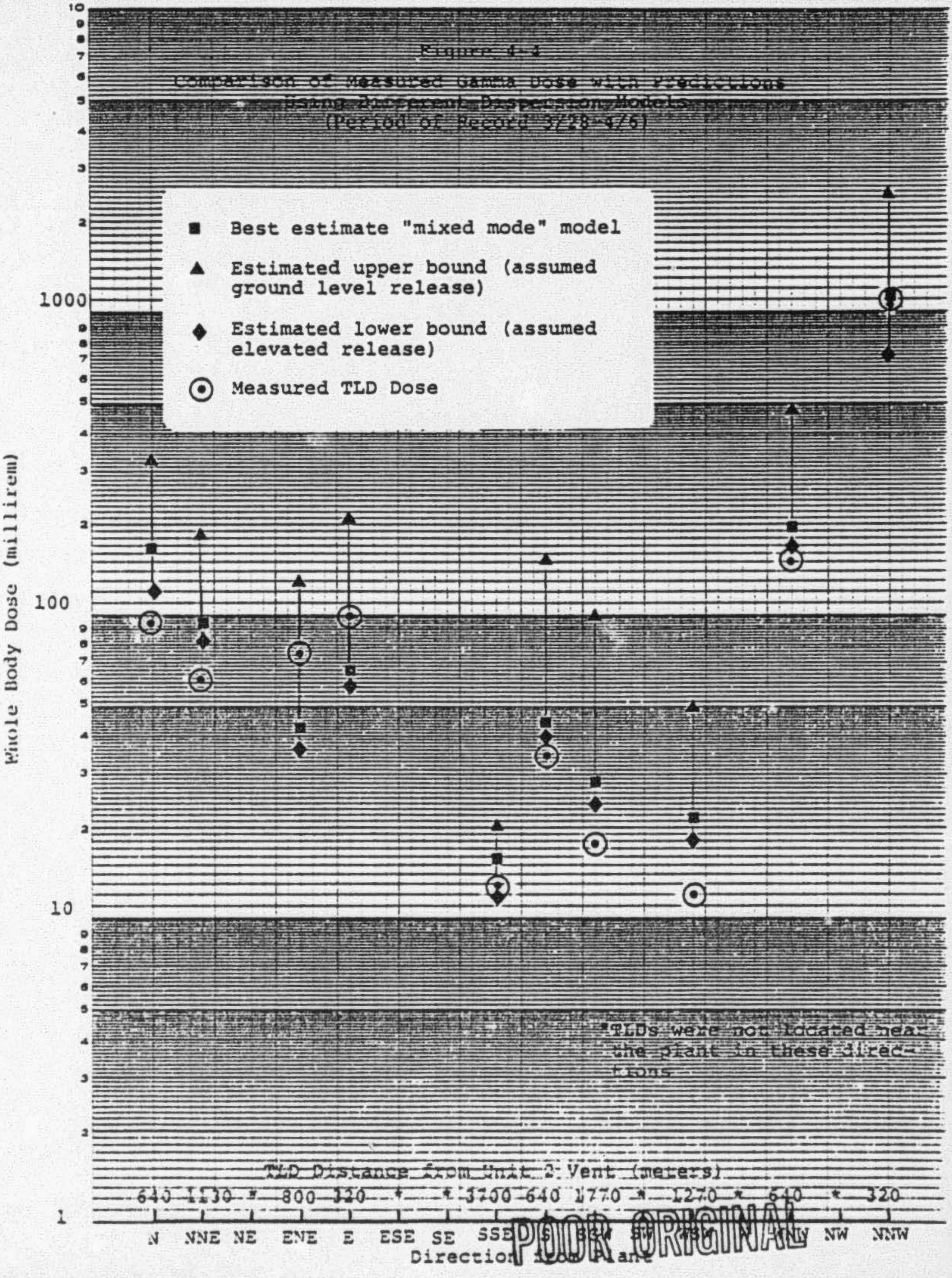


Figure 4-4
Comparison of Measured Gamma Dose with Predictions
Using Different Dispersion Models
(Period of Record 3/28-4/6)
Best estimate "mixed mode" model
Estimated upper bound (assumed ground level release)
Estimated lower bound (assumed elevated release)
Measured TLD Dose
Whole Body Dose (millirem)
1000
100
10
1
*TLDs were not located near the plant in these directions
TLD Distance from Unit 2 Vent (meters)
640 1130 * 800 320 * * 3700 640 1770 * 1270 * 640 * 320
N NNE NE ENE E ESE SE SSE S SSW SW WSW W WNW NW NNW
Direction from Plant
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Figure 4-5

Approximate Tracks of Plume Centerline Starting Every 15 Minutes from 3/28 @ 1700 through 3/29 @ 0600 (Based on TMI Onsite Meteorological Tower Data)

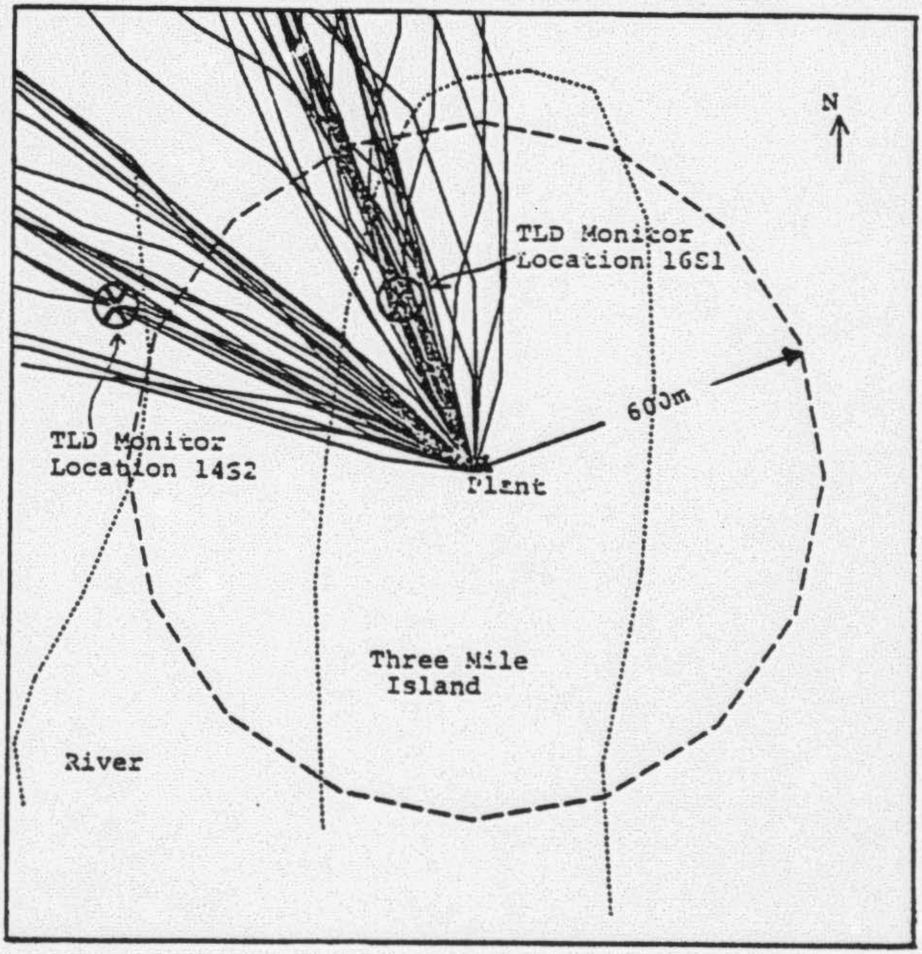
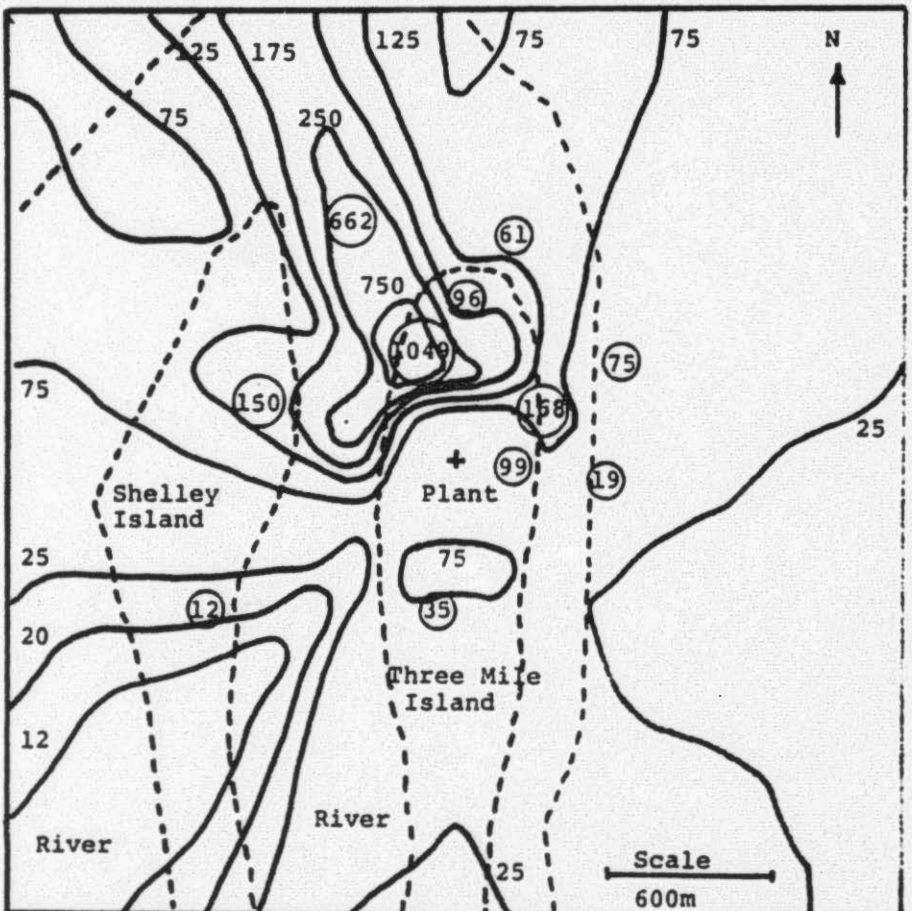


Figure 4-6

Estimated Whole Body Dose (millirem)
Within a One Mile Radius*

(Period of Record 3/28-4/6)**



*Measured TLD doses over the same time period given in circles for comparison

**Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

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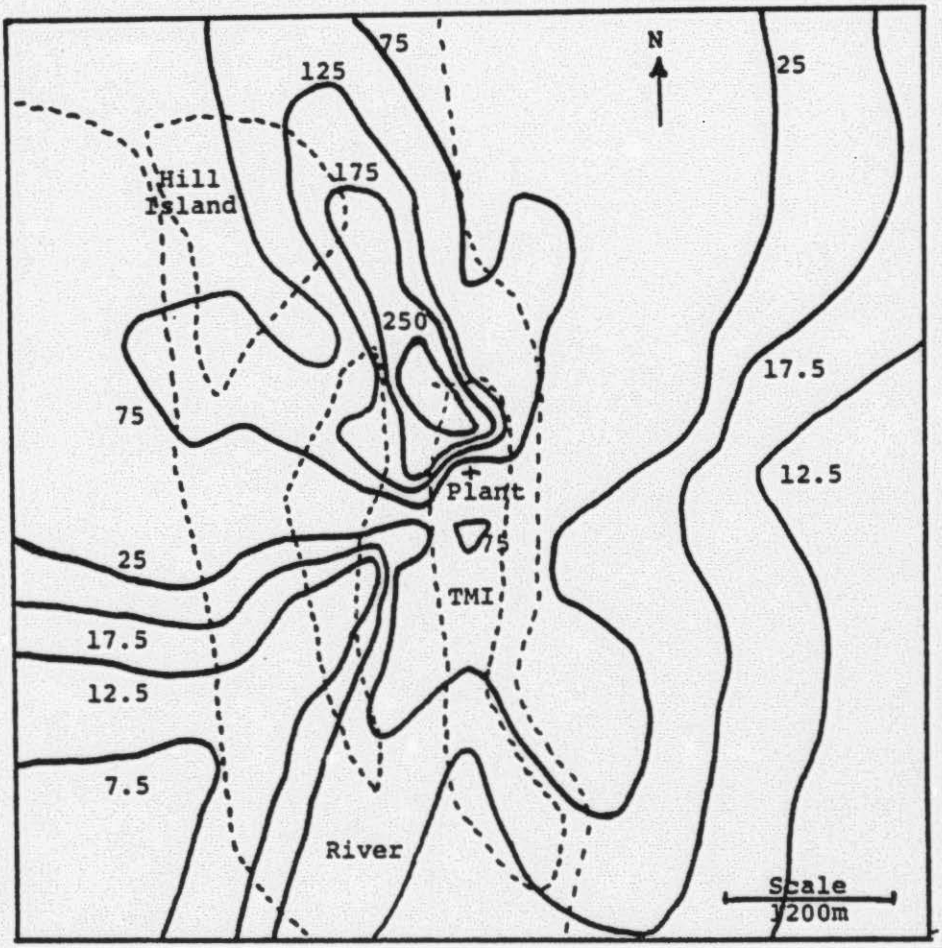
Figure 4-7

Estimated Whole Body Dose (millirem)
Within a Two Mile Radius

(Period of Record 3/28-4/6)*

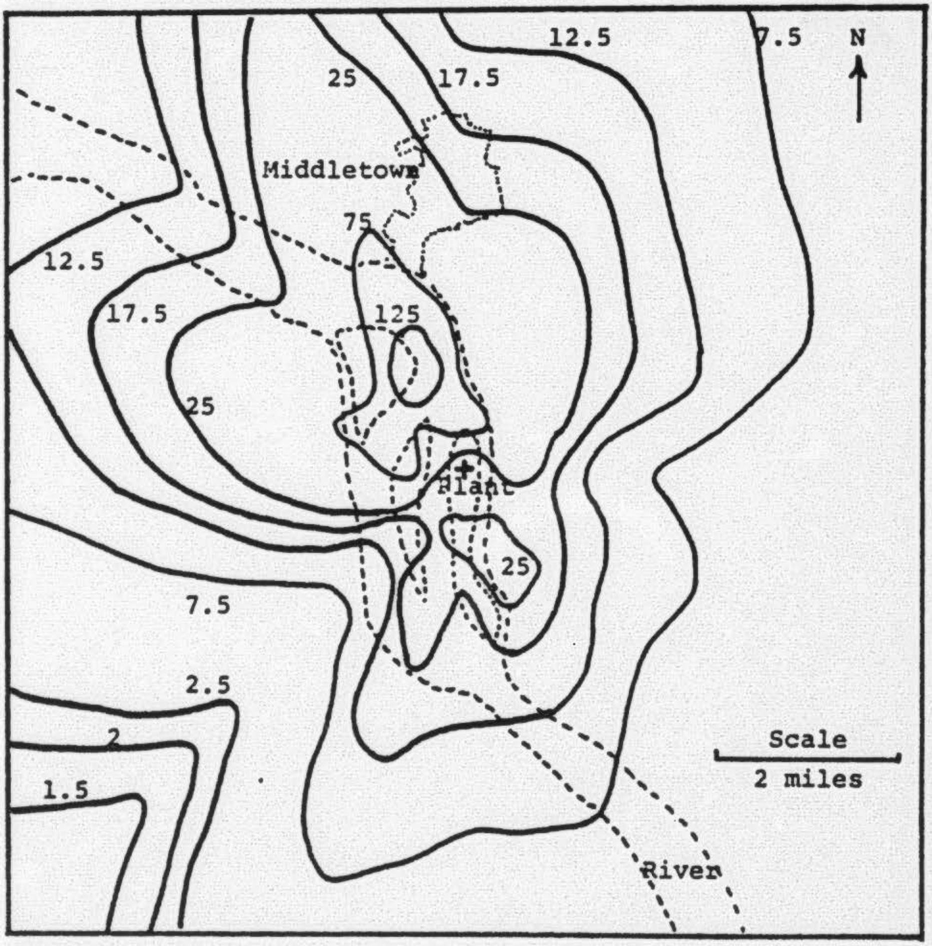


*Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

Figure 4-8

Estimated Whole Body Dose (millirem)
Within a Five Mile Radius

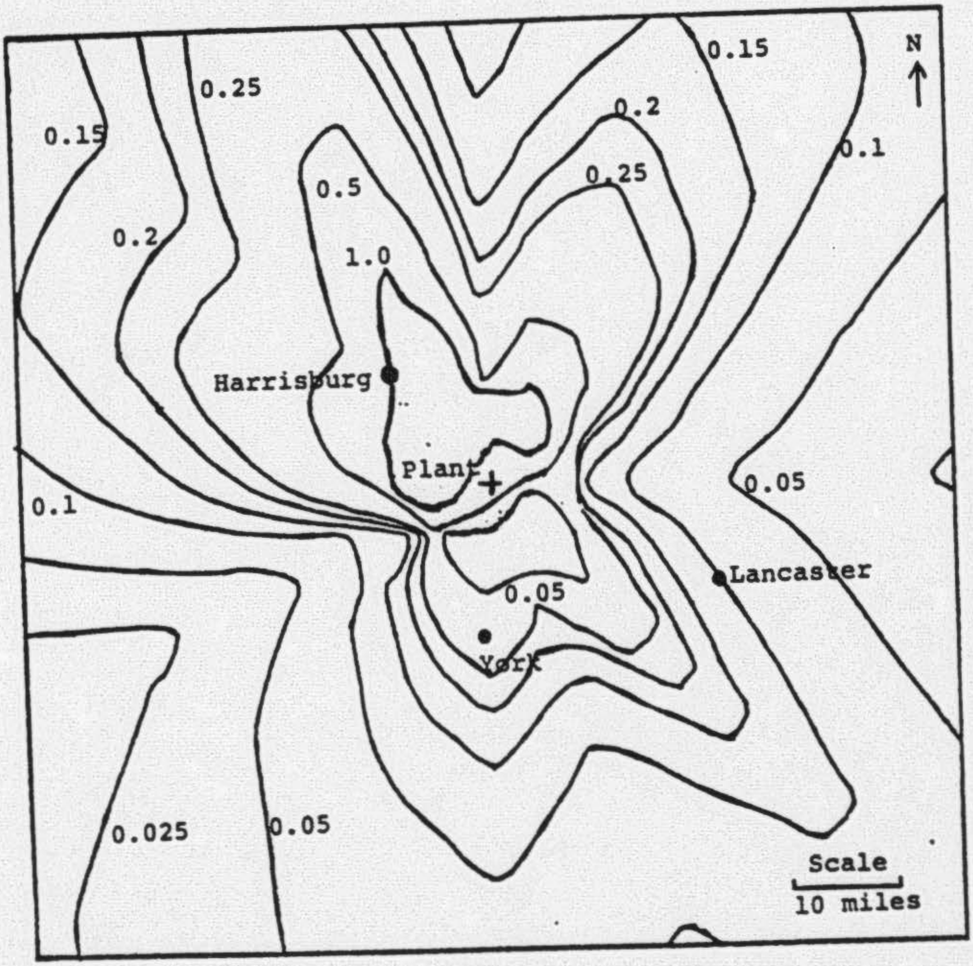
(Period of Record 3/28-4/6)*



*Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

Figure 4-9

Estimated Whole Body Dose (millirem)
Within a 50 Mile Radius
(Period of Record 3/28-4/6)*

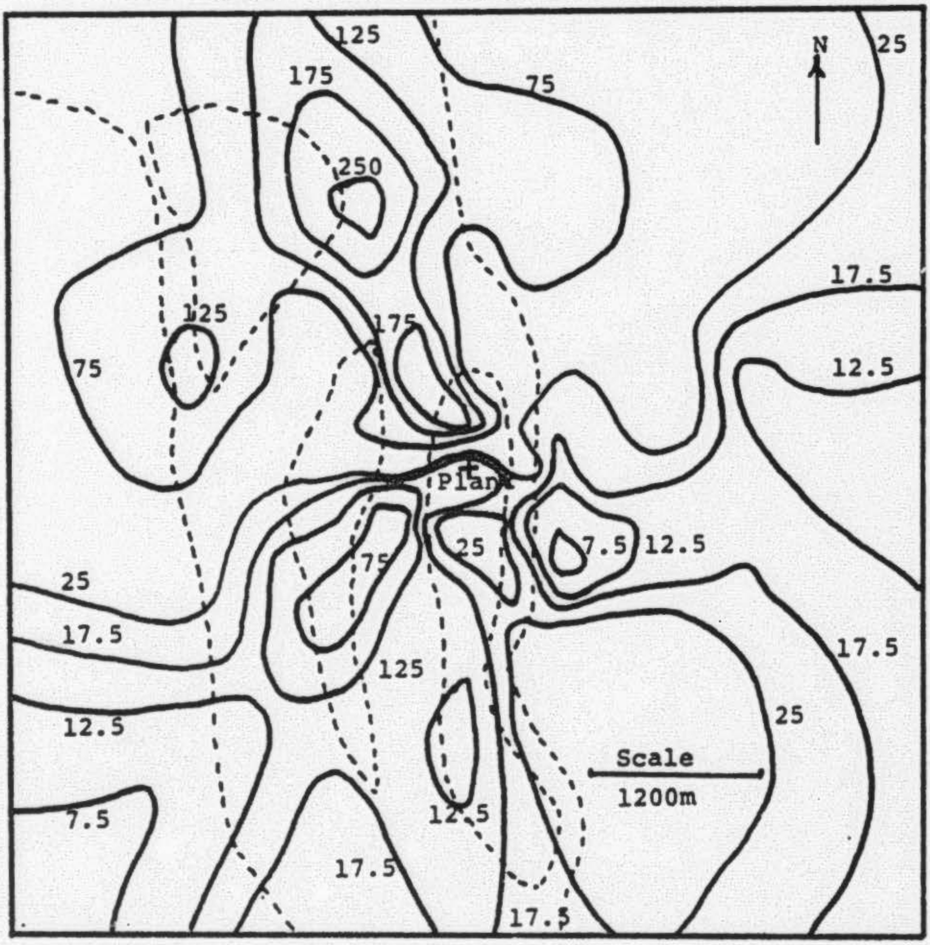


*Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

Figure 4-10

Estimated Beta Dose to Skin (millirem)
Within a Two Mile Radius

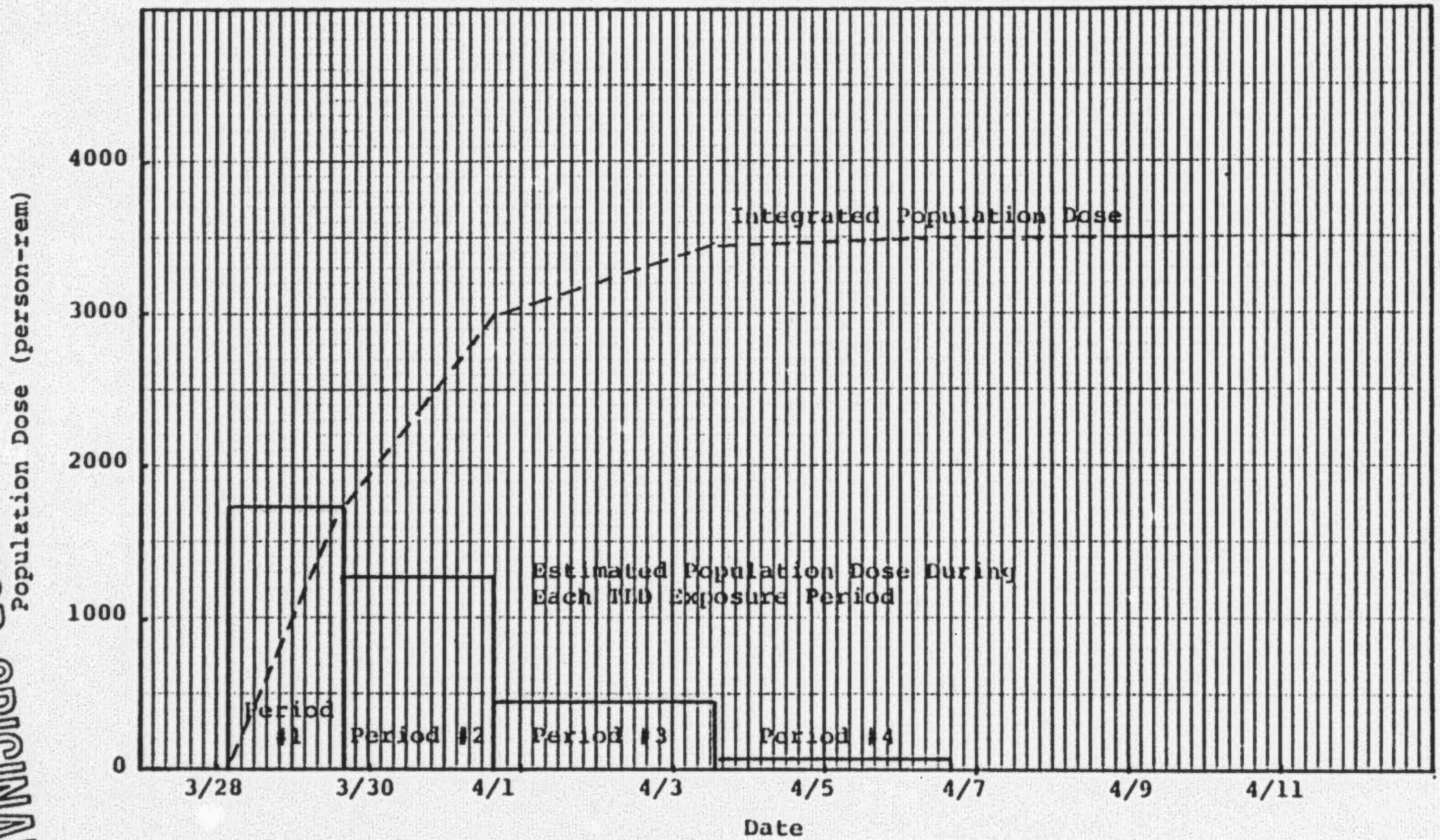
(Period of Record 3/28-4/6)*



*Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

Figure 4-11

Estimated Integrated Whole Body Population Dose as a Function of Time Following the Accident



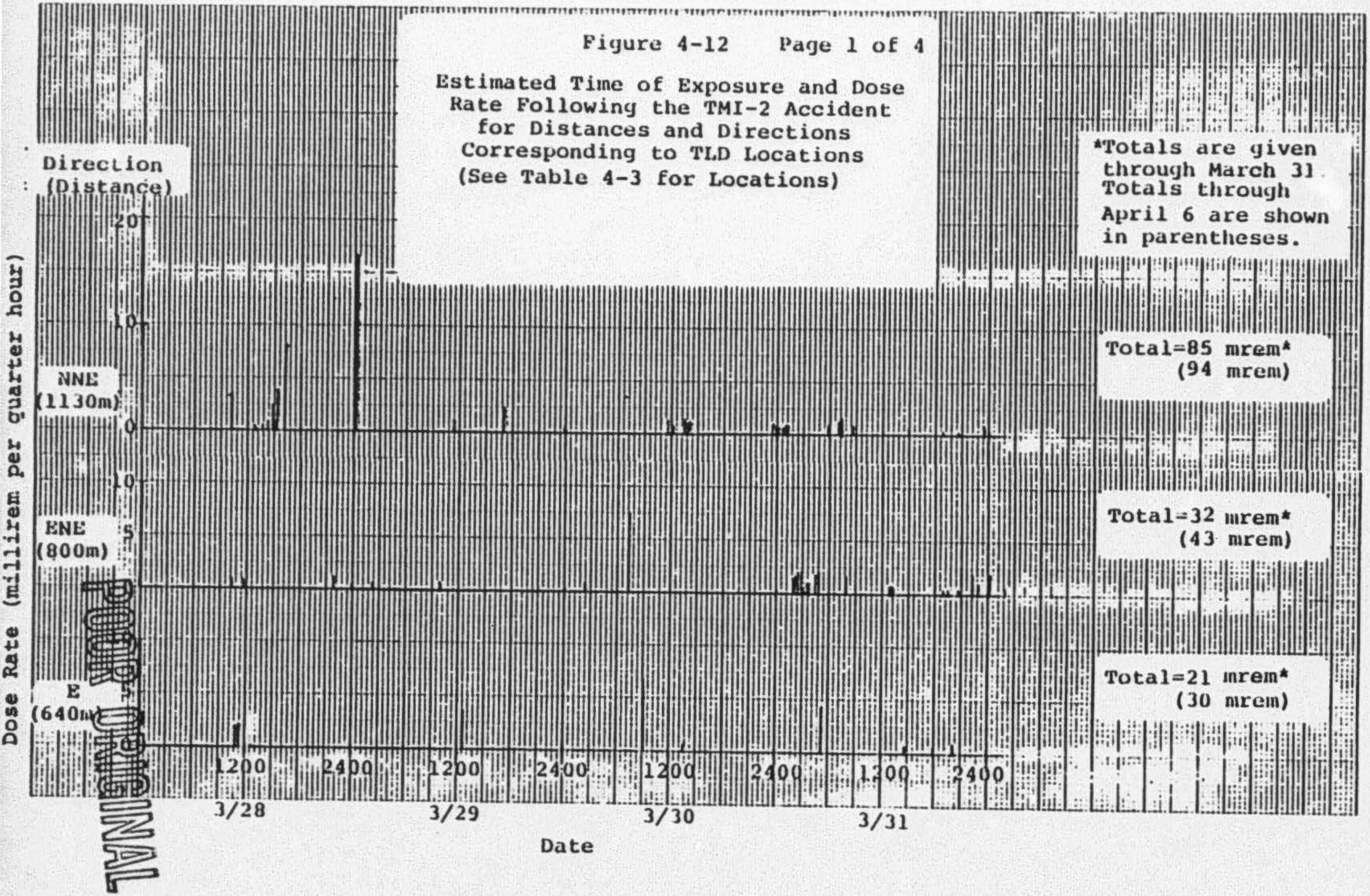


Figure 4-12 Page 1 of 4
Estimated Time of Exposure and Dose Rate Following the TMI-2 Accident for Distances and Directions Corresponding to TLD Locations (See Table 4-3 for Locations)
Direction (Distance)
Dose Rate (millirem per quarter hour)
20
10
0
10
5
NNE (1130m)
ENE (800m)
E (640m)
*Totals are given through March 31. Totals through April 6 are shown in parentheses.
Total=85 mrem* (94 mrem)
Total=32 mrem* (43 mrem)
Total=21 mrem* (30 mrem)
1200
2400
1200
2400
1200
2400
1200
2400
3/28
3/29
3/30
3/31
Date
POOR ORIGINAL

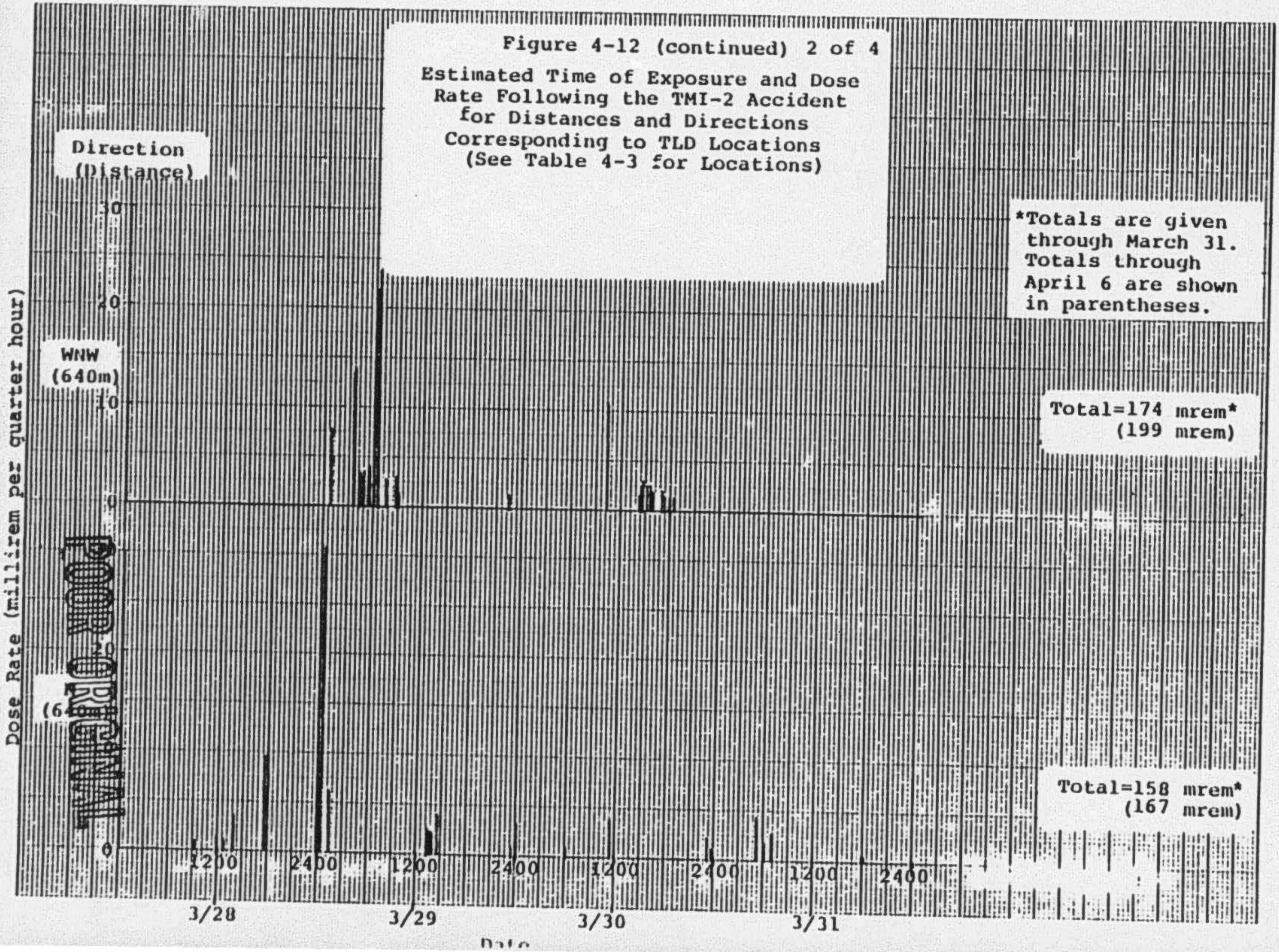


Figure 4-12 (continued) 2 of 4

Estimated Time of Exposure and Dose Rate Following the TMI-2 Accident for Distances and Directions Corresponding to TLD Locations (See Table 4-3 for Locations)

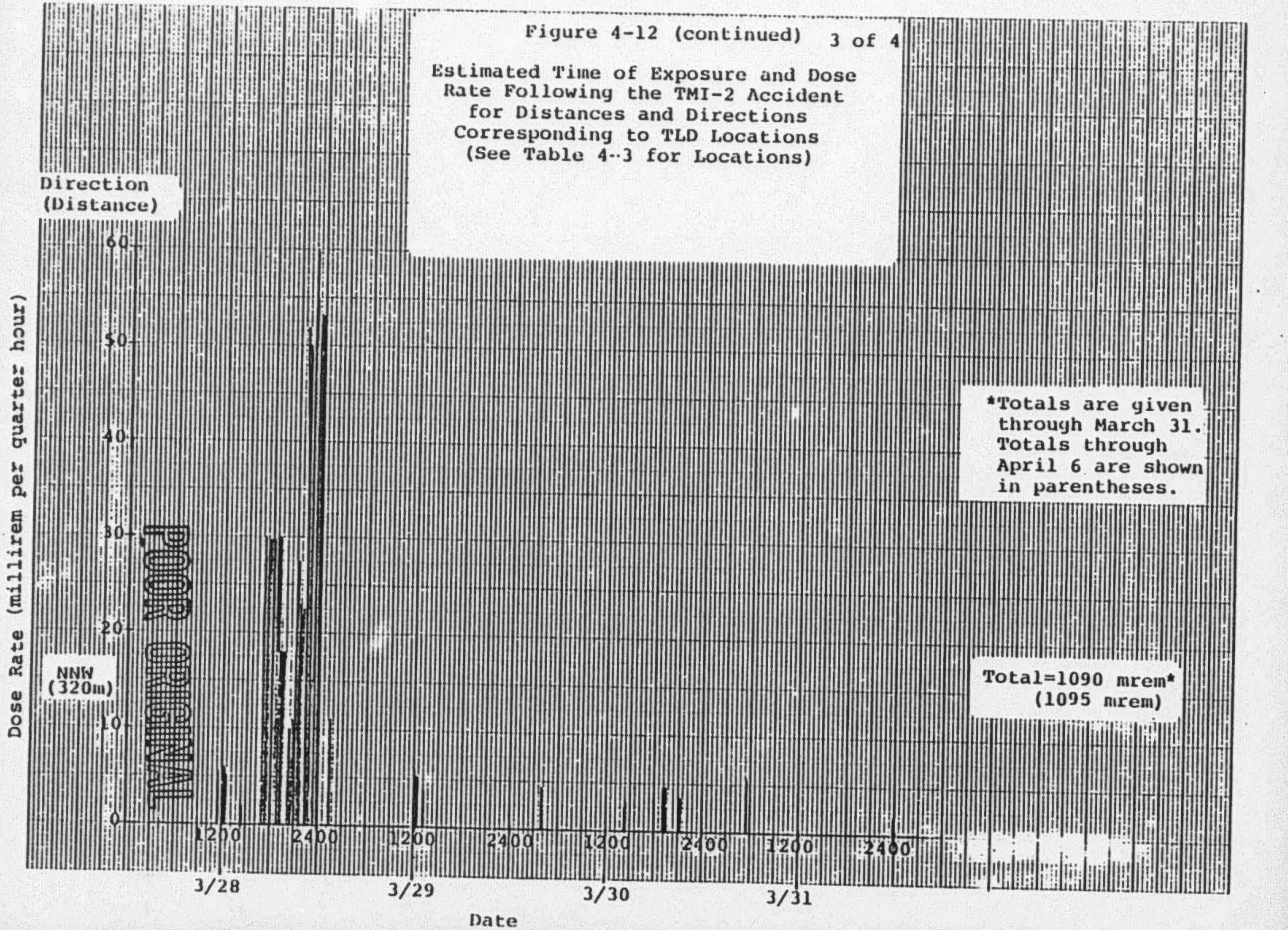


Figure 4-12 (continued) 3 of 4
Estimated Time of Exposure and Dose Rate Following the TMI-2 Accident for Distances and Directions Corresponding to TLD Locations (See Table 4-3 for Locations)
Direction (Distance)
NNW (320m)
Dose Rate (millirem per quarter hour)
60
50
40
30
20
10
0
1200
2400
1200
2400
1200
2400
1200
2400
3/28
3/29
3/30
3/31
Date
*Totals are given through March 31. Totals through April 6 are shown in parentheses.
Total=1090 mrem*
(1095 mrem)
POOR ORIGINAL

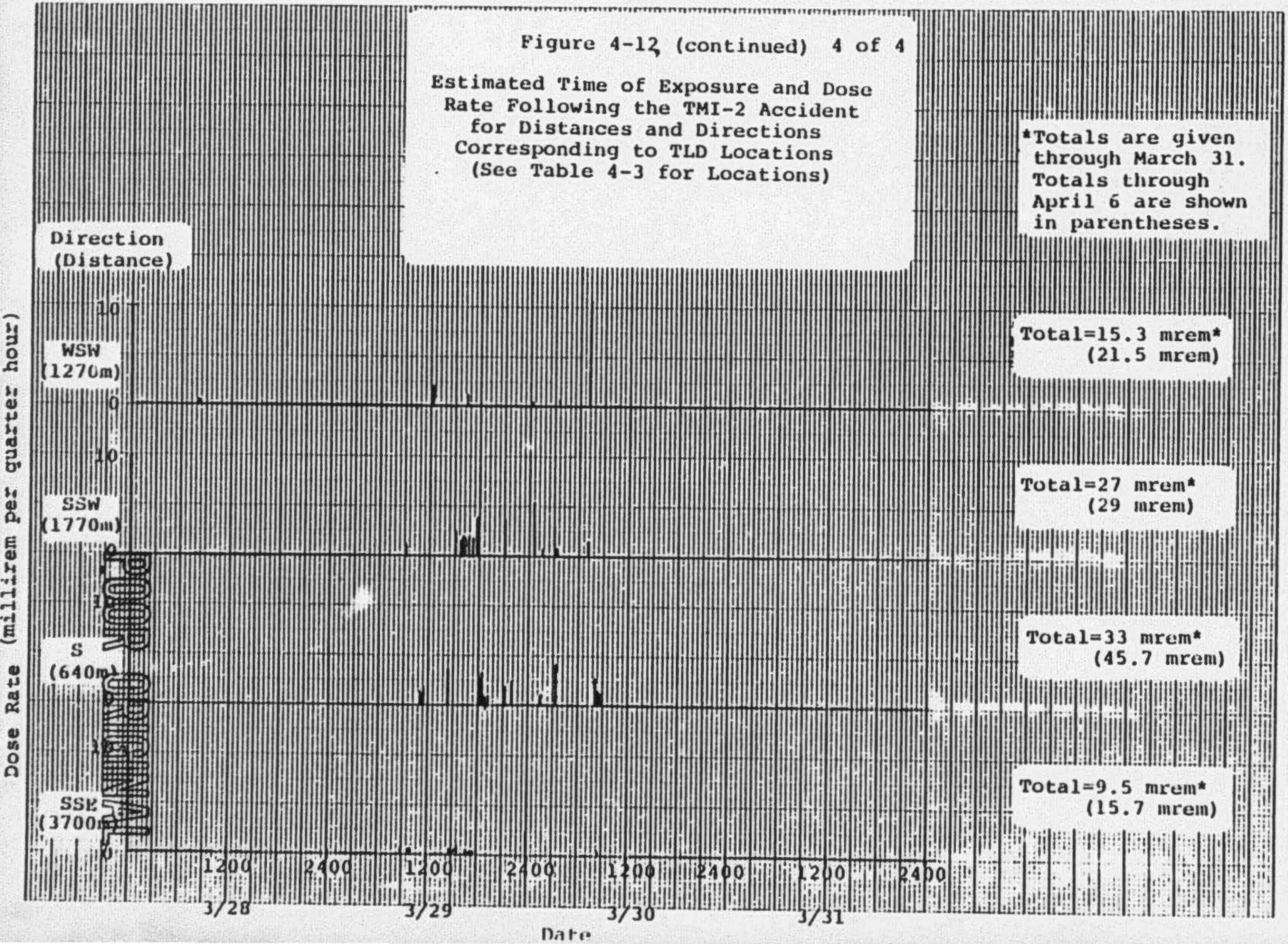


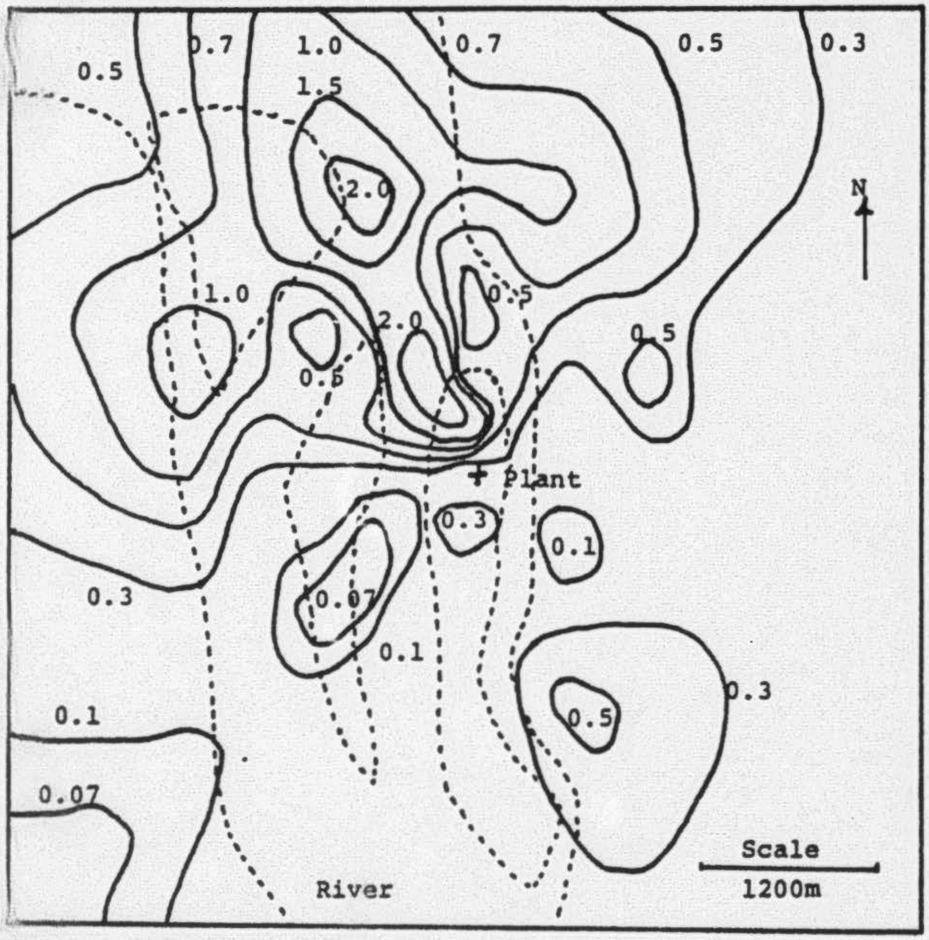
Figure 4-12 (continued) 4 of 4

Estimated Time of Exposure and Dose Rate Following the TMI-2 Accident for Distances and Directions Corresponding to TLD Locations (See Table 4-3 for Locations)

Figure 4-13

Estimated Fraction of Annual MPC for Noble Gases Released After the Accident

(Period of Record 3/28-4/6)**



**Dose is the total dose from all activity due to the accident which was released through April 6. This is more than 99% of all such activity released through April 30.

5.0 OFFSITE IODINE AND PARTICULATE RELEASES AND DOSES

5.1 Releases

During the period March 28, 1979 through April 30, 1979, about 14.1 curies of iodine-131 and 2.6 curies of iodine-133 were released to the atmosphere from the ventilation systems of Units 1 and 2. The small fraction of the iodine discharged from Unit 1 came from Unit 2, probably through the Fuel Handling Building shared by the two units. Preliminary evaluations of particulate radioisotopes in airborne effluents indicate that these isotopes are not a significant contributor to offsite doses.

These estimates are based on analyses of air samples from the ventilation systems. Air leaving the plant through the ventilation system is continously sampled for radioactive particles and iodine by drawing a small side stream through a filter which traps particulate isotopes and a treated charcoal cartridge which traps iodine. The filters and cartridges are changed periodically and are analyzed in the laboratory to determine radioactive isotope concentrations in the effluent air. After the accident started, iodine samples from Unit 2 vent samples (HPR-219) were collected and analyzed every other day. For the few short periods when continuous samples are not available from HPR-219, release rates have been estimated by interpolation from data taken before and after. These interpolations are supported by analyses of continuous air samples drawn from the several air streams which flow into the Unit 2 vent during these periods.

Table 5-1 shows the estimated average release of iodine versus time from the plant vent through April 30, 1979. For purposes of the dose calculations release rates given in detail in Appendix C, Tables 3 and 4, have been grouped in periods during which release rates were reasonably constant. The selected periods and release rates are shown in Table 5-1. These periods are typically about three days long. Shorter time periods are used during periods of rapidly changing release rates.

5.2 Environmental Measurements

In addition to sampling air in the plant ventilation exhausts, Metropolitan Edison routinely and continuously samples air for radioactive iodine and particulates at specified locations both on and offsite as a part of the Radiological Environmental Monitoring Program (REMP) described in Appendix D. This environmental monitoring program also includes sampling of vegetation and milk. The program was in effect at the time of the accident and has continued with a higher than normal sampling frequency since the accident. Appendix D is a tabulation of measured data and a brief discussion of the program. Results from this program indicate that iodine-131 was the only radioactive isotope or particulate isotope released in significant quantities. Iodine-131 was detected in air and milk samples, as discussed below, and was also detected in some grass samples.

5.3 Thyroid Dose Estimates

Of the particulate and iodine isotopes released, iodine-131 accounts for essentially all the offsite dose. This dose results from concentration of iodine in the thyroid gland if air containing iodine-131 is inhaled of if milk from cows which have eaten grass containing iodine-131 is ingested. Two methods were used to estimate doses. In cases where sufficiently sensitive measurements of iodine-131 concentrations in air or milk were available, they were used to calculate doses. Otherwise, measured release rates and meteorological data were used in the dispersion model described in Appendix B to calculate concentrations of iodine-131 in air and milk. The first method was used primarily for assessing maximum doses to individuals and the second method was used primarily for assessing aggregate doses to the population within fifty miles.

Where possible, both methods were used and results were compared to aid in determining that the limited number of sampling points reasonably reflected the maximum dose to an individual and to aid in assessing the accuracy of the results obtained using the mathematical model.

5.3.1 Thyroid Doses Based on Effluent Data and Dispersion Model

5.3.1.1 Inhalation Pathway

As a part of the calculation of offsite inhalation doses from iodine-131, estimates were made of the average iodine-131 concentration in air, at all offsite locations near the plant. Results on Figure 5-1 show the highest average concentration from March 28 through April 30 to be 6.6 pCi/m^3 about 2400 meters west of the plant. If an adult had occupied this location throughout the accident, the inhalation dose would have been about 7.3 mrem as shown in Figure 5-2. Because of differences in thyroid size and breathing rates, the dose to a child would have been slightly higher, about 9.8 mrem.

The population dose due to inhalation of iodine was estimated using the release rates and the hourly dispersion model to compute inhalation doses at each population grid location (see Figure B-1 and B-2 of Appendix B). These were then multiplied by the population in each sector and summed. The total population dose was estimated to be 180 person-rems to the population within fifty miles of the plant (about two million people).

Measurements of airborne iodine-131 concentrations near Three Mile Island are useful in assessing the uncertainties involved in estimating concentrations (and doses) using release rate and meteorological data with the dispersion model. An illustration of the magnitude of these uncertainties is given in Figure 5-3, which compares airborne iodine-131 measured concentrations versus calculated. Data in this figure are presented in Table 5-2.

Data in Figure 5-3 suggest that the calculated airborne iodine-131 concentration is likely to be within a factor of 4 of that measured. As shown in Figure 5-3, 14 of 23 comparisons were within this range and calculated values are more likely to be higher that those measured. The data in Figure 5-3 include all data collected in the REMP from March 28, 1979 through April 21, 1979, except for Station 8C1 during the period April 3 through April 12 when data were questionable.

Some caution should be used in interpreting the four points on Figure 5-3 with measured concentrations less than 0.05 pCi/m^3. These points represent stations at least 20,000 meters from the plant, and one or more of the three individual samples comprising the set used to determine a single point contained iodine-131 at levels lower than the lower limit of detection. In such cases, the concentration was assumed to be zero. Except for the four points under discussion, this assumption does not affect results. For these four points, however, actual concentrations may have been somewhat higher than this treatment of measurement results would indicate. A more accurate treatment would move these points horizontally somewhat closer to the line of agreement.

It should be expected that (the performance of) the atmospheric dispersion model is less accurate for calculating ground-level iodine-131 concentration than for calculating gamma doses (Section 4). The calculated gamma dose is a function of airborne radioactivity concentration integrated for significant spatial volumes around the receptor point whereas the ground level iodine concentration is calculated for a single point. Furthermore, calculated gamma dose does not depend as heavily on plume height as ground level concentration does. Thus, for any particular location, the gamma dose calculation is relatively less sensitive to uncertainties in the determination of plume height and the spatial distribution of concentration about the plume centerline.

5.3.1.2 Milk Pathway

Population doses from ingestion of milk produced within fifty miles were also estimated. These estimates were developed using detailed cow inventories out to 5 miles. Beyond 5 miles, county milk production rates were used to estimate cow populations assuming each cow produces 34 pounds of milk per day. Milk produciton rates within a 50-mile radius suggest a population of about 300,000 dairy cows. The population density in sectors to the ENE, E, ESE, and SE is about 75 cows per square mile which is approximately 2.5 times that in other sectors. There is evidence from cow population surveys within five miles that stored feed is an important fraction of the dairy cattle diet. Supporting evidence was found on page 2.1-4 of the TMI-2 FSAR which shows that in three counties near the plant only 5 to 10 percent of the land is used for pasture. At the grass yield (0.7 kg wet/m^2) specified for dose calculations in Regulatory Guide 1.109 (Rev. 1), pasture grass from 7.5 percent of the land within fifty miles of the plant could provide only twenty percent of the diet for 300,000 cows each consuming 50 kg per day. For these reasons and since warnings had been issued to keep cows in barns during the period following the accident, it has been assumed in making estimates of doses due to consumption of milk that pasture grass accounted for ten percent of the average cow's diet. All milk produced was assumed to be consumed in the form of fresh milk. Conversion to cheese and other processed forms would lead to reduction in doses due to decay of the iodine-131 during processing and storage.

The portion of iodine that was released in organic form does not deposit on grass. It was measured periodically in the exhaust vent and found to be at least 50 percent of the total on the average. This has been taken into account in making the thyroid dose estimates.

Iodine concentrations in milk were estimated using the atmospheric dispersion model previously described and iodine uptake models which are the basis for Regulatory Guide 1.109. Details of this calculation are shown in Table 5-3. The population dose was estimated by calculating the average iodine concentration in milk produced in each sector within 50 miles. The sectors and cow populations in each sector are shown in Figure B-1 and B-2 of Appendix B. Results were then multiplied by the amount of milk produced in the sector and added to determine the total population dose. Results of these calculations indicated the potential for population thyroid doses to be 1100 person-rems due to consumption of milk produced within fifty miles of the plant.

This estimate is likely to be higher than the true population dose. In a test of the model for three locations at which suitably sensitive analyses of iodine-131 in cow milk were available, doses calculated using the model with assumptions noted above were ten to fifty times those estimated from measured concentrations in milk. The estimates based on reliable measured concentrations are certainly more accurate because the model must simulate the process of dispersion in air, deposition on grass, and transport from grass to milk, each of which is subject to some analytical uncertainty.

As shown in Figure 5-4, the points at which milk samples were collected in the REMP are representative of those locations where highest concentrations of iodine-131 in milk would be expected, based on calculated iodine-131 concentrations in air. Because of this fact and because conservative results were obtained in the test described above, the model was deemed unsuitable for accurate assessment of maximum doses to individuals consuming milk.

However, this model is considered suitable for assessment of population doses even though it leads to substantial overestimates. Measured concentration of iodine-131 in the many milk samples collected within fifty miles of the plant are not useful for making a population dose assessment. Measurements of iodine-131 in milk collected by organizations other than Metropolitan Edison at distances beyond a few miles indicated no detectable concentrations for the most part. However, the sensitivities of these measurements are not sufficient to provide an accurate population dose estimate.

5.3.2 Thyroid Doses Based on Environmental Samples

The above dose estimates have been made independently of measured iodine concentrations in air and milk. Measurement results in Appendix D indicate peak iodine levels in goat milk to be less than 110 pCi/l, with an average from March 28 through April 30 at any one sample location of about 29 pCi/l. These figures apply to goat milk collected at location 1B1 (see Appendix D), about one mile north of the plant. The comparable values for cow milk are 21 pCi/l peak and 2.4 pCi/l average at location 7B3, 1.4 miles SE. If an infant had been consuming milk produced at these locations from March 28 through April 30, 1979, his dose is estimated to be 1.1 millirems from cow milk or 13 millirems from goat milk. However, as noted in Appendix E, the goat milk is not now being used for human consumption. Airborne sample results (Appendix D) indicate that the highest average airborne iodine concentration at any location from March 28 through April 30, 1979 was 3.3 pCi/m^3 which would result in an adult inhalation dose of 3.7 millirems and a child inhalation dose of 5.0 millirems. These values are slightly lower than the estimated adult inhalation thyroid dose of 7.3 millirems and child inhalation dose of 9.8 millirems based on effluent releases and weather data as discussed in section 5.3.1 above.

Table 5-1

Smoothed Iodine Release Rate Data
Used in Dose Assessments

Start Date (yr. mo. da. hr.)	I-131 Release Rate µCi/sec
79032804	4.2
79032819	22.7
79033022	2.7
79040106	9.7
79040303	2.3
79040319	7.0
79040519	0.43
79040615	3.7
79040706	6.9
79040803	12.7
79040909	0.46
79041016	1.3
79041119	2.2
79041323	4.1
79041410	6.6
79041505	8.6
79041508	14.0
79041518	6.0
79041616	11.0
79041624	3.0
79041716	5.5
79041804	7.5
79041808	2.0
79041914	5.5
79042022	1.5
79042213	2.5
79042304	1.0
79042312	3.8
79042316	1.5
79042406	0.80
79042516	0.50

Table 5-2
Calculated Versus Measured Concentrations
of Iodine-131 in Air (pCi/m^3)
(3/28/79-4/21/79)

Station	Distance	Direction	3/28-4/3 Calculated	3/28-4/3 Measured	4/3-4/12 Calculated	4/3-4/12 Measured	4/12-4/21 Calculated	4/12-4/21 Measured
9G1	21000	S	.98	.22	.09	.02	.12	.02
12B1	2600	WSW (close to W)	16.733	8.26	7.85	.58	3.66	.21
15G1	24000	NW	.42	.61	.12	0	.26	.02
1S2	640	N	2.43	8.00	1.29	.36	.22	.32
1C1	4200	N	3.42	3.81	.61	.16	1.23	.16
5A1	640	E	1.73	6.9	1.29	1.72	.83	2.89
7F1	14500	SE	.85	.17	.30	.11	.22	.21
8C1	3400	SSE	4.30	7.39	1.06	*	1.12	.23

* Measurements for each period are based on time-weighted averages of concentration measured as follows:

Data for 3/28-4/3 are based on samples 3/22-3/29, 3/29-3/31, 3/31-4/3 with 3/22-3/29 results adjusted to the period 3/28-3/29.

Data for 4/3-4/12 are based on samples 4/3-4/6, 4/6-4/9, and 4/9-4/12.

Data for 4/12-4/21 are absed on samples 4/12-4/15, 4/15-4/18, and 4/18-4/21.

Data for the period 4/3-4/12 at station 8C1 are not included because the data for 4/3-4/9 are questionable.

TABLE 5-3

Calculation of Population Dose From Milk Ingestion

$$D = f_p * f * \frac{1}{\lambda_{eff}} * \frac{1}{Y_v} * Q_f * F_m * Y_m * \frac{1}{U} * F_d * \exp(-\lambda_i t_f)$$

$$* \sum_{k}^{time} \sum_{j}^{space} N_j * Q_k * (D/Q)_{kj}$$

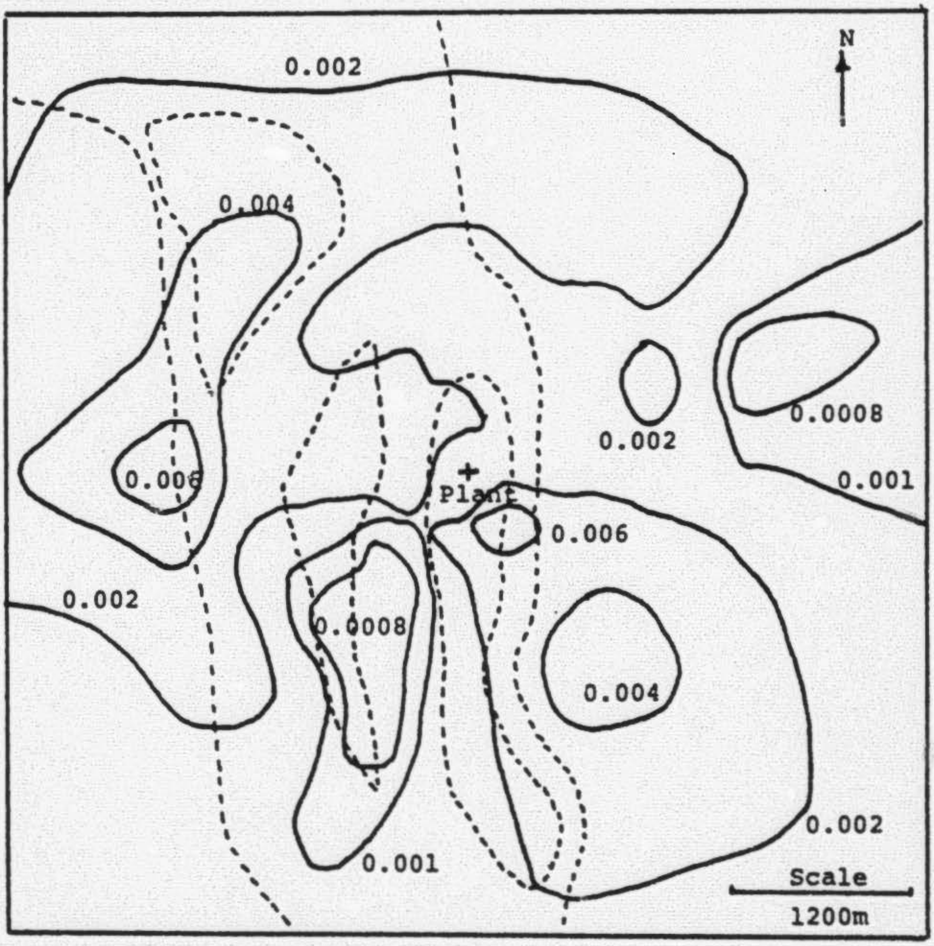
where

D	=	population dose (person-rem)
f_p	=	fraction of feed from pasture, 0.1 (see text)
f	=	fraction of organic iodine in iodine release, 0.5 (see text)
λ_{eff}	=	effective removal constant from vegetation, 49.5 yr^{-1}
Y_v	=	areal vegetation density, 0.7 kg (wet)/m^2
Q_f	=	rate of consumption of feed by cow, 50 kg (wet)/day
F_m	=	transfer factor from cow feed to cow milk, 0.006 day/liter
Y_m	=	milk yield for one cow, 5640 liters/year or 34 lb/day (from local agricultural statistics)
U	=	age weighted milk consumption rate, 137 liters/year-person
F_d	=	age and consumption weighted ingestion dose factor for iodine-131, 3.8 E+08 rem-liter/year-curie
λ_i	=	iodine-131 radioactive decay constant, 0.0861 day^{-1}
t_f	=	delay time between milk production and consumption, 2 days
N_j	=	number of cows in sector segment j (see Appendix B)
Q_k	=	iodine-131 release in time period k (see Section 5)
D/Q	=	deposition parameter (m^{-2}), (see Appendix B)

Unless specified otherwise above, values for all parameters are based on values in USNRC Regulatory Guide 1.109 (Rev. 1), October, 1977.

FIGURE 5-1

Estimated Fraction of Annual MPC (F_{MPC}) for Iodine-131 Starting at 0700 on 3/28/79 through 4/30/79 Within Two Miles of Three Mile Island[1]



(1) Concentrations are based on measured release rates and site meteorological data used with a straight-line dispersion model. MPC is 10CFR20, App. B, Table II, maximum permissible concentration for iodine-131 in air 1×10^{-10} μCi/cc. Concentration averaged over the period 3/28 - 4/30 is calculated as follows:

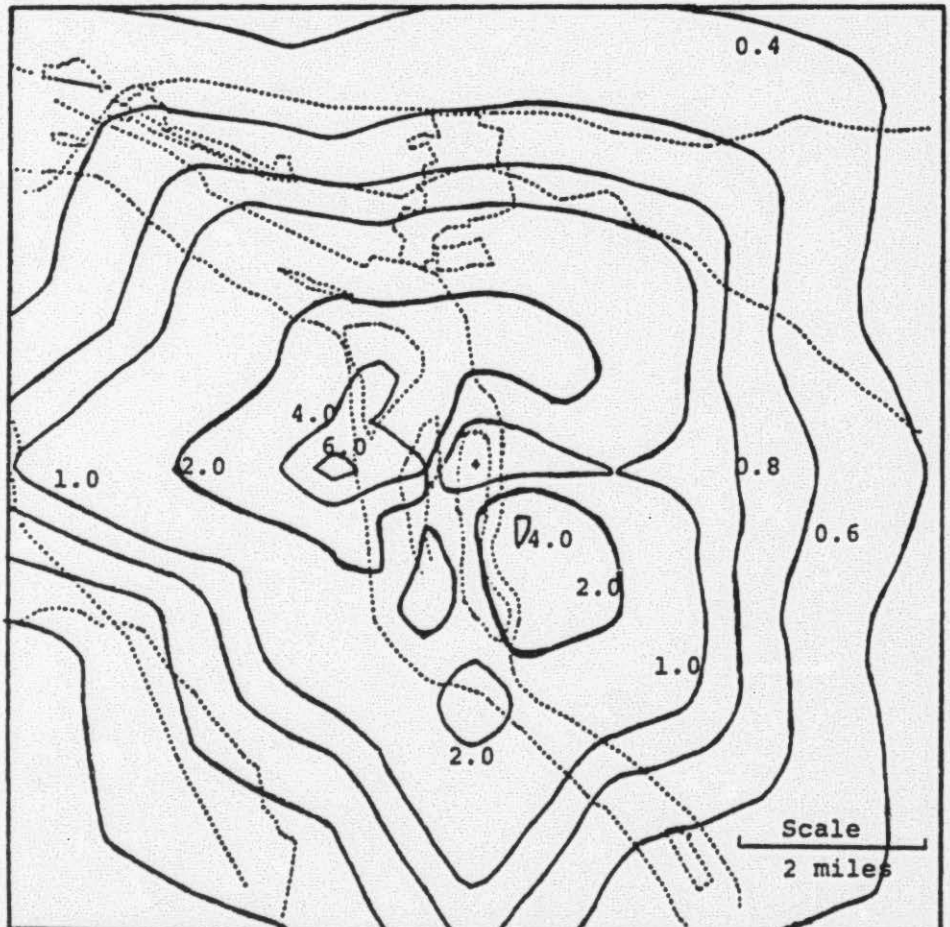
$$C = F_{MPC} * 1E\text{-}10 * 1E12 * 8760 * \frac{1}{808}$$

$$\frac{pCi}{m^3} \quad \frac{\mu Ci}{cc} \quad \frac{pCi\text{-}cc}{\mu Ci\text{-}m^3} \quad \frac{hr}{yr} \quad \frac{period}{hr}$$

$$C = F_{MPC} * 1100$$

Figure 5-2

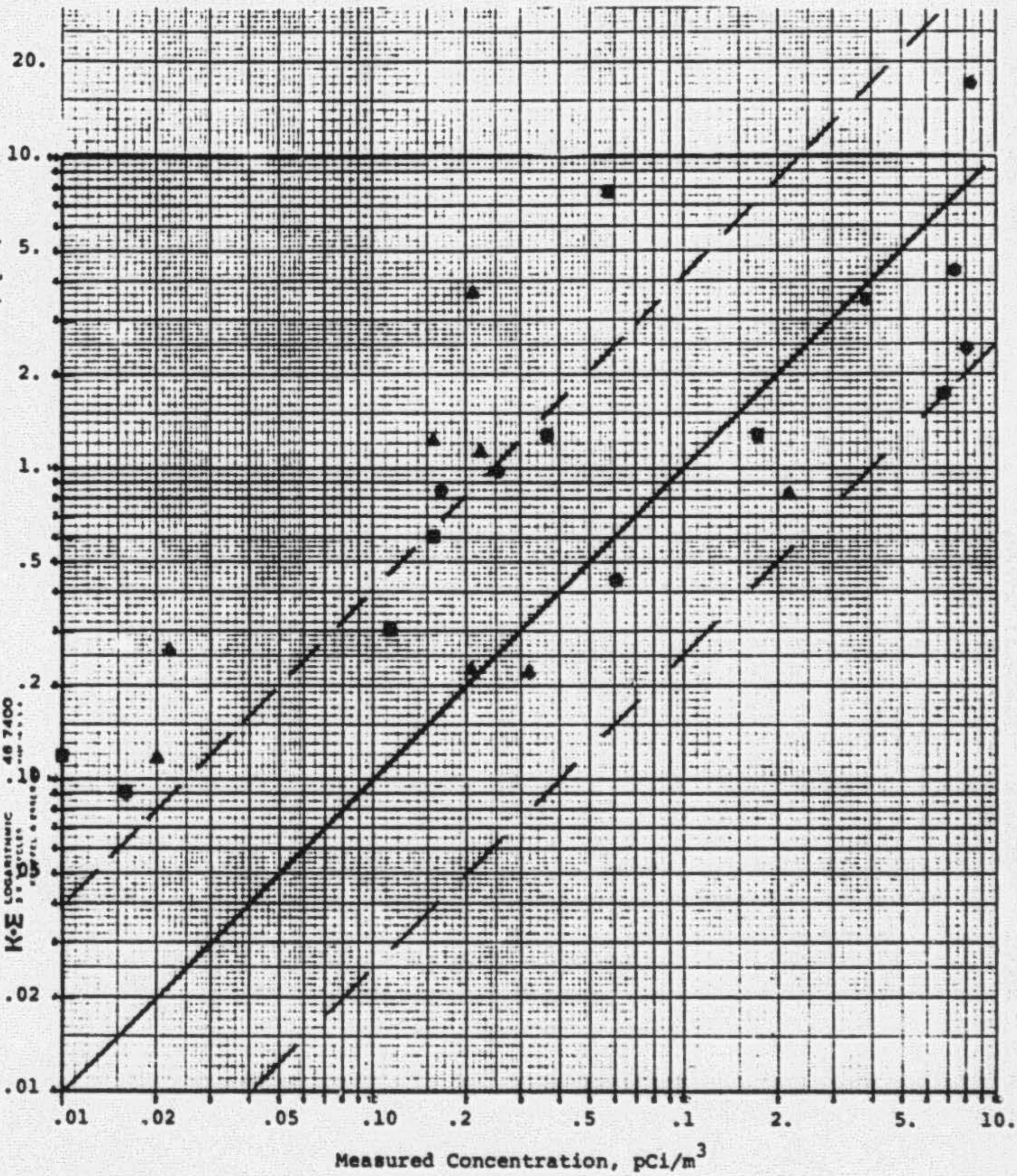
Estimated Adult Inhalation Thyroid Dose (millirem)
Within Five Miles of Three Mile Island[1]
From Iodine-131 Released at 0700 on 3/28/79 through 4/30/79



(1) Multiply by 1.5 to obtain dose to child thyroid
Multiply by 1.3 to obtain dose to infant and teen-age thyroid

FIGURE 5-3

Calculated Versus Measured Concentrations of Iodine-131 in Air at Three Mile Island Environmental Monitoring Stations



● 3/28-4/3
■ 4/3-4/12
▲ 4/12-4/21

Points within dashed lines agree within a factor of four.

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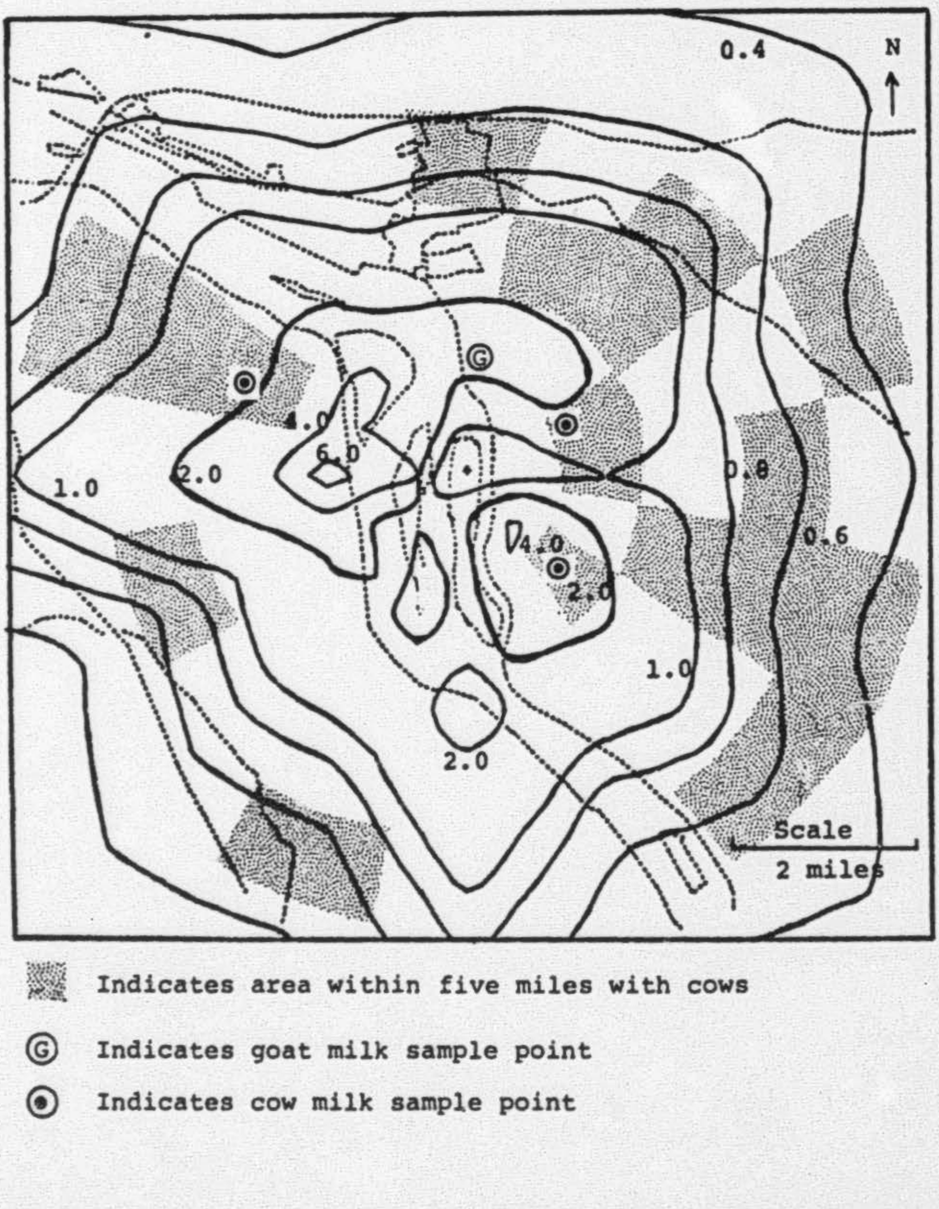
Figure 5-4

Cow Locations and REMP Milk Sample Points
Within a Five Mile Radius
With Isopleth of Concentration
of Iodine-131 in Air (pCi/m^3)
Averaged Over the Period 3/28/79-4/30/79



6.0 CONCLUSIONS

Records from in-plant radiation monitors, the onsite weather tower and radiation measurements outside the plant and offsite have been used to estimate the amount of radioactive materials released during the accident and the consequent radiation doses. A summary of the estimated doses is given in the table on page v.

From this information, it is concluded that the significant releases were about 0.24 Ci of Iodine-131 to the river (Section 3.0), and 10 million Ci of noble gases (Section 4.0) along with 14 Ci of Iodine-131 (Section 5.0) in air exhausted through the plant vent to atmosphere. The estimates of Iodine-131 releases are based on measurements of samples taken from liquids and gases just before release. The noble gas estimate was derived by comparing doses calculated using an atmospheric dispersion model with measured doses and adjusting the release rate so that calculated doses best matched those measured.

7.0 RECOMMENDATIONS

The quality and large quantity of data available for this report make it unlikely that new information will turn-up which substantially changes the dose assessments reported herein. But, if such information exists it is important to find it and assess the effect.

Consequently it is recommended that:

1. The systematic review of new information related to dose assessments should be continued to identify and evaluate any important effects it might have on the dose assessments in this report. This recommendation applies particularly to a large body of environmental data collected by governmental agencies in the early days following the accident. Only a part of this data was available for the preparation of this report. The recommendation also applies to any plant data which might enable better definition of isotope releases, particularly noble gas isotope releases.

An important part of the uncertainty in the calculation of doses from noble gases stems from the limited information available for characterizing noble gas releases from the accident. The second recommendation is aimed at improving capabilities for obtaining that kind of information in the future.

Consequently, it is recommended that:

2. An integrated review should be conducted of all radiation monitoring programs (including in-plant area monitoring, effluent measurements, and environmental measurements to evaluate the capability

2. (cont'd)

for determining the nature, the pathways, the fates, and the impacts of radioactive isotopes which might be released through plant pathways into the environment in normal and accident conditions. To be comprehensive, the review should also consider predictive capability. The report resulting from this review should identify modifications which would improve these capabilities and should include an assessment of limitations in these capabilities.

If, in the future, it becomes desirable to improve the accuracy and reduce the uncertainties in the dose assessments, the atmospheric dispersion models used could be improved. Experience in doing the dose assessments shows that the focus of such improvements would be better definition of the effects of wind direction change, better estimation of the effects of dilution in the wake of plant structures and better estimation of plume height. It is unlikely that work in this area would lead to substantial increases in the dose assessments provided in the body of this report. However, some decreases might result.

SECTION 8.0 APPENDICES

Appendix A - Three Mile Island Meteorological Program and Summary of Post Accident Data

Appendix B - Atmospheric Dispersion and Dose Assessment Models

Appendix C - Effluent Monitor Data

Appendix D - Emergency Radiological Environmental Monitoring Data

Appendix E - Interim Report on TMI Offsite Emergency Radiological Monitoring Program - Porter-Gertz Consultants, Inc.

Appendix F - Atmospheric Dispersion Estimates for TMI Unit-2 Vicinity of Plant Structures

Appendix G - Response of Teledyne Dosimeters to Xenon-133

APPENDIX A

THREE MILE ISLAND
METEOROLOGICAL PROGRAM

and

SUMMARY OF POST ACCIDENT DATA

1.0 INTRODUCTION

Meteorological parameters at Three Mile Island are monitored by redundant equipment on a 150ft tower located at the north end of the island. The meteorological program was updated in January 1976 to include a new tower and redundant instrumentation. The tower was in calibration and fully operational at the time of the accident. Table A-1 summarizes the equipment characteristics and tower configuration.

2.0 PROGRAM OPERATION

Meteorological data from each sensor are sampled every ten seconds by a Sperry-Univac mini-computer under control of software which enables remote access, provides calibration checks and prints system QC diagnostics. The 10-second values are then averaged over each 15-minute period, centered on each quarter hour (i.e., data for the on-the-hour sample are from 7-1/2 minutes before the hour to 7-1/2 minutes after the hour). The data are stored by the computer at the site for four hours, at which time data are transferred automatically to a disc file located at a central computer in a subcontractor's facility in Rockville, Maryland via telephone line. In the event of a communications problem or central computer problem, the site mini-computer can store data for up to three days. In addition, strip charts on site provide backup to the computerized system. Additional strip chart recorders for key parameters are located in the control room. Once a month, the data on the disc file are transferred to two tapes, an hourly tape and a tape containing each quarter hour of data.

3.0 SURVEILLANCE

The site meteorological data are checked daily by Pickard, Lowe and Garrick, Inc. personnel to assure quality. Other quality checks of the data such as the coincident plotting of redundant sensors for comparison and an evaluation of data recovery are done on a weekly basis. Any problems are referred to Metropolitan Edison's site maintenance personnel for correction.

4.0 MAINTENANCE AND CALIBRATION

The meteorological equipment are maintained by Metropolitan Edison personnel at the site according to procedures outlined in the plant QA program. The meteorological tower has been calibrated semi-annually by an independent subcontractor according to a time table specified in Section 4.3.3.4 of the TMI Unit 2 Technical Specifications. The last calibration prior to the accident was performed by D. Conning of Technical Environmental Enterprises (TEE) on September 1-3, 1978. A post-accident calibration by the same subcontractor on June 4-6, 1979 showed no significant calibration problems, thus, it is concluded that the tower was in calibration following the accident.

5.0 SUMMARY OF DATA FOLLOWING THE ACCIDENT

Table A-2 is a joint frequency table of wind speed and direction from 100ft versus delta temperature measured between 150ft and 33ft for the period from the beginning of the accident through the month of April 1979. Figure A-1 is a wind rose from the 100ft level on the TMI meteorological tower for the same period as the joint frequency tables. Table A-3 is a complete compilation of all hourly meteorological data collected following the accident through April 30, 1979. Values for X/Q for the ground centerline, ground average, depletion and deposition cases at a distance of 600m (the minimum site boundary) based on the hourly meteorological data are included in this table. These calculations are made for a ground level release in the building wake (containment size only) without taking any "meander factor" into account as recently suggested in NRC's draft Regulatory Guide 1.XXX titled "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants".

Table A-1

TMI Site Weather Instruments

Approximate Height Above Tower Base (ft)	Sensed Parameters	Recorded Parameters	Recorders** Analog	Recorders** Digital	Instrument Description
100A 100B	Wind speed & direction Wind speed & direction	Wind speed & direction Wind speed & direction	Esterline Angus Model L1112S servo type two channel strip chart recorder for each level. Accuracy 0.1% of full scale. Eleven inch chart width.	Varian-V71 mini-computer with automatic transmittal via phone line to disc storage.	Wind speed is Teledyne Model 50.1. Anemometers are three cup with a threshold of 0.(- mph and a distance constant of 5 ft. Accuracy is 0.15 mph or 1%, whichever is greater. Direction is measured using Teledyne 50.2. Quick-2 vanes are used with threshold of 0.(- mph, a distance constant of 3.7 ft, and damping ratio of 0.4 at initial attack angle of 10°. Direction accuracy is ±2°.
150A 150B 33A 33B	Temperature Temperature Temperature-reference for comparison with other level. Temperature-reference for comparison with other level.	ΔT 150-33A ft ΔT 150-33B ft Ambient temperature 33 ft Ambient temperture 33 ft	Westronics Model M11D2. Twelve channel Selectronic potentiometric dot printing recorder. Accuracy better than 0.3% of full scale.	Same as above	Dual Rosemont platinum 4 wire RTDs Model 104 MP (calibration traceable to NBS), with 414 L linear triple bridges. Accuracy (RSS for system) is 0.17F.
Ground level	Rainfall	Rainfall		Same as above	Belfort Model 5915 weighing rain gauge. Accuracy 1.2% of full scale.
150A 150B 150A 150B	Dew point temperature Dew point temperature Ambient temperature Ambient temperature	Dew point temperature Dew point temperature Ambient temperature Ambient temperature $T_{Amb\ 340} - T_{DP\ 340}$ $T_{Amb\ 33} - T_{DP\ 33}$	Same as above	Same as above	EG&G Model 110 SM-thermoelectric dew point system. Accuracy ±.5F.

** All parameters are continuously recorded.

Table A-2
Three Mile Island
Joint Frequency Tables of Wind Speed and Direction from 100 ft
Versus Delta Temperature 150-33 ft
3/28/79-4/30/79

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .LE. -1.0 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	1	4	0	0	0	0	0	5	9.4	4.5
NNE	0	1	0	0	0	0	0	0	1	1.9	1.3
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	1	1	0	0	0	0	0	2	3.8	4.2
S	0	2	3	0	0	0	0	0	5	9.4	4.4
SSW	0	0	1	3	0	0	0	0	4	7.5	8.9
SW	0	0	3	2	0	0	0	0	5	9.4	7.4
WSW	0	0	4	0	0	0	0	0	4	7.5	4.0
W	0	2	1	1	0	0	0	0	4	7.5	5.3
WNW	0	0	3	0	0	0	0	0	3	5.7	5.0
NW	0	2	4	2	1	0	0	0	9	17.0	7.0
NNW	0	1	7	2	1	0	0	0	11	20.8	6.1
TOTAL	0	10	31	10	2	0	0	0	53	100.0	
%	0.0	18.9	58.5	18.9	3.8	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 5.8 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 5

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. -1.0 BUT .LE. -.9 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	2	0	0	0	1	0	0	3	33.3	8.8
NNE	0	1	0	0	0	0	0	0	1	11.1	1.9
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	0	0	0	0	0	0	0	0	0.0	0.0
SSE	0	1	0	0	0	0	0	0	1	11.1	3.1
S	0	0	0	0	0	0	0	0	0	0.0	0.0
SSW	0	0	0	0	0	0	0	0	0	0.0	0.0
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	1	0	0	0	0	0	0	1	11.1	2.8
W	0	0	0	0	0	0	0	0	0	0.0	0.0
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	2	0	0	0	0	2	22.2	11.7
NNW	0	1	0	0	0	0	0	0	1	11.1	2.7
TOTAL	0	6	0	2	0	1	0	0	9	100.0	
%	0.0	66.7	0.0	22.2	0.0	11.1	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 6.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 4

POOR ORIGINAL

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. -.9 BUT .LE. -.8 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	0	0	0	0	0	0	0	0	0.0	0.0
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	0	0	0	0	0	0	0	0	0.0	0.0
ENE	0	0	0	0	0	0	0	0	0	0.0	0.0
E	0	0	0	0	0	0	0	0	0	0.0	0.0
ESE	0	0	0	0	0	0	0	0	0	0.0	0.0
SE	0	1	0	0	0	0	0	0	1	8.3	3.3
SSE	0	1	1	0	0	0	0	0	2	16.7	4.5
S	0	0	1	0	1	0	0	0	2	16.7	9.7
SSW	0	0	1	0	0	0	0	0	1	8.3	6.3
SW	0	0	0	0	0	0	0	0	0	0.0	0.0
WSW	0	1	0	0	0	0	0	0	1	8.3	1.9
W	0	0	0	1	0	2	0	0	3	25.0	17.8
WNW	0	0	0	0	0	0	0	0	0	0.0	0.0
NW	0	0	0	0	0	0	0	0	0	0.0	0.0
NNW	0	0	1	0	1	0	0	0	2	16.7	10.1
TOTAL	0	3	4	1	2	2	0	0	12	100.0	
%	0.0	25.0	33.3	8.3	16.7	16.7	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 9.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 3

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. -.8 BUT .LE. -.3 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	4	2	0	0	0	0	0	6	3.9	3.8
NNE	0	0	0	0	0	0	0	0	0	0.0	0.0
NE	0	1	2	0	0	0	0	0	3	2.0	3.7
ENE	0	0	2	0	0	0	0	0	2	1.3	6.3
E	0	3	2	2	0	0	0	0	7	4.6	6.1
ESE	0	2	5	4	2	0	0	0	13	8.5	8.8
SE	0	2	5	1	1	0	0	0	9	5.9	6.5
SSE	0	3	5	2	3	0	0	0	13	8.5	7.8
S	0	1	7	1	1	0	0	0	10	6.5	6.4
SSW	0	1	0	2	0	0	0	0	3	2.0	8.0
SW	0	2	2	1	0	0	0	0	5	3.3	6.3
WSW	0	1	2	0	0	0	0	0	3	2.0	6.1
W	0	0	0	3	1	3	1	0	8	5.2	17.3
WNW	0	2	0	0	10	2	3	0	17	11.1	17.8
NW	0	1	2	3	17	10	1	0	34	22.2	18.0
NNW	0	2	8	4	6	0	0	0	20	13.1	8.8
TOTAL	0	25	44	23	41	15	5	0	153	100.0	
%	0.0	16.3	28.8	15.0	26.8	9.8	3.3	0.0	100.0		

AVE SPEED FOR THIS TABLE= 10.6 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 17

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. -.3 BUT .LE. .8 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	9	13	3	3	0	0	0	28	6.7	6.8
NNE	0	4	7	6	0	0	0	0	17	4.0	6.1
NE	0	2	8	1	0	0	0	0	11	2.6	5.3
ENE	0	7	10	0	0	0	0	0	17	4.0	4.1
E	0	6	23	5	2	0	0	0	36	8.6	6.6
ESE	0	4	19	17	9	0	0	0	49	11.6	8.5
SE	0	7	12	6	5	0	0	0	30	7.1	7.1
SSE	0	4	6	13	1	0	0	0	24	5.7	7.5
S	0	2	8	3	0	0	0	0	13	3.1	5.9
SSW	0	0	11	4	2	0	0	0	17	4.0	7.7
SW	0	1	1	0	1	0	0	0	3	.7	7.3
WSW	0	4	5	1	1	0	0	0	11	2.6	5.7
W	0	2	6	2	1	0	0	0	11	2.6	7.3
WNW	0	1	11	29	11	3	0	0	55	13.1	10.7
NW	0	2	8	27	17	7	2	0	63	15.0	12.5
NNW	0	2	12	13	8	1	0	0	36	8.6	9.6
TOTAL	0	57	160	130	61	11	2	0	421	100.0	
%	0.0	13.5	38.0	30.9	14.5	2.6	.5	0.0	100.0		

AVE SPEED FOR THIS TABLE= 8.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 30

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. .8 BUT .LE. 2.2 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	3	2	0	1	0	0	0	6	6.7	5.8
NNE	0	3	2	0	0	0	0	0	5	5.6	4.8
NE	0	2	3	0	0	0	0	0	5	5.6	3.3
ENE	0	2	2	0	0	0	0	0	4	4.5	4.0
E	0	1	1	0	0	0	0	0	2	2.2	3.9
ESE	0	0	2	1	0	0	0	0	3	3.4	6.0
SE	0	4	9	0	0	0	0	0	13	14.6	4.3
SSE	0	1	2	0	0	0	0	0	3	3.4	3.7
S	0	1	1	0	0	0	0	0	2	2.2	5.1
SSW	0	4	3	1	1	0	0	0	9	10.1	5.3
SW	0	6	2	0	0	0	0	0	8	9.0	3.7
WSW	0	5	2	0	0	0	0	0	7	7.9	3.3
W	0	2	2	0	0	0	0	0	4	4.5	3.3
WNW	0	0	0	1	0	0	0	0	1	1.1	9.0
NW	0	1	3	2	0	0	0	0	6	6.7	7.0
NNW	0	2	7	2	0	0	0	0	11	12.4	5.3
TOTAL	0	37	43	7	2	0	0	0	89	100.0	
%	0.0	41.6	48.3	7.9	2.2	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 4.4 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 15

POOR ORIGINAL

JOINT FREQUENCY TABLES
TEMPERATURE DIFFERENCE .GT. 8.2 DEG.F/100 FT

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	2	0	1	0	0	0	0	3	4.2	5.3
NNE	0	2	0	0	0	0	0	0	2	2.8	2.9
NE	0	4	0	0	0	0	0	0	4	5.6	1.8
ENE	0	1	1	0	0	0	0	0	2	2.8	3.8
E	0	4	1	0	0	0	0	0	5	7.0	2.8
ESE	0	8	2	0	0	0	0	0	10	14.1	2.8
SE	0	4	1	0	0	0	0	0	5	7.0	3.0
SSE	0	3	1	0	0	0	0	0	4	5.6	3.0
S	0	5	0	0	0	0	0	0	5	7.0	2.3
SSW	0	3	3	0	0	0	0	0	6	8.5	3.1
SW	0	4	1	0	0	0	0	0	5	7.0	2.7
WSW	0	3	1	0	0	0	0	0	4	5.6	2.0
W	0	5	0	0	0	0	0	0	5	7.0	1.8
WNW	0	1	0	0	0	0	0	0	1	1.4	1.0
NW	0	3	3	0	0	0	0	0	6	8.5	3.8
NNW	0	1	2	0	1	0	0	0	4	5.6	6.8
TOTAL	0	53	16	1	1	0	0	0	71	100.0	
%	0.0	74.6	22.5	1.4	1.4	0.0	0.0	0.0	100.0		

AVE SPEED FOR THIS TABLE= 3.0 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 18

JOINT FREQUENCY TABLES (totals)

SPEED (MPH)

DIR	CALM	CALM+ - 3.5	3.6 - 7.5	7.6 -12.5	12.6 -18.5	18.6 -24.5	24.6 -32.5	32.6+	TOTAL	%	AVE SPEED
N	0	21	21	4	4	1	0	0	51	6.3	5.7
NNE	0	11	9	8	0	0	0	0	28	3.2	5.1
NE	0	9	13	1	0	0	0	0	23	2.8	4.1
ENE	0	10	15	0	0	0	0	0	25	3.1	4.1
E	0	14	27	7	2	0	0	0	50	6.2	5.8
ESE	0	14	28	22	11	0	0	0	75	9.3	7.8
SE	0	18	27	7	6	0	0	0	58	7.2	5.9
SSE	0	14	18	15	4	0	0	0	49	6.1	6.8
S	0	11	20	4	2	0	0	0	37	4.6	6.3
SSW	0	8	19	10	3	0	0	0	40	5.0	6.8
SW	0	12	9	3	1	0	0	0	28	3.8	4.8
WSW	0	15	14	1	1	0	0	0	31	3.8	4.8
W	0	11	9	7	2	5	1	0	35	4.3	6.9
WNW	0	4	14	20	21	5	3	0	77	9.5	11.7
NW	0	9	20	38	36	17	3	0	120	14.8	13.4
NNW	0	9	37	21	17	1	0	0	85	10.5	8.2
TOTAL	0	191	298	174	109	28	7	0	908	100.0	
%	0.0	23.8	36.9	21.5	13.5	3.6	.9	0.0	100.0		

AVE SPEED FOR THIS TABLE= 7.7 MPH
HOURS IN ABOVE TABLE WITH VARIABLE DIRECTION= 90

POOR ORIGINAL

Legend for Meteorological Data Printouts
Included in Table A-3 Which Follows

Table A-3 consists of 34 pages summarizing the hourly meteorological data collected from March 28, 1979 through April 30, 1979. Twenty-four hours of data are included on each page. The following guide describes data on each page.

Column 1 HR - Hour of the day (1-24). All data that follows will be for a 15-minute average centered on the hour.

Column 2 R - Release Point - Number 1 will always be used (for a ground level release).

Column 3 SPD - Wind Speed from 100 ft in mph x 10, i.e.: 53 = 5.3 mph.

Column 4 S - Status Code. 0 = good data; 2 = bad data; 4 = calm wind speed.

Column 5 DIR - Average wind direction at 100ft (indicates wind from one of 16 sectors)

Column 6 S - Status Code. 0 = good data; 2 = bad data; 3 = unsteady direction; 5 = flat direction.

Column 7 PG - Pasquill-Gifford Stability Category (A-G).

Column 8 DT - Delta Temperature 150-33 ft in ^{o}F x 10 (-17 = -1.7^{o}F).

Column 9 S - Status Code. 0 = good data; 2 = bad data.

Column 10 XQGCL - X/Q ground centerline case (sec/m^3).

Column 11 XQGAV - X/Q ground average case (sec/m^3).

Column 12 DPLETN - Depleted X/Q (sec/m^3).

Column 13 DEPOSN - Deposition,D/Q (m^{-2}).

Column 14 DSB - Distance at which values are calculated in meters.

Table A-3

X/Q HOURLY DATA----FOR MAR 28, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
4	1	53	0	N	0	E	1	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
5	1	56	0	NE	0	E	6	0	1.57E-04	5.29E-05	4.91E-05	3.17E-07	600
6	1	47	0	E	0	E	5	0	1.87E-04	6.30E-05	5.85E-05	3.17E-07	600
7	1	25	0	E	3	E	-3	0	3.51E-04	1.18E-04	1.10E-04	3.17E-07	600
8	1	61	0	ENE	0	D	-6	0	8.90E-05	3.81E-05	3.54E-05	3.17E-07	600
9	1	29	0	SSE	3	C	-10	0	8.03E-05	5.56E-05	5.16E-05	3.17E-07	600
10	1	43	0	WSW	0	A	-17	0	6.32E-06	8.65E-06	8.03E-06	3.17E-07	600
11	1	34	0	W	0	A	-21	0	7.99E-06	1.09E-05	1.02E-05	3.17E-07	600
12	1	47	0	S	0	A	-13	0	5.78E-06	7.91E-06	7.35E-06	3.17E-07	600
13	1	57	0	S	0	A	-12	0	4.77E-06	6.53E-06	6.06E-06	3.17E-07	600
14	1	83	0	SSW	0	A	-15	0	3.27E-06	4.48E-06	4.16E-06	3.17E-07	600
15	1	121	0	SSW	0	A	-14	0	2.24E-06	3.07E-06	2.86E-06	3.17E-07	600
16	1	101	0	SSW	0	D	-7	0	5.37E-05	2.30E-05	2.14E-05	3.17E-07	600
17	1	93	0	SSE	0	D	-4	0	5.84E-05	2.50E-05	2.32E-05	3.17E-07	600
18	1	88	0	SSE	0	E	-2	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
19	1	101	0	SSE	0	E	-1	0	8.68E-05	2.93E-05	2.72E-05	3.17E-07	600
20	1	77	0	SSE	0	E	2	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
21	1	71	0	SSE	0	E	1	0	1.24E-04	4.17E-05	3.87E-05	3.17E-07	600
22	1	90	0	SSE	0	E	1	0	9.74E-05	3.29E-05	3.06E-05	3.17E-07	600
23	1	93	0	SSE	0	E	-1	0	9.43E-05	3.18E-05	2.96E-05	3.17E-07	600
24	1	84	0	SSE	0	E	-2	0	1.04E-04	3.52E-05	3.27E-05	3.17E-07	600

RETURN TO CONTINUE, S TO STOP

X/Q HOURLY DATA----FOR MAR 29, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	61	0	S	0	E	1	0	1.44E-04	4.85E-05	4.51E-05	3.17E-07	600
2	1	42	0	SE	0	E	0	0	2.09E-04	7.05E-05	6.55E-05	3.17E-07	600
3	1	44	0	SE	0	E	-1	0	1.99E-04	6.73E-05	6.25E-05	3.17E-07	600
4	1	60	0	ESE	0	E	-2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
5	1	67	0	ESE	0	E	-2	0	1.31E-04	4.42E-05	4.10E-05	3.17E-07	600
6	1	54	0	ESE	0	E	0	0	1.62E-04	5.48E-05	5.09E-05	3.17E-07	600
7	1	29	0	E	0	E	-1	0	3.02E-04	1.02E-04	9.48E-05	3.17E-07	600
8	1	29	0	E	0	D	-4	0	1.87E-04	8.02E-05	7.45E-05	3.17E-07	600
9	1	28	0	ESE	3	D	-7	0	1.94E-04	8.31E-05	7.72E-05	3.17E-07	600
10	1	25	0	NE	3	D	-7	0	2.17E-04	9.31E-05	8.64E-05	3.17E-07	600
11	1	22	0	N	3	E	-1	0	3.99E-04	1.35E-04	1.25E-04	3.17E-07	600
12	1	31	0	SSE	0	B	-11	0	3.38E-05	3.35E-05	3.11E-05	3.17E-07	600
13	1	50	0	SSE	0	D	-7	0	1.09E-04	4.65E-05	4.32E-05	3.17E-07	600
14	1	41	0	S	0	D	-9	0	1.32E-04	5.68E-05	5.27E-05	3.17E-07	600
15	1	94	0	NNW	0	E	5	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
16	1	53	0	ENE	0	E	0	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
17	1	51	0	NNE	0	E	9	0	1.72E-04	5.80E-05	5.39E-05	3.17E-07	600
18	1	35	0	NNE	0	F	20	0	3.78E-04	1.34E-04	1.24E-04	3.17E-07	600
19	1	52	0	N	0	F	20	0	2.54E-04	9.02E-05	8.37E-05	3.17E-07	600
20	1	62	0	NNW	0	F	20	0	2.13E-04	7.56E-05	7.02E-05	3.17E-07	600
21	1	129	0	NNW	0	G	33	0	1.77E-04	5.72E-05	5.31E-05	3.17E-07	600
22	1	16	0	N	3	F	11	0	8.27E-04	2.93E-04	2.72E-04	3.17E-07	600
23	1	21	0	E	3	F	21	0	6.30E-04	2.23E-04	2.07E-04	3.17E-07	600
24	1	31	0	S	0	G	38	0	7.35E-04	2.38E-04	2.21E-04	3.17E-07	600

RETURN TO CONTINUE, S TO STOP

X/O HOURLY DATA----FOR MAR 30, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	29	0	NE	3	G	41	0	7.86E-04	2.55E-04	2.36E-04	3.17E-07	600
2	1	46	0	NNW	0	F	25	0	2.88E-04	1.02E-04	9.47E-05	3.17E-07	600
3	1	26	0	NW	0	G	27	0	8.76E-04	2.84E-04	2.64E-04	3.17E-07	600
4	1	35	0	NNE	0	G	32	0	6.51E-04	2.11E-04	1.96E-04	3.17E-07	600
5	1	26	0	E	3	G	29	0	8.76E-04	2.84E-04	2.64E-04	3.17E-07	600
6	1	21	0	SW	0	G	26	0	1.08E-03	3.51E-04	3.26E-04	3.17E-07	600
7	1	22	0	SSW	0	F	17	0	6.01E-04	2.13E-04	1.98E-04	3.17E-07	600
8	1	18	0	N	3	F	15	0	7.35E-04	2.60E-04	2.42E-04	3.17E-07	600
9	1	71	0	NNW	0	E	9	0	1.24E-04	4.17E-05	3.87E-05	3.17E-07	600
10	1	16	0	WNW	0	D	-5	0	3.39E-04	1.45E-04	1.35E-04	3.17E-07	600
11	1	14	0	E	3	D	-4	0	3.88E-04	1.66E-04	1.54E-04	3.17E-07	600
12	1	26	0	SW	3	D	-9	0	2.09E-04	8.95E-05	8.31E-05	3.17E-07	600
13	1	23	0	SE	3	C	-10	0	1.01E-04	7.01E-05	6.51E-05	3.17E-07	600
14	1	29	0	SSW	3	D	-8	0	1.87E-04	8.02E-05	7.45E-05	3.17E-07	600
15	1	48	0	ESE	0	D	-7	0	1.13E-04	4.85E-05	4.50E-05	3.17E-07	600
16	1	45	0	E	0	E	-1	0	1.95E-04	6.58E-05	6.11E-05	3.17E-07	600
17	1	39	0	SE	0	F	18	0	3.39E-04	1.20E-04	1.12E-04	3.17E-07	600
18	1	82	0	ESE	0	F	10	0	1.61E-04	5.72E-05	5.31E-05	3.17E-07	600
19	1	87	0	SE	0	E	7	0	1.01E-04	3.40E-05	3.16E-05	3.17E-07	600
20	1	55	0	SSE	0	F	14	0	2.41E-04	8.52E-05	7.92E-05	3.17E-07	600
21	1	69	0	SE	0	F	23	0	1.92E-04	6.79E-05	6.31E-05	3.17E-07	600
22	1	75	0	SE	0	F	15	0	1.76E-04	6.25E-05	5.81E-05	3.17E-07	600
23	1	60	0	SE	0	F	19	0	2.20E-04	7.81E-05	7.26E-05	3.17E-07	600
24	1	132	0	SSW	0	F	10	0	1.00E-04	3.55E-05	3.30E-05	3.17E-07	600

RETURN TO CONTINUE, S TO STOP

X/Q HOURLY DATA----FOR MAR 31, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	124	0	SSW	0	F	11	0	1.07E-04	3.78E-05	3.51E-05	3.17E-07	600
2	1	66	0	WSW	0	F	11	0	2.00E-04	7.10E-05	6.60E-05	3.17E-07	600
3	1	65	0	WSW	0	E	8	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
4	1	36	0	SW	0	F	14	0	3.67E-04	1.30E-04	1.21E-04	3.17E-07	600
5	1	17	0	SW	3	F	21	0	7.78E-04	2.76E-04	2.56E-04	3.17E-07	600
6	1	37	0	SSW	0	G	42	0	6.16E-04	1.99E-04	1.85E-04	3.17E-07	600
7	1	28	0	SW	0	G	29	0	8.14E-04	2.64E-04	2.45E-04	3.17E-07	600
8	1	33	0	WSW	0	E	3	0	2.66E-04	8.97E-05	8.33E-05	3.17E-07	600
9	1	52	0	SW	0	D	-6	0	1.04E-04	4.47E-05	4.16E-05	3.17E-07	600
10	1	52	0	SW	0	A	-12	0	5.22E-06	7.15E-06	6.64E-06	3.17E-07	600
11	1	100	0	SW	0	D	-4	0	5.43E-05	2.33E-05	2.16E-05	3.17E-07	600
12	1	100	0	SW	0	A	-13	0	2.72E-06	3.72E-06	3.45E-06	3.17E-07	600
13	1	124	0	WSW	0	E	-3	0	7.07E-05	2.39E-05	2.22E-05	3.17E-07	600
14	1	139	0	WSW	0	E	0	0	6.31E-05	2.13E-05	1.98E-05	3.17E-07	600
15	1	52	0	SSW	0	E	8	0	1.69E-04	5.69E-05	5.29E-05	3.17E-07	600
16	1	67	0	NW	0	F	10	0	1.97E-04	7.00E-05	6.50E-05	3.17E-07	600
17	1	62	0	NW	0	G	26	0	3.67E-04	1.19E-04	1.11E-04	3.17E-07	600
18	1	40	0	W	0	F	10	0	3.31E-04	1.17E-04	1.09E-04	3.17E-07	600
19	1	36	0	WSW	0	G	26	0	6.33E-04	2.05E-04	1.90E-04	3.17E-07	600
20	1	36	0	SSW	0	G	28	0	6.33E-04	2.05E-04	1.90E-04	3.17E-07	600
21	1	25	0	SW	0	F	20	0	5.29E-04	1.88E-04	1.74E-04	3.17E-07	600
22	1	30	0	SW	0	F	18	0	4.41E-04	1.56E-04	1.45E-04	3.17E-07	600
23	1	9	0	SSW	0	F	23	0	1.47E-03	5.21E-04	4.84E-04	3.17E-07	600
24	1	23	0	NW	0	G	43	0	9.90E-04	3.21E-04	2.98E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 1, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	26	0	SSW	0	G	46	0	8.76E-04	2.84E-04	2.64E-04	3.17E-07	600
2	1	10	0	ESE	3	G	43	0	2.28E-03	7.38E-04	6.86E-04	3.17E-07	600
3	1	20	0	NE	0	G	31	0	1.14E-03	3.69E-04	3.43E-04	3.17E-07	600
4	1	10	0	WNW	0	G	29	0	2.28E-03	7.38E-04	6.86E-04	3.17E-07	600
5	1	30	0	NNW	3	G	28	0	7.59E-04	2.46E-04	2.29E-04	3.17E-07	600
6	1	33	0	N	0	G	31	0	6.90E-04	2.24E-04	2.08E-04	3.17E-07	600
7	1	17	0	SW	0	F	12	0	7.78E-04	2.76E-04	2.56E-04	3.17E-07	600
8	1	14	0	W	3	F	12	0	9.45E-04	3.35E-04	3.11E-04	3.17E-07	600
9	1	75	0	NW	0	F	18	0	1.76E-04	6.25E-05	5.81E-05	3.17E-07	600
10	1	65	0	NE	0	E	4	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
11	1	61	0	N	0	E	1	0	1.44E-04	4.85E-05	4.51E-05	3.17E-07	600
12	1	77	0	NNW	0	D	-5	0	7.05E-05	3.02E-05	2.81E-05	3.17E-07	600
13	1	46	0	NNW	0	C	-10	0	5.06E-05	3.50E-05	3.25E-05	3.17E-07	600
14	1	61	0	NNW	0	D	-4	0	8.90E-05	3.81E-05	3.54E-05	3.17E-07	600
15	1	50	0	NNW	0	D	-8	0	1.09E-04	4.65E-05	4.32E-05	3.17E-07	600
16	1	39	0	NNW	0	D	-4	0	1.39E-04	5.97E-05	5.54E-05	3.17E-07	600
17	1	45	0	ENE	0	D	-4	0	1.21E-04	5.17E-05	4.80E-05	3.17E-07	600
18	1	70	0	NE	0	E	-2	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
19	1	43	0	E	0	E	1	0	2.04E-04	6.88E-05	6.39E-05	3.17E-07	600
20	1	46	0	NE	0	F	16	0	2.88E-04	1.02E-04	9.47E-05	3.17E-07	600
21	1	53	0	ESE	0	F	12	0	2.50E-04	8.85E-05	8.22E-05	3.17E-07	600
22	1	139	0	SE	0	E	-2	0	6.31E-05	2.13E-05	1.98E-05	3.17E-07	600
23	1	109	0	SE	0	E	1	0	8.05E-05	2.72E-05	2.52E-05	3.17E-07	600
24	1	95	0	ESE	0	E	-2	0	9.23E-05	3.12E-05	2.89E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 2, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAU	DPLETN	DEPOSN	DSB
1	1	155	0	ESE	0	E	-3	0	5.66E-05	1.91E-05	1.77E-05	3.17E-07	600
2	1	143	0	ESE	0	E	-3	0	6.13E-05	2.07E-05	1.92E-05	3.17E-07	600
3	1	123	0	SE	0	E	2	0	7.13E-05	2.41E-05	2.24E-05	3.17E-07	600
4	1	101	0	ESE	0	E	-3	0	8.68E-05	2.93E-05	2.72E-05	3.17E-07	600
5	1	106	0	ESE	0	D	-4	0	5.12E-05	2.20E-05	2.04E-05	3.17E-07	600
6	1	116	0	ESE	0	D	-4	0	4.68E-05	2.01E-05	1.86E-05	3.17E-07	600
7	1	110	0	ESE	0	E	0	0	7.97E-05	2.69E-05	2.50E-05	3.17E-07	600
8	1	84	0	E	0	E	2	0	1.04E-04	3.52E-05	3.27E-05	3.17E-07	600
9	1	103	0	ESE	0	E	4	0	8.51E-05	2.87E-05	2.67E-05	3.17E-07	600
10	1	92	0	ESE	0	E	4	0	9.53E-05	3.22E-05	2.99E-05	3.17E-07	600
11	1	103	0	ESE	0	E	4	0	8.51E-05	2.87E-05	2.67E-05	3.17E-07	600
12	1	91	0	ESE	0	E	4	0	9.64E-05	3.25E-05	3.02E-05	3.17E-07	600
13	1	71	0	ESE	0	E	4	0	1.24E-04	4.17E-05	3.87E-05	3.17E-07	600
14	1	56	0	SE	0	E	4	0	1.57E-04	5.29E-05	4.91E-05	3.17E-07	600
15	1	94	0	ESE	0	E	4	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
16	1	40	0	E	0	E	5	0	2.19E-04	7.40E-05	6.87E-05	3.17E-07	600
17	1	59	0	ESE	0	E	5	0	1.49E-04	5.02E-05	4.66E-05	3.17E-07	600
18	1	37	0	ENE	0	E	6	0	2.37E-04	8.00E-05	7.43E-05	3.17E-07	600
19	1	42	0	ENE	0	E	5	0	2.09E-04	7.05E-05	6.55E-05	3.17E-07	600
20	1	58	0	N	0	E	7	0	1.51E-04	5.10E-05	4.74E-05	3.17E-07	600
21	1	37	0	N	0	E	5	0	2.37E-04	8.00E-05	7.43E-05	3.17E-07	600
22	1	22	0	NNE	3	E	5	0	3.99E-04	1.35E-04	1.25E-04	3.17E-07	600
23	1	30	0	ENE	3	E	5	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
24	1	32	0	N	0	E	5	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600

X/Q HOTRLY DATA----FOR APR 3, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XOGCL	XOGAV	DPLETN	DEPOSN	DSB
1	1	39	0	N	0	E	5	0	2.25E-04	7.59E-05	7.05E-05	3.17E-07	600
2	1	105	0	NNW	0	E	6	0	8.35E-05	2.82E-05	2.62E-05	3.17E-07	600
3	1	73	0	N	0	E	5	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
4	1	49	0	NW	0	E	4	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
5	1	32	0	NW	0	E	5	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600
6	1	83	0	N	0	E	5	0	1.06E-04	3.57E-05	3.31E-05	3.17E-07	600
7	1	36	0	NNW	0	E	4	0	2.44E-04	8.22E-05	7.64E-05	3.17E-07	600
8	1	18	0	SE	3	E	6	0	4.87E-04	1.64E-04	1.53E-04	3.17E-07	600
9	1	103	0	NW	0	F	10	0	1.28E-04	4.55E-05	4.23E-05	3.17E-07	600
10	1	101	0	NW	0	F	16	0	1.31E-04	4.64E-05	4.31E-05	3.17E-07	600
11	1	124	0	NNW	0	E	4	0	7.07E-05	2.39E-05	2.22E-05	3.17E-07	600
12	1	57	0	NW	0	E	9	0	1.54E-04	5.19E-05	4.82E-05	3.17E-07	600
13	1	51	0	NW	0	E	5	0	1.72E-04	5.80E-05	5.39E-05	3.17E-07	600
14	1	62	0	N	0	E	3	0	1.41E-04	4.77E-05	4.43E-05	3.17E-07	600
15	1	46	0	WNW	0	E	5	0	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600
16	1	77	2	SSE	2	E	1	2	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600
17	1	40	0	NW	0	E	1	0	2.19E-04	7.40E-05	6.87E-05	3.17E-07	600
18	1	96	0	NNW	0	E	0	0	9.14E-05	3.08E-05	2.86E-05	3.17E-07	600
19	1	52	0	N	0	A	-15	0	5.22E-06	7.15E-06	6.64E-06	3.17E-07	600
20	1	51	0	NNW	0	F	19	0	2.59E-04	9.19E-05	8.54E-05	3.17E-07	600
21	1	68	0	NNW	0	E	8	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
22	1	23	0	NNE	3	F	14	0	5.75E-04	2.04E-04	1.89E-04	3.17E-07	600
23	1	39	0	NE	0	F	22	0	3.39E-04	1.20E-04	1.12E-04	3.17E-07	600
24	1	40	0	N	0	E	9	0	2.19E-04	7.40E-05	6.87E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 4, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	30	0	N	3	E	4	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
2	1	48	0	NE	0	E	3	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
3	1	49	0	NNE	0	E	3	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
4	1	17	0	SE	3	E	2	0	5.16E-04	1.74E-04	1.62E-04	3.17E-07	600
5	1	48	0	NNE	0	E	5	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
6	1	6	4	SE	3	E	0	0	9.80E-04	3.31E-04	3.07E-04	3.17E-07	600
7	1	19	0	ENE	3	E	1	0	4.62E-04	1.56E-04	1.45E-04	3.17E-07	600
8	1	74	0	E	0	E	-2	0	1.19E-04	4.00E-05	3.72E-05	3.17E-07	600
9	1	106	0	E	0	D	-4	0	5.12E-05	2.20E-05	2.04E-05	3.17E-07	600
10	1	122	0	E	0	E	-3	0	7.19E-05	2.43E-05	2.25E-05	3.17E-07	600
11	1	122	0	ESE	0	E	-3	0	7.19E-05	2.43E-05	2.25E-05	3.17E-07	600
12	1	93	0	E	0	E	-2	0	9.43E-05	3.18E-05	2.96E-05	3.17E-07	600
13	1	60	0	E	0	E	-2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
14	1	62	0	ENE	0	E	-2	0	1.41E-04	4.77E-05	4.43E-05	3.17E-07	600
15	1	92	0	E	0	D	-4	0	5.90E-05	2.53E-05	2.35E-05	3.17E-07	600
16	1	112	0	ESE	0	E	-3	0	7.83E-05	2.64E-05	2.46E-05	3.17E-07	600
17	1	88	0	ESE	0	E	-3	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
18	1	41	0	ESE	0	E	-2	0	2.14E-04	7.22E-05	6.71E-05	3.17E-07	600
19	1	90	0	NNW	0	D	-4	0	6.03E-05	2.59E-05	2.40E-05	3.17E-07	600
20	1	87	0	NNW	0	D	-4	0	6.24E-05	2.67E-05	2.48E-05	3.17E-07	600
21	1	53	0	ENE	0	E	-2	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
22	1	37	0	ENE	0	E	-2	0	2.37E-04	8.00E-05	7.43E-05	3.17E-07	600
23	1	18	0	ESE	3	E	-2	0	4.87E-04	1.64E-04	1.53E-04	3.17E-07	600
24	1	21	0	WSW	0	E	-2	0	4.18E-04	1.41E-04	1.31E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 5, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	25	0	SSE	0	E	-3	0	3.51E-04	1.18E-04	1.10E-04	3.17E-07	600
2	1	43	0	S	0	E	-2	0	2.04E-04	6.88E-05	6.39E-05	3.17E-07	600
3	1	46	0	SW	0	E	-3	0	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600
4	1	51	0	WSW	0	E	-3	0	1.72E-04	5.80E-05	5.39E-05	3.17E-07	600
5	1	64	0	SSW	0	E	-2	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
6	1	56	0	WSW	0	E	-1	0	1.57E-04	5.29E-05	4.91E-05	3.17E-07	600
7	1	72	0	W	0	E	-2	0	1.22E-04	4.11E-05	3.82E-05	3.17E-07	600
8	1	74	0	WSW	0	D	-5	0	7.33E-05	3.14E-05	2.92E-05	3.17E-07	600
9	1	128	0	W	0	D	-4	0	4.24E-05	1.82E-05	1.69E-05	3.17E-07	600
10	1	137	0	WNW	0	D	-7	0	3.96E-05	1.70E-05	1.58E-05	3.17E-07	600
11	1	179	0	WNW	0	D	-4	0	3.03E-05	1.30E-05	1.21E-05	3.17E-07	600
12	1	119	0	W	0	D	-7	0	4.56E-05	1.96E-05	1.82E-05	3.17E-07	600
13	1	149	0	WNW	0	D	-5	0	3.64E-05	1.56E-05	1.45E-05	3.17E-07	600
14	1	162	0	NW	0	E	-3	0	5.41E-05	1.83E-05	1.70E-05	3.17E-07	600
15	1	116	0	W	0	D	-8	0	4.68E-05	2.01E-05	1.86E-05	3.17E-07	600
16	1	177	0	WNW	0	D	-5	0	3.07E-05	1.31E-05	1.22E-05	3.17E-07	600
17	1	119	0	WNW	0	E	-3	0	7.37E-05	2.49E-05	2.31E-05	3.17E-07	600
18	1	87	0	WNW	0	E	-2	0	1.01E-04	3.40E-05	3.16E-05	3.17E-07	600
19	1	48	0	W	0	E	6	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
20	1	48	0	WSW	0	E	4	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
21	1	37	0	S	0	F	20	0	3.58E-04	1.27E-04	1.18E-04	3.17E-07	600
22	1	60	0	S	0	E	2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
23	1	48	0	SSW	0	F	10	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
24	1	69	0	SSW	0	E	1	0	1.27E-04	4.29E-05	3.99E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 6, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XOGCL	XOGAV	DPLETN	DEPOSN	DSB
1	1	103	0	S	0	E	2	0	8.51E-05	2.87E-05	2.67E-05	3.17E-07	600
2	1	114	0	SSW	0	E	5	0	7.69E-05	2.60E-05	2.41E-05	3.17E-07	600
3	1	140	0	SSW	0	E	3	0	6.26E-05	2.11E-05	1.96E-05	3.17E-07	600
4	1	136	0	SSW	0	E	4	0	6.45E-05	2.18E-05	2.02E-05	3.17E-07	600
5	1	150	0	SW	0	E	5	0	5.85E-05	1.97E-05	1.83E-05	3.17E-07	600
6	1	142	0	W	0	E	-1	0	6.18E-05	2.08E-05	1.94E-05	3.17E-07	600
7	1	239	0	W	0	D	-4	0	2.27E-05	9.74E-06	9.04E-06	3.17E-07	600
8	1	233	0	WNW	0	D	-6	0	2.33E-05	9.99E-06	9.28E-06	3.17E-07	600
9	1	198	0	W	0	D	-7	0	2.74E-05	1.18E-05	1.09E-05	3.17E-07	600
10	1	245	0	WNW	0	D	-8	0	2.22E-05	9.50E-06	8.82E-06	3.17E-07	600
11	1	219	0	W	0	C	-10	0	1.06E-05	7.36E-06	6.84E-06	3.17E-07	600
12	1	237	0	W	0	C	-10	0	9.83E-06	6.80E-06	6.32E-06	3.17E-07	600
13	1	277	0	WNW	0	D	-8	0	1.96E-05	8.40E-06	7.80E-06	3.17E-07	600
14	1	230	0	W	0	D	-9	0	2.36E-05	1.01E-05	9.40E-06	3.17E-07	600
15	1	250	0	W	0	D	-8	0	2.17E-05	9.31E-06	8.64E-06	3.17E-07	600
16	1	291	0	WNW	0	D	-6	0	1.87E-05	8.00E-06	7.43E-06	3.17E-07	600
17	1	252	0	WNW	0	D	-4	0	2.15E-05	9.23E-06	8.58E-06	3.17E-07	600
18	1	202	0	WNW	0	E	-3	0	4.34E-05	1.47E-05	1.36E-05	3.17E-07	600
19	1	250	0	NW	0	E	-2	0	3.51E-05	1.18E-05	1.10E-05	3.17E-07	600
20	1	149	0	WNW	0	E	-2	0	5.89E-05	1.99E-05	1.85E-05	3.17E-07	600
21	1	161	0	WNW	0	E	-2	0	5.45E-05	1.84E-05	1.71E-05	3.17E-07	600
22	1	219	0	WNW	0	E	-3	0	4.00E-05	1.35E-05	1.26E-05	3.17E-07	600
23	1	182	0	NW	0	E	-3	0	4.82E-05	1.63E-05	1.51E-05	3.17E-07	600
24	1	225	0	NW	0	D	-4	0	2.41E-05	1.03E-05	9.60E-06	3.17E-07	600

X/Q HOURLY DATA----FOR APR 7, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	136	0	WNW	0	E	-2	0	6.45E-05	2.18E-05	2.02E-05	3.17E-07	600
2	1	115	0	WNW	0	E	-3	0	7.63E-05	2.57E-05	2.39E-05	3.17E-07	600
3	1	161	0	WNW	0	E	-3	0	5.45E-05	1.84E-05	1.71E-05	3.17E-07	600
4	1	195	0	NW	0	D	-4	0	2.78E-05	1.19E-05	1.11E-05	3.17E-07	600
5	1	123	0	WNW	0	E	-3	0	7.13E-05	2.41E-05	2.24E-05	3.17E-07	600
6	1	182	0	WNW	0	D	-4	0	2.98E-05	1.28E-05	1.19E-05	3.17E-07	600
7	1	254	0	NW	0	D	-5	0	2.14E-05	9.16E-06	8.51E-06	3.17E-07	600
8	1	211	0	NW	0	D	-7	0	2.57E-05	1.10E-05	1.02E-05	3.17E-07	600
9	1	212	0	NW	0	D	-7	0	2.56E-05	1.10E-05	1.02E-05	3.17E-07	600
10	1	195	0	NW	0	D	-7	0	2.78E-05	1.19E-05	1.11E-05	3.17E-07	600
11	1	190	0	NW	0	D	-9	0	2.86E-05	1.22E-05	1.14E-05	3.17E-07	600
12	1	218	0	NW	0	D	-8	0	2.49E-05	1.07E-05	9.91E-06	3.17E-07	600
13	1	174	0	NW	0	D	-9	0	3.12E-05	1.34E-05	1.24E-05	3.17E-07	600
14	1	201	0	NW	0	D	-8	0	2.70E-05	1.16E-05	1.08E-05	3.17E-07	600
15	1	198	0	NW	0	D	-7	0	2.74E-05	1.18E-05	1.09E-05	3.17E-07	600
16	1	179	0	NW	0	D	-6	0	3.03E-05	1.30E-05	1.21E-05	3.17E-07	600
17	1	175	0	WNW	0	D	-4	0	3.10E-05	1.33E-05	1.23E-05	3.17E-07	600
18	1	159	0	NW	0	E	-3	0	5.52E-05	1.86E-05	1.73E-05	3.17E-07	600
19	1	103	0	NW	0	E	1	0	8.51E-05	2.87E-05	2.67E-05	3.17E-07	600
20	1	94	0	NNW	0	E	1	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
21	1	39	0	NW	0	F	10	0	3.39E-04	1.20E-04	1.12E-04	3.17E-07	600
22	1	27	0	WSW	0	F	14	0	4.90E-04	1.74E-04	1.61E-04	3.17E-07	600
23	1	61	0	NNW	0	F	13	0	2.17E-04	7.69E-05	7.14E-05	3.17E-07	600
24	1	35	0	NW	0	F	17	0	3.78E-04	1.34E-04	1.24E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 8, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	47	0	NNW	0	E	4	0	1.87E-04	6.30E-05	5.85E-05	3.17E-07	600
2	1	73	0	N	0	E	2	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
3	1	50	0	N	0	E	2	0	1.75E-04	5.92E-05	5.50E-05	3.17E-07	600
4	1	78	0	N	0	E	0	0	1.12E-04	3.80E-05	3.53E-05	3.17E-07	600
5	1	73	0	NNW	0	E	6	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
6	1	30	0	ENE	3	E	3	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
7	1	30	0	ENE	3	E	-3	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
8	1	35	0	N	0	D	-9	0	1.55E-04	6.65E-05	6.17E-05	3.17E-07	600
9	1	33	0	N	0	B	-11	0	3.17E-05	3.14E-05	2.92E-05	3.17E-07	600
10	1	31	0	N	0	A	-15	0	8.76E-06	1.20E-05	1.11E-05	3.17E-07	600
11	1	29	0	SSE	3	D	-5	0	1.87E-04	8.02E-05	7.45E-05	3.17E-07	600
12	1	51	0	S	0	D	-4	0	1.06E-04	4.56E-05	4.24E-05	3.17E-07	600
13	1	68	0	S	0	D	-5	0	7.98E-05	3.42E-05	3.18E-05	3.17E-07	600
14	1	32	0	SSE	0	D	-7	0	1.70E-04	7.27E-05	6.75E-05	3.17E-07	600
15	1	18	0	NW	3	D	-6	0	3.02E-04	1.29E-04	1.20E-04	3.17E-07	600
16	1	31	0	ENE	0	E	-3	0	2.83E-04	9.55E-05	8.87E-05	3.17E-07	600
17	1	70	0	ENE	0	E	-3	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
18	1	64	0	E	0	E	-3	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
19	1	69	0	E	0	E	-1	0	1.27E-04	4.29E-05	3.99E-05	3.17E-07	600
20	1	64	0	E	0	E	-2	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
21	1	60	0	ESE	0	E	-2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
22	1	41	0	NNE	0	E	-1	0	2.14E-04	7.22E-05	6.71E-05	3.17E-07	600
23	1	58	0	E	0	E	-2	0	1.51E-04	5.10E-05	4.74E-05	3.17E-07	600
24	1	59	0	E	0	E	-1	0	1.49E-04	5.02E-05	4.66E-05	3.17E-07	600

X/Q HOURLE DATA----FOR APR 9, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAU	DPLETN	DEPOSN	DSB
1	1	53	0	E	0	E	-2	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
2	1	63	0	E	0	E	-2	0	1.39E-04	4.70E-05	4.36E-05	3.17E-07	600
3	1	49	0	ENE	0	E	-2	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
4	1	49	0	ENE	0	E	-1	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
5	1	81	0	E	0	E	-3	0	1.08E-04	3.65E-05	3.39E-05	3.17E-07	600
6	1	65	0	E	0	E	-2	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
7	1	73	0	E	0	E	-3	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
8	1	68	0	E	0	E	-3	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
9	1	65	0	E	0	E	-2	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
10	1	75	0	E	0	E	-2	0	1.17E-04	3.95E-05	3.67E-05	3.17E-07	600
11	1	64	0	ENE	0	E	-2	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
12	1	46	0	NE	0	D	-4	0	1.18E-04	5.06E-05	4.70E-05	3.17E-07	600
13	1	64	0	NE	0	E	-3	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
14	1	48	0	NE	0	E	-3	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
15	1	77	0	NNW	0	E	-3	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
16	1	81	0	NW	0	E	-2	0	1.08E-04	3.65E-05	3.39E-05	3.17E-07	600
17	1	96	0	WNW	0	E	1	0	9.14E-05	3.08E-05	2.86E-05	3.17E-07	600
18	1	116	0	W	0	E	-2	0	7.56E-05	2.55E-05	2.37E-05	3.17E-07	600
19	1	100	0	W	0	D	-4	0	5.43E-05	2.33E-05	2.16E-05	3.17E-07	600
20	1	95	0	W	0	E	-3	0	9.23E-05	3.12E-05	2.89E-05	3.17E-07	600
21	1	132	0	WNW	0	D	-4	0	4.11E-05	1.76E-05	1.64E-05	3.17E-07	600
22	1	156	0	WNW	0	E	-2	0	5.62E-05	1.90E-05	1.76E-05	3.17E-07	600
23	1	227	0	NW	0	E	-2	0	3.86E-05	1.30E-05	1.21E-05	3.17E-07	600
24	1	214	0	NW	0	E	-2	0	4.10E-05	1.38E-05	1.28E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 10, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	200	0	NW	0	E	-2	0	4.39E-05	1.48E-05	1.37E-05	3.17E-07	600
2	1	167	0	NW	0	E	-2	0	5.25E-05	1.77E-05	1.65E-05	3.17E-07	600
3	1	177	0	NW	0	E	-2	0	4.95E-05	1.67E-05	1.55E-05	3.17E-07	600
4	1	252	0	NW	0	E	-2	0	3.48E-05	1.17E-05	1.09E-05	3.17E-07	600
5	1	228	0	NW	0	E	-2	0	3.85E-05	1.30E-05	1.21E-05	3.17E-07	600
6	1	209	0	NW	0	E	-2	0	4.20E-05	1.42E-05	1.32E-05	3.17E-07	600
7	1	186	0	NW	0	E	-2	0	4.72E-05	1.59E-05	1.48E-05	3.17E-07	600
8	1	204	0	NW	0	D	-5	0	2.66E-05	1.14E-05	1.06E-05	3.17E-07	600
9	1	166	0	NW	0	D	-4	0	3.27E-05	1.40E-05	1.30E-05	3.17E-07	600
10	1	180	0	NW	0	D	-6	0	3.02E-05	1.29E-05	1.20E-05	3.17E-07	600
11	1	180	0	NW	0	D	-7	0	3.02E-05	1.29E-05	1.20E-05	3.17E-07	600
12	1	136	0	NW	0	D	-9	0	3.99E-05	1.71E-05	1.59E-05	3.17E-07	600
13	1	140	0	WNW	0	D	-8	0	3.88E-05	1.66E-05	1.54E-05	3.17E-07	600
14	1	162	0	NW	0	D	-6	0	3.35E-05	1.44E-05	1.33E-05	3.17E-07	600
15	1	148	0	NW	0	D	-5	0	3.67E-05	1.57E-05	1.46E-05	3.17E-07	600
16	1	156	0	NW	0	D	-4	0	3.48E-05	1.49E-05	1.39E-05	3.17E-07	600
17	1	135	0	NW	0	E	1	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
18	1	113	0	NW	0	E	2	0	7.76E-05	2.62E-05	2.43E-05	3.17E-07	600
19	1	88	0	NW	0	E	5	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
20	1	49	0	NW	0	G	36	0	4.65E-04	1.51E-04	1.40E-04	3.17E-07	600
21	1	23	0	NNE	3	G	38	0	9.90E-04	3.21E-04	2.98E-04	3.17E-07	600
22	1	19	0	W	3	G	50	0	1.20E-03	3.88E-04	3.61E-04	3.17E-07	600
23	1	15	0	W	0	G	45	0	1.52E-03	4.92E-04	4.57E-04	3.17E-07	600
24	1	12	0	SW	0	G	27	0	1.90E-03	6.15E-04	5.71E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 11, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	13	0	WSW	0	G	30	0	1.75E-03	5.68E-04	5.27E-04	3.17E-07	600
2	1	21	0	NW	0	G	39	0	1.08E-03	3.51E-04	3.26E-04	3.17E-07	600
3	1	24	0	ENE	3	G	35	0	9.49E-04	3.08E-04	2.86E-04	3.17E-07	600
4	1	23	0	SSW	0	F	14	0	5.75E-04	2.04E-04	1.89E-04	3.17E-07	600
5	1	6	4	WSW	3	F	19	0	1.48E-03	5.24E-04	4.87E-04	3.17E-07	600
6	1	8	0	SSE	0	F	21	0	1.48E-03	5.24E-04	4.87E-04	3.17E-07	600
7	1	17	0	E	3	E	9	0	5.16E-04	1.74E-04	1.62E-04	3.17E-07	600
8	1	9	0	NNW	3	D	-7	0	6.03E-04	2.58E-04	2.40E-04	3.17E-07	600
9	1	30	0	ESE	3	D	-6	0	1.81E-04	7.76E-05	7.20E-05	3.17E-07	600
10	1	40	0	WSW	0	A	-19	0	6.79E-06	9.30E-06	8.64E-06	3.17E-07	600
11	1	28	0	S	3	A	-13	0	9.70E-06	1.33E-05	1.23E-05	3.17E-07	600
12	1	34	0	SSE	0	A	-12	0	7.99E-06	1.09E-05	1.02E-05	3.17E-07	600
13	1	46	0	NNW	0	A	-15	0	5.90E-06	8.09E-06	7.51E-06	3.17E-07	600
14	1	37	0	NW	0	A	-14	0	7.34E-06	1.01E-05	9.34E-06	3.17E-07	600
15	1	44	0	N	0	D	-7	0	1.23E-04	5.29E-05	4.91E-05	3.17E-07	600
16	1	50	0	E	0	D	-5	0	1.09E-04	4.65E-05	4.32E-05	3.17E-07	600
17	1	45	0	E	0	D	-4	0	1.21E-04	5.17E-05	4.80E-05	3.17E-07	600
18	1	31	0	E	0	E	0	0	2.83E-04	9.55E-05	8.87E-05	3.17E-07	600
19	1	46	0	ESE	0	F	12	0	2.88E-04	1.02E-04	9.47E-05	3.17E-07	600
20	1	23	0	NNE	3	F	16	0	5.75E-04	2.04E-04	1.89E-04	3.17E-07	600
21	1	42	0	ESE	0	G	26	0	5.42E-04	1.76E-04	1.63E-04	3.17E-07	600
22	1	27	0	SE	0	G	31	0	8.44E-04	2.73E-04	2.54E-04	3.17E-07	600
23	1	29	0	SSW	0	F	24	0	4.56E-04	1.62E-04	1.50E-04	3.17E-07	600
24	1	21	0	ESE	0	G	34	0	1.08E-03	3.51E-04	3.26E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 12, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	23	0	S	0	G	38	0	9.90E-04	3.21E-04	2.98E-04	3.17E-07	600
2	1	6	4	NE	3	G	41	0	2.55E-03	8.25E-04	7.66E-04	3.17E-07	600
3	1	40	0	ENE	0	G	29	0	5.69E-04	1.85E-04	1.71E-04	3.17E-07	600
4	1	37	0	E	0	F	14	0	3.58E-04	1.27E-04	1.18E-04	3.17E-07	600
5	1	34	0	SE	0	F	15	0	3.89E-04	1.38E-04	1.28E-04	3.17E-07	600
6	1	36	0	SSW	0	F	19	0	3.67E-04	1.30E-04	1.21E-04	3.17E-07	600
7	1	21	0	NNE	3	E	8	0	4.18E-04	1.41E-04	1.31E-04	3.17E-07	600
8	1	39	0	NE	0	D	-4	0	1.39E-04	5.97E-05	5.54E-05	3.17E-07	600
9	1	23	0	NE	3	E	8	0	3.81E-04	1.29E-04	1.20E-04	3.17E-07	600
10	1	32	0	N	0	E	5	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600
11	1	6	4	ENE	3	F	11	0	1.48E-03	5.24E-04	4.87E-04	3.17E-07	600
12	1	30	0	NNW	0	E	4	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
13	1	38	0	NNE	0	E	2	0	2.31E-04	7.79E-05	7.24E-05	3.17E-07	600
14	1	64	0	NNW	0	E	0	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
15	1	16	0	WNW	0	E	0	0	5.48E-04	1.85E-04	1.72E-04	3.17E-07	600
16	1	34	0	N	0	E	5	0	2.58E-04	8.71E-05	8.09E-05	3.17E-07	600
17	1	45	0	NNE	0	E	7	0	1.95E-04	6.58E-05	6.11E-05	3.17E-07	600
18	1	32	0	NNE	0	E	0	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600
19	1	25	0	ENE	3	E	1	0	3.51E-04	1.18E-04	1.10E-04	3.17E-07	600
20	1	42	0	N	0	F	11	0	3.15E-04	1.12E-04	1.04E-04	3.17E-07	600
21	1	23	0	WSW	0	F	10	0	5.75E-04	2.04E-04	1.89E-04	3.17E-07	600
22	1	6	4	SE	0	F	14	0	1.48E-03	5.24E-04	4.87E-04	3.17E-07	600
23	1	18	0	NE	3	F	18	0	7.35E-04	2.60E-04	2.42E-04	3.17E-07	600
24	1	43	0	NE	0	F	17	0	3.08E-04	1.09E-04	1.01E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 13, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	16	0	ESE	3	E	6	0	5.48E-04	1.85E-04	1.72E-04	3.17E-07	600
2	1	21	0	NE	3	F	11	0	6.30E-04	2.23E-04	2.07E-04	3.17E-07	600
3	1	35	0	ENE	0	F	15	0	3.78E-04	1.34E-04	1.24E-04	3.17E-07	600
4	1	132	0	E	0	E	2	0	6.64E-05	2.24E-05	2.08E-05	3.17E-07	600
5	1	149	0	E	0	E	0	0	5.89E-05	1.99E-05	1.85E-05	3.17E-07	600
6	1	163	0	ESE	0	E	1	0	5.38E-05	1.82E-05	1.69E-05	3.17E-07	600
7	1	148	0	ESE	0	E	-1	0	5.93E-05	2.00E-05	1.86E-05	3.17E-07	600
8	1	120	0	ESE	0	E	-2	0	7.31E-05	2.47E-05	2.29E-05	3.17E-07	600
9	1	136	0	ESE	0	E	-3	0	6.45E-05	2.18E-05	2.02E-05	3.17E-07	600
10	1	151	0	ESE	0	D	-4	0	3.59E-05	1.54E-05	1.43E-05	3.17E-07	600
11	1	121	0	ESE	0	D	-5	0	4.49E-05	1.92E-05	1.79E-05	3.17E-07	600
12	1	164	0	SE	0	D	-4	0	3.31E-05	1.42E-05	1.32E-05	3.17E-07	600
13	1	135	0	SE	0	E	-3	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
14	1	145	0	ESE	0	D	-4	0	3.74E-05	1.60E-05	1.49E-05	3.17E-07	600
15	1	132	0	ESE	0	E	-3	0	6.64E-05	2.24E-05	2.08E-05	3.17E-07	600
16	1	114	0	ESE	0	E	-2	0	7.69E-05	2.60E-05	2.41E-05	3.17E-07	600
17	1	119	0	ESE	0	E	-2	0	7.37E-05	2.49E-05	2.31E-05	3.17E-07	600
18	1	154	0	ESE	0	E	-2	0	5.69E-05	1.92E-05	1.79E-05	3.17E-07	600
19	1	138	0	SE	0	E	-2	0	6.36E-05	2.15E-05	1.99E-05	3.17E-07	600
20	1	162	0	ESE	0	E	-2	0	5.41E-05	1.83E-05	1.70E-05	3.17E-07	600
21	1	107	0	E	0	E	-2	0	8.20E-05	2.77E-05	2.57E-05	3.17E-07	600
22	1	77	0	ESE	0	E	-2	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
23	1	72	0	E	0	E	-2	0	1.22E-04	4.11E-05	3.82E-05	3.17E-07	600
24	1	70	0	E	0	E	-2	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 14, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XOGCL	XOGAV	DPLETN	DEPOSN	DSB
1	1	70	0	E	0	E	-2	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
2	1	57	0	ESE	0	E	-2	0	1.54E-04	5.19E-05	4.82E-05	3.17E-07	600
3	1	56	0	NNW	0	E	-3	0	1.57E-04	5.29E-05	4.91E-05	3.17E-07	600
4	1	57	0	N	0	E	-3	0	1.54E-04	5.19E-05	4.82E-05	3.17E-07	600
5	1	49	0	NE	0	E	-2	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
6	1	39	0	N	0	E	-2	0	2.25E-04	7.59E-05	7.05E-05	3.17E-07	600
7	1	57	0	N	0	E	-3	0	1.54E-04	5.19E-05	4.82E-05	3.17E-07	600
8	1	66	0	NNW	0	D	-4	0	8.22E-05	3.53E-05	3.27E-05	3.17E-07	600
9	1	65	0	NNW	0	D	-8	0	8.35E-05	3.58E-05	3.32E-05	3.17E-07	600
10	1	56	0	NW	0	D	-8	0	9.69E-05	4.15E-05	3.86E-05	3.17E-07	600
11	1	59	0	NNW	0	D	-9	0	9.20E-05	3.94E-05	3.66E-05	3.17E-07	600
12	1	40	0	NNW	0	A	-15	0	6.79E-06	9.30E-06	8.64E-06	3.17E-07	600
13	1	72	0	NW	0	A	-12	0	3.77E-06	5.17E-06	4.80E-06	3.17E-07	600
14	1	169	0	NW	0	D	-4	0	3.21E-05	1.38E-05	1.28E-05	3.17E-07	600
15	1	175	0	NW	0	E	-3	0	5.01E-05	1.69E-05	1.57E-05	3.17E-07	600
16	1	147	0	NNW	0	E	4	0	5.97E-05	2.01E-05	1.87E-05	3.17E-07	600
17	1	76	0	NW	0	E	3	0	1.15E-04	3.90E-05	3.62E-05	3.17E-07	600
18	1	21	0	N	3	E	4	0	4.18E-04	1.41E-04	1.31E-04	3.17E-07	600
19	1	48	0	SE	0	F	15	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
20	1	229	2	W	2	F	34	2	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
21	1	46	0	SE	0	E	9	0	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600
22	1	41	0	SE	0	F	23	0	3.23E-04	1.14E-04	1.06E-04	3.17E-07	600
23	1	19	0	SE	0	F	16	0	6.96E-04	2.47E-04	2.29E-04	3.17E-07	600
24	1	26	0	N	3	F	18	0	5.09E-04	1.80E-04	1.67E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 15, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	51	0	SE	0	F	13	9	2.59E-04	9.19E-05	8.54E-05	3.17E-07	600
2	1	68	0	SSW	0	E	0	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
3	1	25	0	WSW	0	E	5	0	3.61E-04	1.18E-04	1.10E-04	3.17E-07	600
4	1	20	0	WSW	0	E	3	0	4.39E-04	1.48E-04	1.37E-04	3.17E-07	600
5	1	24	0	SW	3	E	9	0	3.65E-04	1.23E-04	1.15E-04	3.17E-07	600
6	1	33	0	NW	0	E	9	0	2.66E-04	8.97E-05	8.33E-05	3.17E-07	600
7	1	18	0	SSE	0	E	8	0	4.87E-04	1.64E-04	1.53E-04	3.17E-07	600
8	1	53	0	SSW	0	E	0	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
9	1	82	0	NNW	0	D	-5	0	6.62E-05	2.84E-05	2.64E-05	3.17E-07	600
10	1	120	0	WNW	0	E	-2	0	7.31E-05	2.47E-05	2.29E-05	3.17E-07	600
11	1	106	0	NW	0	E	-2	0	8.27E-05	2.79E-05	2.59E-05	3.17E-07	600
12	1	166	0	NW	0	E	-3	0	5.28E-05	1.78E-05	1.66E-05	3.17E-07	600
13	1	155	0	NW	0	E	-2	0	5.66E-05	1.91E-05	1.77E-05	3.17E-07	600
14	1	207	0	NW	0	E	-3	0	4.24E-05	1.43E-05	1.33E-05	3.17E-07	600
15	1	193	0	WNW	0	E	-3	0	4.54E-05	1.53E-05	1.42E-05	3.17E-07	600
16	1	161	0	WNW	0	D	-7	0	3.37E-05	1.45E-05	1.34E-05	3.17E-07	600
17	1	167	0	WNW	0	D	-4	0	3.25E-05	1.39E-05	1.29E-05	3.17E-07	600
18	1	135	0	WNW	0	E	-1	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
19	1	141	0	WNW	0	E	0	0	6.22E-05	2.10E-05	1.95E-05	3.17E-07	600
20	1	146	0	WNW	0	E	1	0	6.01E-05	2.03E-05	1.88E-05	3.17E-07	600
21	1	125	0	WNW	0	E	0	0	7.02E-05	2.37E-05	2.20E-05	3.17E-07	600
22	1	115	0	WNW	0	E	1	0	7.63E-05	2.57E-05	2.39E-05	3.17E-07	600
23	1	90	0	WNW	0	E	0	0	9.74E-05	3.29E-05	3.06E-05	3.17E-07	600
24	1	137	0	NW	0	E	1	0	6.40E-05	2.16E-05	2.01E-05	3.17E-07	600

X/Q HOURLY DATA---FOR APR 16, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	100	0	WNW	0	E	1	0	8.77E-05	2.96E-05	2.75E-05	3.17E-07	600
2	1	87	0	WNW	0	E	-1	0	1.01E-04	3.40E-05	3.16E-05	3.17E-07	600
3	1	87	0	WNW	0	E	1	0	1.01E-04	3.40E-05	3.16E-05	3.17E-07	600
4	1	70	0	W	0	E	0	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
5	1	70	0	WNW	0	E	2	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
6	1	91	0	WNW	0	E	1	0	9.64E-05	3.25E-05	3.02E-05	3.17E-07	600
7	1	69	0	WNW	0	E	-1	0	1.27E-04	4.29E-05	3.99E-05	3.17E-07	600
8	1	73	0	WNW	0	E	-2	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
9	1	67	0	W	0	E	-2	0	1.31E-04	4.42E-05	4.10E-05	3.17E-07	600
10	1	82	0	WNW	0	E	-2	0	1.07E-04	3.61E-05	3.35E-05	3.17E-07	600
11	1	97	0	WNW	0	E	-2	0	9.04E-05	3.05E-05	2.83E-05	3.17E-07	600
12	1	91	0	WNW	0	E	-2	0	9.64E-05	3.25E-05	3.02E-05	3.17E-07	600
13	1	102	0	NW	0	E	-1	0	8.60E-05	2.90E-05	2.70E-05	3.17E-07	600
14	1	115	0	WNW	0	E	-2	0	7.63E-05	2.57E-05	2.39E-05	3.17E-07	600
15	1	123	0	NW	0	E	-2	0	7.13E-05	2.41E-05	2.24E-05	3.17E-07	600
16	1	229	2	W	2	E	-2	2	7.13E-05	2.41E-05	2.24E-05	3.17E-07	600
17	1	118	0	WNW	0	E	-2	0	7.43E-05	2.51E-05	2.33E-05	3.17E-07	600
18	1	155	0	WNW	0	E	1	0	5.66E-05	1.91E-05	1.77E-05	3.17E-07	600
19	1	99	0	WNW	0	E	0	0	3.86E-05	2.99E-05	2.78E-05	3.17E-07	600
20	1	117	0	WNW	0	E	0	0	7.50E-05	2.53E-05	2.35E-05	3.17E-07	600
21	1	173	0	NNW	0	E	-1	0	5.07E-05	1.71E-05	1.59E-05	3.17E-07	600
22	1	143	0	WNW	0	E	1	0	6.13E-05	2.07E-05	1.92E-05	3.17E-07	600
23	1	135	0	NW	0	E	1	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
24	1	109	0	NW	0	E	1	0	8.05E-05	2.72E-05	2.52E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 17, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	94	0	NNW	0	E	-1	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
2	1	111	0	NW	0	E	-1	0	7.90E-05	2.67E-05	2.48E-05	3.17E-07	600
3	1	94	0	NNW	0	E	1	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
4	1	68	0	NNW	0	E	1	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
5	1	88	0	NNW	0	E	-1	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
6	1	90	0	NW	0	E	-1	0	9.74E-05	3.29E-05	3.06E-05	3.17E-07	600
7	1	112	0	NW	0	E	-2	0	7.83E-05	2.64E-05	2.46E-05	3.17E-07	600
8	1	105	0	NW	0	E	-3	0	8.35E-05	2.2[illegible]E-05	2.62E-05	3.17E-07	600
9	1	106	0	NW	0	D	-9	0	5.12E-05	2.20E-05	2.04E-05	3.17E-07	600
10	1	156	0	NNW	0	C	-10	0	1.49E-05	1.03E-05	9.60E-06	3.17E-07	600
11	1	146	0	NNW	0	E	-1	0	6.01E-05	2.03E-05	1.88E-05	3.17E-07	600
12	1	118	0	NW	0	E	-3	0	7.43E-05	2.51E-05	2.33E-05	3.17E-07	600
13	1	146	0	NW	0	E	-1	0	6.01E-05	2.03E-05	1.88E-05	3.17E-07	600
14	1	134	0	NW	0	D	-4	0	4.05E-05	1.74E-05	1.61E-05	3.17E-07	600
15	1	160	0	NW	0	E	-3	0	5.48E-05	1.85E-05	1.72E-05	3.17E-07	600
16	1	169	0	NNW	0	E	1	0	5.19E-05	1.75E-05	1.63E-05	3.17E-07	600
17	1	136	0	NW	0	E	1	0	6.45E-05	2.18E-05	2.02E-05	3.17E-07	600
18	1	143	0	NW	0	E	1	0	6.13E-05	2.07E-05	1.92E-05	3.17E-07	600
19	1	97	0	NW	0	E	3	0	9.04E-05	3.05E-05	2.83E-05	3.17E-07	600
20	1	47	0	WNW	0	E	6	0	1.87E-04	6.30E-05	5.85E-05	3.17E-07	600
21	1	80	0	WNW	0	F	17	0	1.65E-04	5.86E-05	5.44E-05	3.17E-07	600
22	1	108	0	NW	0	E	8	0	8.12E-05	2.74E-05	2.55E-05	3.17E-07	600
23	1	77	0	WNW	0	E	3	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
24	1	92	0	WNW	0	E	5	0	9.53E-05	3.22E-05	2.99E-05	3.17E-07	600

RETURN TO CONTINUE, S TO STOP

X/Q HOURLY DATA----FOR APR 18, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	75	0	W	0	E	4	0	1.17E-04	3.95E-05	3.67E-05	3.17E-07	600
2	1	67	0	WNW	0	E	3	0	1.31E-04	4.42E-05	4.10E-05	3.17E-07	600
3	1	50	0	WSW	0	E	9	0	1.75E-04	5.92E-05	5.50E-05	3.17E-07	600
4	1	65	0	W	0	E	5	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
5	1	94	0	NW	0	E	4	0	9.13E-05	3.15E-05	2.93E-05	3.17E-07	600
6	1	73	0	WNW	0	E	1	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
7	1	120	0	NW	0	E	-3	0	7.31E-05	2.47E-05	2.29E-05	3.17E-07	600
8	1	138	0	NW	0	D	-5	0	3.93E-05	1.69E-05	1.57E-05	3.17E-07	600
9	1	159	0	NW	0	D	-5	0	3.41E-05	1.46E-05	1.36E-05	3.17E-07	600
10	1	166	0	NW	0	D	-5	0	3.27E-05	1.40E-05	1.30E-05	3.17E-07	600
11	1	141	0	NW	0	D	-9	0	3.85E-05	1.65E-05	1.53E-05	3.17E-07	600
12	1	156	0	NNW	0	D	-5	0	3.85E-05	1.65E-05	1.53E-05	3.17E-07	600
13	1	165	0	NNW	0	D	-4	0	3.29E-05	1.41E-05	1.31E-05	3.17E-07	600
14	1	176	0	NNW	0	E	1	0	4.98E-05	1.68E-05	1.56E-05	3.17E-07	600
15	1	207	0	NNW	0	E	4	0	4.24E-05	1.43E-05	1.33E-05	3.17E-07	600
16	1	185	0	N	0	E	6	0	4.74E-05	1.60E-05	1.49E-05	3.17E-07	600
17	1	159	0	N	0	F	10	0	8.32E-05	2.95E-05	2.74E-05	3.17E-07	600
18	1	161	0	N	0	E	5	0	5.45E-05	1.84E-05	1.71E-05	3.17E-07	600
19	1	108	0	NNE	0	E	4	0	8.12E-05	2.74E-05	2.55E-05	3.17E-07	600
20	1	110	0	NNE	0	E	5	0	7.97E-05	2.69E-05	2.50E-05	3.17E-07	600
21	1	117	0	N	0	E	7	0	7.50E-05	2.53E-05	2.35E-05	3.17E-07	600
22	1	95	0	NNE	0	E	3	0	9.23E-05	3.12E-05	2.89E-05	3.17E-07	600
23	1	62	0	NNE	0	E	4	0	1.41E-04	4.77E-05	4.43E-05	3.17E-07	600
24	1	35	0	N	0	E	8	0	2.51E-04	8.46E-05	7.86E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 19, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	85	0	NNW	0	F	19	0	1.56E-04	5.52E-05	5.12E-05	3.17E-07	600
2	1	70	0	NNW	0	G	37	0	3.25E-04	1.05E-04	9.79E-05	3.17E-07	600
3	1	22	0	N	3	G	26	0	1.04E-03	3.36E-04	3.12E-04	3.17E-07	600
4	1	22	0	W	0	G	32	0	1.04E-03	3.36E-04	3.12E-04	3.17E-07	600
5	1	18	0	SSW	0	G	33	0	1.27E-03	4.10E-04	3.81E-04	3.17E-07	600
6	1	19	0	NE	3	G	43	0	1.20E-03	3.88E-04	3.61E-04	3.17E-07	600
7	1	65	0	NNW	0	E	0	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
8	1	229	2	W	2	E	-6	2	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
9	1	165	0	NNW	0	D	-5	0	3.29E-05	1.41E-05	1.31E-05	3.17E-07	600
10	1	149	0	NNW	0	D	-7	0	3.64E-05	1.56E-05	1.45E-05	3.17E-07	600
11	1	181	0	NNW	0	D	-7	0	3.00E-05	1.29E-05	1.19E-05	3.17E-07	600
12	1	154	0	NNW	0	A	-14	0	1.76E-06	2.42E-06	2.24E-06	3.17E-07	600
13	1	201	0	N	0	B	-11	0	5.21E-06	5.16E-06	4.79E-06	3.17E-07	600
14	1	129	0	NNW	0	D	-6	0	4.21E-05	1.80E-05	1.68E-05	3.17E-07	600
15	1	134	0	NW	0	D	-4	0	4.05E-05	1.74E-05	1.61E-05	3.17E-07	600
16	1	173	0	NNW	0	E	0	0	5.07E-05	1.71E-05	1.59E-05	3.17E-07	600
17	1	159	0	NNW	0	E	0	0	5.52E-05	1.86E-05	1.73E-05	3.17E-07	600
18	1	137	0	N	0	E	1	0	6.40E-05	2.16E-05	2.01E-05	3.17E-07	600
19	1	88	0	NNE	0	E	5	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
20	1	111	0	NNE	0	E	4	0	7.90E-05	2.67E-05	2.48E-05	3.17E-07	600
21	1	82	0	NNE	0	E	3	0	1.07E-04	3.61E-05	3.35E-05	3.17E-07	600
22	1	60	0	NE	0	E	2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
23	1	80	0	NE	0	E	6	0	1.10E-04	3.70E-05	3.44E-05	3.17E-07	600
24	1	71	0	ENE	0	F	15	0	1.86E-04	6.60E-05	6.13E-05	3.17E-07	600

X/O HOURLY DATA----FOR APR 20, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAU	DPLETN	DEPOSN	DSB
1	1	72	0	NNE	0	F	11	0	1.84E-04	6.51E-05	6.05E-05	3.17E-07	600
2	1	48	0	NNW	0	F	12	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
3	1	6	4	S	3	E	9	0	9.80E-04	3.31E-04	3.07E-04	3.17E-07	600
4	1	6	4	E	5	G	35	0	2.55E-03	8.25E-04	7.66E-04	3.17E-07	600
5	1	20	0	SE	0	G	38	0	1.14E-03	3.69E-04	3.43E-04	3.17E-07	600
6	1	8	0	W	0	G	30	0	2.55E-03	8.25E-04	7.66E-04	3.17E-07	600
7	1	28	0	NNW	3	D	-6	0	1.94E-04	8.31E-05	7.72E-05	3.17E-07	600
8	1	39	0	NNW	0	A	-14	0	6.96E-06	9.54E-06	8.86E-06	3.17E-07	600
9	1	27	0	NW	0	A	-15	0	1.01E-05	1.38E-05	1.28E-05	3.17E-07	600
10	1	36	0	NNW	0	A	-21	0	7.54E-06	1.03E-05	9.60E-06	3.17E-07	600
11	1	68	0	NW	0	A	-19	0	3.99E-06	5.47E-06	5.08E-06	3.17E-07	600
12	1	42	0	NNW	0	A	-18	0	6.47E-06	8.86E-06	8.23E-06	3.17E-07	600
13	1	57	0	WNW	0	A	-19	0	4.77E-06	6.53E-06	6.06E-06	3.17E-07	600
14	1	54	0	WNW	0	A	-18	0	5.03E-06	6.89E-06	6.40E-06	3.17E-07	600
15	1	37	0	WSW	0	A	-17	0	7.34E-06	1.01E-05	9.34E-06	3.17E-07	600
16	1	38	0	NW	0	A	0	2	7.34E-06	1.01E-05	9.34E-06	3.17E-07	600
17	1	25	0	WSW	3	B	-11	0	4.19E-05	4.15E-05	3.85E-05	3.17E-07	600
18	1	48	0	SSW	0	E	-3	0	1.83E-04	6.17E-05	5.73E-05	3.17E-07	600
19	1	55	0	SSW	0	E	1	0	1.59E-04	5.38E-05	5.00E-05	3.17E-07	600
20	1	22	0	S	0	G	45	0	1.04E-03	3.36E-04	3.12E-04	3.17E-07	600
21	1	20	0	WSW	0	G	50	0	1.14E-03	3.69E-04	3.43E-04	3.17E-07	600
22	1	16	0	E	3	G	51	0	1.42E-03	4.61E-04	4.28E-04	3.17E-07	600
23	1	30	0	ESE	3	G	36	0	7.59E-04	2.46E-04	2.29E-04	3.17E-07	600
24	1	10	0	WSW	3	G	32	0	2.28E-03	7.38E-04	6.86E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 21, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	24	0	WSW	3	F	25	0	5.51E-04	1.95E-04	1.81E-04	3.17E-07	600
2	1	15	0	SE	3	G	33	0	1.52E-03	4.92E-04	4.57E-04	3.17E-07	600
3	1	21	0	SSE	0	G	44	0	1.08E-03	3.51E-04	3.26E-04	3.17E-07	600
4	1	31	0	ESE	0	G	49	0	7.35E-04	2.38E-04	2.21E-04	3.17E-07	600
5	1	23	0	ESE	3	G	38	0	9.90E-04	3.21E-04	2.98E-04	3.17E-07	600
6	1	28	0	E	0	G	29	0	8.14E-04	2.64E-04	2.45E-04	3.17E-07	600
7	1	23	0	E	0	D	-4	0	2.36E-04	1.01E-04	9.40E-05	3.17E-07	600
8	1	13	0	NNE	3	A	-12	0	2.09E-05	2.86E-05	2.66E-05	3.17E-07	600
9	1	19	0	WSW	3	C	-10	0	1.23E-04	8.48E-05	7.88E-05	3.17E-07	600
10	1	56	0	SW	0	A	-26	0	4.85E-06	6.64E-06	6.17E-06	3.17E-07	600
11	1	40	0	SE	0	D	-7	0	1.36E-04	5.82E-05	5.40E-05	3.17E-07	600
12	1	60	0	SSE	0	C	-10	0	3.88E-05	2.69E-05	2.50E-05	3.17E-07	600
13	1	66	0	S	0	C	-10	0	3.53E-05	2.44E-05	2.27E-05	3.17E-07	600
14	1	54	0	S	0	D	-8	0	1.01E-04	4.31E-05	4.00E-05	3.17E-07	600
15	1	87	0	S	0	D	-9	0	6.24E-05	2.67E-05	2.48E-05	3.17E-07	600
16	1	63	0	SSW	0	C	-10	0	3.70E-05	2.56E-05	2.38E-05	3.17E-07	600
17	1	71	0	S	0	D	-4	0	7.64E-05	3.28E-05	3.04E-05	3.17E-07	600
18	1	78	0	ESE	0	E	0	0	1.12E-04	3.80E-05	3.53E-05	3.17E-07	600
19	1	106	0	SSE	0	E	0	0	8.27E-05	2.79E-05	2.59E-05	3.17E-07	600
20	1	79	0	SSE	0	E	4	0	1.11E-04	3.75E-05	3.48E-05	3.17E-07	600
21	1	80	0	S	0	E	1	0	1.10E-04	3.70E-05	3.44E-05	3.17E-07	600
22	1	45	0	SSE	0	E	6	0	1.95E-04	6.58E-05	6.11E-05	3.17E-07	600
23	1	60	0	S	0	E	2	0	1.46E-04	4.93E-05	4.58E-05	3.17E-07	600
24	1	48	0	SSE	0	F	14	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 22, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	52	0	SE	0	G	31	0	4.38E-04	1.42E-04	1.32E-04	3.17E-07	600
2	1	45	0	ESE	0	G	26	0	5.06E-04	1.64E-04	1.52E-04	3.17E-07	600
3	1	62	0	E	0	G	31	0	3.67E-04	1.19E-04	1.11E-04	3.17E-07	600
4	1	22	0	ESE	0	G	27	0	1.04E-03	3.36E-04	3.12E-04	3.17E-07	600
5	1	18	0	SE	0	F	23	0	7.35E-04	2.60E-04	2.42E-04	3.17E-07	600
6	1	25	0	E	3	E	8	0	3.51E-04	1.18E-04	1.10E-04	3.17E-07	600
7	1	30	0	ESE	3	E	-1	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
8	1	15	0	SSE	3	E	-3	0	5.85E-04	1.97E-04	1.83E-04	3.17E-07	600
9	1	28	0	SE	3	D	-5	0	1.94E-04	8.31E-05	7.72E-05	3.17E-07	600
10	1	18	0	N	3	D	-4	0	3.02E-04	1.29E-04	1.20E-04	3.17E-07	600
11	1	43	0	S	0	D	-7	0	1.26E-04	5.41E-05	5.03E-05	3.17E-07	600
12	1	19	0	NNE	3	B	-11	0	5.51E-05	5.46E-05	5.07E-05	3.17E-07	600
13	1	50	0	ESE	0	D	-8	0	1.09E-04	4.65E-05	4.32E-05	3.17E-07	600
14	1	49	0	SE	0	D	-8	0	1.11E-04	4.75E-05	4.41E-05	3.17E-07	600
15	1	37	0	SSE	0	D	-6	0	1.47E-04	6.29E-05	5.84E-05	3.17E-07	600
16	1	53	0	S	0	D	-6	0	1.02E-04	4.39E-05	4.08E-05	3.17E-07	600
17	1	65	0	SSW	0	E	-3	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
18	1	58	0	SE	0	E	2	0	1.51E-04	5.10E-05	4.74E-05	3.17E-07	600
19	1	48	0	SE	0	F	11	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
20	1	11	0	SSW	0	G	33	0	2.07E-03	6.71E-04	6.23E-04	3.17E-07	600
21	1	34	0	SE	0	G	49	0	6.70E-04	2.17E-04	2.02E-04	3.17E-07	600
22	1	39	0	SSE	0	G	27	0	5.84E-04	1.89E-04	1.76E-04	3.17E-07	600
23	1	57	0	SSW	0	G	39	0	4.00E-04	1.29E-04	1.20E-04	3.17E-07	600
24	1	27	0	SSE	3	G	56	0	8.44E-04	2.73E-04	2.54E-04	3.17E-07	600

X/O HOURLY DATA----FOR APR 23, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XOGCL	XOGAV	DPLETN	DEPOSN	DSB
1	1	37	0	NW	0	G	39	0	6.16E-04	1.99E-04	1.85E-04	3.17E-07	600
2	1	103	0	NNW	0	F	12	0	1.28E-04	4.55E-05	4.23E-05	3.17E-07	600
3	1	103	0	N	0	G	29	0	2.21E-04	7.17E-05	6.66E-05	3.17E-07	600
4	1	45	0	NNW	0	F	17	0	2.94E-04	1.04E-04	9.68E-05	3.17E-07	600
5	1	20	0	NNW	3	F	25	0	6.61E-04	2.34E-04	2.18E-04	3.17E-07	600
6	1	42	0	NNW	0	G	28	0	5.42E-04	1.76E-04	1.63E-04	3.17E-07	600
7	1	50	0	NNW	0	E	9	0	1.75E-04	5.92E-05	5.50E-05	3.17E-07	600
8	1	62	0	N	0	D	-5	0	8.75E-05	3.75E-05	3.49E-05	3.17E-07	600
9	1	47	0	NNW	0	D	-8	0	1.15E-04	4.95E-05	4.60E-05	3.17E-07	600
10	1	45	0	NNW	0	A	-15	0	6.04E-06	8.27E-06	7.68E-06	3.17E-07	600
11	1	49	0	NNW	0	A	-14	0	5.54E-06	7.59E-06	7.05E-06	3.17E-07	600
12	1	37	0	NW	0	A	-18	0	7.34E-06	1.01E-05	9.34E-06	3.17E-07	600
13	1	40	0	WNW	0	A	-17	0	6.79E-06	9.30E-06	8.64E-06	3.17E-07	600
14	1	29	0	NW	3	A	-15	0	9.37E-06	1.28E-05	1.19E-05	3.17E-07	600
15	1	28	0	WSW	3	D	-5	0	1.94E-04	8.31E-05	7.72E-05	3.17E-07	600
16	1	33	0	SW	0	D	-5	0	1.64E-04	7.05E-05	6.55E-05	3.17E-07	600
17	1	68	0	SSW	0	E	-2	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
18	1	80	0	SSW	0	E	4	0	1.10E-04	3.70E-05	3.44E-05	3.17E-07	600
19	1	42	0	SW	0	F	15	0	3.15E-04	1.12E-04	1.04E-04	3.17E-07	600
20	1	66	0	WSW	0	F	22	0	2.00E-04	7.10E-05	6.60E-05	3.17E-07	600
21	1	33	0	SW	0	F	18	0	4.01E-04	1.42E-04	1.32E-04	3.17E-07	600
22	1	23	0	S	0	G	41	0	9.90E-04	3.21E-04	2.98E-04	3.17E-07	600
23	1	32	0	SW	0	G	56	0	7.12E-04	2.31E-04	2.14E-04	3.17E-07	600
24	1	12	0	W	0	G	36	0	1.90E-03	6.15E-04	5.71E-04	3.17E-07	600

X/Q HOURLY DATA----FOR APR 24, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAU	DPLETN	DEPOSN	DSB
1	1	8	0	ESE	5	G	46	0	2.55E-03	8.25E-04	7.66E-04	3.17E-07	600
2	1	33	0	SSE	0	G	27	0	6.90E-04	2.24E-04	2.08E-04	3.17E-07	600
3	1	40	0	SW	0	G	35	0	5.69E-04	1.85E-04	1.71E-04	3.17E-07	600
4	1	31	0	ESE	0	G	31	0	7.35E-04	2.38E-04	2.21E-04	3.17E-07	600
5	1	48	0	ENE	0	F	20	0	2.76E-04	9.77E-05	9.07E-05	3.17E-07	600
6	1	22	0	NNW	0	E	3	0	3.99E-04	1.35E-04	1.25E-04	3.17E-07	600
7	1	29	0	N	3	E	0	0	3.02E-04	1.02E-04	9.48E-05	3.17E-07	600
8	1	33	0	N	0	D	-4	0	1.64E-04	7.05E-05	6.55E-05	3.17E-07	600
9	1	37	0	NNW	0	E	-3	0	2.37E-04	8.00E-05	7.43E-05	3.17E-07	600
10	1	17	0	SSE	3	D	-6	0	3.19E-04	1.37E-04	1.27E-04	3.17E-07	600
11	1	58	0	ESE	0	D	-7	0	9.36E-05	4.01E-05	3.73E-05	3.17E-07	600
12	1	59	0	ESE	0	D	-5	0	9.20E-05	3.94E-05	3.66E-05	3.17E-07	600
13	1	53	0	SE	0	D	-5	0	1.02E-04	4.39E-05	4.08E-05	3.17E-07	600
14	1	70	0	ESE	0	D	-9	0	7.75E-05	3.32E-05	3.09E-05	3.17E-07	600
15	1	56	0	SE	0	D	-8	0	9.69E-05	4.15E-05	3.86E-05	3.17E-07	600
16	1	67	0	SSE	0	D	-5	0	8.10E-05	3.47E-05	3.23E-05	3.17E-07	600
17	1	94	0	SSW	0	E	-3	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
18	1	115	0	S	0	E	-2	0	7.63E-05	2.57E-05	2.39E-05	3.17E-07	600
19	1	61	0	S	0	E	1	0	1.44E-04	4.85E-05	4.51E-05	3.17E-07	600
20	1	64	0	SSE	0	E	0	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
21	1	33	0	SE	0	E	9	0	2.66E-04	8.97E-05	8.33E-05	3.17E-07	600
22	1	31	0	SSE	0	E	8	0	2.83E-04	9.55E-05	8.87E-05	3.17E-07	600
23	1	39	0	ESE	0	E	8	0	2.25E-04	7.59E-05	7.05E-05	3.17E-07	600
24	1	50	0	ESE	0	E	6	0	1.75E-04	5.92E-05	5.50E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 25, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	43	0	SE	0	E	5	0	2.04E-04	6.88E-05	6.39E-05	3.17E-07	600
2	1	51	0	SE	0	E	4	0	1.72E-04	5.80E-05	5.39E-05	3.17E-07	600
3	1	50	0	SE	0	E	5	0	1.75E-04	5.92E-05	5.50E-05	3.17E-07	600
4	1	43	0	ESE	0	E	2	0	2.04E-04	6.88E-05	6.39E-05	3.17E-07	600
5	1	42	0	ESE	0	E	0	0	2.09E-04	7.05E-05	6.55E-05	3.17E-07	600
6	1	47	0	ESE	0	E	-1	0	1.87E-04	6.30E-05	5.85E-05	3.17E-07	600
7	1	36	0	SSE	0	E	1	0	2.44E-04	8.22E-05	7.64E-05	3.17E-07	600
8	1	49	0	SE	0	D	-4	0	1.11E-04	4.75E-05	4.41E-05	3.17E-07	600
9	1	58	0	SSE	0	D	-5	0	9.36E-05	4.01E-05	3.73E-05	3.17E-07	600
10	1	58	0	SSE	0	D	-9	0	9.36E-05	4.01E-05	3.73E-05	3.17E-07	600
11	1	80	0	SSW	0	A	-12	0	3.40E-06	4.65E-06	4.32E-06	3.17E-07	600
12	1	72	0	SSW	0	A	-13	0	3.77E-06	5.17E-06	4.80E-06	3.17E-07	600
13	1	127	0	S	0	C	-10	0	1.83E-05	1.27E-05	1.18E-05	3.17E-07	600
14	1	138	0	S	0	D	-7	0	3.93E-05	1.69E-05	1.57E-05	3.17E-07	600
15	1	134	0	SSE	0	D	-6	0	4.05E-05	1.74E-05	1.61E-05	3.17E-07	600
16	1	139	0	SSE	0	D	-6	0	3.90E-05	1.67E-05	1.55E-05	3.17E-07	600
17	1	135	0	SSE	0	D	-6	0	4.02E-05	1.72E-05	1.60E-05	3.17E-07	600
18	1	125	0	SSE	0	E	-2	0	7.02E-05	2.37E-05	2.20E-05	3.17E-07	600
19	1	110	0	SSE	0	E	1	0	7.97E-05	2.69E-05	2.50E-05	3.17E-07	600
20	1	88	0	SSE	0	E	0	0	9.97E-05	3.36E-05	3.12E-05	3.17E-07	600
21	1	94	0	SSE	0	E	0	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
22	1	78	0	SE	0	E	3	0	1.12E-04	3.80E-05	3.53E-05	3.17E-07	600
23	1	95	0	SE	0	E	3	0	9.23E-05	3.12E-05	2.89E-05	3.17E-07	600
24	1	70	0	E	0	E	3	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 26, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	28	0	E	0	E	5	0	3.13E-04	1.06E-04	9.82E-05	3.17E-07	600
2	1	65	0	SE	0	E	2	0	1.35E-04	4.55E-05	4.23E-05	3.17E-07	600
3	1	71	0	SE	0	E	1	0	1.24E-04	4.17E-05	3.87E-05	3.17E-07	600
4	1	68	0	SE	0	E	2	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
5	1	69	0	SE	0	E	2	0	1.27E-04	4.29E-05	3.99E-05	3.17E-07	600
6	1	56	0	ESE	0	E	1	0	1.57E-04	5.29E-05	4.91E-05	3.17E-07	600
7	1	54	0	ESE	0	E	-3	0	1.62E-04	5.48E-05	5.09E-05	3.17E-07	600
8	1	59	0	ESE	0	E	-2	0	1.49E-04	5.02E-05	4.66E-05	3.17E-07	600
9	1	68	0	SSE	0	E	-3	0	1.29E-04	4.35E-05	4.04E-05	3.17E-07	600
10	1	121	0	SSE	0	D	-4	0	4.49E-05	1.92E-05	1.79E-05	3.17E-07	600
11	1	126	0	SSE	0	E	-3	0	6.96E-05	2.35E-05	2.18E-05	3.17E-07	600
12	1	117	0	SSE	0	E	-3	0	7.50E-05	2.53E-05	2.35E-05	3.17E-07	600
13	1	118	0	SE	0	D	-4	0	4.60E-05	1.97E-05	1.83E-05	3.17E-07	600
14	1	120	0	ESE	0	D	-4	0	4.52E-05	1.94E-05	1.80E-05	3.17E-07	600
15	1	117	0	ESE	0	E	-2	0	7.50E-05	2.53E-05	2.35E-05	3.17E-07	600
16	1	132	0	ESE	0	E	1	0	6.64E-05	2.24E-05	2.08E-05	3.17E-07	600
17	1	153	0	SE	0	E	-3	0	5.73E-05	1.93E-05	1.80E-05	3.17E-07	600
18	1	157	0	SE	0	E	-1	0	5.59E-05	1.89E-05	1.75E-05	3.17E-07	600
19	1	97	0	SE	0	E	1	0	9.04E-05	3.05E-05	2.83E-05	3.17E-07	600
20	1	70	0	E	0	E	0	0	1.25E-04	4.23E-05	3.93E-05	3.17E-07	600
21	1	55	0	ESE	0	E	-1	0	1.59E-04	5.38E-05	5.00E-05	3.17E-07	600
22	1	41	0	ESE	0	E	1	0	2.14E-04	7.22E-05	6.71E-05	3.17E-07	600
23	1	30	0	NNE	3	E	1	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
24	1	44	0	S	0	E	1	0	1.99E-04	6.73E-05	6.25E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 27, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	36	0	S	0	E	1	0	2.44E-04	8.22E-05	7.64E-05	3.17E-07	600
2	1	63	0	S	0	E	-1	0	1.39E-04	4.70E-05	4.36E-05	3.17E-07	600
3	1	55	0	SSE	0	E	0	0	1.59E-04	5.38E-05	5.00E-05	3.17E-07	600
4	1	32	0	SE	0	E	0	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600
5	1	30	0	SE	0	E	1	0	2.92E-04	9.87E-05	9.17E-05	3.17E-07	600
6	1	28	0	ESE	3	E	-1	0	3.13E-04	1.06E-04	9.82E-05	3.17E-07	600
7	1	46	0	ESE	0	E	-2	0	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600
8	1	24	0	ENE	3	E	-2	0	3.65E-04	1.23E-04	1.15E-04	3.17E-07	600
9	1	22	0	NE	3	E	-2	0	3.99E-04	1.35E-04	1.25E-04	3.17E-07	600
10	1	16	0	N	3	D	-4	0	3.39E-04	1.45E-04	1.35E-04	3.17E-07	600
11	1	53	0	NW	0	E	-1	0	1.65E-04	5.59E-05	5.19E-05	3.17E-07	600
12	1	93	0	NW	0	E	-1	0	9.43E-05	3.18E-05	2.96E-05	3.17E-07	600
13	1	59	0	NW	0	E	3	0	1.49E-04	5.02E-05	4.66E-05	3.17E-07	600
14	1	47	0	NNW	0	D	-4	0	1.15E-04	4.95E-05	4.60E-05	3.17E-07	600
15	1	101	0	NW	0	E	-3	0	8.68E-05	2.93E-05	2.72E-05	3.17E-07	600
16	1	101	0	WNW	0	E	-2	0	8.68E-05	2.93E-05	2.72E-05	3.17E-07	600
17	1	102	0	WNW	0	E	-1	0	8.60E-05	2.90E-05	2.70E-05	3.17E-07	600
18	1	135	0	NW	0	E	-2	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
19	1	82	0	NW	0	E	0	0	1.07E-04	3.61E-05	3.35E-05	3.17E-07	600
20	1	91	0	WNW	0	E	0	0	9.64E-05	3.25E-05	3.02E-05	3.17E-07	600
21	1	73	0	NW	0	E	2	0	1.20E-04	4.06E-05	3.77E-05	3.17E-07	600
22	1	49	0	NNW	0	E	8	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
23	1	69	0	NW	0	E	2	0	1.27E-04	4.29E-05	3.99E-05	3.17E-07	600
24	1	89	0	NNW	0	E	1	0	9.85E-05	3.33E-05	3.09E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 28, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	43	0	NNW	0	F	19	0	3.08E-04	1.09E-04	1.01E-04	3.17E-07	600
2	1	76	0	NNW	0	E	0	0	1.15E-04	3.90E-05	3.62E-05	3.17E-07	600
3	1	55	0	NNE	0	F	11	0	2.41E-04	8.52E-05	7.92E-05	3.17E-07	600
4	1	32	0	N	0	E	8	0	2.74E-04	9.25E-05	8.59E-05	3.17E-07	600
5	1	47	0	SE	0	F	25	0	2.81E-04	9.98E-05	9.27E-05	3.17E-07	600
6	1	12	0	SW	0	F	19	0	1.10E-03	3.91E-04	3.63E-04	3.17E-07	600
7	1	19	0	WNW	3	D	-7	0	2.86E-04	1.22E-04	1.14E-04	3.17E-07	600
8	1	26	0	SE	3	D	-7	0	2.09E-04	8.95E-05	8.31E-05	3.17E-07	600
9	1	80	0	NNW	0	A	-15	0	3.40E-06	4.65E-06	4.32E-06	3.17E-07	600
10	1	50	0	N	0	A	-21	0	5.43E-06	7.44E-06	6.91E-06	3.17E-07	600
11	1	29	0	W	3	A	-17	0	9.37E-06	1.28E-05	1.19E-05	3.17E-07	600
12	1	39	0	WSW	0	A	-18	0	6.96E-06	9.54E-06	8.86E-06	3.17E-07	600
13	1	39	0	N	0	A	-16	0	6.96E-06	9.54E-06	8.86E-06	3.17E-07	600
14	1	34	0	NNW	0	A	-18	0	7.99E-06	1.09E-05	1.02E-05	3.17E-07	600
15	1	34	0	S	0	D	-5	0	1.60E-04	6.84E-05	6.36E-05	3.17E-07	600
16	1	56	0	SW	0	D	-7	0	9.69E-05	4.15E-05	3.86E-05	3.17E-07	600
17	1	49	0	SSW	0	E	-2	0	1.79E-04	6.04E-05	5.61E-05	3.17E-07	600
18	1	137	0	NNW	0	E	-1	0	6.40E-05	2.16E-05	2.01E-05	3.17E-07	600
19	1	107	0	NW	0	E	0	0	8.20E-05	2.77E-05	2.57E-05	3.17E-07	600
20	1	135	0	WNW	0	E	-3	0	6.50E-05	2.19E-05	2.04E-05	3.17E-07	600
21	1	122	0	NW	0	E	-3	0	7.19E-05	2.43E-05	2.25E-05	3.17E-07	600
22	1	87	0	NW	0	E	-2	0	1.01E-04	3.40E-05	3.16E-05	3.17E-07	600
23	1	132	0	NW	0	E	-3	0	6.64E-05	2.24E-05	2.08E-05	3.17E-07	600
24	1	113	0	NW	0	E	-3	0	7.76E-05	2.62E-05	2.43E-05	3.17E-07	600

RETURN TO CONTINUE, S TO STOP

X/Q HOURLY DATA----FOR APR 29, 1979

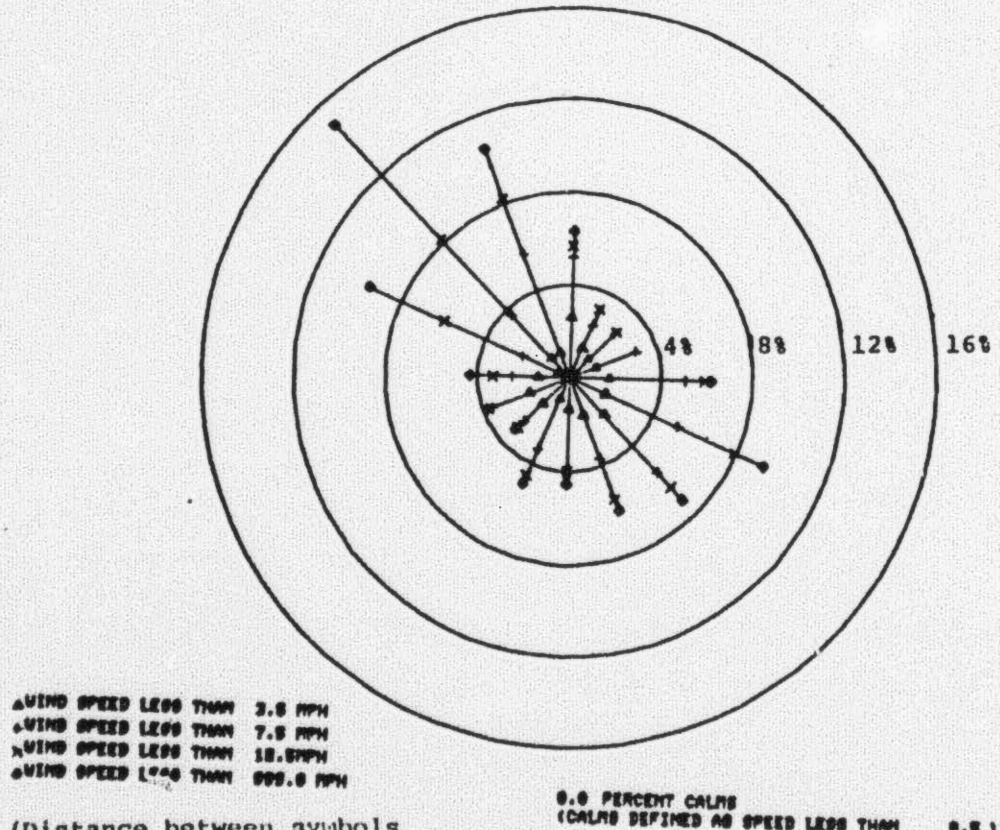
HR	R	SPD	S	DIR	S	PG	DT	S	XQGCL	XQGAV	DPLETN	DEPOSN	DSB
1	1	100	0	WNW	0	E	-1	0	8.77E-05	2.96E-05	2.75E-05	3.17E-07	600
2	1	113	0	WNW	0	E	-2	0	7.76E-05	2.62E-05	2.43E-05	3.17E-07	600
3	1	125	0	WNW	0	E	-2	0	7.02E-05	2.37E-05	2.20E-05	3.17E-07	600
4	1	173	0	NW	0	D	-4	0	3.14E-05	1.34E-05	1.25E-05	3.17E-07	600
5	1	117	0	NW	0	E	-3	0	7.50E-05	2.53E-05	2.35E-05	3.17E-07	600
6	1	117	0	NW	0	D	-4	0	4.64E-05	1.99E-05	1.85E-05	3.17E-07	600
7	1	104	0	NW	0	D	-7	0	5.22E-05	2.24E-05	2.08E-05	3.17E-07	600
8	1	119	0	NW	0	B	-11	0	8.80E-06	8.72E-06	8.09E-06	3.17E-07	600
9	1	109	0	NNW	0	A	-15	0	2.49E-06	3.41E-06	3.17E-06	3.17E-07	600
10	1	125	0	NW	0	A	-14	0	2.17E-06	2.98E-06	2.76E-06	3.17E-07	600
11	1	129	0	NW	0	A	-14	0	2.11E-06	2.88E-06	2.68E-06	3.17E-07	600
12	1	104	0	NW	0	A	-18	0	2.61E-06	3.58E-06	3.32E-06	3.17E-07	600
13	1	115	0	NW	0	B	-11	0	9.11E-06	9.02E-06	8.38E-06	3.17E-07	600
14	1	78	0	W	0	C	-10	0	2.99E-05	2.07E-05	1.92E-05	3.17E-07	600
15	1	78	0	W	0	A	-13	0	3.48E-06	4.77E-06	4.43E-06	3.17E-07	600
16	1	70	0	W	0	A	-15	0	3.88E-06	5.31E-06	4.94E-06	3.17E-07	600
17	1	56	0	NW	0	D	-7	0	9.69E-05	4.15E-05	3.86E-05	3.17E-07	600
18	1	64	0	WNW	0	E	-3	0	1.37E-04	4.63E-05	4.30E-05	3.17E-07	600
19	1	77	0	WNW	0	E	1	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
20	1	42	0	W	0	F	13	0	3.15E-04	1.12E-04	1.04E-04	3.17E-07	600
21	1	35	0	W	0	F	20	0	3.78E-04	1.34E-04	1.24E-04	3.17E-07	600
22	1	51	0	WNW	0	E	6	0	1.72E-04	5.80E-05	5.39E-05	3.17E-07	600
23	1	55	0	WNW	0	E	3	0	1.59E-04	5.38E-05	5.00E-05	3.17E-07	600
24	1	46	0	WNW	0	E	9	0	1.91E-04	6.44E-05	5.98E-05	3.17E-07	600

X/Q HOURLY DATA----FOR APR 30, 1979

HR	R	SPD	S	DIR	S	PG	DT	S	XOGCL	XOGAV	DPLETN	DEPOSN	DSB
1	1	31	0	W	0	E	8	0	2.83E-04	9.55E-05	8.87E-05	3.17E-07	600
2	1	14	0	NNW	3	F	18	0	9.45E-04	3.35E-04	3.11E-04	3.17E-07	600
3	1	6	4	S	0	F	24	0	1.48E-03	5.24E-04	4.87E-04	3.17E-07	600
4	1	21	0	WSW	0	F	22	0	6.30E-04	2.23E-04	2.07E-04	3.17E-07	600
5	1	19	0	W	3	E	6	0	4.62E-04	1.56E-04	1.45E-04	3.17E-07	600
6	1	17	0	S	0	G	27	0	1.34E-03	4.34E-04	4.03E-04	3.17E-07	600
7	1	9	0	SE	3	E	-1	0	9.74E-04	3.29E-04	3.06E-04	3.17E-07	600
8	1	51	0	N	0	A	-15	0	5.33E-06	7.29E-06	6.77E-06	3.17E-07	600
9	1	27	0	NNW	3	B	-11	0	3.88E-05	3.84E-05	3.57E-05	3.17E-07	600
10	1	27	0	S	3	A	-13	0	1.01E-05	1.38E-05	1.28E-05	3.17E-07	600
11	1	50	0	SSE	0	A	-14	0	5.43E-06	7.44E-06	6.91E-06	3.17E-07	600
12	1	74	0	SW	0	A	-24	0	3.67E-06	5.03E-06	4.67E-06	3.17E-07	600
13	1	61	0	S	0	A	-14	0	4.45E-06	6.10E-06	5.66E-06	3.17E-07	600
14	1	90	0	SW	0	A	-16	0	3.02E-06	4.13E-06	3.84E-06	3.17E-07	600
15	1	29	0	N	3	B	-11	0	3.61E-05	3.58E-05	3.32E-05	3.17E-07	600
16	1	52	0	WSW	0	D	-9	0	1.04E-04	4.47E-05	4.16E-05	3.17E-07	600
17	1	115	0	SSW	0	D	-5	0	4.72E-05	2.02E-05	1.88E-05	3.17E-07	600
18	1	94	0	SSW	0	E	0	0	9.33E-05	3.15E-05	2.93E-05	3.17E-07	600
19	1	59	0	SSW	0	E	6	0	1.49E-04	5.02E-05	4.66E-05	3.17E-07	600
20	1	55	0	SSW	0	F	25	0	2.41E-04	8.52E-05	7.92E-05	3.17E-07	600
21	1	33	0	S	0	E	9	0	2.66E-04	8.97E-05	8.33E-05	3.17E-07	600
22	1	123	0	NW	0	E	3	0	7.13E-05	2.41E-05	2.24E-05	3.17E-07	600
23	1	77	0	NNW	0	E	0	0	1.14E-04	3.84E-05	3.57E-05	3.17E-07	600
24	1	125	0	NNW	0	E	2	0	7.02E-05	2.37E-05	2.20E-05	3.17E-07	600

Figure A-1

Three Mile Island Wind Rose*
100ft Level
(Period of Record 3/28/79-4/30/79)



(Distance between symbols
represents percent of time wind
speed is in the given speed category)

*Spoke points in direction wind is coming from

APPENDIX B

ATMOSPHERIC DISPERSION AND DOSE ASSESSMENT MODELS

1.0 INTRODUCTION

Two atmospheric dispersion models have been used to compute doses based on gaseous releases during the accident. For whole body gamma dose, a finite plume model was used, and for thyroid and skin dose, a Gaussian dispersion model was used which computes ground level concentrations. Both are sector average models appropriate for releases of duration more than a few hours. Input data such as terrain elevations and population were common to both models as discussed below. These models are commonly used throughout the nuclear industry for dose assessment and are documented in the appropriate NRC regulatory guides as discussed below.

2.0 ATMOSPHERIC DISPERSION MODEL FOR CALCULATING GROUND LEVEL CONCENTRATIONS

The Gaussian plume model is used to compute ground level concentrations of nuclides for assessment of all doses other than those due to gamma radiation. Since releases occurred over a relatively long period of time (days rather than hours), the sector average version of the diffusion equation given as Equation (3) in Regulatory Guide 1.111 is used, along with corrections for wakes and elevated releases as discussed below. This model is referred to as the "best-estimate" model in the main body of the report.

3.0 GENERIC CORRECTION FACTORS

Since releases from the plant vent may be influenced by the turbulent wakes of adjacent large structures at the site, doses were evaluated using a combination of both elevated and ground level (in the building wake) models in accordance with the "mixed mode" approach given in Section C.2.b of Regulatory Guide 1.111. Most releases were made from the plant vent which has characteristics given in Table B-1. During low wind speeds, the plume will be lofted somewhat due to the momentum of the exiting gas. However, for most wind directions, air flow streamlines will result in some lowering of the plume as it travels downwind. Therefore, no increase in plume height was assumed for the momentum jet. The building wake correction given in Equation (9) of the same regulatory guide is also used for releases trapped in the building wake. The fraction of time that the plume is treated as a ground level release is given by Equations (7) and (8) of Regulatory Guide 1.111.

A detailed study of plume-wake interactions was undertaken for this analysis by James Halitsky. Halitsky's method, which is detailed in Appendix F, considered the interaction of the vent plume with cavity-wake flows generated by the containment structure and the entire reactor building complex for a 157.5° wind. Plume rise due to jet momentum and streamline curvature was accounted for. The fraction of time that the plume should be treated as an effective ground level release was calculated for several wind speeds. A comparison between Halitsky's values and those used here (Regulatory Guide 1.111) is given in Table B-2. It is seen that the Halitsky method predicts a much smaller fraction for the effective ground release. It is concluded that the Regulatory Guide values used above produce configuration for winds traveling in the NNW direction.

4.0 FINITE PLUME MODEL FOR GAMMA DOSE

All gamma dose calculations were made using the finite plume model described in detail in NRC Regulatory Guide 1.109, Section C.2, and in greater detail in Appendix B of the same guide. Solution of the "$\bar{I}$" functions in the model utilize the computer subroutine given in Appendix F of Regulatory Guide

1.109, attributed to J. Hamawi. A "finite plume" model is used for gamma dose because it accounts for the actual dimensions of the plume which is important for obtaining realistic gamma dose calculations.

5.0 SKIN DOSE

Dose to the skin was computed in accordance with the procedure outlined in Regulatory Guide 1.109 and Equation (11) therein. Contributions to this dose from both beta and gamma radiation are accounted for. Skin dose factors for each isotope are given in Table B-1 of the Regulatory Guide.

6.0 THYROID DOSES

Thyroid doses can occur due to inhalation or ingestion of iodine. To assess inhalation doses the dispersion values (X/Q) obtained using the model discussed in Section 2.0 above were used each hour in Equation (13) of Regulatory Guide 1.109 for estimating inhalation dose. Thyroid doses due to ingestion of milk were computed using Equation (14) of Regulatory Guide 1.109.

7.0 CALCULATION PROCEDURE

Source term (Q) values (release rates of each isotope) for each type of release are established for each hour for use in the dispersion equation. Meteorological data averaged over sequential 15-minute intervals are used along with the source terms to compute the dose for each 15-minute period. Then the total dose is computed by summing over the period of interest. Population doses were made using hourly averages for ten distances (corresponding to the terrain and population tables) in each of sixteen direction sectors. Isopleths (contour lines of equal dose) are then drawn through the grid of computed values.

8.0 INPUT DATA

Plant characteristics, population data, meteorological instrument descriptions and other data used as input to the model calculations are given in Tables B-1, B-3 and B-4, and Figures B-1 and B-2.

TABLE B-1

INPUT DATA FOR DISPERSION MODELLING

METEOROLOGICAL DATA

Parameter	Characteristics
Wind speed -	Measured at 100 ft, used uncorrected for ground releases and adjusted exponentially to 160 ft for elevated releases
Wind direction -	Measured at 100 ft
Stability -	Based on Δt 150-33 ft and PG (A-G) dispersion categories in accordance with Regulatory Guide 1.23
σ_z (dispersion coefficient)	Based on PG curves, limited to 1000m

Site Specific Data

Terrain height	See Table B-2
Population distribution	See Figures B-1 and B-2
Cow population distribution	See Table B-3

Plant Specific Data

Vent Height	160 ft
Vent exit diameter	3.0 m
Vent exit velocity	9.1 m/sec
Building Height for computation of Σ_z, the effective dispersion coefficient	170 ft

Table B-2

Fraction of Time that Plume is an Effective Ground Level Release

Wind Speed (mph)	Fraction of Source as Ground Level Release: Values Used Here USNRC Regulatory Guide 1.111	Values Calculated by Halitsky* (Appendix F)
10	0.06	0.0
15	0.18	0.01
20	0.43	0.04

*The Halitsky analysis calculates the fraction of the time-averaged vent plume that can be treated as an effective ground release. This is equivalent to the fraction of time that the instantaneous plume can be treated as an effective ground release.

Table B-3

Approximate Terrain Elevations (meters) within 12 Miles of the TMI Site*

Distance (meters)	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,000	0	0	6	6	[illegible]	5	5	5	0	0	0	0	0	0	0	0
1,500	10	25	20	20	25	20	35	30	0	0	0	0	0	0	0	0
2,000	60	75	35	40	25	30	50	50	0	0	35	65	65	65	63	50
4,000	60	75	75	65	35	65	65	60	65	75	90	85	65	95	65	50
6,000	75	90	90	65	60	90	65	60	65	75	130	125	65	162	65	50
8,000	75	190	130	80	105	110	65	65	65	130	165	150	168	203	65	70
12,000	80	200	155	80	110	110	65	70	130	152	305	150	310	310	75	80
20,000	100	200	200	100	130	120	75	305	170	152	310	310	350	350	100	100

*Terrain height for distances beyond 20,000 was assumed to be unchanged from the last value since higher elevations would result in little change in dispersion at greater distances.

Table B-4

Estimated Milk Cow Population within 50 Miles of TMI [1]

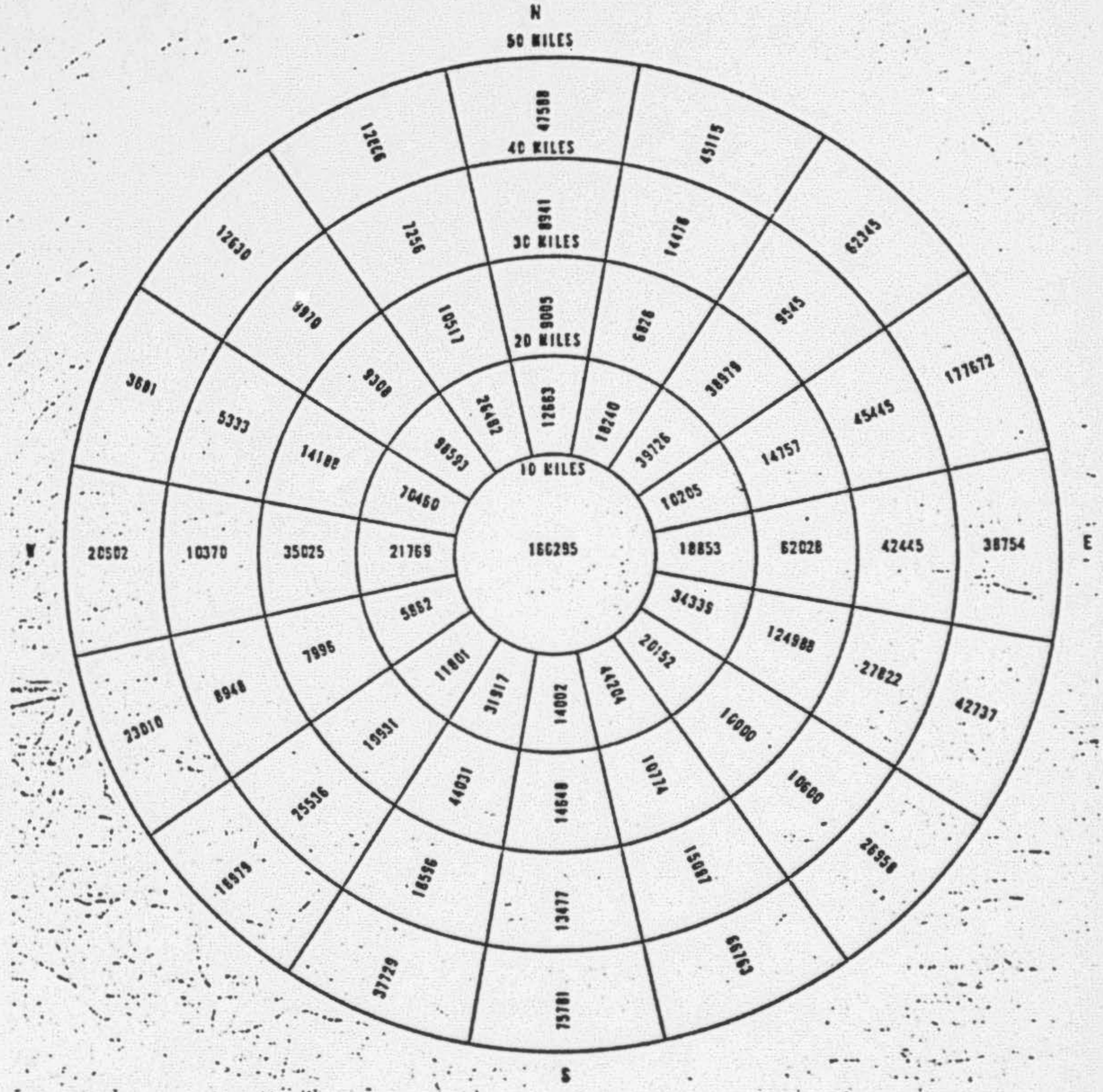
Direction	Distance from Plant (miles) 0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10 - 20	20 - 30	30 - 40	40 - 50
S	0	0	0	0	0	444	1767	2943	4140	5310
SSW	0	0	0	0	28	444	1767	2943	4140	5310
SW	0	0	0	0	0	444	1767	2943	4140	5310
WSW	0	0	0	1	0	444	1767	2943	4140	5310
W	0	0	0	0	0	444	1767	2943	4140	5310
WNW	0	0	27	37	1	444	1767	2943	4140	5310
NW	0	0	0	0	0	444	1767	2943	4140	5310
NNW	0	0	0	0	0	444	1767	2943	4140	5310
N	0	0	0	70	0	444	1767	2943	4140	5310
NNE	0	0	1	0	0	444	1767	2943	4140	5310
NE	0	0	20	148	0	444	1767	2943	4140	5310
ENE	0	42	0	0	221	1110	4417	7357	10,350	13,270
E	0	39	0	40	0	1110	4417	7357	10,350	13,270
ESE	0	0	25	124	37	1110	4417	7357	10,350	13,270
SE	0	33	0	0	231	1110	4417	7357	10,350	13,270
SSE	0	0	0	0	0	1110	4417	7357	10,350	13,270

[1] Data for area within 5 miles from Metropolitan Edison survey.

Data from beyond 5 miles calculated from county milk production data, pro-rated by the factor of the county area falling within 50 miles of the plant. Results indicated a fairly uniform population density, over wide areas, so averages were used where appropriate by conversion to cow population density assuming 34 lb/day.

The total number of cows is approximately 320,000.

Figure B-1

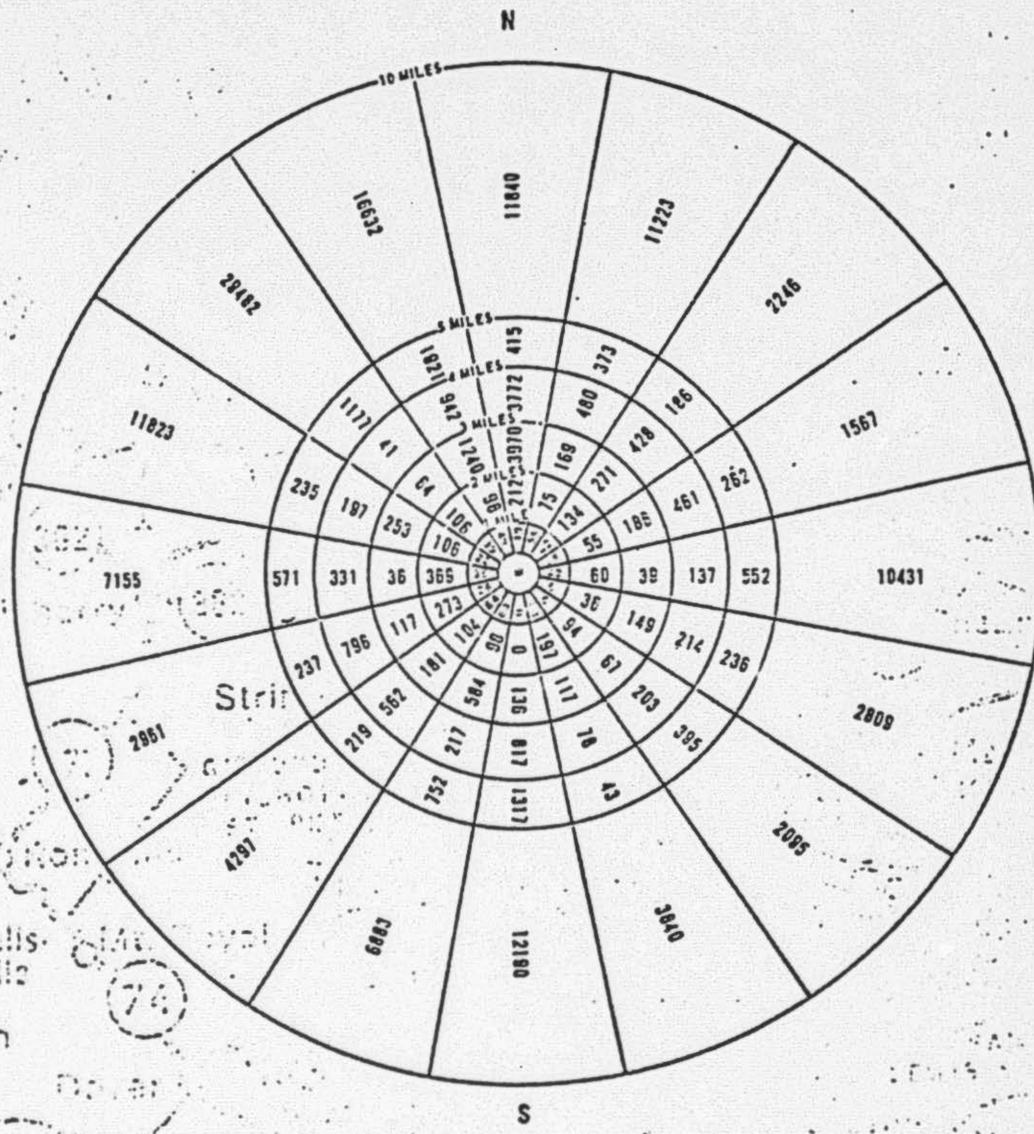


DISTANCE	TOTAL	CUM. TOTAL
0-10 MI.	166,295	
10-20 MI.	577,288	745,583
20-30 MI.	433,001	1,178,584
30-40 MI.	273,857	1,452,441
40-50 MI.	713,210	2,165,651

POPULATION DISTRIBUTION
0 TO 50 MILES – 1980
THREE MILE ISLAND NUCLEAR STATION UNIT

FIGURE 2.1-

Figure B-2



DISTANCE	TOTAL	CUM. TOTAL
0–1 MI.	658	
1–2 MI.	2,017	2,675
2–3 MI.	7,579	10,254
3–4 MI.	9,676	19,930
4–5 MI.	8,891	28,821
5–10 MI.	137,474	166,295

* EXCLUSION RADIUS

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POPULATION DISTRIBUTION
0 TO 10 MILES – 1980
THREE MILE ISLAND NUCLEAR STATION

FIGU

APPENDIX C

EFFLUENT MONITOR DATA

TABLE C-1

LIQUID EFFLUENT RELEASES OF IODINE-131

(3/28/79-4/30/79)

Start	Stop	Tank	(µCi/cc) [1]Concentration at Station Discharge (dilution calc.)	(µCi/cc) [2]Concentration at Station Discharge (grab samples)	µCi Discharged	Cumu µC Disc
3/28 0400	3/28 0900	IWTS	$1.6x10^{-7}$	$4x10^{-8}$ at 1100 hrs.	6469	6,4
3/28 0320	3/28 0655	WECST-B	None		None[3]	6,4
3/29 0015	3/29 1215	WECST-B	None		None	6,4
3/29 1315	3/29 1410	IWTS	$7.5x10^{-10}$		7.5	64
3/29 1610	3/29 1815	IWTS	$7.5x10^{-10}$	$5.-x10^{-10}$ at 1700 hrs.	17.0	649
3/30 0020	3/30 0753	SEC. NEUT.	None		None[4]	649
3/30 1200	3/30 1630	IWTS	$1.2x10^{-9}$		135.9	662
3/30 0300	3/30 1600	IWTS	$6.7x10^{-10}$		133	678
3/30 2020	3/30 2253	SEC. NEUT.	None		None	678
3/31 0140	3/31 0430	IWTS	$2.5x10^{-8}$		241.3	702
3/30 1600	3/30 2400	IWTS	$5.5x10^{-8}$		6,981	1-00
3/31 0001	3/31 2400	IWTS	$2.7x10^{-7}$		92,112	10611
3/31 0240	3/31 0710	WECST-A	$3.9x10^{-9}$		140	10625
3/31 2230	[illegible]	SEC. NEUT.	None		None	[illegible]
[illegible] 0650	[illegible]	WECST-B	None		None	[illegible]

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TABLE C-1

LIQUID EFFLUENT RELEASES OF IODINE-131

(3/28/79-4/30/79)

Start	Stop	Tank	(μCi/cc) [1]Concentration at Station Discharge (dilution calc.)	(μCi/cc) [2]Concentration at Station Discharge (grab samples)	μCi Discharged	Cumu[illegible] μCi Disc[illegible]
4/1 0011	4/1 2400	IWTS	$1.49x10^{-7}$	6.2×10^{-8}* 2020 hrs.	54673	[illegible]
4/1 0130	4/1 053-	IWTS	$2.5x10^{-8}$		346.3	[illegible]
4/1 1501	4/1 1913	IWTS	$2.5x10^{-8}$		396	[illegible]
4/2 0001	4/2 1950	IWTS	$1.08x10^{-7}$	1.5×10^{-8}* 1130 hrs.	27854	[illegible]
4/2 1650	4/2 1850	SEC. NEUT.	None		None	[illegible]
4/2 0515	4/2 1110	IWTS	$2.5x10^{-8}$		394.6	[illegible]
4/3 1025	4/3 1915	SEC. NEUT.	None	7.3×10^{-10}* 1540 hrs.	None	[illegible]
4/5 1813	4/6 0750	WECST-A	$1x10^{-8}$	2×10^{-10}* 1815 hrs; 1.0×10^{-10} 4/5 at 1305 hrs.*	1010	[illegible]
4/5 1800	4/6 0003	SEC. NEUT.	None		None	[illegible]
4/6 0310	4/6 0400	IWTS	$1.9x10^{-7}$		480.1	[illegible]
4/6 0615	4/7 2230	IWTS	$7.9x10^{-8}$	5.9×10^{-9}* 4/6 at 1640 hrs.	16665	[illegible]
4/6 1930	4/7 0450	IWTS	$5.1x10^{-8}$		930.9	[illegible]
4/7 0355	4/7 1430	SEC. NEUT.	None	$<6x10^{-8}$; 6.3×10^{-9}* 4/7 at 1045 hrs.	None	[illegible]

TABLE C-1

EFFLUENT RELEASES OF IODINE-131

(3/28/79-4/30/79)

Start	Stop	Tank	[1](μCi/cc) Concentration at Station Discharge (dilution calc.)	[2](μCi/cc) Concentration at Station Discharge (grab samples)	μCi Discharged	Cumula[tive] μCi Discha[rged]
4/7 1745	4/8 0150	WECST-B		$<4x10^{-8}$ $<3 x 10^{-11}$* 4/8 at 1100 hrs.	2180	21070.
4/8 2005	4/9 0945	SEC. NEUT.	None	$<4x10^{-8}$	None	[illegible]
4/9 0155	4/9 0945	WECST-B		$<4x10^{-8}$ $<2 x 10^{-10}$* 4/9 at 1910 hrs.	443	[illegible]
4/10 0645	4/10 1410	IWFS	$5.7 x 10^{-9}$	$<6.5x10^{-8}$ [illegible] $x 10^{-9}$* 4/10 at 1710 hrs.	80.6	[illegible]
4/10 1125	4/10 1900	WECST-A		$<6.5x10^{-8}$	129.0	[illegible]
4/11 0840	4/11 1600	SEC. NEUT.	None	$<1.1x10^{-8}$ $1.4 x 10^{-9}$* 4/11 at 1620 hrs.	None	[illegible]
4/12 0055	4/12 1230	WECST-B		$<3.9x10^{-9}$ $1.5 x 10^{-9}$* 4/12 at 2000 hrs.	200.0	[illegible]
4/13 0535	4/13 2005	WECST-A	None	$<3.6x10^{-9}$	None	[illegible]
4/13 0555	4/13 1250	SEC. NEUT.	None	$<3x10^{-9}$	None	[illegible]
4/13 [illegible]	4/13 0449	WECST-B		$<5.1x10^{-8}$	60.0	[illegible]
4/13 1550	4/13 0535	IWTS	$2.1 x 10^{-8}$	$<2.3x10^{-8}$	6.205	[illegible]
4/13 2140	4/14 0127	IWFS	[illegible]$.6 x 10^{-8}$	$<1.6x10^{-8}$ $1.2 x 10^{-9}$* 4/13 at 2230 hrs.	1,956	[illegible]
4/14 2226	4/14 0440	WECST-A	None	$<5.1x10^{-8}$	None	[illegible]
4/14 [illegible]	4/15 0215	IWTS	[illegible]$.5 x 10^{-9}$	$<2.2x10^{-8}$ $1.9 x 10^{-9}$* 4/14 at 1530 hrs.	1325	[illegible]
4/15	4/15 2015	WECST-A		$<3.6x10^{-8}$ [illegible] $x 10^{-9}$* 4/15 at 1550 hrs.	1590.0	[illegible]
4/16 1035	4/16 1515	IWFS	$1.0 x 10^{-9}$	$<3.0x10^{-8}$ $<3 x 10^{-11}$ 4/16 at 1600 hrs.	100.6	[illegible]

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TABLE C-1

LIQUID EFFLUENT RELEASES OF IODINE-131

(3/28/79-4/30/79)

Start	Stop	Tank	µCi/cc Concentration at Station Discharge dilution calc.	µCi/cc Concentration at Station Discharge grab samples	Ci Discharged	Cumulative Ci Discharged
[illegible]	[illegible]	IWTS	[illegible] x 10[illegible]	[illegible] x 10[illegible] [illegible] x 10^{-9*} [illegible] at [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	WECST-A		[illegible] x 10^{-8}	[illegible]	[illegible]
[illegible]	[illegible]	WECST-B	[illegible] x 10^{-9}	[illegible].75 x 10^{-8} [illegible] x 10^{-9*}	[illegible]	[illegible]
[illegible]	[illegible]	IWTS	[illegible] x 10^{-9}	5.1 x 10^{-8} [illegible] x 10^{-9*} [illegible] at 1930	[illegible]	[illegible]
[illegible]	[illegible]	IWTS	[illegible] x 10^{-8}	[illegible] x 10^{-8}	2910.58	[illegible]
[illegible]	4/19 2005	WECST-B		3.7 x 10^{-8} [illegible] x 10^{-9*} Ci/cc [illegible]/19 at 2150 hrs.	315	[illegible]
[illegible] 1535	[illegible]	IWTS	3.1 x 10^{-8}	3.1 x 10^{-8} [illegible].75 x 10^{-9*} Ci/cc 4/20 at 2010 hrs.	77	[illegible]
[illegible] 1830	[illegible]	WECST-A		1.39 x 10^{-8} 1.65 x 10^{-9*} Ci/cc 4/21 at 1535 hrs.	562	[illegible]
[illegible] 0500	[illegible] 0230	WECST-A		6.9 x 10^{-10}	1520	[illegible]
[illegible]	[illegible]	SEC. NEUT. TANKS	None	3.1 x 10^{-8} 4.2 x 10^{-9*}	None	[illegible]
[illegible] 1910	[illegible]	IWTS	3.1 x 10^{-8}	3.1 x 10^{-8} 2 x 10^{-10*}	108	[illegible]
[illegible] 0950	[illegible] 0630	WECST-B		1.7 x 10^{-8} 3 x 10^{-10*}	1200	[illegible]
[illegible]	[illegible]	SEC. NEUT. TANKS	None	[illegible] x 10^{-8}	None	[illegible]
[illegible]	[illegible]	WECST-A		[illegible] x 10^{-8} [illegible] x 10^{-10}	[illegible]	[illegible]
[illegible]	[illegible]	IWTS	[illegible] x 10^{-9}	[illegible] x 10^{-9}	[illegible]	[illegible]
[illegible]	[illegible]	WECST-B		[illegible] x 10^{-8}	[illegible]	[illegible]
[illegible]	[illegible]	IWTS	[illegible]	[illegible]	[illegible]	[illegible]

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Rev. [illegible]

TABLE C-1

LIQUID EFFLUENT RELEASES OF IODINE-131
(3/28/79-4/30/79)

Start	Stop	Tank	μCi/cc [1] Concentration at Station Discharge (dilution calc.)	μCi/cc [2] Concentration at Station Discharge (grab samples)	μCi Discharged	Cumulative μCi Discharged
[illegible]	[illegible]	Sec Neut Tanks	None	3.1×10^{-8} [illegible] $\times 10^{-9}$*	None	[illegible]
[illegible]	[illegible]	WECST-A		3.1×10^{-8}	592	[illegible]
[illegible]	[illegible]	Sec Neut Tanks	None	3.1×10^{-8} 4.0×10^{-10}*	None	[illegible]
[illegible]	[illegible]	Sec Neut Tanks	None	3.1×10^{-8}	None	[illegible]
[illegible]	[illegible]	IWTS	1.9×10^{-9}	3.1×10^{-8} 1.7×10^{-9}*	688.8	[illegible]

NOTES

1. Calculated based on average tank sample and known dilution factor (df) data during the period of time that the tank was being released. Discharges for IWTS are averaged over a 24 hour period.

2. Calculated by averaging the station discharge (RML-7) grab samples taken during the time the tank was being released. If the number appearing in this column is a "less than" (<) number, all the numbers averaged were less than MDA numbers and the MDA's were used for the purpose of averaging. This calculation is conservative in that it overestimates the actual I-131 concentration at the station discharge.

3. WECST Tank releases are controlled by procedure HP 1621 which limits the release concentration to 0.1 MPC. The HP 1621 permit takes the specific activity of all the isotopes in the tank, assumes a dilution factor from MDCT flow and calculates a release rate so that 0.1 MPC is not exceeded while discharging.

TABLE C-1

<u>NOTES</u> (continued)

4 The source of water into the Secondary Neutralizing Tank is from the regeneration of the Illinois Water Treatment System demineralizers. The Illinois Water Treatment System produces demin water by taking pretreated river water from upstream of the station discharge and sending it through demineralizers. The water from the regeneration of these demineralizers goes to the Secondary Neutralizing Tank. All isotopic samples on this tank after 4/2/79 showed no detectable I-131 or I-133.

Since the input to this tank is essentially river water from upstream of the station discharge, it is reasonable to assume that from 3/28 at 0400 to 4/2 at 1850, no I-131 was released from this tank.

Table C-2
RADIOGAS RELEASES TMI II

STATION VENT

(From Grab Sample - Gamma Spec.)

Xe 133

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	DAY Ci/DAY
4-19-79 1218	4-19-79 2400	6.52 E+4	3.08 E+7	5.3 E-5	1.63 E+3	4.21 E+4	6.86 E+1	4-19-79 1.41 E+2
4-19-79 2400	4-20-79 2400	6.10 E+4	2.88 E+7	5.3 E-5	1.53 E+3	8.64 E+4	1.32 E+2	4-20-79 1.32 E+2
4-20-79 2400	4-21-79 1230	7.2 E+4	3.40 E+7	5.3 E-5	1.80 E+3	4.50 E+4	8.10 E+1	
4-21-79 1230	4-21-79 1645	7.2 E+4	3.40 E+7	2.34 E-5	7.96 E+2	1.53 E+4	1.22 E+1	
4-21-79 1645	4-21-79 2400	7.2 E+4	3.40 E+7	1.90 E-5	6.46 E+2	1.89 E+4	1.22 E+1	4-21-79 1.05 E+2
4-21-79 2400	4-22-79 0815	6.47 E+4	3.05 E+7	1.90 E-5	5.80 E+2	2.97 E+4	1.72 E+1	
4-22-79 0815	4-22-79 0930	6.47 E+4	3.05 E+7	8.75 E-6	2.67 E+2	4.50 E+3	1.20 E+0	
4-22-79 0930	4-22-79 2400	6.47 E+4	3.05 E+7	5.27 E-6	1.61 E+2	5.22 E+4	8.39 E+0	4-22-79 2.68 E+1
4-22-79 2400	4-23-79 2400	5.80 E+4	2.74 E+7	5.27 E-6	1.44 E+2	8.64 E+4	1.25 E+1	4-23-79 1.25 E+1
4-23-79 2400	4-24-79 1525	6.76 E+4	3.19 E+7	5.27 E-6	1.68 E+2	5.55 E+4	9.33 E+0	
4-24-79 1525	4-24-79 2400	6.76 E+4	3.19 E+7	2.35 E-6	7.50 E+1	3.09 E+4	2.32 E+0	4-24-79 1.17 E+1
4-24-79 [illegible]	4-25-79 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		4-25-79 [illegible]

STATION VENT

RADIOGAS RELEASES THI II

(From Grab Sample - Gamma Spec.)

Xe 133

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	DAY Ci/DAY
4-25-79 2400	4-26-79 0945	9.02 E+3	4.25 E+7	2.35 E-6	9.99 E+1	3.51 E+4	3.51 E+0	
4-26-79 0945	4-26-79 2400	9.02 E+4	4.25 E+7	1.41 E-5	5.99 E+2	5.13 E+4	3.07 E+1	4-26-79 3.43 E+1
4-26-79 2400	4-27-79 1355	8.30 E+4	3.91 E+7	1.41 E-5	5.51 E+2	5.01 E+4	2.76 E+1	
4-27-79 1355	4-27-79 2400	8.30 E+4	3.91 E+7	8.57 E-4	3.35 E+4	3.63 E+4	1.22 E+3	4-27-79 1.25 E+3
4-27-79 2400	4-28-79 2400	8.80E+4	4.15E+7	8.57E-4	3.54E+4	8.64E+4	3.06E+3	4-28-79 3.06E+3
4-28-79 2400	4-29-79 2400	7.70E+4	3.63E+7	8.57E-4	3.11E+4	8.64E+4	2.69E+3	4-29-79 2.69E+3
4-29-79 2400	4-30-79 2400	7.85E+4	3.70E+7	8.57E-4	3.16E+4	8.64E+4	2.73E+3	4-30-79 2.73E+3

XENON RELEASES TMI II

Station Vent

Eberline HPR 219 Remote Readout

FROM	AVER. OVER 1 DAY	CFM	AVER. FLOW RATE CC/SEC	U Ci/CC	Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
NA	4/20/79	NA	2.92E +7	2.3E -5	6.7E -4	NA	NA	57.97
NA	4/21/79	NA	3.96E +7	3.7E -5	1.47E -3	NA	NA	127.0
NA	4/22/79	NA	3E +7	6.55E -5	1.97E -3	NA	NA	170.21
NA	4/23/79	NA	2.7E +7	1.05E -4	2.84E -3	NA	NA	245.38
NA	4/24/79	NA	3.1E +7	1.2E -4	3.72E -3	NA	NA	321.41
NA	4/25/79	NA	3.93E +7	1.3E -5	5.1E -4	NA	NA	44.06
NA	4/26/79	NA	4.3E +7	7.5E -5	3.2E -3	NA	NA	276.48
NA	4/27/79	NA	4.03E +7	7.13E -5	2.9E -3	NA	NA	250.56
NA	4/28/79	NA	4.04E +7	1.28E -4	5.2E -4	NA	NA	44.53
NA	4/29/79	NA	4.17E +7	8.22E -5	3.43E -3	NA	NA	296.35
NA	4/30/79	NA	3.99E +7	3.76E -5	1.5E -3	NA	NA	129.6

Table C-3

HPR-219
STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	* CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
3/28/79 0400	3/28/79 1900	8.2E + 4	3.87E +7	**	(4.0)	5.40E + 4	(0.22)	(0.35)
3/28/79 1900	3/30/79 1900	8.83E +4	4.17E +7	5.4E -7	22.5	1.73E +5	3.90	1.95
3/30/79 2200	4/1/79 0600	8.92E +4	4.21 E +7	6.4E -8	2.69	1.15E +5	0.31	0.23
4/1/79 0600	4/3/79 0315	8.9E +4	4.20E +7	2.3E -7	9.66	1.63E +5	1.57	0.83
4/3/79 0315	4/3/79 1905	9.1E +4	4.29E +7	5.36E -8	2.30	5.70E +4	0.13	0.20
4/3/79 1905	4/3/79 2232	9.1E +4	4.29E +7	1.6E -7	6.86	1.24E +4	0.09	0.59
4/3/79 2232	4/5/79 1830	9.1E +4	4.29E +7	1.7E -7	7.29	1.58E +5	1.15	0.63
4/5/79 1830	4/6/79 1516	9.1E +4	4.29E +7	1.0E -8	0.43	7.48E +4	0.03	0.04
4/6/79 1516	4/7/79 0600	9.1E +4	4.29E +7	Lost***	(3.7)	5.30E +4	(0.18)	(0.32)
4/7/79 0600	4/8/79 0245	9.1E +4	4.29E +7	1.6E -7	6.86	7.47E +4	0.51	0.59

*Flow rates determined from chart records (+7000 CFM for service bldg.)
**No release point data. Auxiliary and fuel handling building release rates used.
***Interpolated

HPR-219
STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	CI/DAY
4/8/79 0245	4/9/79 0425	9.1E +4	4.29E +7	2.96E -7	12.70	9.24E +4	1.17	1.10
4/9/79 0925	4/10/79 1608	9.1E +4	4.29E +7	1.08E -8	0.46	1.11E +5	0.05	0.04
4/10/79 1608	4/11/79 1840	9.1E +4	4.29E +7	2.96E -8	1.27	9.55E +4	0.12	0.11
4/11/79 1920	4/13/79 2315	9.1E +4	4.29E +7	5.22E -8	2.23	1.87E +5	0.39	0.19
4/13/79 2315	4/14/79 1030	9.1E +4	4.29E +7	*	(4.15)	4.05E +4	(0.17)	(0.36)
4/14/79 ~~1300~~	4/14/79 ~~1400~~	9.1E +4	4.29E +7	3.4E -7	14.6	3.6E +3	0.05	1.26
4/14/79 1030	4/14/79 1915	9.1E +4	4.29E +7	1.41E -7	6.05	3.15E +4	0.19	0.52
4/14/79 1915	4/15/79 0522	9.1E +4	4.29E +7	1.54E -7	6.61	3.64E +4	0.24	0.57
4/15/79 0522	4/15/79 0804	9.1E +4	4.29E +7	2E -7	8.58	9.72E +3	0.08	0.74
4/15/79 0804	4/15/79 1802	**8.2E +4	3.9E +7	4E -7	14.0	3.6E +4	0.51	1.22

*Interpolated--Monitor was not in operation because of installation of the new eberline monitor with the Cy-130 SAI silver Zeolite cartridge and CY 100 charcoal.

**Auxiliary Vent fan tripped at 0600-1214. Flow was reduced from 45,000 CFM to 33,750 CFM where it remained even after fan was restarted.

HPR-219
STATION VENT

RADIOIODINE RELEASES TMI II

I-131

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/15/79 1802	4/15/79 2140	8.2E +4	3.9E +7	1.78E -7	6.9	1.3E +4	0.09	0.54
4/15/79 2140	4/15/79 2346	8.2E +4	3.9E +7	1.46E -7	5.7	7.6E +4	0.05	0.6
4/15/79 2346	4/16/79 0408	8.2E +4	3.9E +7	1.6E -7	6.24	1.57E +4	0.099	0.54
4/16/79 0408	4/16/79 0758	8.2E +4	3.9E +7	1.39E -7	5.5	1.38E +4	0.076	0.48
4/16/79 0758	4/16/79 1156	8.2E +4	3.9E +7	1.2E -7	4.68	1.44E +4	0.067	0.40
4/16/79 1156	4/16/79 1550	8.2E +4	3.9E +7	9.56E -8	3.7	1.4E +4	0.05	0.32
4/16/79 1556	4/16/79 1810	8.2E +4	3.9E +7	2.91E -7	11.35	8.04E +3	0.09	1.08
4/16/79 1810	4/16/79 2356	8.2E +4	3.9E +7	1.59E -7	6.2	2.2E +4	0.13	0.78
4/16/79 2356	4/17/79 0402	* 6.4E +4	3.02E +7	1.01E -7	3.05	1.44E +4	0.04	0.26
4/17/79 0402	4/17/79 0835	6.4E +4	3.02E +7	9.7E -8	2.93	1.64E +4	0.05	0.05

*Change due to filters being exchanged in Auxiliary Building Filter Banks. Flow reduced to 15,750 CFM. 2400 4/16.

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STATION VENT

RADIOIODINE RELEASES TMI II

I-131

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	CI/DAY
4/17/79 0835	4/17/79 1226	6.4E +4	3.02E +7	8.4E -8	2.54	1.32E +4	0.03	0.22
4/17/79 1226	4/17/79 1634	*(4/17/-1500) 6.1E +4	2.88E +7	8.6E -8	2.5	1.1E +4	0.03	0.23
4/17/79 1640	4/17/79 1946	6.1E +4	2.88E +7	2.0E -7	5.76	1.12E +4	0.06	0.49
4/17/79 1958	4/17/79 2357	(4/18-0230) 6.5E +4	3.06E +7	1.5E -7	4.59	1.44E +4	0.07	0.40
4/17/79 2357	4/18/79 0405	6.5E +4	3.06E +7	1.74E -7	5.32	1.44E +4	0.08	0.48
4/18/79 0405	4/18/79 0550	6.5E +4	3.06E +7	2.78E -7	8.51	6.3E +3	0.054	0.74
4/18/79 0550	4/18/79 0800	6.5E +4	3.06E +7	2.2E -7	6.72	7.8E +3	0.052	0.58
4/18/79 0800	4/18/79 0945	7E +4	3.3E +7	9.88E -8	3.3	6E +3	0.02	0.29
4/18/79 0950	4/18/79 1200	7E +7	3.3E +7	6.41E -8	2.02	7E +3	0.014	0.17
4/18/79 1204	4/18/79 1647	7.3E +4	3.44E +7	4.38E -8	1.5	1.7E +4	0.03	0.13

*Reduction because of filter (20K CFM Aux) (41K FH)

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STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	CI/DAY
4/18/79 1650	4/18/79 1823	7.3E +4	3.44E +7	4.36E -8	1.5	5.4E 3	0.01	0.13
4/18/79 2347	4/19/79 0358	8.4E +4	4E +7	8.58E -8	3.4	1.35E +4	0.05	0.30
4/19/79 0358	4/19/79 0800	7.4E +4	3.49E +7	5.83E -8	2.03	1.45E +4	0.03	0.18
4/19/79 0803	4/19/79 1210	7.4E +4	3.49E +7	4.9 E -8	1.7	1.48E +4	0.03	0.15
4/19/79 1212	4/19/79 1355	7.4 E +7	3.49E +7	1.4E -8	0.5	5.6E +3	0.003	0.04
4/19/79 1355	4/19/79 1725	7.4E +4	3.49E +7	1.2E -7	4.19	1.26E 4	.053	0.362
4/19/79 1728	4/19/79 2025	7.4E +4	3.49E +7	1.24E -7	4.32	1.06E +4	0.046	0.37
4/19/79 2025	4/20/79 0001	7.4E +4	3.49E +7	8.8E -8	3.1	1.3 E +4	0.04	0.27
4/20/79 0001	4/20/79 0351	6.4E +4	3.02E +7	2.58E -7	7.79	1.44E +4	0.11	0.67
4/20/79 0351	4/20/79 0821	6.4E +4	3.02E +7	1.97E -7	5.94	1.6E +4	0.1	0.51
4/20/79 0821	4/20/79 1105	6.4E +4	3.02E +7	1.9E -7	5.7	9.2E +3	0.05	0.5

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STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/20/79 1105	4/20/79 1300	5.72E +4	2.7E +7	2.8E -7	7.6	6.9E +3	0.05	0.66
4/20/79 1300	4/20/79 1620	5.72E +4	2.7E +7	1.1E -7	2.97	1.2E +4	0.041	0.26
4/20/79 1620	4/20/79 2019	6.3E +4	3E +7	9.6E -8	3	1.44E +4	0.04	0.26
4/20/79 2023	4/20/79 2204	6.3E +4	3E +7	1.37E -7	4.1	6E +3	0.03	0.35
4/20/79 2249	4/21/79 0317	6.3E +7	3E +7	6.72E -8	2.02	1.44E +4	0.03	0.17
4/21/79 0320	4/21/79 0402	6.3E +4	3E +7	4.08E -8	1.2	2.5E +3	0.03	0.10
4/21/79 0404	4/21/79 0819	8.9E +4	4.2E +7	2.77E -8	1.2	1.53E +4	0.02	0.10
4/21/79 0819	4/21/79 1201	8.9E +4	4.2E +7	3.44E -8	1.44	1.32E +4	0.02	0.12
4/21/79 1204	4/21/79 1624	8.9E +4	4.2E +7	3.64E -8	1.53	1.56E +4	0.02	0.13
4/21/79 1628	4/21/79 2017	8.9E +4	4.2E +7	2.88E -8	1.2	1.37E +4	0.02	0.10
4/21/79 2018	4/22/79 0103	5.9E +4	2.8E +7	6.83E -8	1.90	1.7E +4	0.03	0.16

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STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/22/79 0105	4/22/79 0441	6.5E +4	3.1E +7	4.93E -8	1.5	1.3E +4	0.02	0.13
4/22/79 0447	4/22/79 0804	6.5E +4	3.1E +7	4.74E -8	1.5	1.2E +4	0.02	0.13
4/22/79 0807	4/22/79 1229	6.5E +4	3.1E +7	4.89E -8	1.5	1.6E +4	0.02	0.13
4/22/79 1230	4/22/79 1621	6.9E +4	3.3E +7	6.9E -8	2.2	1.4E +4	0.03	0.19
4/22/79 1624	4/22/79 2024	5.8E +4	2.7E +7	1.14E -7	3.1	1.4E +4	0.04	0.27
4/22/79 2036	4/22/79 2130	5.8E +4	2.7E +7	1.12E -7	3.0	3.2E +3	0.001	2.26
4/22/79 2133	4/23/79 0004	5.8E +4	2.7E +7	8.82E -8	2.4	9.2E +3	0.02	0.21
4/23/79 0007	4/23/79 0406	5.8E +4	2.7E +7	6.7E -8	1.83	1.43E +4	0.03	.16
4/23/79 0358	4/23/79 0758	5.8E +4	2.7E +7	3.75E -8	1.02	1.44E +4	0.015	.09
4/23/79 0801	4/23/79 1201	5.8E +4	2.7E +7	3.85E -8	1.04	1.44E +4	0.015	.09
4/23/79 1223	4/23/79 1614	5.8E +4	2.7E +7	1.4E -7	3.78	1.39E +4	0.05	0.33

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STATION VENT

RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/23/79 1617	4/23/79 2010	5.8E +4	2.7E +7	2.22E -8	0.6	1.4E +4	0.008	0.05
4/23/79 2014	4/23/79 2156	5.8E +4	2.7E +7	6.3E -8	1.7	6.1E +3	0.01	0.15
4/23/79 2159	4/24/79 0015	5.8E +4	2.7E +7	4.8E -8	1.31	8.46E +3	.01	.11
4/24/79 0004	4/24/79 0404	5.8E +4	2.7E +7	5.8E -8	1.59	1.44E +4	.023	.14
4/24/79 0408	4/24/79 0637	5.8E +4	2.7E +7	6.0E -8	1.62	8.9E +3	0.014	0.140
4/24/79 0642	4/24/79 0813	6.88E +4	3.2E +7	2.9E -8	.94	5.46E +3	.005	.081
4/24/79 0815	4/24/79 1215	7.34E +4	3.46E +7	1.9E -8	0.66	1.44E +4	0.01	0.057
4/24/79 1217	4/24/79 1600	7.12E +4	3.36E +7	1.08E -8	.36	1.34E +4	.005	.03
4/24/79 1600	4/24/79 1955	6.8E +4	3.2E +7	4.9E -8	1.6	1.41E +4	0.02	0.14
4/24/79 1958	4/25/79 0001	6.8E +4	3.2E +7	2.5E -8	0.8	1.4E +4	0.01	0.07
4/25/79 0004	4/25/79 0512	6.8E +4	3.2E +7	1.54E -8	0.5	1.85E +4	.009	0.04

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RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/25/79 0520	4/25/79 0658	8.33E + 4	3.93E + 7	1.36E -8	0.53	5.88E + 3	0.003	0.046
4/25/79 0701	4/25/79 1200	8.75E + 4	4.16E + 7	1.3E -8	0.54	1.8E + 4	0.009	0.046
4/25/79 1200	4/25/79 1555	8.83E + 4	4.16E + 7	1.82E -8	0.76	1.4E + 4	0.01	0.065
4/25/79 1557	4/25/79 2010	8.9E + 4	4.2E + 7	1.2E -8	0.5	1.52E + 4	0.008	0.043
4/25/79 2013	4/26/79 0013	8.9E + 4	4.2E + 7	1.1E -8	0.46	1.44E + 4	0.007	0.04
4/26/79 0016	4/26/79 0357	8.9E + 4	4.2E +.7	1.1E -8	0.462	1.33E + 4	0.006	0.04
4/26/79 0400	4/26/79 0802	8.9E + 4	4.2E + 7	7.1E -9	0.3	1.45E + 4	0.004	0.026
4/26/79 0805	4/26/79 1220	9.23E + 4	4.4E + 7	8.6E -9	0.38	1.5E + 4	0.006	0.03
4/26/79 1220	4/26/79 1558	9.3E + 4	4.4E + 7	7.3E -9	0.32	1.3E + 4	0.004	0.03
4/26/79 1606	4/26/79 1913	9.1E + 4	4.3E + 7	1.1E -8	0.46	1.1E + 4	0.01	0.005
4/26/79 1913	4/27/79 0006	8.78E + 4	4.14E + 7	1.4E -8	0.58	1.76E + 4	0.01	0.05

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RADIOIODINE RELEASES TMI II

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FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/27/79 0011	4/28/79 0038	8.3E + 4	3.92E + 7	9.4E -9	0.37	8.8E + 4	0.033	0.032
4/28/79 0042	4/28/79 0830	8.3E + 4	3.92E + 7	3.06E -9	0.12	2.8E + 4	0.003	0.01
4/28/79 0832	4/28/79 1625	8.83E + 4	4.17E + 7	9.3E -9	0.39	2.84E + 4	0.01	0.034
4/28/79 1645	4/29/79 0025	8.83E + 4	4.17E + 7	8.9E -9	0.37	2.76E + 4	0.01	0.032
4/29/79 0028	4/30/79 0008	8.45E + 4	3.99E + 7	1.4E -8	0.56	8.52E + 4	0.05	0.048
4/30/79 0010	5/1/79 0010	7.84E + 4	3.7E + 7	1.3E -8	0.48	8.64E + 4	0.04	.042
						SUB-TOTAL	13.34	
			Interpolated values for periods between above periods				0.66	
						Total	14.00	

Table C-4

RADIOIODINE RELEASES TMI I

RMA - 8

STATION VENT UNIT #1

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
3/27/79 1610	3/30/79 2215	9.6 E+4	4.53 E+7	4.2 E-9	0.19	2.81 E+5	0.053	0.016
3/30/79 2215	3/31/79 1110	9.6 E+4	4.53 E+7	2.3 E-9	0.104	4.65 E+4	4.8 E-3	8.98 E-3
3/31/79 1110	4/2/79 1820	9.6 E+4	4.53 E+7	1.14 E-9	0.05	1.98 E+5	9.9 E-3	4.32 E-3
4/2/79 1820	4/3/79 1500	9.6 E+4	4.53 E+7	1.79 E-10	8.11 E-3	7.44 E+4	6.03 E-4	7.0 E-4
4/3/79 1500	4/9/79 2006	9.6 E+4	4.53 E+7	2.2 E-11	9.97 E-4	5.37 E+5	5.4 E-4	8.6 E-5
4/9/79 2006	4/12/79 1335	9.6 E+4	4.53 E+7	4.4 E-11	2 E-3	2.36 E+5	4.7 E-4	1.7 E-4
4/12/79 1347	4/12/79 1417	9.6 E+4	4.53 E+7	2.7 E-10	1.2 E-2	1.8 E+3	2.1 E-5	1.0 E-3
4/12/79 1417	4/15/79 1910	9.6 E+4	4.53 E+7	1.5 E-9	0.07	2.77 E+5	0.02	0.006
4/15/79 1910	4/16/79 1000	9.6 E+4	4.53 E+7	5.3 E-9	0.24	5.34 E+4	0.013	0.021
4/16/79 1000	4/18/79 1445	9.6 E+4	4.53 E+7	1.33 E-9	0.06	1.90E 5	0.011	0.005
4/18/79 1449	4/19/79 1735	1.03 E+5	4.86 E+7	1.3 E-9	0.06	9.64 E+4	0.006	0.005
4/19/79 1735	4/20/79 1525	7.4 E+4	3.49 E+7	3.38 E-10	0.012	7.86 E+4	0.001	0.001

RADIOIODINE RELEASES TMI I

RMA - 8

Station Vent Unit I

FROM	TO	CFM	CC/SEC	U Ci/CC	U Ci/SEC	SAMPLE TIME SEC	TOTAL CURIES	Ci/DAY
4/20/79 1525	4/21/79 1313	7.4 E+4	3.49 E+7	2.75 E-10	0.01	7.8 E+4	0.0008	0.0009
4/21/79 1313	4/21/79 1630	7.4 E+4	3.49 E+7	5.7 E-10	0.02	1.18 E+4	0.0002	0.002
4/21/79 1630	4/22/79 0649	7.4 E+4	3.49 E+7	3.44 E-10	0.012	5.15 E+4	0.0006	0.001
4/22/79 0649	4/23/79 1537	7.4 E+4	3.49 E+7	1.5 E-10	0.005	1.18 E+5	0.006	0.0004
4/23/79 1537	4/24/79 1330	8.7 E+4	4.1 E+7	1.4 E-9	0.057	7.88 E+4	0.0045	0.0049
4/24/79 1330	4/25/79 1349	8.7 E+4	4.1 E+7	1.9 E-10	0.008	8.75 E+4	0.0006	0.0007
4/25/79 1349	4/26/79 1219	8.7 E+4	4.1 E+7	1.3 E-10	0.005	8.1 E+4	0.0004	0.0004
4/26/79 1219	4/27/79 1738	8.5 E+4	4 E+7	4.1 E-11	1.6 E-3	1.05 E+5	1.72 E-4	1.38 E-4
4/27/79 1744	4/28/79 1342	8.5 E+4	4 E+7	1.27 E-11	5.1 E-4	7.2 E+4	4 E-5	4 E-5
4/28/79 1345	4/30/79 0130	8.5 E+4	4 E+7	1.13 E-10	4.52 E-3	1.29 E+5	5.8 E-4	3.9 E-4
						Total	0.1342	

APPENDIX D

EMERGENCY RADIOLOGICAL

ENVIRONMENTAL MONITORING DATA

PROGRAM DESCRIPTION

PROGRAM DESCRIPTION

Metropolitan Edison Company has been conducting an operational Radiological Environmental Monitoring Program (REMP) in the environs of Three Mile Island Nuclear Station (TMINS) for nearly five years. The program includes sampling and analysis of media from the aquatic, terrestrial, and atmospheric environments to enable evaluation of any radiological impact from TMINS operations. This program is managed by Porter-Gertz Consultants, Inc. Most analytical work is performed by Teledyne Isotopes, but a substantial fraction of the total analytical work, 10 percent or more, is performed by Radiation Management Corporation. The latter work represents replicate or split sample analysis to provide independent quality assurance for the Teledyne Isotopes' results. The quality assurance aspect of this program is considered a key feature.

Three other elements of the program are considered particularly important:

1. Environmental data (meteorology, hydrology, demography, etc.) specific to the site were used extensively in designing the program, particularly in determining sampling and monitoring locations, so that sensitivity of the program for detecting radiological impact was optimized.
2. State-of-the-art monitoring and analysis techniques are used to maximize the sensitivity of the program. The use of sophisticated techniques has been reduced to routine practice as a result of the experience gained over the five-year operating period.
3. A solid five-year data base has been accumulated for comparative use.

The following summary description of the routine operation REMP is extracted from the 1978 Annual Report[1] prepared by Teledyne Isotopes. A description of expansion of this program for the emergency operation REMP, is given in Appendix E.

In the operational phase of the REMP, radioanalytical data are collected for comparison to that generated in the preoperational phase. Differences between these two periods are compared to determine whether any station effects exist based on the magnitude and fluctuations of radioactivity levels determined in the preoperational phase.

Objectives

The objectives of the operational radiological environmental program are:

1. To fulfill the obligations of the Radiological Environmental Surveillance sections of the Environmental Technical Specifications for TMI-1 and the Preoperational Program for TMI-2.
2. To determine whether any statistically significant increase occurs in the concentration of radionuclides in critical pathways.
3. To detect any buildup of long-lived radionuclides in the environment.
4. To detect any change in ambient gamma radiation levels.
5. To verify that radioactive releases are within allowable limits and that TMI-1 operations have no detrimental effects on the health and safety of the public or on the environment.

[1] Metropolitan Edison Company Radiological Environmental Monitoring Report: Three Mile Island Nuclear Station: 1978 Annual Report, January 1 through December 31. Teledyne Isotopes, Westwood, N.J. IWL-5590-443 1979.

Design

In order to meet the stated objectives, an appropriate operational REMP was developed for Metropolitan Edison Compnay prior to plant operation. Samples for the operational REMP were taken from the aquatic, atmospheric, and terrestrial environments. Samples of various media were selected to obtain data for the evaluation of the radiation dose to man and important organisms. Sample types were based on (1) established critical pathways for the transfer of radionuclides through the environment to man, and (2) experience gained during the preoperational and initial operational phases. Sampling locations were determined from site meteorology, Susquehanna River hydrology, local demography and land uses.

Sampling locations were divided into two classes--indicator and control. Indicator stations are those which are expected to manifest station effects, if any exist; control samples are collected at locations which are believed to be unaffected by station operations. Fluctuations in the levels of radionuclides and direct radiation at indicator stations are evaluated with respect to analogous fluctuations at control stations, which are unrelated to station operations. Indicator station data are also evaluated relative to background characteristics established prior to station operation. Additional samples beyond those required by the Environmental Technical Specifications were collected and analyzed and were designated as management audit samples.

The analysis of samples and the analytical data generated during the program were routinely evaluated by the TI project leader who is the liaison with Metropolitan Edison Company personnel. Further review of REMP design and analytical data are performed by TI and the Metropolitan Edison Company professional staff in light of current regulatory trends and operating experience.

Table D-1, D-2 and D-3 and Maps D1, D2, and D3 present information on the Three Mile Island Nuclear Station operational REMP. Table D-1 explains the sample coding system which specifies sample type and relative locations at a glance. Table D-2 gives the pertinent location and sampling information for individual sampling locations, which are shown on Maps D-1, 2 and 3.

Operation After March 28, 1979

After the accident, the emergency REMP was started. This program is described in Tables D-10 and D-11.

Table D-1

Sampling Locations

Sample Identification

Metropolitan Edison identifies samples by a three-part code. The first two letters are the power station identification code, in this case TM. The next one to three letters are for the media sampled.

AI	=	Air Iodine	FPL	=	Green Leafy Vegetables
AP	=	Air Particulates	ID	=	Immersion Dose (TLD)
AQF	=	Fish	M	=	Milk
AQP	=	Aquatic Plants	RW	=	Precipitation
AQS	=	Sediment	SW	=	Surface Water
E	=	Soil	V	=	Fodder Crops
FPF	=	Fruit	MG	=	Milk (Goats)

The last four symbols are a location code based on direction and distance from the site. Of the last four symbols, the first two represent each of the sixteen angular sectors of 22½ degrees centered about the reactor site. Sector one is divided evenly by the north axis and the other sectors are numbered in a clockwise direction; i.e., 2 = NNE, 3 = NE, 4 = ENE, 5 = E, etc. The next digit is a letter which represents the radial distance from the plant:

S	=	On-site location	E	=	4-5 miles off-site
A	=	0-1 miles off-site	F	=	5-10 miles off-site
B	=	1-2 miles off-site	G	=	10-20 miles off-site
D	=	3-4 miles off-site	H	=	L.T. 20 miles off-site

The last number is the station numerical designation within each sector and zone; e.g., 1, 2, ...

The location portions of these codes (i.e. 1S1, 3A1, etc.) are shown in the attached table along with more detailed information and a map coordinate number used to designate the individual samples in the analytical results tables.

Table D-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLING LOCATIONS

SAMPLE MEDIUM	LOCATION CODE	MAP NO.	DESCRIPTION*
AI,AP,ID	1S2	2	0.4 mile N of site, N. Weather Station
ID	2S2	3	0.7 mile NNE of site on light pole in middle of North Bridge
ID	4S2	5	0.3 mile ENE of site on top of dike, East Fence
ID	5S2	6	0.2 mile E of site on top of dike, East Fence
ID	9S2	8	0.4 mile S of site at South Beach of Three Mile Island
ID	11S1	9	0.1 mile SW of site, west of Mechanical Draft Towers on dike
ID	14S1	10	0.4 mile WNW of site at Shelly's Island picnic area
ID	16S1	11	0.2 mile NNW of site at gate in fence on west side of Three Mile Island
AQP,AQS	1A2	12	0.7 mile N of site at north tip of Three Mile Island
ID	4A1	13	0.5 mile ENE of site on Laurel Rd., Met. Ed. pole #668-OL
AI,AP,ID,RW	5A1	14	0.4 mile E of site on north side of Observation Center Building
AQP,SW	9A2	15	0.5 mile S of site below Discharge Pipe
ID	16A1	17	0.4 mile NNW of site on Kohr Island
M	4B1	18	1.1 miles ENE of site, west of Gringrich Road
FPL,M	5B1	19	1.0 mile E of site on Peck Road
FBL,M	7B3	20	1.6 miles SE of on east side of Conewago Creek
AQF,AQP,AQS,SW	9B1	21	1.5 miles S of site, above York Haven Dam
ID	10B1	23	1.1 miles SSW of site on south beach of Shelly's Island
AP,ID	12B1	24	1.6 miles WSW of site adjacent to Fishing Creek
AQF	16B1	25	1.1 miles NNW of site below Fall Island
AI,AP,ID	1C1	26	2.6 miles N of site at Middletown Substation
SW	1C3	27	2.3 miles N of site at Swatara Creek
AI,AP,ID,RW	8C1	28	2.3 miles SSE of site
FPL,M	14C1	29	2.7 miles WNW of site near intersection of Routes 262 and 392
SW	8E1	30	4.1 miles SSE of site at Brunner Island
AI,AP,ID,RW	7F1	34	9 miles SE of site at Drager Farm off Engle's Tollgate Road
SW	15F1	35	8.7 miles NW of site at Steelton Municipal Water Works
FPL,M	2G1	36	2 miles NNE of Hershey on Rt. 39 Hummelstown
ID	4G1	37	10 miles ENE of site at Lawn - Met. Ed. Pole #J1813
ID,SW	7G1	38	15 miles SE of site at Columbia Water Treatment Plant
AP,ID	9G1	39	13 miles S of site in Met. Ed. York Load Dispatch Station
AI,AP,ID,RW	15G1	40	15 miles NW of site at West Fairview Substation
SW	8C2	43	2.3 miles SSE of site - York Haven Hydro
AQS	10A1	44	0.8 mile SSW of site
M	1B1	45	1.2 miles N of site - along Rt. 441

* All distances are measured from a point that is midway between the Reactor Buildings of Units One and Two

Table D-3

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

SAMPLE COLLECTION AND ANALYSIS METHODS

Analysis	Sample Medium	Sampling Method	Sample Size Collected	Procedure Manual Number	Procedure Abstract
Gross alpha	AP	quarterly composite of weekly, continuous air sampling through filter paper	13 weeks of filters per sampling site (~ 3600 Cu.M.)	032-14	sample is leached with nitric acid, filtered, and evaporated onto planchette, Low Level gas flow proportional counting
Gross beta	AP	continuous weekly air sampling through filter paper	1 filter (~ 280 Cu.M.)	032-10	low level gas flow proportional counting
	RW,SW	according to sampling site, various compositing frequencies	4 liters	032-1	sample is evaporated, residue transferred to planchette, and activity measured by low level counting
Gamma Spectroscopy	AP	monthly and quarterly composites of weekly, continuous air sampling through filter paper	4 weeks or 13 weeks of filters (~1100 or 3600 Cu.M.)	042-5	high resolution Ge(Li) gamma isotopic analysis
	AI	continuous weekly air sampling through filter paper	1 cartridge (~ 280 Cu.M.)	042-5	same
	M	grab sample	8 liters	042-5	same
	RW, SW	according to sampling site, various compositing frequencies	4 liters	042-5	same
	AQF,AQP AQS,FPL,FPF	grab sample	2 kg	042-5	same
	H,SW	according to sampling site, various compositing frequencies	4 liters	052-2	Water is converted to hydrogen, Methane added, and counted in 1 liter proportional counter

TABLE D-3 (CONT.)

Analysis	Sample Medium	Sampling Method	Sample Size Collected	Procedure Manual Number	Procedure Abstract
I-131	M,SW	grab sample for M and according to sampling site, various compositing frequencies	8 liters	032-11	anion-exchange, solvent extraction, palladium iodide precipitate, low lev gas flow counting
Sr-89,90	AP	quarterly composite of weekly, continuous air sampling through filter paper	13 weeks of filters per sampling site (~ 3600 Cu.M.)	032-24	Strontium in sample (with carrier) is precipitated as SrNO mount, Sr-90 inferre from Y-90 on yttrium oxalate mount, low level gas flow counting
	AQF	grab sample	2kg	032-23	similar
	AQS	grab sample	2 kg	032-24	similar
	RW,SW	according to sampling site, various compositing frequencies	4 liters	032-16	similar
	M	grab sample	8 liters	032-18	oxalate precipitatic of TCA filtrate, barium and iron scavenge, 7 day yttrium ingrowth,Sr- on yttrium oxalate mount, low level gas flow counting
TLD	ID	quarterly exposure	TLD	342-17	Thermoluminscent dosimetry

TABLE D-4

Thermoluminescent Dosimetry Data

Regular Stations - Results in Milli-roentgens/hour
Q " - " " Milli-rads/hour
(Milli-roentgens)(.955) = milli-rads

TLD'S
mr/hr
INCLUDES BACKGROUND

x(x) = Duplicates

Map #		page 1 of 5	Sample	9/30-12/27	12/27-3/29	3/29-3/31	3/31-4/3	4/3-4/6	4/6-4/9	4/9-4/12	4/12-4/15	4/15-4/18	4/18-4/21	4/21-4/24	4/24-4/28
2	1	N. Weather Station	1S2	0.007	0.045	0.444	0.099	0.009	0.018	0.004	0.004	0.004	0.023	0.009	0.008
2	2	N. Weather Station	1S2Q.	0.008	0.043	0.341	0.017	0.011	0.011	0.011	0.011	0.010	0.011	0.008	0.009
3	3	N. Bridge	2S2	0.006	0.020	0.722	0.046	0.011	0.009	0.004	0.002	0.002	0.006	0.005	0.007
5	4	Top of Dike	4S2	0.006	0.016	2.757	0.381	0.108	0.022	0.009	0.002	0.004	0.006	0.008	0.006
5	5	Top of Dike	4S2Q	0.007	0.014	1.587	0.288	0.064	0.014	0.013	0.010	0.012	0.010	0.008	0.009
6	6	Top of Dike	5S2	0.006	0.014	1.098	0.363	0.211	0.081	0.037	0.002	0.004	0.006	0.008	0.008
6	7	Top of Dike	5S2Q	0.007	0.013	0.817	0.287	0.158	0.064	0.030	0.013	0.010	0.012	0.007	0.010
28	8	Falmouth-Collins Sub	8C1	0.005	0.006	0.233	0.024	0.018	0.013	0.007	0.002	0.002	0.006	0.010	0.005
28	9	Falmouth-Collins Sub	8C1Q	0.006	0.006	0.184	0.036	0.015	0.008	0.010	0.008	0.008	0.007	0.007	0.008
8	10	S. TMI	9S2	0.008	0.011	0.581	0.062	0.024	0.018	0.004	0.004	0.004	0.007	0.008	0.007
9	11	MDCT	11S1	0.008	0.100	2.431	0.614	0.297	0.114	0.015	0.009	0.009	0.010	0.011	0.009
9	12	MDCT	11S1Q	0.008	0.080	1.720	0.479	0.194	0.073	0.014	0.014	0.014	0.012	0.011	0.014
11	13	N. Boat Dock	16S1	0.008	0.477	1.903	0.095	0.022	0.013	0.009	0.009	0.009	0.009	0.010	0.011
11	14	N. Boat Dock	16S1Q	0.008	0.421	1.400	0.076	0.017	0.012	0.011	0.013	0.012	0.011	0.012	0.011
10	15	Shelley	14S2	←.030(.034)→		1.047	0.132	0.022	0.011	0.007	0.002	0.002	0.006	0.007	0.005
13	16	Laurel Rd	4A1	0.007	0.009	0.757	0.574	0.031	0.009	0.009	0.007	0.004	0.008	0.007	0.006
[illegible]	17	Observ. Center	5A1	0.006	0.009	0.180	0.108	0.042	0.018	0.031	0.002	0.004	0.006	0.007	0.006
[illegible]	18	Observ. Center	5A1Q	0.008	0.007	0.120	0.073	0.028	0.018	0.024	0.008	0.010	0.009	0.009	0.009
[illegible]	19	Kohr Island	16A1	←.207(.103)→		0.909	0.024	0.011	0.009	0.007	0.002	0.004	0.005	0.010	0.005
23	20	S. End Shelley	10B1	←.009(.008)→		0.319	0.004	0.015	0.011	0.007	0.007	0.004	0.008	0.013	0.007
24	21	Goldsboro Air Station	12B1	0.006	0.007	0.205	0.002	0.018	0.018	0.004	0.002	0.002	0.005	0.010	0.005
[illegible]	22	Middletown Sub	1C1	0.006	0.009	0.068	0.020	0.007	0.009	0.007	0.004	0.004	0.005	0.007	0.007
[illegible]	23	Drager Farm	7F1	0.010	0.011	0.024	0.007	0.011	0.013	0.009	0.009	0.011	0.009	0.011	0.010
[illegible]	24	Drager Farm	7F1Q	0.011	0.011	0.018	0.021	0.012	0.013	0.012	0.014	0.013	0.013	0.013	0.014
[illegible]	25	RTE 241	4G1	0.008	0.008	0.026	0.009	0.009	0.011	0.004	0.004	0.004	0.007	0.013	0.006
[illegible]	26	RTE 241	4G1Q	0.009	0.008	0.014	0.020	0.009	0.011	0.010	0.010	0.010	0.013	0.008	0.010
[illegible]	27	N. York Sub	9G1	0.008	0.010	0.031	0.000	0.009	0.011	0.009	0.007	0.007	0.008	0.008	0.007
40	28	W. Fairview	15G1	0.008	0.008	0.042	0.600	0.007	0.011	0.007	0.007	0.009	0.007	0.008	0.007
40	29	W. Fairview	15G1Q	0.009	0.008	0.024	0.011	0.009	0.008	0.009	0.010	0.010	0.012	0.009	0.009
38	30	Columbia	7G1	0.010	0.012	0.022	0.499	0.011	0.132	0.009	0.007	0.011	0.011	0.014	0.010
	31														

POOR ORIGINAL

X (X) = Duplicate
Teledyne Results in milli-roentgens
RMC (Q) Results in milli-rads
The Total Error is 1 sigma

TLD'S

NET EXPOSURES
INCLUDES BACKGROUND

Map #				9/27/78 - 12/27/78	12/27/78 - 3/29/79	3/29 - 3/31	3/31 - 4/3	4/3 - 4/6	4/6 -
2	1	N. Weather Station	1S2		97.9 ± 1.9	20.0 ± 3.4	-0.1 ± 0.1	0.6 ± 0.1	1.4 ± 1.0
2	2	N. Weather Station	1S2Q		95.7 ± 5.0	15.25 ± 2.63	1.28 ± 0.14	0.81 ± 0.14	0.85 ± 0.05
3	3	N. Bridge	2S2		43.7 ± 4.4	32.5 ± 5.6	3.4 ± 0.6	0.9 ± 0.2	0.6 ± 0.1
5	4	Top of Dike	4S2		35.5 ± 4.3	124.3 ± 32.7	28.0 ± 9.1	7.9 ± 2.3	1.6 ± 0.2
5	5	Top of Dike	4S2Q		31.4 ± 1.6	71.35 ± 13.0	21.27 ± 6.60	4.68 ± 0.36	1.04 ± 0.07
6	6	Top of Dike	5S2		30.5 ± 1.3	49.3 ± 11.2	26.7 ± 5.3	15.5 ± 5.0	6.0 ± 1.6
6	7	Top of Dike	5S2Q		27.7 ± 4.0	36.65± 0.8	21.16 ± 3.11	11.54 ± 2.37	4.74 ± 0.94
28	8	Falmouth-Collins Sub	8C1		13.0 ± 0.3	10.7 ± 1.6	1.7 ± 1.1	1.3 ± 0.4	1.0 ± 0.8
28	9	Falmouth-Collins Sub	8C1Q		12.6 ± 0.6	8.36 ± 0.97	2.63 ± 0.17	1.11 ± 0.08	0.65 ± 0.11
8	10	S. TMI	9S2		25.0 ± 3.0	25.3 ± 2.6	4.6 ± 1.0	1.8 ± 0.3	1.3 ± 0.2
9	11	MDCT	11S1		216.0 ±24.1	107.1 ± 12.7	45.0 ± 15.2	21.8 ± 7.3	8.5 ± 2.6
9	12	MDCT	11S1Q		168.5 ± 15.6	75.71± 12.7	35.22 ± 3.32	14.2 ± 1.1	5.47 ± 0.58
11	13	N. Boat Dock	16S1		1044.2 ±128.2	83.7 ± 17.5	7.0 ± 0.7	1.5 ± 0.3	1.0 ± 0.1
11	14	N. Boat Dock	16S1Q		929.4 ± 90.5	61.6 ± 12.2	5.59 ± 0.96	1.26 ± 0.25	0.88 ± 0.10
10	15	Shelley	14S2	←— 131.2±20.6(148.3±9.7)→		48.8 ± 8.6	9.5 ± 4.3	1.5 ± 0.4	0.8 ± 0.3
13	16	Laurel Rd	4A1		20.2 ± 1.3	34.3 ± 8.6	41.4 ± 8.5	2.2 ± 0.4	0.7 ± 0.0
14	17	Observ. Center	5A1		18.6 ± 1.0	8.3 ± 2.8	7.7 ± 2.5	3.0 ± 1.2	1.2 ± 0.2
14	18	Observ. Center	5A1Q		16.1 ± 1.3	5.45 ± 1.0	5.24 ± 0.90	2.0 ± 0.61	1.28 ± 0.10
17	19	Kohr Island	16A1	←— 907.7±49.4(453.4±12.2)→		45.1 ± 2.1	1.7 ± 1.1	0.9 ± 0.1	0.7 ± 0.1
23	20	S. End Shelley	10B1	←— 40.6± 3.5(36.6±1.3) —→		14.9 ± 0.9	0.4 ± 0.3	1.1 ± 0.2	0.8 ± 0.1
24	21	Goldsboro Air Station	12B1		16.3 ±0.9	9.4 ± 1.6	0.2 ± 0.3	1.2 ± 0.2	1.3 ± 0.2
26	22	Middletown Sub	1C1		20.1 ±1.3	3.2 ± 0.7	1.4 ± 0.4	0.5 ± 0.1	0.5 ± 0.1
34	23	Drager Farm	7F1		24.1 ± 1.8	1.1 ± 0.1	0.5 ± 0.5	0.9 ± 0.1	1.0 ± 0.1
34	24	Drager Farm	7F1Q		23.3 ±0.5	0.80±0.15	1.52 ± 0.20	0.90 ± 0.04	0.97 ± 0.11
37	25	RTE 241	4G1		17.2 ± 2.1	1.2 ± 0.2	0.6 ± 0.2	0.6 ± 0.1	0.7 ± 0.0
37	26	RTE 241	4G1Q		17.7 ±0.1	0.64±0.11	1.43 ± 0.09	0.69 ± 0.07	0.75 ± 0.08
39	27	N. York Sub	9G1		21.3 ± 1.4	1.4 ± 0.1	0.1 ± 0.2	0.6 ± 0.1	0.9 ± 0.2
40	28	W. Fairview	15G1		18.4 ± 2.0	1.9 ± 0.3	-0.7 ± 0.1	0.5 ± 0.0	0.8 ± 0.1
40	29	W. Fairview	15G1Q		17.6 ±0.6	1.14±0.13	0.77 ± 0.07	0.68 ± 0.16	0.61 ± 0.09
38	30	Columbia	7G1		25.8 ± 0.6	1.0 ± 0.1	-0.5 ± 0.0	0.8 ± 0.0	1.1 ± 0.2
	31								

Teledyne Results in milli-roentgens
RMC (Q) Results in milli-rads
The Total Error is 1 sigma

TLD'S

NET EXPOSURES
INCLUDES BACKGROUND

Map #		Page 3 of 5		4/9-4/12	4/12-4/15	4/15-4/18	4/18-21	4/21-4/24	4/24-4/2
2	1	N. Weather Station	1S2	0.4 ± 0.2	0.2 ± 0.6	0.3 ± 0.1	1.6 ± 0.4	0.7 ± 0.2	0.7 ± 0.2
2	2	N. Weather Station	1S2Q	0.81 ± 0.18	0.72±0.08	0.78±0.11	0.77±0.11	0.61±0.13	0.83±0.14
3	3	N. Bridge	2S2	0.3 ± 0.3	0.2 ± 0.5	0.2 ± 0.2	0.4 ± 0.4	0.4 ± 0.1	0.6 ± 0.2
5	4	Top of Dike	4S2	0.6 ± 0.2	0.2 ± 0.5	0.3 ± 0.1	0.4 ± 0.4	0.6 ± 0.2	0.5 ± 0.2
5	5	Top of Dike	4S2Q	0.96±0.03	0.65±0.13	0.88±0.09	0.69±0.12	0.63±0.08	0.83±0.07
6	6	Top of Dike	5S2	2.7 ± 0.9	0.2 ± 0.5	0.4 ± 0.1	0.4 ± 0.4	0.6 ± 0.1	0.7 ± 0.2
6	7	Top of Dike	5S2Q	2.2 ± 0.17	0.87±0.5	0.76±0.06	0.79±0.14	0.55±0.15	0.89±0.10
28	8	Falmouth-Collins Sub	8C1	0.4 ± 0.2	0.1 ±0.5	0.2 ± 0.2	0.4 ± 0.4	0.7 ± 0.2	0.5 ± 0.2
28	9	Falmouth-Collins Sub	8C1Q	0.65±0.14	0.57±0.08	0.60±0.04	0.47±0.02	0.47±0.12	0.80±0.05
8	10	S. TMI	9S2	0.4 ± 0.1	0.3 ± 0.5	0.3 ±0.1	0.5 ± 0.4	0.6 ± 0.2	0.6 ± 0.2
9	11	MDCT	11S1	1.1 ± 0.1	0.6 ± 0.5	0.6 ± 0.2	0.7 ± 0.4	0.9 ± 0.2	0.8 ± 0.2
9	12	MDCT	11S1Q	0.99±0.22	0.93±0.06	1.04±0.07	0.83±0.11	0.86±0.20	1.27±0.13
11	13	N. Boat Dock	16S1	0.6 ± 0.3	0.6 ± 0.5	0.6 ± 0.2	0.6 ± 0.4	0.8 ± 0.2	1.0 ± 0.3
11	14	N. Boat Dock	16S1Q	0.80±0.19	0.91 ±0.10	0.88±0.06	0.72±0.06	0.92±0.03	0.99±0.15
10	15	Shelley	14S2	0.3 ± 0.2	0.1 ± 0.5	0.2 ± 0.1	0.4 ± 0.4	0.5 ± 0.2	0.5 ± 0.2
13	16	Laurel Rd	4A1	0.6 ± 0.2	0.4 ± 0.7	0.3 ± 0.1	0.5 ± 0.4	0.5 ± 0.2	0.6 ± 0.2
14	17	Observ. Center	5A1	2.2 ± 1.0	0.2 ±0.5	0.4 ± 0.2	0.4 ± 0.4	0.5 ± 0.1	0.6 ± 0.2
14	18	Observ. Center	5A1Q	1.76±0.16	0.57±0.03	0.75±0.03	0.62±0.06	0.67±0.16	0.91±0.5
17	19	Kohr Island	16A1	0.4 ± 0.4	0.2 ± 0.5	0.4 ± 0.3	0.3 ± 0.4	0.7 ± 0.2	0.5 ± 0.2
23	20	S. End Shelley	10B1	0.6 ± 0.3	0.4 ± 0.5	0.4 ± 0.1	0.5 ± 0.4	0.9 ± 0.2	0.7 ± 0.2
24	21	Goldsboro Air Station	12B1	0.3 ± 0.3	0.1 ± 0.5	0.2 ± 0.1	0.3 ± 0.4	0.7 ± 0.4	0.5 ± 0.2
26	22	Middletown Sub	1C1	0.6 ± 0.3	0.3 ± 0.5	0.3 ± 0.1	0.4 ± 0.4	0.6 ± 0.2	0.6 ± 0.2
34	23	Drager Farm	7F1	0.7 ± 0.2	0.5 ± 0.5	0.8 ± 0.2	0.6 ± 0.4	0.8 ± 0.1	1.0 ± 0.2
34	24	Drager Farm	7F1Q	0.96±0.03	0.87±0.13	1.04±0.10	0.87±0.04	0.90±0.10	1.32±0.03
37	25	RTE 241	4G1	0.4 ± 0.2	0.3 ± 0.5	0.4 ± 0.2	0.5 ± 0.4	0.9 ± 0.2	0.6 ± 0.2
37	26	RTE 241	4G1Q	0.81 ± 0.11	0.70±0.12	0.80±0.06	0.90±0.16	0.54±0.09	0.94±0.11
39	27	N. York Sub	9G1	0.6 ± 0.3	0.5 ± 0.6	0.5 ± 0.2	0.5 ± 0.4	0.6 ± 0.1	0.7 ± 0.2
40	28	W. Fairview	15G1	0.4 ± 0.3	0.5 ± 0.7	0.6 ± 0.3	0.5 ± 0.4	0.6 ± 0.2	0.7 ± 0.2
40	29	W. Fairview	15G1Q	0.62±0.08	0.71±0.10	0.81 ± 0.11	0.79±0.20	0.64±0.11	0.82±0.09
38	30	Columbia	7G1	0.7 ± 0.2	0.4 ± 0.5	0.8 ± 0.2	0.7 ± 0.4	1.0 ± 0.2	1.0 ± 0.2
	31								

TLD'S
EXPOSURE TIMES

Map #	Sampling Location	Loca. Code	Time Col 3/29	Elpd. Hrs.	Time Col. 3/31	Elpd. Hrs.	Time Col. 4/3	Elpd. Hrs.	Time Col. 4/6	Elpd. Hrs.	Time Col. 4/9	Elpd. Hrs.	Time Col. 4/12
2	N. Weather Station	1S2	1640	44.92	1335	73.63	1513	73.00	1613	74.53	1845	72.83	1935
2	N. Weather Station	1S2Q.											
3	N. Bridge	2S2	1715	45.00	1415	73.62	1552	73.13	1700	74.55	1933	72.73	2017
5	Top of Dike	4S2	1705	45.00	1405	73.75	1550	73.00	1650	74.58	1925	72.63	2003
5	Top of Dike	4S2Q											
6	Top of Dike	5S2	1705	44.92	1400	73.75	1545	73.13	1653	74.58	1928	72.65	2007
6	Top of Dike	5S2Q											
28	Falmouth-Collins Sub	8C1	0930	45.75	0715	72.08	0720	72.33	0740	76.25	1155	67.42	0720
28	Falmouth-Collins Sub	8C1Q											
8	S. TMI	9S2	1655	44.00	1355	73.58	1530	73.00	1630	74.55	1903	72.78	1950
9	MDCT	11S1	1650	44.00	1350	73.53	1522	73.05	1625	74.52	1856	72.82	1945
9	MDCT	11S1Q											
11	N. Boat Dock	16S1	1645	44.00	1345	73.58	1520	73.00	1620	74.55	1853	72.78	1940
11	N. Boat Dock	16S1Q											
10	Shelley	14S2	1215	46.58	1050	72.17	1100	72.83	1150	76.42	1615	67.17	1125
13	Laurel Rd	4A1	0920	45.33	0640	72.17	0650	72.42	0715	71.80	0703	71.87	0655
14	Observ. Center	5A1	0900	45.92	0655	72.08	0700	72.50	0730	71.42	0655	72.25	0710
14	Observ. Center	5A1Q											
17	Kohr Island	16A1	1210	46.58	1045	72.17	1055	72.50	1125	76.67	1605	67.17	1115
23	S. End Shelley	10B1	1225	46.58	1100	72.12	1107	73.38	1230	75.88	1623	67.20	1135
24	Goldsboro Air Station	12B1	1150	45.92	0945	72.75	1030	72.50	1100	76.67	1540	67.25	1055
26	Middletown Sub	1C1	1445	46.08	1250	72.58	1325	74.33	1545	64.83	0835	80.17	1645
34	Drager Farm	7F1	0955	45.67	0735	72.00	0735	72.42	0800	77.00	1300	77.00	1800
34	Drager Farm	7F1Q											
37	RTE 241	4G1	1810	45.42	1535	73.08	1640	73.42	1805	66.42	1230	78.83	1920
37	RTE 241	4G1Q											
39	N. York Sub	9G1	1050	46.08	0855	72.42	0920	72.25	0935	77.00	1435	69.42	1200
40	W. Fairview	15G1	1330	46.08	1135	72.50	1205	74.25	1420	75.17	1730	63.50	0900
40	W. Fairview	15G1Q											
38	Columbia	7G1	1020	33.67	0800	72.13	0808	71.87	0800	77.30	1318	76.95	1815

TLD'S

EXPOSURE TIMES

Map #		Sampling Location	Loca. Code	Time Col. 4/12	Elpd. Hrs.	Time Col. 4/15	Elpd. Hrs.	Time Col. 4/18	Elpd. Hrs.	Time Col. 4/21	Elpd. Hrs.	Time Col. 4/24	Elpd. Hrs.	Time Col. 4/28
2	1	N. Weather Station	1S2	1935	67.92	1530	75.50	1900	68.17	1510	79.33	2230	88.17	1440
2	2	N. Weather Station	1S2Q.											
3	3	N. Bridge	2S2	2017	67.88	1610	75.67	1950	67.08	1455	80.62	2332	88.42	1557
5	4	Top of Dike	4S2	2003	67.95	1600	75.67	1940	68.17	1550	79.63	2328	88.37	1550
5	5	Top of Dike	4S2Q											
6	6	Top of Dike	5S2	2007	67.97	1605	75.67	1945	68.13	1553	79.53	2325	88.47	1553
6	7	Top of Dike	5S2Q											
28	8	Falmouth-Collins Sub	8C1	0720	72.00	0720	77.50	1250	66.42	0715	71.92	0710	96.83	0800
28	9	Falmouth-Collins Sub	8C1Q											
8	10	S. TMI	9S2	1950	67.92	1545	75.50	1915	68.08	1520	79.42	2245	88.20	1457
9	11	MDCT	11S1	1945	67.92	1540	75.47	1908	68.12	1515	79.42	2240	88.12	1447
9	12	MDCT	11S1Q											
11	13	N. Boat Dock	16S1	1940	67.92	1535	75.50	1905	67.92	1500	79.62	2237	88.12	1444
11	14	N. Boat Dock	16S1Q											
10	15	Shelley	14S2	1125	71.20	1037	77.47	1605	66.58	1040	71.95	1037	96.30	1055
13	16	Laurel Rd	4A1	0655	72.00	0655	77.42	1220	66.58	0655	71.92	0650	96.92	0745
14	17	Observ. Center	5A1	0710	71.92	0705	77.50	1235	66.50	0705	71.83	0655	97.00	0755
14	18	Observ. Center	5A1Q											
17	19	Kohr Island	16A1	1115	71.28	1032	77.47	1600	66.58	1035	71.95	1032	96.30	1050
23	20	S. End Shelley	10B1	1135	71.15	1044	77.43	1610	66.58	1045	72.00	1045	96.33	1105
24	21	Goldsboro Air Station	12B1	1055	71.25	1010	77.58	1545	66.42	1010	71.92	1005	96.42	1030
26	22	Middletown Sub	1C1	1645	68.17	1255	71.08	1200	72.92	1255	81.00	2155	87.17	1305
34	23	Drager Farm	7F1	1800	61.58	0735	77.50	1305	66.50	0735	71.83	0725	96.78	0812
34	24	Drager Farm	7F1Q											
37	25	RTE 241	4G1	1920	66.75	1405	78.42	2030	67.83	1620	70.50	1450	95.42	1415
37	26	RTE 241	4G1Q											
39	27	N. York Sub	9G1	1200	69.17	0910	77.33	1430	66.08	0835	72.00	0835	96.50	0905
40	28	W. Fairview	15G1	0900	74.67	1140	77.42	1705	66.67	1145	72.00	1145	96.17	1155
40	29	W. Fairview	15G1Q											
38	30	Columbia	7G1	1815	61.70	0757	77.55	1330	66.42	0755	71.97	0753	96.53	0825
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TABLE D-5 Milk

X = result by radiochemistry
(X)= result by gamma spec.

Milk
Iodine - 131 (pCi/l)

Map Loc	Page 1 of 4	Sample	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9
18	Alvine Farm	4B1	<0.2	-	8.5 (14.4)	4.6	2.6	1.0	<0.4	<0.3	0.64	0.47	<0.2	<0.2
20	Becker Farm	7B3	<0.2	-	21.0 (18.6)	-	3.8	2.1	0.87	0.72	0.25	<0.2	1.2	0.78
20	Becker Farm	7B3Q	<0.3	-	19		3.2	2.7	1.26	0.65		<0.4	1.34	1.28
29	Conley Farm	14C1	2.7	-	4.4	2.9	-	-	-	-	-	-	-	-
-	Fisher Farm	14D1	-	-	-	2.5	-	2.0	1.9	0.54	0.49	.32,<.2	-	< 0.3
36	Oellig Farm	2G1	<0.2	-	< 0.3	< 0.3	< 0.3	< 0.3	<0.4	< 0.2	< 0.2	< 0.1	< 0.2	< 0.2
45	Hardison Farm	1B1	1.1	41.0 (59.0)	-	27.0 (48.8)	12.0 (26.5)	19.0 (39.4)	-	12.0,11.0 (36.6)(<40)	-	3.4	-	-

X = result by radiochemistry
(X) = result by gamma spec.

Effective 4/18 - 40 gm/gal $NaHSO_3$ to each sample

Milk
Iodine - 131 (pCi/ℓ)

Map Loc		Sample	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
18	Alwine Farm	4B1	<0.3	<0.2	<0.3	0.24	<0.1	<0.2	0.39	0.34	0.59	0.54	0.35	0.27
20	Becker Farm	7B3	0.58	1.3	1.1	1.8	0.94	0.57	3.4	3.7	5.6	6.6	3.1	2.1
20	Becker Farm	7B3Q	2.4	1.6	1.4	1.8	1.3	1.1	5.2	4.4	11.5	7.8	4.4	2.8
-	Fisher Farm	14D1	-	<0.3	<.3,0.84	-	0.73	0.26	0.27	<0.2	< 0.1	<0.2	<0.1	<0.3
36	Oellig Farm	2C1	<0.3	<0.2	<0.3	<0.3	<0.2	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
45	Hardison Farm	1B1	4.2	6.0	34.0	10.0	4.1	8.0	3.3	13.0	-	-	-	-
					(47.1)					(28.4)				

X = result by radiochemistry
(X) = result by gamma spec.
40 gm/gal $NaHSO_3$ to each sample

Milk
Iodine - 131 (pCi/ℓ)

Map Loc	Page 3 of 4	Sample	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
18	Alvine Farm	4B1	<0.2	0.19	<0.2	<0.4	<0.2	<0.2	<0.4	<0.4	<0.3	<0.3	<0.2	< 0.2
20	Becker Farm	7B3	0.57	0.72	<0.4	0.42	0.86	0.49	<0.5	3.6	4.7.	3.6	2.9	2.7
20	Becker Farm	7B3Q	1.7	<0.8	<2.2	0.5	<0.5	<0.7	<0.4	4.5	5.2	5.4	2.2	1.6
-	Fisher Farm	14D1	0.31	0.40	1.0	0.77	2.1	-	.89 <.5	<0.3	-	<0.4	<.3 <.2	-
36	Oellig Farm	2G1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3	<0.5	<0.5	<0.3	<0.3	<0.2	<0.1
45	Hardison Farm	1B1	-	-	-	110.	57.	39.	22.	37.	26.	49.	46.	37.
						(97.6)	(60.8)	(46.8)	(28.9)	(50.8)	(21.6)			

X = result by radiochemistry
(X) = result by gamma spec.

40 gm/gal $NaHSO_3$

Milk
Iodine - 131 (pCi/ℓ)

Map Loc	Page 4 of 4	Sample	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15
18	Alvine Farm	4B1	<0.3	<0.2	<0.5	<0.3	<0.3	<0.3	<0.3	<0.4	<0.4	<0.4	<0.3	<0.3
20	Becker Farm	7B3	1.9	1.4	4.7	1.8	1.9	2.3	0.86	1.4	1.4	1.1	1.0	1.0
20	Becker Farm	7B3Q	1.7	1.6	5.3	3.7	2.3	2.3	1.5	1.5	1.8	1.4	1.8	0.65
-	Fisher Farm	14D1	<0.2	<0.2	<0.2	<0.3	0.72	0.65	0.34	<0.4	0.43	<0.4	<0.3	<0.4
36	Oellig Farm	2O1	<0.3	<0.2	<0.3	<0.5	<0.3	<0.3	<0.3	<0.5	<0.4	<0.5	<0.4	<0.4
45	Hardison Farm	1B1	35.0	-	19.0	14.0	13.0	9.7	16.0	17.0	16.0	6.9	6.4	7.1

TABLE D-6

†Composite began 4/10
*Composite began 2/28

Air Particulates - Air Iodine
(Gross Beta) (Iodine-131)
pCi/m3

	page 1 of 2		Station	3/21-3/29	3/29-3/31	3/31-4/3	4/3-4/6	4/6-4/9	4/9-4/12	4/12-4/15	4/15-4/18	4/18-4/21	4/21-4/24	4/24-4/27	2/2 4/3
2	North Weather Station	AP-GROSS BETA	1S2	0.033	0.17	0.035	0.043	0.058	0.057	0.058	0.030	0.091	0.10	0.067	0.0[illegible]
28	Falmouth Sub.	AP-GROSS BETA	8C1	<0.002	0.0387	0.013	<4.17	-	0.220†	0.071	0.028	0.069	0.076	0.034	0.034
14	Observation Cntr.	AP-GROSS BETA	5A1	0.025	0.21	0.026	0.073	0.047	0.040	0.028	0.160	0.040	0.040	0.039	0.053
40	West Fairview	AP-GROSS BETA	15G1	0.035	0.12	0.032	0.039	0.047	0.041	0.047	0.042	0.074	0.074	0.060	0.035
34	Drager Farm	AP-GROSS BETA	7F1	0.065*	0.19	0.084	0.074	0.110	0.096	0.070	0.069	0.140	0.140	0.092	0.073
34	Drager Farm	AP-GROSS BETA	7F1Q	0.124*	0.155	0.202	0.04	0.06	0.04	0.05	0.04	0.09	0.08	0.051	0.033
26	Middletown	AP-GROSS BETA	1C1	0.039*	0.24	0.035	0.044	0.06	0.065	0.047	0.041	0.110	0.060	0.053	0.039
26	Middletown	AP-GROSS BETA	1C1Q	0.124*	0.212	0.184	0.04	0.06	0.03	0.05	0.03	0.09	0.05	0.044	0.030
24	Goldsboro Air Station	AP-GROSS BETA	12B1	0.049*	0.22	0.038	0.045	0.038	0.061	0.053	0.027	0.089	0.073	0.053	0.051
39	North York Sub.	AP-GROSS BETA	9G1	0.034*	0.10	0.045	0.038	0.048	0.046	0.038	0.029	0.069	0.058	0.052	0.042
2	North Weather Station	AI-IODINE 131	1S2	0.468	22.6	0.110	0.317	0.364	0.412	0.346	< 0.07	0.611	0.963	0.253	<0.046
28	Falmouth Sub.	AI-IODINE 131	8C1	< 0.02	20.1	1.39	< 5.27	-	0.152†	0.449	0.057	0.172	0.086	<0.050	<0.17
14	Observation Cntr.	AI-IODINE 131	5A1	< 0.02	20.3	0.279	3.87	0.666	0.627	0.197	8.39	0.082	0.105	<0.027	0.647
40	West Fairview	AI-IODINE 131	15G1	< 0.03	1.83	<0.024	<0.047	<0.052	<0.01	0.065	< 0.04	< 0.07	<0.065	<0.078	<0.14
34	Drager Farm	AI-IODINE 131	7F1	< 0.04*	0.266	0.155	0.090	0.039	0.205	<0.03	0.39	0.233	<0.061	<0.065	<0.23
34	Drager Farm	AI-IODINE 131	7F1Q	< 0.02*	0.09	<0.09	0.08	<0.07	0.09	<0.07	0.17	0.09	<0.078	<0.051	<0.076
26	Middletown	AI-IODINE 131	1C1	0.082*	12.7	0.051	0.167	0.202	0.098	0.381	< 0.06	0.069	0.184	<0.035	<0.042
26	Middletown	AI-IODINE 131	1C1Q	0.05*	9.8	< 0.05	0.1	0.15	<0.07	0.15	<0.06	0.12	0.049	<0.068	<0.058
24	Goldsboro Air Station	AI-IODINE 131	12B1	0.295*	23.9	0.068	0.368	0.687	0.675	0.462	<0.06	0.168	0.130	<0.046	< 0.16
39	North York Sub.	AI-IODINE 131	9G1	< 0.02*	0.143	0.355	< 0.037	0.048	< 0.04	0.061	<0.04	< 0.06	<0.051	<0.037	<0.062

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water
— Indicates Composite

Water pCi/ℓ TRITIUM

Map Location	Location	Sample	2/28	3/7	3/21	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/
27	Swatara Creek	1C3						110			<120	110	<100	100
27	Swatara Creek	1C3Q									<268	181	<274	<263
30	Brunner Island	8E1						—350	<120	220	810	160	330	150
30	Brunner Island	8E1*				—130					—<130	100	<120	170
30	Brunner Island	8E1Q							—<211		—<268		—175	
30	Brunner Island	8E1Q*											—234	
38	Columbia Water Plant	7G1				—130		—<200	320	190	<130	100	<120	100
38	Columbia Water Plant	7G1Q							<211	130	<268	175	<307	<286
35	Steelton Water Works	15F1*						—170,140	<110	<150	110	110	160	210
35	Steelton Water Works	15F1Q*							<211	<217	<268	349	<274	258
48	YHGS	8C2				—260		—110	180	290	590	<110	240	100
48	YHGS	8C2Q			—<265	—<265			—<273	<217	<268	<274	<274	428
	Discharge Pit	10S1			—19,300	500			500	100	120	150	100	<130
	Discharge Pit	10S1Q			—16,900	<265			218	<307	<203	<274	<307	<292
	York	9G2*							440	180	<130	130	420	140
	York	9G2Q*				<281		<281	<211	<217	578	<274	<307	223
	Holtwood/Safe Habor	-											—150	

TABLE D-7 Water Sample I-131

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water
— Indicates Composite

Water
pCi/ℓ

IODINE-131

X = Result by radiochemi:
(X) = Result by gamma spec
Y,Y = Normal sample, Sodium Bisulfite adde

Map Location	Location	Sample	2/28	3/7	3/21	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/
27	Swatara Creek	1C3						<0.3			<0.2	<0.2	<0.2	<0.2
27	Swatara Creek	1C3Q									<0.3	<0.4	<0.4	<0.3
30	Brunner Island	8E1						<0.2	<0.2	<0.5	<0.1	<0.2	<0.2	<0.2
30	Brunner Island	8E1*				<0.2					<0.2	<0.1	<0.3	<0.2
30	Brunner Island	8E1Q							<0.2		<0.2		<0.3	
30	Brunner Island	8E1Q*											<0.6	
38	Columbia Water Plant	7G1				<0.3		0.4	0.72	0.66	<0.2	<0.3	<0.2	<0.3
38	Columbia Water Plant	7G1Q							0.88	0.63	<0.3	<0.4	<0.3	<0.4
35	Steelton Water Works	15F1*						<.1, .2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
35	Steelton Water Works	15F1Q*							<0.2	<0.2	<0.2	<0.4	<0.4	<0.3
48	YHGS	8C2				<0.1		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3
48	YHGS	8C2Q			<0.7	<0.3			<1.4	<0.2	<0.3	<0.5	<0.4	<0.4
	Discharge Pit	10S1			<0.5	0.54			62.0 (73.)	43.0 (67.)	0.73	<0.2	<0.1	5.9
	Discharge Pit	10S1Q			<0.7	0.62			52.7 (71.)	48.6 (54.)	1.13	<0.6	<0.6	7.3 (18.)
	York	9G2*							<0.3	<0.2	<0.2	<0.1	<0.2	<0.4
	York	9G2Q*				<0.3		<0.2	<0.2	<0.2	<0.3	<0.4	<0.4	<0.2
	Holtwood/Safe Harbor	-											<0.4	

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/ℓ

IODINE-131

X - Result by radiochemi
(X) - Result by gamma spec
Y,Y = Normal sample, Sodium Bisulfite adde

Map Location	Page 2 of 4	Sample	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4,
27	Swatara Creek	1C3	<0.2	<0.2	<0.2	<0.5	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0
27	Swatara Creek	1C3Q	<0.2	<0.3	<0.4	<0.2	<0.4	<0.4	<0.3	<0.2	<0.2	<0.5	<0.3	<0.4
30	Brunner Island	8E1	<0.2	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.3	<0.4	<0.2	<0.3	<0.3 <0.3
30	Brunner Island	8E1*	<0.2	<0.3	<0.3	<0.2	<0.1	<0.2	<0.3	<0.3	<0.2	<0.5	<0.4	<0.2 <0.2
38	Columbia Water Plant	7G1	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.2	<0.4	<0.2	<0.4	<0.3	<0.3
38	Columbia Water Plant	7G1Q	<0.2	<0.5	<0.4	<0.3	<0.4	<0.5	<0.3	<0.2	<0.2	<0.4	<0.3	<0.3
35	Steelton Water Works	15F1*	<0.2	<0.3	<0.2	<0.3	<0.3	<0.3	<0.2	<0.4	<0.2	<0.4	<0.3	<0.3
35	Steelton Water Works	15F1Q*	<0.2	<0.4	<0.6	<0.3	<0.5	<0.3	<0.3	<0.2	<0.2	<0.3	<0.3	<0.3
48	YHGS	8C2	<0.2	<0.4	<0.2	<0.2	<0.5	<0.2	<0.2	<0.5	<0.4	<0.3	<0.4	<0.5
48	YHGS	8C2Q	<0.3	<0.5	<0.3	<0.5	<0.4	<0.4	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3
	Discharge Pit	10S1	6.3	<0.3	<0.2	4.2	4.1	1.5	1.2	1.9	2.3	<0.3	6.6,8.9	4.7,4.9
	Discharge Pit	10S1Q	7.3	0.8	<0.6	4.5	4.6	1.6	2.4	1.9	3.6	1.7	10.0	5.1
			(11.)			(5.8)				(3.4)	(3.3)		(11.)	(7.8)
	York	9G2*	<0.3	<0.5	<0.4	<0.2	<0.2	<0.2	<0.3	<0.2	<0.2	<0.3	<0.5	<0.3
	York	9G2Q*	<0.3	<0.4	<0.4	<0.4	<0.4	<0.5	<0.2	<0.3	<0.3	<0.4	<0.3	<0.4
	Holtwood/Safe Habor	-												

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/l

IODINE-131

X = Result by radiochemist
(X) = Result by gamma spec.
Y,Y = Normal sample, Sodium Bisulfite added

Map Location		Sample	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/3
27	Swatara Creek	1C3	<0.3	0.41	<0.2	<0.3	<0.3	<0.2	<0.1	<0.3	<0.2	<0.4	<0.3	<0.3
27	Swatara Creek	1C3Q	0.57	<0.4	<0.3	<0.3	<0.3	<0.2	<0.3	<0.3	<0.2	0.7	<0.4	<0.4
30	Brunner Island	8E1	<0.2	<0.2	<0.4	<0.3	<0.2	<0.2	<0.5	<.2 <.2	0.37	<0.3	<0.2	<0.4
30	Brunner Island	8E1*	<0.4	<0.3	<0.4	<0.3	<0.3	<0.2	<0.4	<.5 <.3	<0.2	<0.2	<0.2	<0.3
38	Columbia Water Plant	7G1	<0.2	<0.2	<0.1	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.3	<0.3	<0.4
38	Columbia Water Plant	7G1Q	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.2	<0.3	<0.3	<0.3
35	Steelton Water Works	15F1*	<0.2	<0.2	<0.2	<0.5	<0.4	<0.2	<0.1	<0.5	<0.4	<0.3	<0.2	<0.3
35	Steelton Water Works	15F1Q*	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3	<0.2	<0.3	<0.3	<0.2	<0.3	<0.4
48	YNGS	8C2	<0.4	<0.3	<0.3	<0.3	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5
48	YNGS	8C2Q	<0.3	<0.3	<0.2	<0.3	<0.3	<0.2	<0.3	<0.3	<0.2	<0.3	<0.2	<0.3
	Discharge Pit	10S1	3.7,3.6	5.6,5.9	1.5,1.8	-, 1.4	-, 4.2	-,<.2	-,<.3	-, .98	-, 1.5	-, 1.1	-,< .4	-,1.7
	Discharge Pit	10S1Q	4.1 (3.6)	5.8 (7.7)	1.5	2.0	4.3 (6.9)	3.7 (4.3)	1.2	1.3	2.2	2.2	0.9	2.5
	York	9G2*	<0.2	<0.2	<0.3	<0.3	<0.4	<0.3	<0.2	<0.2	<0.3	<0.2	<0.4	<0.2
	York	9G2Q*	<0.2	<0.2	<0.3	<0.3	<0.3	<0.5	<0.2	<0.3	<0.4	<0.3	<0.3	<0.3
	Holtwood/Safe Habor	-												
	Wrightsville	7G2				<0.4	<0.4	<0.2	<0.3	<0.3	0.55	<0.2	<0.4	<0.3
	[illegible]	[illegible]				<0.4	<0.3	<0.5	<0.3	<0.3	0.49	<0.3	<0.2	<0.3

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/ℓ

IODINE-131

X = result by radiochemistry
(X) = " " gamma spec

Map Location	Page 4 of 4	Sample	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/1
27	Swatara Creek	1C3	<0.4	<0.3	<0.4	<0.6	<0.5	<0.2	<0.4	<0.2	<0.3	<0.2	<0.2	<0.4
27	Swatara Creek	1C3Q	<0.4	<0.5	0.7	0.7	0.5	0.5	0.6	<0.5	0.6	<0.2	<0.4	<0.4
30	Brunner Island	8E1	<0.3	<0.5	<0.3	<0.4	<0.3	<0.3	<0.3	<0.5	<0.5	<0.2	<0.3	<0.5
30	Brunner Island	8E1*	<0.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.5	<0.5	<0.3	<0.5	<0.5
38	Columbia Water Plant	7G1	<0.4	<0.5	<0.3	<0.3	<0.3	<0.4	<0.4	<0.4	<0.5	<0.4	<0.3	1.3
38	Columbia Water Plant	7G1Q	<0.3	<0.3	<0.3	<0.4	<0.3	<0.3	<0.4	<0.3	<0.5	<0.3	<0.3	1.5
35	Steelton Water Works	15F1*	<0.2	<0.5	<0.4	<0.2	<0.3	<0.3	<0.4	<0.4	<0.3	<0.3	<0.5	0.7
35	Steelton Water Works	15F1Q*	<0.3	<0.3	<0.2	<0.3	<0.3	<0.4	<0.4	<0.5	<0.4	<0.2	<0.6	0.8
48	YHGS	8C2	<0.3	<0.4	<0.4	<0.5	<0.4	<0.5	<0.4	<0.5	<0.5	<0.4	<0.5	<0.4
48	YHGS	8C2Q	<0.5	<0.3	<0.2	<0.3	<0.4	<0.3	<0.3	<0.4	<0.3	<0.4	<0.6	<0.6
	Discharge Pit	10S1	2.2	2.7	<0.4	<0.3	1.4	<0.4	<0.3	0.43	0.67	.0.5	7.2	<0.4
	Discharge Pit	10S1Q	2.7	3.9	<0.4	<0.5	2.0	<0.5	<0.5	<0.5	0.7	<0.7	6.2 (5.4)	1.4
	York	9G2*	<0.5	<0.4	<0.4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.4	<0.4	<0.4
	York	9G2Q*	<0.3	<0.3	<0.3	<0.3	<0.3	0.6	<0.4	<0.3	<0.3	<0.4	<0.6	< 0.7
	Wrightsville	7G2	<0.5	<0.4	<0.4	<0.3	<0.3	<0.5	<0.3	<0.3	<0.3	<0.4	<0.5	<0.4

TABLD D-8

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water
— Indicates Composite

Water
pCi/l

GROSS BETA

Map Location		Sample	2/28	3/7	3/21	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
27	Swatara Creek	1C3						2.5			3.0	2.6	5.8	4.7
27	Swatara Creek	1C3Q									<2.95	<3.21	4.59	3.26
30	Brunner Island	8E1						— 2.7	3.8	4.5	3.3	5.7	<5.5	5.7
30	Brunner Island	8E1*				— 2.7					— 2.4	<1.0	<1.0	<1.0
30	Brunner Island	8E1Q							— <3.3		— 3.00		— 5.35	
30	Brunner Island	8E1Q*											— <3.55	
38	Columbia Water Plant	7G1				— 2.8		— 2.3	3.8	3.8	2.5	3.4	3.3	4.7
38	Columbia Water Plant	7G1Q							2.6	<3.3	2.13	<3.21	<3.21	3.09
35	Steelton Water Works	15F1*						— 2.1, 1.4	3.2	3.9	1.7	28.0	4.5	1.9
35	Steelton Water Works	15F1Q*							<3.3	<3.3	<2.95	<3.21	2.42	<3.55
48	YHGS	8C2				— 3.7		— 3.3	3.1		<1.0	1.7	3.3	2.0
48	YHGS	8C2Q			— 5.17	— <2.89			— 3.0	<3.3	2.05	<3.21	<3.21	<3.55
	Discharge Pit	10S1				4.3			6.2	4.7	2.1	1.7	3.1	3.2
	Discharge Pit	10S1Q			— 18.1	<2.89			33.0	23.8	<2.95	<3.21	2.67	7.86
	York	9G2*							2.0	1.8	2.1	3.3	2.7	2.3
	York	9G2Q*				<2.89		2.05	<3.3	<3.3	<2.95	<3.21	<3.21	<3.55
	Holtwood/Safe Harbor	-											— 2.0	

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/ℓ

GROSS BETA

Map Location	Page 2 of 4	Sample	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
27	Swatara Creek	1C3	3.9	3.0	1.8	4.1	3.1	3.8	3.2	1.9	2.6	4.3	3.3	2.7
27	Swatara Creek	1C3Q	<3.55	4.2	3.1	2.8	3.6	<3.0	<3.0	<3.0	2.1	<3.3	<3.3	3.3
30	Brunner Island	8E1	3.9	4.4	4.0	3.0	4.3	7.8	4.2	3.5	6.1	4.1	2.4	3.4 / 2.9
30	Brunner Island	8E1*	5.9	<1.0	<1.0	1.9	1.4	-	1.9	1.3	2.2	<1.0	2.3	1.3 / <1.0
38	Columbia Water Plant	7G1	4.8	2.8	3.1	2.4	3.1	2.5	4.9	4.7	3.0	1.7	2.8	2.9
38	Columbia Water Plant	7G1Q	5.10	2.5	3.1	2.6	<3.1	<3.0	2.3	2.1	<3.0	<3.3	7.8	2.64
35	Steelton Water Works	15F1*	1.9	<0.9	2.4	<1.0	1.9	2.6	2.5	2.7	2.2	2.1	<1.0	2.8
35	Steelton Water Works	15F1Q*	7.78	2.2	2.5	<3.1	3.5	8.0	<3.0	<3.0	<3.0	<3.3	<3.3	2.2
48	YHGS	8C2	2.5	3.6	2.0	2.3	1.6	2.6	4.9	2.7	2.9	2.0	<1.0	2.6
48	YHGS	8C2Q	<3.55	3.4	4.9	2.3	<3.0	<3.0	<3.0	<3.0	< 3.0	<3.3	<3.3	<2.9
	Discharge Pit	10S1	3.0	5.0	3.0	2.7	2.4	3.4	8.1	3.5	7.3	1.9	17.0	3.2
	Discharge Pit	10S1Q	8.78	6.5	5.2	5.4	7.8	<3.0	5.1	2.5	8.5	<3.3	12.5	2.5
	York	9G2*	2.3	2.0	1.5	2.2	1.4	2.4	2.3	3.2	2.9	3.5	2.6	2.1
	York	9G2Q*	<3.55	3.0	2.5	<3.1	3.6	<3.0	<3.0	<3.0	<3.0	<3.3	<3.3	2.2

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/l

GROSS BETA

Map Location		Sample	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/3
27	Swatara Creek	1C3	2.7	2.4	3.5	3.3	3.8	3.1	2.6	2.4	2.4	2.7	3.5	4.[illegible]
27	Swatara Creek	1C3Q	<2.9	<3.3	<3.3	<3.1	2.4	7.9	2.4	4.4	8.1	<3.3	2.9	<3.1
30	Brunner Island	8E1	2.7	3.9	2.2	3.1	2.6	3.4		3.6 3.5	2.2	2.0	3.8	2.9
30	Brunner Island	8E1*	1.9	<1.0	<1.0	3.9	<1.0	<1.0	1.8	<0.9 1.4	<1.0	4.8	1.4	<0.9
	TMI W. shore 0.5 mi.S.	9A1(2)										5.0		
	TMI W. shore 1.5 mi.S.	9B1										2.0		
38	Columbia Water Plant	7G1	2.9	3.1	2.4	2.1	2.9	1.8	5.3	3.8	3.0	3.1	1.4	1.7
38	Columbia Water Plant	7G1Q	2.4	2.96	<3.3	<3.1	2.8	<3.3	2.4	4.6	4.4	2.9	<3.3	<3.1
35	Steelton Water Works	15F1*	2.3	4.2	1.9	2.5	1.7	1.9	4.5	<1.0	2.0	3.8	2.4	1.4
35	Steelton Water Works	15F1Q*	<2.9	2.71	<3.3	<3.1	2.7	<3.2	<3.3	2.6	3.5	3.2	<3.3	<3.1
48	YHGS	8C2	2.1	1.9	2.1	1.7	2.4	1.5	<1.0	1.9	2.1	1.7	2.0	1.6
48	YHGS	8C2Q	2.8	<3.3	<3.3	2.6	3.1	<3.3	<3.3	2.7	<3.0	4.5	<3.3	<3.1
	Discharge Pit	10S1	2.0	16.	2.5	2.8	7.8	7.9	2.9	3.3	1.1	4.6	3.7	3.8
	Discharge Pit	10S1Q	4.99	10.9	2.45	<3.1	7.7	9.0	2.2	6.7	3.6	6.4	2.5	<3.1
	York	9G2*	1.8	2.2	2.1	1.7	2.2	2.2	1.2	1.7	2.8	2.2	3.3	2.0
	York	9G2Q*	<2.9	<3.3	<3.3	<3.1	<3.1	2.2	2.3	<3.0	3.4	<3.3	<3.3	<3.1
	Wrightsville	7G2				3.0	2.2	2.8	2.4	2.7	2.8	4.3	3.5	3.1

Note: Composite samples are taken at 8E1 and 8C2
*Indicates Finished (Treated) Water

Water
pCi/ℓ

GROSS BETA

Map Location	Page 4 of 4	Sample	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/1
27	Swatara Creek	1C3	2.6	2.6	9.7	3.6	3.5	2.4	2.5	1.9	2.6	2.5	2.7	4.6
27	Swatara Creek	1C3Q	<3.1	<3.3	<3.3	2.2	2.2	3.4	3.4	2.1	2.9	2.7	<3.2	5.0
30	Brunner Island	8E1	3.0	2.9	3.1	8.6	3.6	3.0	3.1	2.2	3.2	3.1	2.4	2.1
30	Brunner Island	8E1*	2.5	<1.0	2.3	<1.0	<1.0	<1.0	3.0	<1.0	2.2	1.9	1.6	<1.0
38	Columbia Water Plant	7G1	2.5	1.9	2.4	4.2	–	3.0	2.5	5.2	2.6	2.3	2.6	4.8
38	Columbia Water Plant	7G1Q	<3.3	<3.3	<3.3	2.2	2.7	3.4	4.0	<3.0	<3.0	2.5	3.1	6.7
35	Steelton Water Works	15F1*	1.6	2.5	1.8	2.7	3.0	2.0	2.3	1.8	1.3	1.9	<1.0	2.2
35	Steelton Water Works	15F1Q*	<3.1	<3.3	<3.3	<3.0	3.6	3.9	2.6	<3.0	<3.0	2.2	7.7	<2.7
48	YHGS	8C2	2.7	1.9	1.4	2.8	1.8	1.4	<1.0	1.3	<1.0	1.6	1.4	1.5
48	YHGS	8C2Q	<3.1	<3.3	<3.3	<3.0	2.2	4.2	2.7	<3.0	<3.0	3.3	2.2	2.1
	Discharge Pit	10S1	6.5	7.7	2.3	2.2	7.7	2.2	2.1	2.7	2.0	1.9	2.8	2.2
	Discharge Pit	10S1Q	<3.3	6.1	3.1	2.9	10.9	2.6	2.6	<3.0	<3.0	3.4	6.8	2.0
	York	9G2*	1.4	2.3	1.4	1.9	2.2	1.7	2.1	1.9	2.6	2.1	2.7	1.8
	York	9G2Q*	<3.3	<3.3	<3.3	<3.0	<3.0	<3.4	3.8	<3.0	<3.0	<3.2	<3.2	2.5
	Wrightsville	7G2	2.9	2.8	2.9	2.5	3.3	4.1	3.4	2.1	2.8	2.8	1.9	3.8

APPENDIX D

TABLE 9

TLD BACKGROUNDS

AVE 1978

mR/30.4 Days ± 2σ

CONTROL TLD's

LOCATION	mR/mo.
7F1	8.32 ± 4.84
4G1	6.38 ± 2.92
9G1	6.76 ± 3.64
15G1	6.27 ± 3.32
7G1	10.1 ± 8.2

INDICATOR TLD's

1S2	5.61 ± 2.42
2S2	4.76 ± 1.80
4S2	5.59 ± 3.38
5S2	5.39 ± 3.56
8C1	4.17 ± 1.96
9S2	6.11 ± 3.34
11S2	8.54 ± 10.3
14S2	6.71 ± 10.2
16S1	9.58 ± 12.2
4A1	5.58 ± 2.68
3A1	5.32 ± 2.88
16A1	5.0 ± 5.8
10B1	5.99 ± 7.52
12B1	4.53 ± 2.54
1C1	4.75 ± 2.26

Table D-10

Emergency REMP

The Emergency REMP requires, in addition to all operational REMP procedures, an increased sampling and analysis frequency and the addition of new analyses and sampling locations. The table below describes the Emergency REMP which started on March 29, 1979.

Media	No. of Indicator Locations	No. of Background Locations	Sampling Frequency	Analyses[1]
Air Particulates	5	3	Every 3 days[2]	Gross beta, gamma s
Air Iodine	5	3	Every 3 days[2]	Radioiodine
Surface/Drinking Water	5[3]	2	Daily[4]	Gross beta, radioio
Effluent Water	1	0	Daily[4]	Tritium, gamma spec
Precipitation (rain water)	2	2	As Available[5]	Gamma spec.
Fishes	1	1	Weekly	Gamma spec, stronti
Aqustic Plants	2	1	Weekly (if available)	Gamma spec.
Aquatic Sediment	2	1	Weekly	Gamma spec, stronti
Milk	4[6]	1	Daily	Radioiodine, gamma
Vegetation	4	1	Monthly	Radioiodine, gamma
Soil	4	1	Monthly	Gamma spec.
Misc. Foodstuffs[7]	1	1	As Available	Gamma spec.
TLD	15	5	Every 3 days[2]	Dose rate

1 The listed analyses are performed on each sample and are additional to those performed in the operational REMP.

2 Sampling periods were from 3/29-3/31, 3/31-4/3, and every three days thereafter until 4/24/79. As of 4/24/79 samples are collected weekly.

3 An indicator location was added on 4/22/79.

4 Sampling was done on 3/29, 3/31, and daily thereafter.

5 Precipitation was collected on 3/31, 4/5 and 4/27.

6 Milk is not always available from a goat farm due to its use by newborn goats.

7 Includes poultry, beef, eggs, pork, and game if available.

Table D-11

Off-Site Emergency Radiological Environmental Monitoring Program
As of May 31, 1979[4]

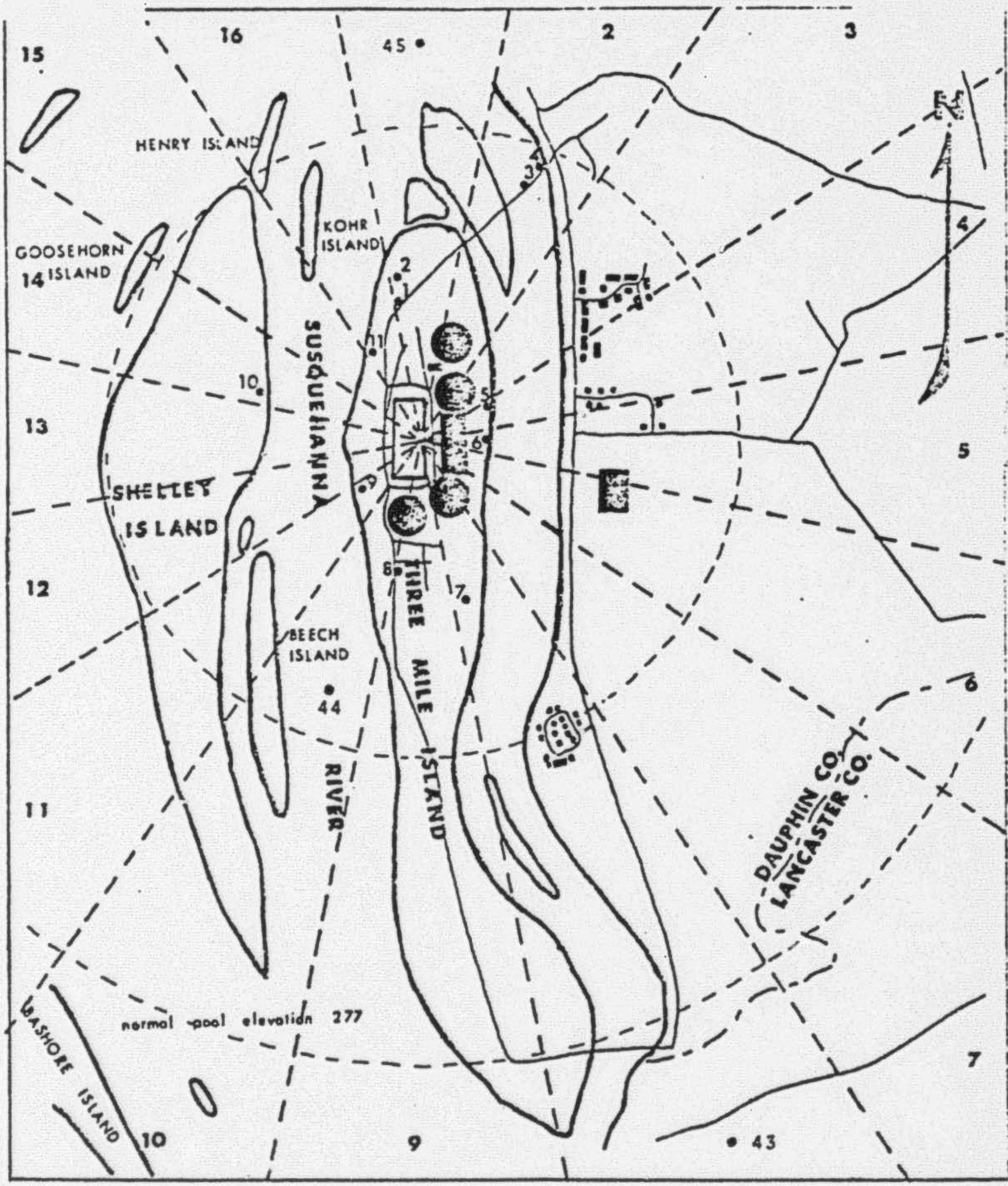
Media	Collection Frequency[1]	Analyses	Analyses Frequency	Action Level[2]
Air Particulates	Weekly	Gross Beta	Each Sample	Indicator >10X Backgrou
Air Iodine	Weekly	Radioiodine	Each Sample	0.9 pCi/m^3.
Surface/Drinking Water	Daily	Radioiodine	Each Sample	2 pCi/l
		Gross Beta	Weekly Composite	Indicator >10X Backgrou
		Tritium	Weekly Composite	20,000 pCi/l
		Gamma Spec	Weekly Composite	Indicator >10X Backgrou
Effluent Water	Daily	Radioiodine	Each Sample	-
		Gross Beta		-
		Tritium		-
		Gamma Spec		-
Precipitation	Monthly	Radioiodine	Monthly	2 pCi/l
		Gross Beta		Indicator >10X Backgro
		Tritium		20,000 pCi/l
		Gamma Spec		Indicator >10X Backgro
Fishes	Semi-Annually (July & October)	Strontium	Each Sample	Indicator >10X Backgro
		Gamma Spec		Indicator >10X Backgro
A .tic Plants	Semi-Annually (July & October)	Gamma Spec	Each Sample	Indicator >10X Backgro
Aquatic Sediment	Semi-Annually (July & October)	Gamma Spec	Each Sample	Indicator >10X Backgro
Milk[3]	Weekly	Radioiodine	Each Sample	5 pCi/l
		Gamma Spec	Each Sample	Indicator >10X Backgro
Misc. Food Stuffs	As Available	Gamma Spec	Each Sample	
TLD	Monthly	Dose Rate	Each Sample	Indicator >10X Backgro

1 Samples are collected only if available.

2 This level, if exceeded, by confirmed analyses, results in the implementation of the more intense surveillance program for that media and location as described in Table 2, until the radioactivity levels are below the action level for three successive samples.

3 One milk location (goat farm at 1B1) is in excess of the action level and will be sampled daily if sufficient milk is available.

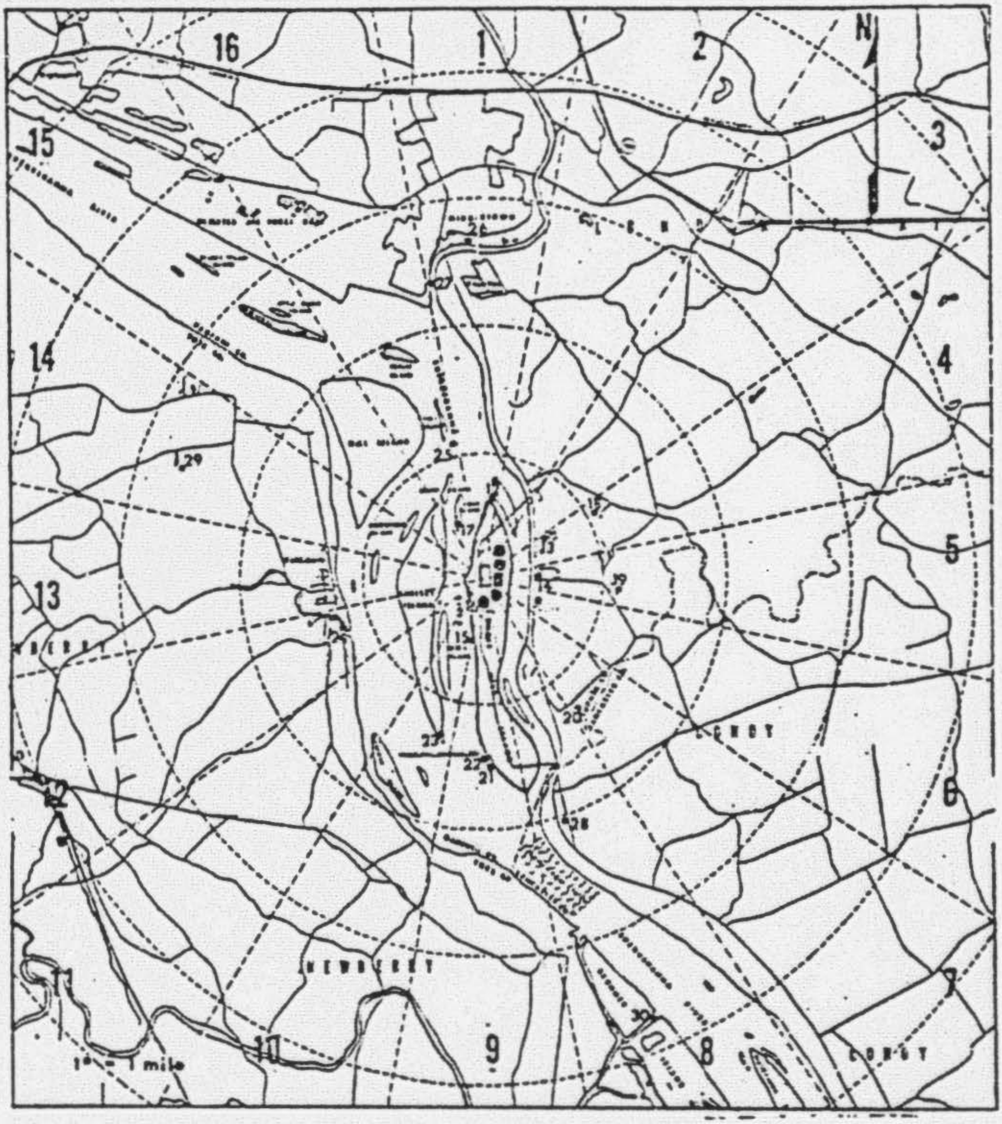
4 The normal operational Radiological Environmental Monitoring Program required by the ETS continues to be maintained per Table 1.



2.5" = 1 mile

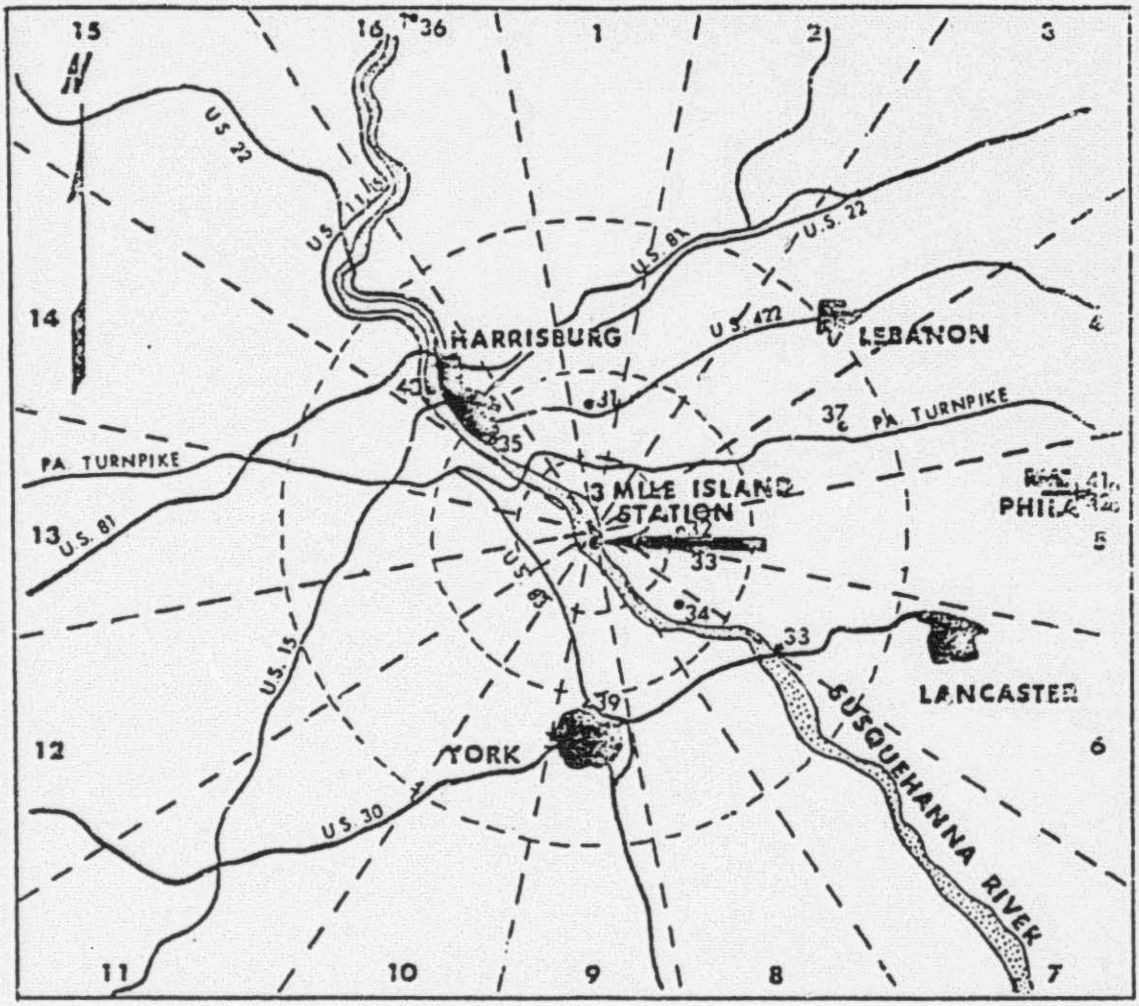
Map D-1

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations within
the Site Boundaries



Map D-2

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations within
5 Miles of the Site



1" = APPR. 10 MILES

Map D-3

THREE MILE ISLAND NUCLEAR STATION
Location of Operational
Radiological Environmental
Monitoring Stations Greater
than 5 Miles from the Site

APPENDIX E

INTERIM REPORTS ON TMI OFFSITE

EMERGENCY RADIOLOGICAL MONITORING PROGRAM -

PORTER-GERTZ CONSULTANTS, INC.

Report Description	Date
PGC-TR-171	May 10, 1979
PGC-TR-172	June 7, 1979

Porter-Gertz Consultants, Inc.
76 RITTENHOUSE PLACE
ARDMORE, PA. 19003
215-896-5353

PGC-TR-171
Revision 1

INTERIM REPORT ON THE THREE MILE ISLAND NUCLEAR STATION OFFSITE EMERGENCY RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

May 10, 1979

INTRODUCTION

This interim report reviews the analytical results for samples taken preincident and generally through mid-April, for surface and drinking water, precipitation, air particulates, and miscellaneous food products, and generally through the end of April for milk, air iodine, and TLDs. This report then notes those sample types and analyses which are reportable under Unit 2's Environmental Technical Specifications, and provides a radiological dose assessment.

Metropolitan Edison Company (Met Ed) has been conducting a routine operational Radiological Environmental Monitoring Program (REMP) in the environs of Three Mile Island Nuclear Station (TMINS) since June 5, 1974, the criticality date for Unit 1. This program involves sampling and analyzing the aquatic, terrestrial, and atmospheric environments along established critical pathways in order to evaluate any radiological impact caused by the operation of TMINS. A complete description of the operational REMP may be found in the 1978 Annual Report(1). On March 28, 1979 there was an incident at TMINS Unit 2 which caused the accidental and intermittently continuing release of some radioactivity to the environment in excess of that released during normal operations. Thus the operational REMP intensified and became the Offsite Emergency REMP.

The Emergency REMP requires, in addition to all operational REMP procedures, an increased sampling and analysis frequency and the addition of new analyses and sampling locations. The table below describes the Emergency REMP which started on March 29, 1979.

Media	No. Of Indicator Locations	No. Of Background Locations	Sampling Frequency	Analyses[1]
Air Particulates	5	3	Every 3 days[2]	Gross beta
Air Iodine	5	3	Every 3 days[2]	Radioiodine
Surface/Drinking Water	5[3]	2	Daily[4]	Gross beta, radioiodine, tritium, gamma spec.
Effluent Water	1	0	Daily[4]	Gross beta, radioiodine, tritium, gamma spec.
Precipitation	2	2	As Available[5]	Gross beta, radioiodine, tritium, gamma spec.
Fishes	1	1	Weekly	Gamma spec, strontium
Aquatic Plants	2	1	Weekly (if available)	Gamma spec.
Aquatic Sediment	2	1	Weekly	Gamma spec, strontium
Milk	4[6]	1	Daily	Radioiodine, gamma spec.
Vegetation	4	1	Monthly	Radioiodine, gamma spec.
Soil	4	1	Monthly	Gamma spec.
Misc. Foodstuffs[7]	1	1	As Available	Gamma spec.
TLD	15	5	Every 3 days[2]	Dose rate

[1]The listed analyses are performed on each sample and are additional to those performed in the operational REMP.

[2]Sampling periods were from 3/29-3/31, 3/31-4/3, and every three days thereafter.

[3]An indicator location was added on 4/22/79.

[4]Sampling was done on 3/29, 3/31, and daily thereafter.

[5]Precipitation was collected on 3/31 and 4/5.

[6]Milk is not always available from a goat farm due to its use by newborn goats.

[7]Includes poultry, beef, eggs, pork, and game if available.

RESULTS

As this is an interim report final results are not yet available for all samples or analyses.

Air Particulates

During the first quarter of 1979 gross beta activities of air particulate samples ranged from <0.002 to 0.09 pCi/m^3 and averaged 0.026 pCi/m^3 with no individual location being uniquely high or low. Post incident air particulate sample gross beta activities through 4/15 ranged from <0.002 to 0.84 pCi/m^3 and averaged 0.12 pCi/m^3 with the observed activities appearing randomly distributed between indicator and background locations.

Since the gross beta activities increased after the incident but appear homogeneously distributed at all locations, it is reasonable to infer that this increase was due to the natural spring rainout phenomena and not TMINS. A similar increase was observed in 1978[1].

Air Iodine

No air radioiodine was detected at any location in the first quarter of 1979. Post incident analyses of air iodine samples through 4/27 noted iodine-131 activities ranging from <0.02 to 23.9 pCi/m^3. Iodine-133 was also found on occasion with the highest activity being 4.82 pCi/m^3. The distribution of observed values was such that locations closest to TMINS or in known downwind directions had the highest radioiodine levels.

Since air radioiodine was not detected in any of the preincident samples in the first quarter of 1979, and since postincident samples show increased radioiodines, it is reasonable to infer that the observed radioiodine levels were due to TMINS gaseous releases. Additional information concerning these air radioiodine levels is supplied in the Reportable Occurrences section of this report.

Surface/Drinking Water

Surface and drinking water samples for the first quarter of 1979 had: no detectable radioiodine, no gamma emitting radionuclides greater than the minimum detectable level, gross beta activities ranging from <1.0 to 6.0 pCi/l and averaging 3.4 pCi/l, and tritium levels ranging from 110 to 2690 pCi/l and averaging 479 pCi/l. Analyses of postincident samples through 4/13 found: three positive radioiodine results (0.4, 0.72, and 0.66 pCi/l) with the remainder being below the detectable limit, no gamma emitting radionuclides except for low levels of naturally occurring potassium-40 and radium-226, tritium levels ranging from <100 to 810 pCi/l and averaging 170 pCi/l, and gross beta levels ranging from 0.9 to 7.8 pCi/l and averaging 3.0 pCi/l.

Based on the pre and post incident radioanalytical results it seems reasonable to conclude that the incident at TMINS had no effect on surface or drinking water quality.

Effluent Water

First quarter 1979 preincident effluent water samples had tritium activities ranging from 310 to 19,300 pCi/l and no detectable radioiodine or gamma emitting radionuclides. Postincident samples through 4/13 had tritium levels ranging from 100 to 2920 pCi/l, iodine-131 levels ranging from <0.1 to 62 pCi/l, and no other detectable gamma emitters. The levels of radioiodines, based on the surface and drinking water results, apparently had no discernible effect offsite.

Precipitation

First quarter 1979 preincident precipitation sample analyses found: gross beta activities ranging from 1.5 to 5.6 pCi/l with an average of 2.8 pCi/l, tritium activities less than 250 pCi/l, no detectable radioiodine, and the presence of no detectable gamma emitting radionuclides except for low levels of naturally occurring beryllium-7. Postincident analyses of precipitation through 4/5 found: gross beta activities ranging from 2.9 to 93 pCi/l (this value was at a background location ~14 miles NW of TMINS) and averaging 19.5 pCi/l, tritium levels ranging from 100 to 160 pCi/l and averaging 138 pCi/l, no gamma emitting radionuclides except for one positive result for naturally occurring beryllium-7, and no detectable radioiodine except for one positive result of 2.1 pCi/l.

The increased gross beta levels found, due to the occurrence of high values at both background and indicator locations, is probably due to spring rainout while the one positive low level radioiodine result may be due to TMINS.

Milk

Analyses of preincident first quarter 1979 milk samples found no detectable radioiodine, expected levels of naturally occurring potassium-40, and low levels of fallout cesium-137. Analysis of postincident milk samples through 4/25 found no change in the potassium-40 or cesium-137 levels, but an increase in the milk radioiodine content was found and two milk samples contained measureable quantities of radioxenon.

The postincident radioiodine levels in cow's milk through 4/25 ranged from <0.1 to 21 pCi/l with an average of 1.1 pCi/l. The higher values were found at the indicator locations during the first post incident week and have been steadily decreasing since. No detectable radioiodine was found in samples from the control location. Postincident radioiodine levels through 4/17 in goat's milk (1 location 1.1 mile N of TMINS) ranged from 1.1 to 41 pCi/l and averaged 13 pCi/l. These levels peaked on 3/30 and 4/12 and have slowly declined after each peak.

The increases of milk radioiodine, based on their times and places of occurrence, are in all likelihood due to TMINS gaseous releases. Additional information concerning these milk radioiodine levels is supplied in the Reportable Occurrences section of this report.

TLDs

The average gamma immersion dose rate around TMINS, due to non-TMINS produced radioactivity, as measured by the fourth quarter of 1978 TLDs, is approximately 0.172 mR/day with extremes of 0.115 to 0.247 mR/day depending on location. The postincident TLD results through 4/28 did show a marked increase in the gamma immersion dose rate at some close-in offsite locations. The highest offsite values, which occurred immediately postincident, peaked at approximately 10 mR/day for the period 3/29-3/31. These high values occurred within a mile of the site and the dose rate decreased to background levels some five miles from the site. The offsite gamma immersion dose rate quickly decreased with time such that by 4/3 all offsite locations were essentially at normal ambient background levels.

Subjective analysis of the TLD data would thus indicate that the transient and slightly increased dose rate found just offsite was caused by TMINS and that this increase was not apparent at distances of five or more miles.

Other Samples

Two of six grass samples showed low but detectable levels of radioiodine which could have been due to TMINS.

Analyses of poultry, beef, eggs, and soil showed the presence of naturally occurring or fallout radioactivity only. No significant differences were found between indicator and background results for these samples.

REPORTABLE OCCURRENCES

Table 3.2-4 of the TMINS Unit 2 Environmental Technical Specifications(2) requires that non-routine operating reports be filed with the Nuclear Regulatory Commission for those sample types whose average quarterly radioactivity levels exceed the listed values. These levels were exceeded in the first quarter of 1979 (samples taken from January 1 - March 31) by iodine-131 in milk and air. These occurrences are discussed below.

Iodine-131 In Milk

The reporting level for iodine-131 in milk is 3 pCi/l. This value was exceeded at locations 7B3 (cow's milk) and 1B1 (goat's milk) where the respective quarterly averages were 4.42 and 8.58 pCi/l. Prior to the March 28 incident no radioiodine was detectable in any milk samples from these locations; the reporting level was exceeded due to one positive result at 7B3 on 3/31 (21 pCi/l) and two positive results at 1B1 on 3/29 and 3/30 (1.1 and 41 pCi/l). Based on radioiodine levels in early April (second quarter) samples it is likely that only location 1B1 will have reportable levels of radioiodine in milk.

The potentially highest radiological dose to an infant's thyroid from drinking one liter of milk per day from these locations for those days when positive results were found in the first quarter, assuming no physical decay and using the dose model and values in reference 3 is calculated below. These calculated doses would also approximate the total infant thyroid dose to this infant for the first quarter of 1979.

Milk from 7B3: (21 pCi/l)(1.39×10^{-2} mrem/pCi ingested) = 0.29 mrem
Milk from 1B1: (1.1 pCi/l + 41 pCi/l)(1.39×10^{-2} mrem/pCi ingested) = 0.59 mrem

Iodine-131 In Air

The reporting level for airborne iodine-131 is 0.9 pCi/m^3. This value was exceeded at 5 sampling locations due to elevated air iodine concentrations in samples taken postincident. No radioiodine was found in samples for the first quarter, taken prior to March 28. The locations, their sampling periods, averages, and peak values which occurred from 3/29 to 3/31 are listed below.

Location	Quarterly Average	Peak Value	Sampling Periods
1S2	1.68 pCi/m^3	22.6 pCi/m^3	Weekly from 12/27 to 3/29/79 and 3/29 to 3/31/79
8C1	1.58 pCi/m^3	20.1 pCi/m^3	
5A1	1.48 pCi/m^3	20.3 pCi/m^3	
12B1	12.1 pCi/m^3	23.9 pCi/m^3	2/28 to 3/29/79 and 3/29/79 to 3/31/79
1C1	4.27 pCi/m^3	12.7 pCi/m^3	1/10/79 to 1/17/79, 2/28/79 to 3/29/79, and 3/29/79 to 3/31/79

The airborne radioiodine levels have, in general, been steadily decreasing in April such that only location 5A1 may be reportable for the second quarter of 1979.

The radiological dose implications to the maximum adult's thyroid from being at location 12B1 (Goldsboro, PA) for the entire 72 hour period (3/29 - 3/31) using the dose model and values in reference 3 is calculated below. This calculated dose would also approximate the maximum total adult thyroid dose for the first quarter of 1979.

At 12B1: $(23.9\ pCi/m^3)(66\ m^3$ of air inhaled/3 days$)(1.49\times10^{-3}$ mrem/pCi inhaled$)$
$= 2.4$ mrem

INCIDENT IMPACT ASSESSMENT

A method whereby the radiological impact of the March 28, 1979 incident at TMINS can be assessed is to consider the potential radiological dose to individuals in the population at large that could have been exposed to TMINS radioeffluents from the time of the incident. The dose models and values used are found in references 3 and 4. This is the method used here for the following pathways: waterborne (drinking water, eating fish, swimming, boating and shoreline activities), drinking milk, inhalation of radioiodine, and gamma immersion dose as measured by TLDs. Each of these pathways and the resultant doses for the noted time periods follow.

Waterborne Pathways

Dose rates for the maximum and average individual have been calculated and reported for the periods 3/28/79 - 3/31/79 and 4/1/79 - 4/7/79[5]. The results of these calculations have been excerpted from the referenced report.

It should be noted that the calculated doses are extremely low and no different from those that would be received from the natural radiation environment.

Milk Ingestion Pathway

Location 7B3 had the highest postincident concentration of radioiodine in cow's milk which averaged 2.5 pCi/l for the time period 3/28/79 - 4/25/79. Thus the potential maximum thyroid dose received by an infant drinking one liter of this milk per day, assuming no physical decay of iodine, is:

(1 liter/day)(28 days)(2.5 pCi/l)(1.39×10^{-2} mrem/pCi ingested) = 0.97 mrem

This is a very low dose and represents a very small additional dose increment, since a typical infant would receive approximately 7.8 mrem to the thyroid over this same time period due to naturally occurring radioactivity.

The goat's milk at location 1B1 averaged 13 pCi/l for the time period 3/28/79 - 4/17/79. Thus the potential maximum thyroid dose received by an infant drinking one liter of this milk per day, assuming no physical decay of iodine, is:

(1 liter/day)(20 days)(13 pCi/l)(1.39×10^{-2} mrem/pCi ingested) = 3.6 mrem

however, most to all of the goat's milk production is being used to suckle newborn kids or for environmental samples and thus there is little to no human exposure via this pathway[6].

Inhalation of Radioiodine

The closest offsite location, 5A1 the observation center, had an air radioiodine concentration which for the period 3/28/79 - 4/27/79 averaged 3.2 pCi/m^3. If an individual were to have been at this location for this entire time period they could have received a thyroid dose of:

(21.9 m^3 of air inhaled/day)(30 days)(3.2 pCi/m^3)(1.49×10^{-3} mrem/pCi inhaled) = 3.1 mrem,

which is low. It represents an approximate 38% increase over natural background exposure levels for the same time period.

The closest population center was Goldsboro, PA (location 12B1), where the air radioiodine concentration averaged 2.4 pCi/m^3 for the period 3/28/79 - 4/27/79. Thus a resident of Goldsboro, if they were not indoors for this entire time period which is quite unlikely, could have received a potential thyroid dose of:

(21.9 m^3 of air inhaled/day)(30 days)(2.4 pCi/m^3)(1.49×10^{-3} mrem/pCi inhaled) = 2.4 mrem,

which is low and represents an approximate 30% increase over natural background exposure levels for the same time period.

Residents of Middletown, PA (location 1C1) were potentially exposed to an average air radioiodine concentration of 1.3 pCi/m^3 for the time period 3/28/79 - 4/27/79. Thus a Middletown resident could have received a potential thyroid dose of:

(21.9 m^3 of air inhaled/day)(30 days)(1.3 pCi/m^3)(1.49×10^{-3} mrem/pCi inhaled) = 1.3 mrem,

which is low and represents an approximate 16% increase over natural background exposure levels for the same time period.

Gamma Immersion Dose

The gamma immersion dose, total external exposure, is calculated for the period 3/28/79 - 4/28/79 at locations 4A1 (north of the observation center on Laurel Road - the highest observed offsite location where people would likely be) and 12B1 (Goldsboro, PA) and 1C1 (Middletown, PA) close in population centers. The results were converted from milliRoentgens to millirem by multiplying the observed values by 0.955 and assuming an RBE of unity. The calculated potential total absorbed doses are thus 37.5 mrem at 4A1, 7.4 mrem at 12B1, and 5.2 mrem at 1C1.

The average normal background exposure rates for these locations for the same time period is approximately 4.5 mrem based on data from the last quarter of 1978. Therefore the potential incremental exposure dose caused by TMINS for this time period is: 33.0 mrem at 4A1, 2.9 mrem at 12B1, and 0.7 mrem at 1C1.

DOSE SUMMARY

Based on the data presented and evaluated in this interim report the following doses can be calculated and conclusions drawn concerning the radiological impact of the March 28, 1979 incident at TMINS.

Dose Summary - Total Doses

Media - Pathway	Time Period Covered	Dose: mrem per time period Max Individual	Avg Individual
Drinking Water	3/28/79 - 4/13/79	6.9E-4	4.1E-4
Eating Fish	3/28/79 - 4/13/79	1.7E-5	1.9E-6
Swimming	3/28/79 - 4/13/79	1.7E-7	7.1E-9
Boating	3/28/79 - 4/13/79	8.5E-8	3.6E-9
Shoreline	3/28/79 - 4/13/79	5.7E-7	2.4E-9
Air Iodine Inhalation	3/29/79 - 4/27/79	3.1[1]	3.2[2]/1.3[3]
Iodine in Cow's Milk	3/29/79 - 4/25/79	9.7E-1[4]	4.3E-1[5]
Immersion Dose	3/28/79 - 4/28/79	37.5[6]	7.4[2]/5.2[3]

[1]At location 5A1
[2]At location 12B1 (Goldsboro)
[3]At location 1C1 (Middletown)
[4]From location 7B3 for the infant thyroid
[5]Based on average for all locations for the infant thyroid
[6]At location 4A1

CONCLUSIONS

1. There was no detectable increase in the radioactivity levels of surface or drinking water.

2. Small increases of radioiodine, which would result in negligible radiological doses to the general population, were found in milk, precipitation, air, and grass which probably were due to TMINS gaseous radioeffluents.

3. The offsite environmental dose rate, as measured by TLDs, did increase within a five mile radius of TMINS for a few days post incident.

and 4. The resultant potential incremental radiological doses to the general population for all pathways considered were generally less than 4 millirem and as such would be less than the dose that would be received from a transcontinental plane flight.

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5. Weekly Radiological Dose Calculations Around Three Mile Island Nuclear Station - Waterborne Pathways Only - From March 28, 1979 On. Porter-Gertz Consultants, Inc. PGC-TR-170, Revision 1. April 1979.

6. Personal communication from Mrs. Hardison, owner of goats at location 1B1.

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Dose Calculations For The Period 3/28/79 - 3/31/79

Nuclides Found and Their Concentrations

Location	Nuclide and Concentration		
TM-SW-3E1	H-3 = 235 pCi/l	I-131 not detected	γ spec = <MDL
TM-SW-7G1	H-3 = 165 pCi/l	I-131 = 0.35 pCi/l	γ spec = <MDL
TM-SW-9G2	no activity detected		
Susquehanna River	H-3 = 218 pCi/l	I-131 = 0.23 pCi/l	γ spec = <MDL

Dose Calculations - Doses Calculated For The Exposure Period

Pathway	Location	Radionuclide	Organ	Dose: mrem/exposure period Max. Individual	Av. Individual	Man-rem
Drinking Water	TM-SW-3E1	H-3	Whole body	2.3E-4	1.4E-4	3.4E-6
Drinking Water	TM-SW-7G1	H-3	Whole body	1.6E-4	9.5E-5	9.5E-4
Drinking Water	TM-SW-7G1	I-131	Thyroid	5.2E-3	3.1E-3	3.1E-2
Eating Fish	River	H-3	Whole body	5.5E-6	6.3E-7	-
Eating Fish	River	I-131	Thyroid	1.3E-3	1.5E-4	-
Swimming	River	H-3	Whole body	0	0	-
Swimming	River	I-131	Thyroid	1.7E-7	7.1E-9	-
Boating	River	H-3	Whole body	0	0	-
Boating	River	I-131	Thyroid	8.5E-8	3.6E-9	-
Shoreline	River	H-3	Whole body	0	0	-
Shoreline	River	I-131	Thyroid	5.7E-7	2.4E-9	-

Conclusion

The doses calculated above are extremely low and no different from those that would be received from natural radiation.

Dose Calculations For The Period 4/1/79 - 4/7/79

clides Found and Their Concentrations

Location	Nuclide and Concentration		
TM-SW-8E1	H-3 = 140 pCi/l	I-131 not detected	γ spec = <MDL
TM-SW-7G1	H-3 = 179 pCi/l	I-131 not detected	γ spec = <MDL
TM-SW-9G2	H-3 = 224 pCi/l	I-131 not detected	γ spec = <MDL
Susquehanna River	H-3 = 194 pCi/l	I-131 not detected	γ spec = <MDL

Dose Calculations - Doses Calculated For The Exposure Period

				Dose: mrem/exposure period		
Pathway	Location	Radionuclide	Organ	Max. Individual	Av. Individual	Man-rem
Drinking Water	TM-SW-8E1	H-3	Whole body	2.5E-4	1.5E-4	3.7E-6
Drinking Water	TM-SW-7G1	H-3	Whole body	3.2E-4	1.9E-4	1.9E-3
Drinking Water	TM-SW-9G2	H-3	Whole body	4.0E-4	2.4E-4	3.0E-3
Eating Fish	River	H-3	Whole body	8.6E-6	9.9E-7	-
Swimming	River	H-3	Whole body	0	0	-
Boating	River	H-3	Whole body	0	0	-
Shoreline	River	H-3	Whole body	0	0	-

Conclusion

The doses calculated above are extremely low and no different from those that would be received from natural radiation.

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INTERIM REPORT ON THE THREE MILE ISLAND NUCLEAR STATION OFFSITE EMERGENCY RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

June 7, 1979

Introduction

Metropolitan Edison Company has been conducting an intensive Offsite Emergency Radiological Environmental Monitoring Program in the environs of Three Mile Island Nuclear Station since March 28, 1979. This intensive program, through April 30, 1979, required: daily samples of drinking and/or surface water at 7 locations, effluent water at 1 location, and milk at 5 local dairy farms; samples every 3 days at 8 air particulate and air iodine locations, and 20 TLD locations (became weekly on April 28, 1979); and samples as available of precipitation at 4 locations, fishes at 2 locations, aquatic plants and sediment at 3 locations, vegetation and soil at 5 locations, and miscellaneous foodstuffs at 2 locations. This interim report reviews the radioanalytical results of analyses on these samples, except TLDs, and evaluates the potential impact portrayed by these results from March 28, 1979 through April 30, 1979 or some prior date based on results availability.

Waterborne Pathways

Surface and Drinking Water

All water samples were analyzed for radioiodine, tritium, and gross beta activities, as well as by gamma spectroscopy. Seven samples, 1 upstream and 6 downstream, had very low positive results for radioiodine (all <1pCi/l) while all other samples had no detectable radioiodine. Tritium and gross beta activities were at normal ambient levels for all samples and no reactor produced radionuclides were found. The dosimetric implications of these results are found in the appendix to this report.

Effluent Water

Tritium levels ranged from 100 to 3690 pCi/l through April 21, 1979; iodine-131 levels ranged from <0.1 to 62 pCi/l through April 30, 1979; no gamma emitters other than iodine-131 and on 2 occasions cobalt-58 were found. The levels of radioactivity found, based on the surface and drinking water results, had no discernible effect offsite.

Fishes - Aquatic Sediment - Aquatic Plants

Analyses of fishes found only naturally occurring potassium-40 and occasional low levels of fallout cesium-137. Analysis of sediment samples found normal levels of naturally occurring radionuclides and on occasion low levels of cobalt-58, cesium-134, and manganese-54. No aquatic plants were found.

Airborne Pathways

Gross beta analyses of airborne particulates found typical background activities at all locations at all times. Radioiodine analyses found activities ranging from <0.02 to 23.9 pCi/m^3. The distribution of these values was such that locations closest to Three Mile Island had the highest activities. The dosimetric implications of these results are in the appendix to this report.

Terrestrial Pathways

Milk

Analyses of cow's milk noted radioiodine levels ranging from <0.1 to 21 pCi/l and normal background levels of cesium-137 and potassium-40. The higher radioiodine results were found immediately post-incident and have been decreasing. The dosimetric implications of these results are in the appendix to this report. Analyses of goats milk found radioiodine levels ranging from 1.1 to 110 pCi/l and normal background levels of cesium-137 and potassium-40. It should be noted that most to all goat's milk production was used to suckle newborn kids and thus there was little to no human exposure via this pathw

Rainwater

Tritium, gross beta, and gamma spectrometric analyses found normal ambient activities and naturally occurring radionuclides only. Radioiodine analyses found detectable activities (2.1 and 1.2 pCi/l) in 2 indicator samples for the period March 31 - April 5, 1979 no other samples had detectable levels of radioiodine.

Other Samples

Two of 6 grass samples had low but detectable levels of radioiodine (0.033 and 0.063 pCi/g); no radioiodine or reactor produced radionuclides were found in soil, poultry, beef, eggs, or game.

Appendix

Information On Potential Radiological Doses For The Noted Pathways And Periods

Waterborne Pathways

Location	Period	Nuclide and Average Concentration*
TM-SW-8E1	3/29-4/21	H-3 = 168 pCi/l
	3/29-4/30	I-131 = None detected
	3/29-4/12	γ = None detected
TM-SW-7G1	3/29-4/21	H-3 = 160 pCi/l
	3/29-4/30	I-131 = 0.28 pCi/l
	3/29-4/10	γ = None detected
TM-SW-7G2	Not available	H-3 =
	4/22-4/30	I-131 = 0.34 pCi/l
	Not available	γ =
TM-SW-9G2	4/1-4/21	H-3 = 170 pCi/l
	4/1-4/30	I-131 = None detected
	4/1-4/9	γ =
Susquehanna River South of TMI	3/29-4/21	H-3 = 165 pCi/l
	3/29-4/30	I-131 = 0.26 pCi/l
	3/29-4/12	γ = None detected

*For purposes of averaging values at or below the detection limit were considered to be the value of the detection limit.

Appendix

Waterborne Pathways (continued) (2)

Pathway	Location	Radionuclide	Organ	Dose: mrem/period Maximum Individual	Average Individual	Man-rem
Drinking Water	TM-SW-8E1	H-3	Whole body	8.5E-4	5.1E-4	1.3E-5
	TM-SW-7G1	H-3	Whole body	8.1E-4	4.8E-4	4.8E-3
	TM-SW-7G1	I-131	Thyroid	3.6E-2	2.2E-2	-
	TM-SW-7G2	I-131	Thyroid	4.4E-2	2.6E-2	-
	TM-SW-9G2	H-3	Whole body	7.5E-4	4.5E-4	5.6E-2
Eating Fish	River	H-3	Whole body	1.9E-5	2.1E-6	-
	River	I-131	Thyroid	1.3E-2	1.4E-3	-
Swimming	River	H-3	Whole body	0	0	-
	River	I-131	Whole body	1.6E-6	6.7E-8	-
Boating	River	H-3	Whole body	0	0	-
	River	I-131	Whole body	7.9E-7	3.3E-8	-
Shoreline	River	H-3	Whole body	0	0	-
	River	I-131	Whole body	5.3E-6	2.2E-8	-

Milk Pathway (cow's milk only)

Location	Radionuclide and Average Concentration	Period	Organ	Dose: mrem/per
TM-M-7B3	I-131 = 2.4 pCi/l	3/29-4/30	Infant Thyroid	1.1
All locations	I-131 = 1.1 pCi/l	3/29-4/30	Infant Thyroid	0.5

Inhalation of Radioiodine

Location	Average Concentration	Period	Organ	Dose: mrem/per
TM-AI-5A1	2.93 pCi/m³	3/22-4/30	Adult Thyroid	3.7
TM-AI-1C1	1.21 pCi/m³	3/22-4/30	Adult Thyroid	1.5
TM-AI-12B1	2.25 pCi/m³	3/22-4/30	Adult Thyroid	2.9

APPENDIX F

ATMOSPHERIC DISPERSION ESTIMATES FOR TMI UNIT-2 VICINITY OF PLANT STRUCTURES

By
James Halitsky, PhD

Introduction

Near field dispersion of effluents from the Unit 2 reactor vent stack is affected by building interference with the wind stream because the stack top is close to, and lower than, the top of the containment structure. This analysis develops the jet plume in the curved flow field surrounding the reactor building in a 157.5° wind (toward the NNW) with atmospheric stability E for a range of wind speeds that plausibly existed during the period of highest release from 1700 through 2400 on March 28, 1979.

The analysis employs potential flow equations to establish the local flow field around the containment (reactor building) structure, and the overall flow field around the plant complex beyond the containment. The stack jet plume is assumed to rise through the curved flow fields according to the Briggs (1977) equation for momentum jets, with warpage according to the local flow field streamline angle. Dispersion around the warped centerline is calculated according to the Halitsky (1966) jet plume model.

The potential flow equations are those for unifrom flow encountering a stationary ellipsoid of revolution or elliptic cylinder, derived from stream functions for translating ellipsoids and cylinders in a stationary fluid given in Lamb (1934). The equations are applied to the Three Mile Island configuration by fitting an ellipsoid of revolution to the containment structure and its cavity, and an elliptic cylinder to the building wake and its cavity. The two flows are treated independently, with plume rise initially controlled by the ellipsoid but passing to the cylinder at a distance where streamline curvature due to the ellispoid becomes small and the elliptic cylinder flow takes over.

The rationale for this approach is that building cavities have roughly elliptical cross sections which can be construed as solid objects for the purpose of estimating streamline patterns external to the objects. Evidently such estimates are poor close to the surfaces of the real building where local irregularities perturb the field, and immediately downwind of the cavity where wake velocities are low. However, if the stack jet has sufficient initial rise to reach a region of relatively unperturbed flow (except for curvature induced by the ellipse), the potential flow approach gives an estimate of plume warpage that seems realistic and can provide guidance for correlation of plume behavior estimates with radioactivity measurements.

Physical Configuration

Figures F-1 and F-2 show the general arrangement of Units 1 and 2 and three of the four cooling towers, as estimated from drawings and an airplane view of the site. The top of the vent stack lies to the east of the containment structure, about 13ft from the exterior cylindrical surface and 10ft lower than the top of the dome.

The stack operating characteristics are:

D_o = diameter = 9.84ft

W_o = emission velocity = 29.85ft/sec

T_o = emission temperature = ambient

h_s = 158.8ft above grade

Atmospheric Conditions

The wind speeds used in this analysis will be referred to the 100ft anemometer on the onsite meteorological tower located to the NNW of the reactor buildings. Using a power law with an exponent of 0.5 for E stability, the wind speed at stack top is

$$u_o(\text{ft/sec}) = 1.407\ u_t(158.8/100)^{0.5} = 1.260\ u_t \qquad (1)$$

where

u_t = 100ft anemometer wind speed (mph)

The analysis will be made for u_t = 5, 10 and 15 mph.

Plume Rise

Plume centerline elevation above ground with zero buoyancy flux is given by Briggs (1975) Equation 45 as

$$h_p = h_s + \left(\frac{3}{4\beta_m^2}\right)^{1/3} \left(\frac{W_o D_o}{u_o}\right)^{2/3} (x)^{1/3} \qquad (2)$$

where

$$h_s = \text{stack height} = 158.8\text{ft}$$

$$\beta_m = 1/3 + u_o/W_o \qquad (3)$$

Figure F-3 shows centerlines calculated by Equation 2.

Maximum plume rise in a stable temperature gradient is given by Briggs (1969) Equation 4.28 as

$$h_{p_{max}} = h_s + 1.5 \left(\frac{W_o^{\,2} D_o^{\,2}}{4u_o}\right)^{1/3} \frac{1}{s^{1/6}} \qquad (4)$$

where

$$s = \frac{g}{T_a} \frac{\partial\theta}{\partial z} \qquad (5)$$

$$g = 9.81 \text{ m/s}^2$$

$$T_a = \text{ambient temperature} = 293°K$$

$$\frac{\partial\theta}{\partial z} = 0.02°\text{K/m for E stability}$$

Substitution of these values in Equations 1 to 5 gives Table F-1.

Plume Centerline Warpage

The following potential flow equations apply to both the ellipsoid of revolution and the elliptical cylinder:

$$\zeta = \left\{ \frac{1}{2}\left[\left(\frac{x}{k}\right)^2 + \left(\frac{\rho}{k}\right)^2 + 1 + \sqrt{\left(\frac{x}{k}\right)^4 + \left(\frac{\rho}{k}\right)^4 + 1 + 2\left(\frac{x}{k}\right)^2 \left\{ \left(\frac{\rho}{k}\right)^2 - 1 \right\} + 2\left(\frac{\rho}{k}\right)^2} \right] \right\}^{1/2} \qquad (6)$$

$$\rho = (y^2 + z^2)^{1/2} \quad (\rho = z \text{ for elliptic cylinder}) \qquad (7)$$

$$k = a\,e \qquad (8)$$

$$e = \sqrt{1-(b/a)^2} \qquad (9)$$

$$\zeta_o = 1/e = \text{value of } \zeta \text{ at obstacle surface} \qquad (10)$$

$$\tan\omega = z/y \qquad (11)$$

a = major radius of elliptical obstruction

b = minor radius of elliptical obstruction

coordinate origin at center of ellipse

x = downwind distance

y = lateral distance

z = vertical distance

ζ = a characteristic parameter, constant along an ellipsoidal or cylindrical surface confocal with the obstruction

The following equations apply only to the ellipsoid:

$$\psi' = \frac{\psi}{Ub^2} = \frac{1}{2}\left(\frac{\rho}{k}\right)^2\left(1 + \frac{Z}{N}\right) \qquad (12)$$

$$Z = \frac{1}{2} \ln \frac{\zeta + 1}{\zeta - 1} - \frac{\zeta}{\zeta^2 - 1} \qquad (13)$$

$$N = \frac{e}{1 - e^2} - \frac{1}{2} \ln \frac{1 + e}{1 - e} \qquad (14)$$

ψ' = normalized stream function

The following equations apply only to the elliptical cylinder;

$$\psi' = \frac{\psi}{Ub} = P\left[\zeta - (\zeta^2 - 1)^{1/2}\right]\left[1 - \frac{(x/k)^2}{\zeta^2}\right] + \frac{z}{b} \qquad (15)$$

$$P = -\left(\frac{a + b}{a - b}\right)^{1/2} \qquad (16)$$

Plume centerline warpage around the ellipsoid caused by streamline curvature was found by treating the plume in discrete sections, starting at the stack. The calculation procedure was as follows:

(1) Start at stack top with coordinates x_1, y_1, z_1.

(2) Calculate ζ_1 at x_1, y_1, z_1 using Equation 6.

(3) Calculate ω_1 at x_1, y_1, z_1 using Equation 11.

(4) Calculate ψ'_1 at x_1, y_1, z_1 using Equation 12.

(5) Assume an increment Δx.

(6) Calculate ζ_2 and ψ'_2 at $x_2 = x_1 + \Delta x$ and $\rho_2 = \rho_1 (\omega_1 = \omega_2)$. If the flow field is curved, ψ'_2 will not be equal to ψ'_1 and point 2 will not lie on stream surface ψ'_1.

(7) Iterate on ρ_2, holding x_2 constant until ψ'_2 is acceptably close to ψ'_1. Point 2 is now on the same streamline as Point 1.

(8) Calculate incremental undeflected plume rise Δh_p over Δx by Equation 2 and add to the final z_2 obtained by the iteration procedure of step 7.

(9) Start calculation over again with initial coordinates x_2, y_2, $z_2 + \Delta h_p$.

The procedure was the same for the elliptical cylinder except that Equation 15 was used in Step 4, and the starting point in Step 9 was the terminal point of the ellipsoid calculation.

Selection of Cavity Ellispoid and Cylinder

There is no precise way to select representative ellipsoids and cylinders in given configurations. For the containment ellipsoid, guidance was taken from the smoke photographs of the EBR-11 cavity in Figure 5.23 of Halitsky (1968), which showed a cavity length about 2 to 2.5 diameters measured from the containment centerline, a cavity height about equal to the dome height, and a cavity width about equal to the containment diameter. Additionally, consideration was given to the departure from sphericity of the containment dome, the collar at the base of the dome, and the projection of the containment above an effective grade at the elevation of the reactor building roof. These considerations led to selection of major and minor axes equal to 127.3 and 90.0ft, respectively, and placement such that the top of the ellipsoid was at the same elevation as the top of the dome and the downwind end of the ellipsoid was located 164.6ft from the center of the containment.

The proportions and placement are shown in Figure F-4. The cavity length is 164.6/69 = 1.19 diameters from the containment center, which is shorter than the EBR-11 cavity length, but consistent with the smaller projection of the containment above effective grade. The minor radius is a compromise between matching the dome plus collar and exaggerating the cylindrical base, with greater emphasis placed on the former.

The elliptical cylinder was chosen to correspond to the lee cavity of the reactor building complex. Figure F-5 shows the estimate of the cavity shape, based on experience in observing cavities by wind tunnel modeling. In the plan view, the cavity starts at the lateral curves of the building complex and closes some 700ft downwind of the center of the complex. A vertical section through the stack (Section A-A) shows the cavity starting at the roof of the auxiliary and fuel handling building and terminating at the ground.

The region of influence of the ellipsoid was assumed to extend to 300ft from the stack, at which point the influence of the elliptical cylinder was assumed to dominate. Accordingly, the center of the ellipitcal cylinder was placed at x = 300ft and the major and minor axes scaled from Section A-A were 680ft and 98ft, respectively.

In actuality, flow over the lee cavity is three-dimensional, not two-dimensional as implied by use of a cylindrical cavity, and would be better represented by an ellipsoidal cavity with unequal longitudinal, vertical and lateral radii. Unfortunately, a potential flow solution is not available for this case. Of the two available solutions (ellipsoid with equal minor radii or elliptical cylinder) the latter is preferable because the width/height ratio of the lee cavity is large.

Figure F-6 shows the warped plume centerlines in E stability for tower wind speeds u_t = 5, 10 and 15 mph, calculated as above. The effect of lee cavity was assumed to terminate when the vertical streamline deflection at plume elevation decayed to 1 ft in 500ft.

Plume centerline elevations at various distances from the stack are tabulated in Table F-2.

Plume Dispersion About Centerline

The Halitsky (1966) jet plume model envisions an initial region extending from Station 0 at the stack orifice to Station 1 at the end of the undiluted core, a second region from Station 1 to Station 2 where jet velocities decay to a small value (end of jet), and a third region downwind of Station 2 where plume expansion is controlled by atmospheric turbulence. Figure 10 of Halitsky (1966) gives the normalized distances s_1/R_o and s_2/R_o along the plume centerline to Stations 1 and 2, and the normalized plume radii R_1/R_o and R_2/R_o at those stations as a function of velocity ratio $m = w_o/u_o$.

The jet plume up to Station 2 and the simple plume beyond Station 2 are linked by the assumption that the simple plume σ_y and σ_z at Station 2 are each equal to $0.4R_2$. The factor 0.4 was arrived at by equating the contaminant mass flux in the jet plume (with its assumed conical concentration distribution) to the flux in the simple plume (with its assumed Gaussian distribution), i.e.:

$$Q = \int_0^R u\chi_o(1 - r/R)2\pi r dr = u\chi_o\ 2\pi\sigma_y\sigma_z \tag{17}$$

which yields $\sigma_y\sigma_z = R^2/6$. At Station 2, $\sigma_y = \sigma_z = \sigma_2$ resulting in $\sigma_2 = R/\sqrt{6} = 0.4R_2$.

The approximation $\sigma = 0.4R$ is useful in visualizing Gaussian plumes because the conical distribution provides a finite plume boundary whereas the Gaussian plume boundary is indefinite.

Beyond Station 2 the plume is assumed to expand at the rate inherent in the Pasquill-Gifford curves as given in Turner (1969). The average rate for the first 100 meters may be found by dividing the ordinate of the appropriate curve at x = 0.1 km in Turner Figures 3-2 and 3-3 by 100. Thus, for Stability D,

$$a_y = \sigma_y/x|_{0.1\ km} = 8.0/100 = 0.080$$

$$a_z = \sigma_z/x|_{0.1\ km} = 4.6/100 = 0.046$$

Applying these expansion rates along the plume centerline (rather than along x), we obtain beyond Station 2

$$P = (h_c - h_p)/\sigma_z \quad (21)$$

where

h_c = height of cavity above grade

The trapped fraction f_c is then obtained from Turner (1969) Figure A-3 where P is the ordinate and f_c is the abscissa. The remaining fraction is retained in the plume. Table F-3 shows the parametric values obtained by scaling Figure F-6.

The concentration field may now be treated as the sum of a building wake plume with source strength f_cQ and an elevated plume with source strength f_pQ and centerline heights as given in Table F-2.

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Table F-2

Plume Centerline Heights

Distance from stack (ft)	Height of Plume Centerline Above Grade (feet)					
	u_t = 5 mph		u_t = 10 mph		u_t = 15 mph	
	Unwarped	Warped	Unwarped	Warped	Unwarped	Warped
100	216	211	186	188	176	173
166	226*	216				
300	226	216	199	186	184	163
728	269	184	212*	167	193	137
1000	281	143	218	123	196	92
1500	299	132	227	114	202	91
1918	311	131	233	113	205*	94

*Final rise according to Equation 4

Table F-3

Plume Cavity Intersections

	u_t=10 mph	u_t=15 mph
x = distance to max penetration	900ft	900ft
h_c = cavity height	50ft	50ft
h_p = plume centerline height	138ft	109ft
σ_z = vertical diffusion coefficient	36.7ft	34.1ft
P = see equation (21)	-2.40	-1.73
f_c = source fraction in building wake	0.01	0.04
$f_p = 1 - f_c$ = source fraction in elevated plume	0.99	0.96

Figure F-1
Plant Physical Configuration
Three Mile Island Station

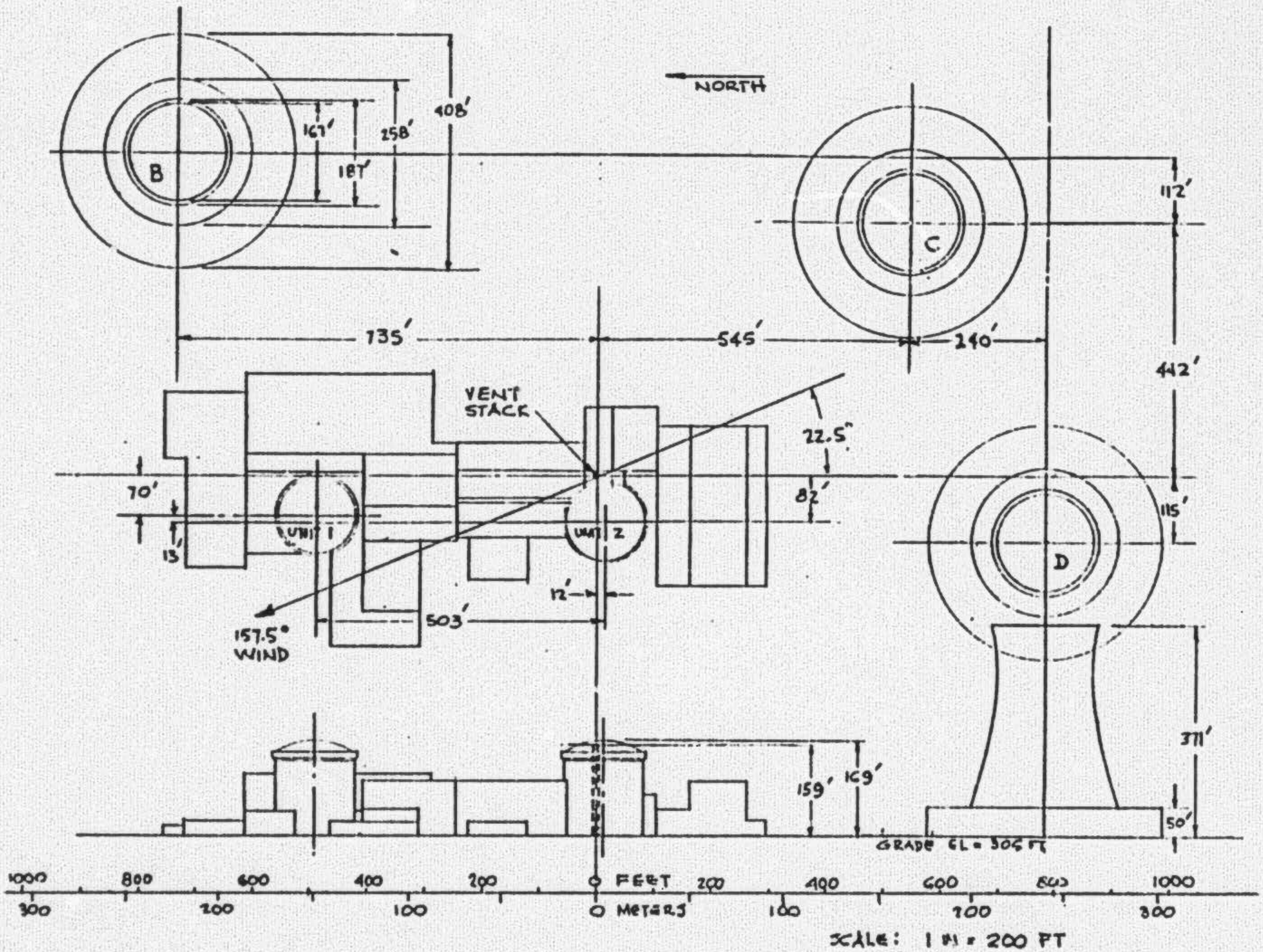


Figure F-2

Detailed Diagram of Unit #2 Physical Configuration
Three Mile Island Station

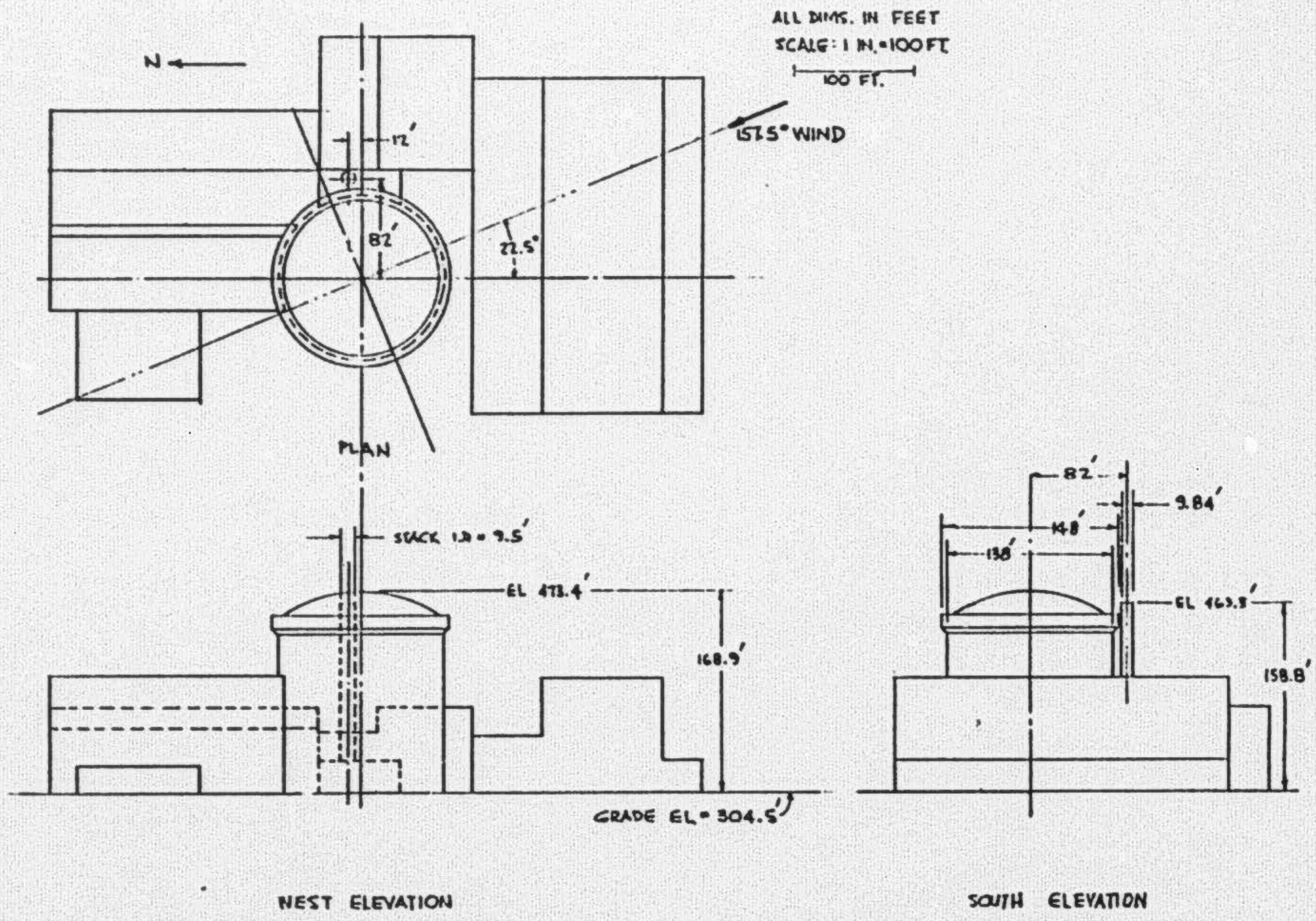


Figure F-3
Undisturbed Plume Centerlines

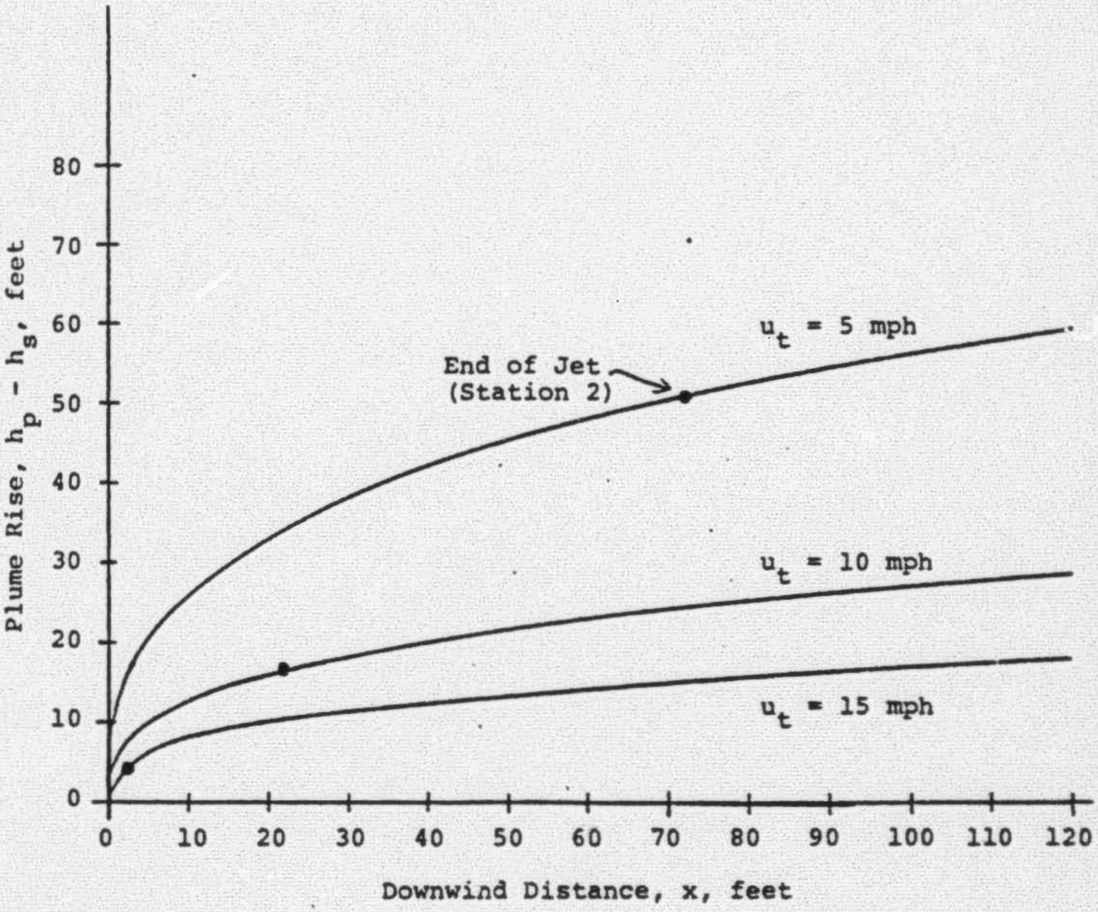


Figure F-4

Unit #2 Containment Cavity Dimensions

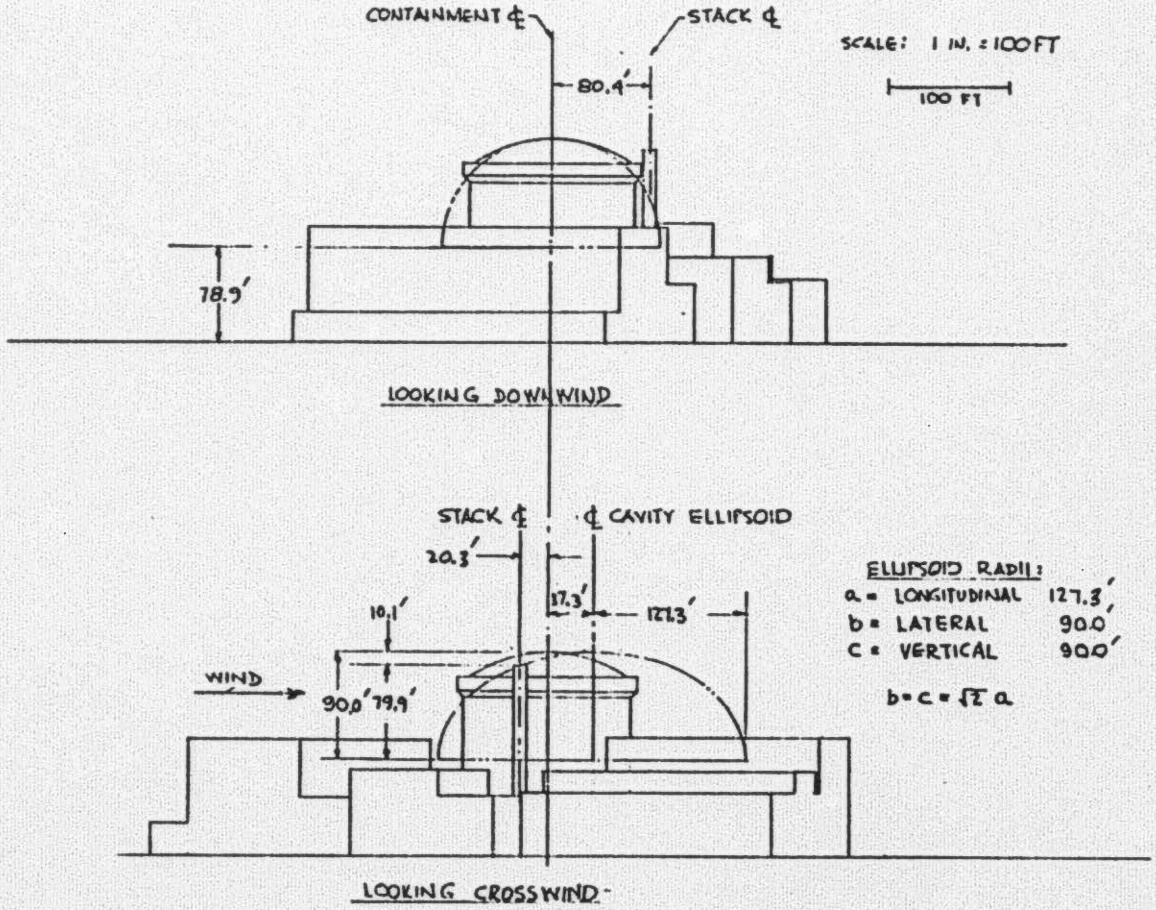


Figure F-5

Reactor Building Complex - Cavity Dimensions

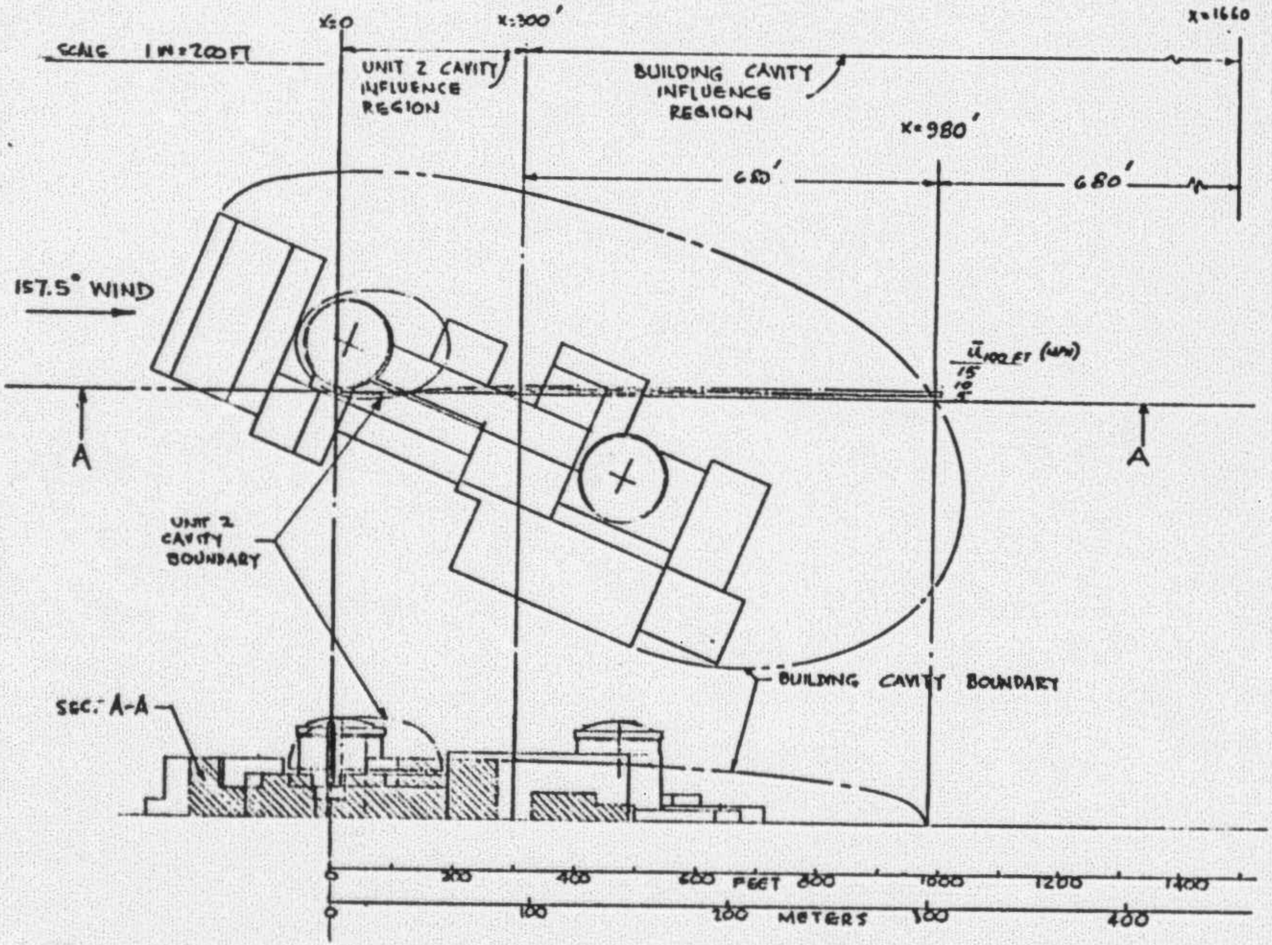
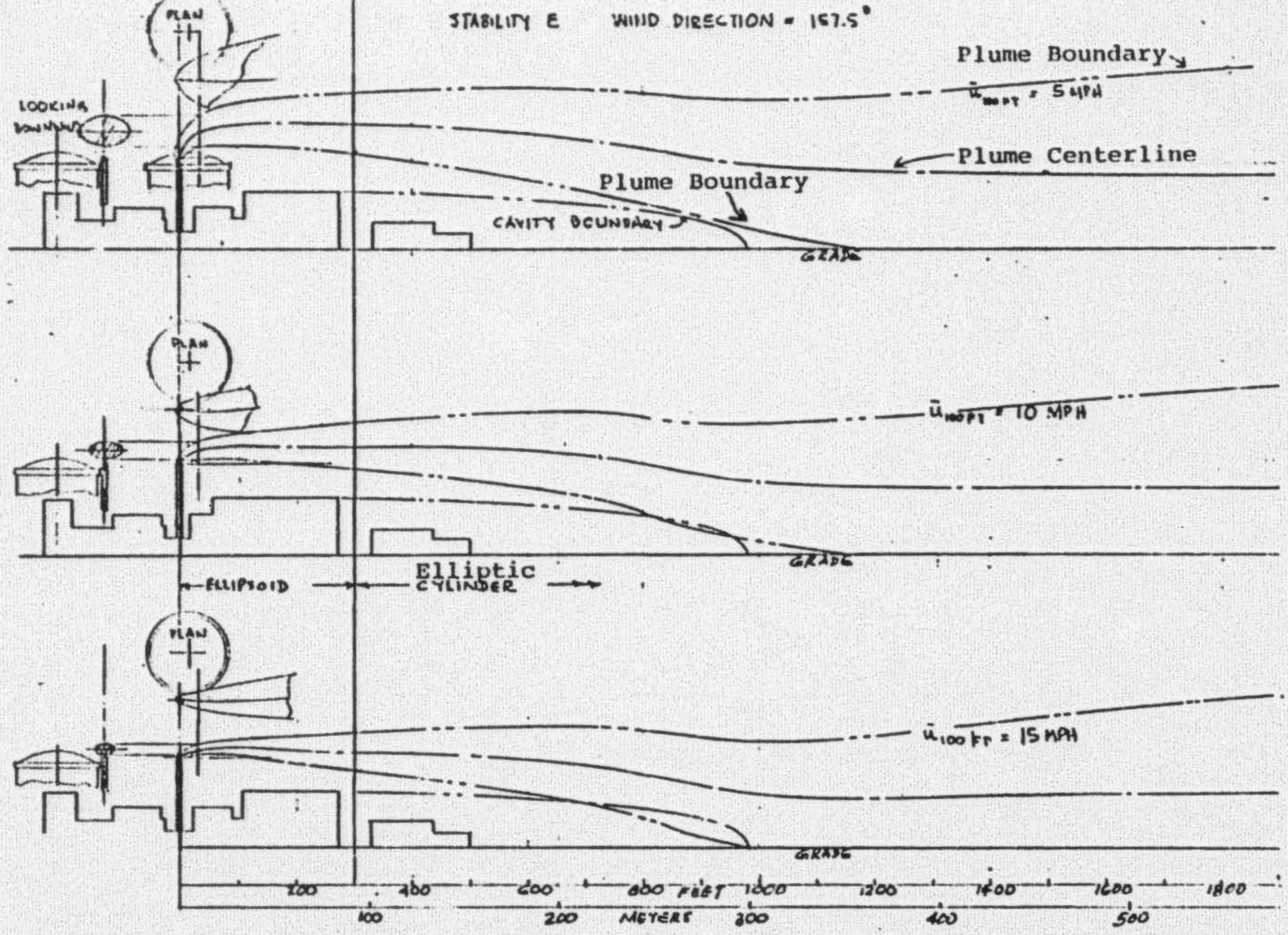


Figure F-6

Three Mile Island Unit #2 Plume Dimensions



APPENDIX G

RESPONSE OF TELEDYNE DOSIMETERS TO XENON-133

Introduction

As described in Section 4.0 in the main body of this report, TLD readings were used along with meteorological data to estimate the total quantity of noble gases released. Therefore, the response of these TLD's to noble gases is important to the conclusions reached. For this reason, Dr. Hoyt Whipple was requested to study the theoretical response capabilities of the Teledyne (Teledyne Isotopes, Inc., Westwood, New Jersey) TLD's. This appendix presents the results of Dr. Whipples' analysis. At the time this report was prepared, there were no definitive field or laboratory test results available to demonstrate the response of Teledyne TLD's used in the environmental monitoring program.

Release of Noble Radioactive Gases

The estimates for the release of noble radioactive gases (Table 4-4 of Section 4.0) indicate that xenon-133 constituted 74% of the total during the first 33 hours and nearly 100% of the total thereafter. Thus, attention is centered on xenon-133. However, during the first 33 hours, xenon-135 constituted 23% of the total, but because of its short half-life (9.14 hours) dropped to insignificance thereafter.

Radiations Emitted by Xenon-133 and Xenon-135

The radiations emitted by xenon-133 and xenon-135 are presented in Table G-1. It is evident that for xenon-133 the dominant photon radiations are 0.08 and 0.03 Mev, and that the maximum electron energy is 0.01 Mev. The table also shows that the 0.25 Mev gamma is the dominant photon emission from xenon-135 and that the maximum electron energy is 0.91 Mev.

Teledyne Dosimeter

The thermoluminescent dosimeter (TLD) used by Metropolitan Edison Company for routine environmental measurements is the Teledyne Isotopes device of the so-called "current design". This device contains a TLD element which is a teflon matrix containing 25% by weight of $CaSO_4$:Dy. The TLD element is 4.45 cm long, 3.18 cm wide and 0.038 cm thick. It is sealed in a thin, black plastic holder, which is fitted front and back with a layer of copper 0.056 cm thick.

Sensitivity of the Teledyne Dosimeter to Beta Radiation

The copper layer in the dosimeter has a thickness of $0.056 \text{ cm} \times 8.92 \text{ g/cm}^3 = 0.5 \text{ g/cm}^2$, which is sufficient to stop completely all beta particles with energies less than 1.2 Mev. Since neither of the principal noble gas isotopes has an energy approaching this value, it may be concluded that the dosimeter is insensitive to the beta radiation from these isotopes.

Sensitivity of the Teledyne Dosimeter to Photon Radiation

The measured response of the Teledyne dosimeter to filtered X rays is given in Figure G-1. The theoretical response of this dosimeter has been calculated by the equations which follow.

$$R_{nm} = R_m / R_{m.6}$$

$$R_m = D_T * e^{-ux} / D_m$$

$$R_{na} = R_a / R_{a.6}$$

$$R_a = D_T * e^{-ux} / (E * u_a)$$

where:

R_{nm} = response, relative to muscle, normalized to R_m at E = 0.6 Mev

R_m = response relative to muscle

R_{na} = response, relative to air, normalized to R_a at E = 0.6 Mev

R_a = response relative to air

$R_{m.6}$ = value of R_m at E = 0.6 Mev

$R_{a.6}$ = value of R_a at E = 0.6 Mev

D_T = $E(1-e^{-u_T y})$, for the unshielded TLD

D_m = $E(1-e^{-u_m z})$, for muscle

E = photon energy, Mev

u = total attenuation coefficient for copper, cm^{-1}

u_T = energy absorption coefficient for $CaSO_4$, cm^{-1}

u_m = energy absorption coefficient for muscle, cm^{-1}

u_a = energy absorption coefficient for air

x = thickness of copper shield = 0.056 cm

y = thickness of the TLD element = 0.038 cm

z = thickness of a unit volume of tissue = 1 cm

Both the measured and calculated responses are plotted in Figure G-1. The agreement between the measured and calculated curves is not good. The agreement could be improved by assuming a copper shield about twice as thick as the 0.056 cm shield which was used, but this would push theory too far. A likely explanation for the lack of agreement between theory and measurement is the spread of X-ray energies about the stated nominal values. The theoretical curves change rapidly with small changes of gamma energy throughout the range of 0.03 to 0.1 Mev and, as a result, the measured response is critically dependent on the mix of photon energies used in this range.

Present interest in Figure G-1 is in the responses at the photon energies emitted by xenon-135 and xenon-133. The response of the Teledyne dosimeter to the 0.25 Mev gamma of xenon-135 is, at most, 5% greater than that of the ideal dosimeter. The response of the Teledyne dosimeter to the 0.03 Mev X rays of xenon-133 is essentially zero. The 0.056 cm copper shield transmits only 0.005 of this photon energy. Thus, even though the TLD material responds vigorously to this energy, so little reaches the TLD element that the response is only about 6% that of the ideal dosimeter.

The response of the Teledyne dosimeter to the 0.08 Mev gamma of xenon-133 is, according to Figure G-1, between 2.1 and 2.9 times that of the ideal dosimeter. For the reasons given above, the calculated response at this energy is probably better than the response measured with X rays. The best estimate for the response of the dosimeter to 0.08 Mev gamma rays is 2.7 $\pm$ 0.2.

The following example illustrates the above conclusions. Consider 1 Ci of xenon-133 at a distance of one meter from the Teledyne dosimeter. Neglect the beta radiation (which will not reach the TLD element) and the attenuation of the photon radiation in the intervening air. The actual dose rate at the position of the dosimeter is

Mev	R/hr 1 m from 1 Ci	Number/dis	R/hr
0.08	0.038	0.37	0.014
0.03	0.088	0.47	0.041
		Total	0.055

Thus, the ideal dosimeter would read 0.055 R/hr at this point, but the Teledyne dosimeter will read 0.014 x 2.7 + 0.041 x 0.06 = 0.04 R/hr, which is about 73% of the actual dose rate. It is interesting to note that a Teledyne dosimeter exposed at the National Bureau of Standards to a xenon-133 source, read 79% of the actual dose, implying a response somewhat greater than the 2.7 deduced above.

The Teledyne dosimeter appears to have the following responses neglecting attenuation, relative to an ideal dosimeter.

xenon-133	beta	response = 0
	0.08 Mev gamma	response = 2.7 to 3
	0.03 Mev X rays	response = 0.06
xenon-135	beta	response = 0
	0.25 Mev gamma	response = 1.0

Immersion Exposure

An immersion dose calculation (dose to air) at the center of a spherical source of uniform Xe-133 concentration in air was made for a dosimeter with an assumed response to the two Xe-133 photons as shown above. The calculation was repeated assuming an ideal (or true) response to obtain the ratio of expected TLD response to true response. Results for spheres of several radii are given below:

Radius of Sphere (m)	Ratio of Expected TLD Dose to True Dose
10^0	0.695
10^1	0.739
$5x10^1$	0.894
10^2	1.001
10^3	1.070
10^4	1.070

It is shown that the TLD's would trend toward an under response for extremely small radii. However, in actuality, as discussed in Section 4.1 of the main report, plumes were often not at ground level near the plant and thus, the dosimeter was not often immersed. Thus, it is shown that the preferential attenuation of the 30 Kev photon relative to the 80 Kev increases the ratio up to a radius of 100 meters. Similar calculations for elevated plumes are discussed below.

Exposure to Elevated Plume

For the case where the plume is above the receptor, the impact of the selective attenuation of the 30 Kev photon is greater. To simulate the dose from a continuous plume of radioactive gases, a calculation assuming a line source in air was made for several plume heights. Ratios of expected TLD response to true dose using the TLD response factors of 0.06 and 2.8 for 30 and 80 Kev photons, respectively, are shown below.

Distance from Line Source to Receptor	Ratio of Expected TLD Dose to True Dose
10^1	1.11
5×10^1	1.49
10^2	2.22
10^3	2.80

These results show that as the 30 Kev photon is preferentially attenuated with increasing source height the relative weight of the TLD response to 80 Kev photons increases. The net effect is an increase in response as shown in the above table.

At certain TLD monitoring stations around the site, quality assurance dosimeters supplied by RMC (Panasonic UD-200S thulium doped calcium sulfate dosimeters) were in place along with the Teledyne dosimeter. Inspection of the response curve for the RMC dosimeter indicates essentially a flat response (i.e., no over-response) through energies below the 30 Kev Xe-133 photon energy. Thus, the RMC dosimeter results are considered to provide results near the true value. A comparison of the measured responses is shown below as ratios of Teledyne to RMC responses.

	Ratio of Teledyne to RMC Dosimeter Results*		
Monitor Location	Before Accident Through March 29 @ 1600	March 29 @ 1700 March 31 @ 1600	March 31 @ 1 April 3 @ 15
1S2	0.97	1.25	-
4S2	1.15	1.66	1.26
5S2	1.10	1.28	1.20
8C1	-	1.22	-
11S1	1.26	1.35	1.22
16S1	1.07	1.29	1.22
5A1	-	1.47	1.44
Average	1.11	1.36	1.27

*Tabulated values are ratios of net exposure (milliroentgen) after subtraction of transit and natural background exposures, but without any correction for energy response. Values are not included if net exposures were less than 5 milliroentgen because of high uncertainties associated with low doses.

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(1) Instrumentation for Environmental Monitoring, Radiation, LBC-1 Volume 3, May, 1972 (updated periodically).

The results of the theoretical calculations and measurements above are consistent. The Teledyne TLD's probably would respond adequately to immersion in a large plume. However, for most periods after the accident, the plume was aloft about 50 meters near the TLD's with highest readings. Thus, it is more appropriate to consider the elevated line source calculations. Here it is noted that for a 50 meter plume height, the over-response is calculated to be 1.49. The trend of this calculation is not inconsistent with ratios derived from comparisons of RMC and Teledyne measurements shown in the above table, which also show Teledyne over-response averaging 1.36 to 1.27 during the second and third periods when the "mix" was almost all Xe-133. There could be a number of explanations for the small observed over-response during the first period. A probable explanation is that the higher energy photons from other isotopes that existed in the mix only during the first period dominated the source response. Over-response is limited to lower energy photons.

Conclusions

The Teledyne dosimeters over-respond to 80 Kev and under-respond to 30 Kev photons. The net effect depends strongly on the source receptor geometry. From the plume geometries encountered in this situation, it is unlikely that the Teledyne dosimeters under-responded. Furthermore, it is unlikely that they over-responded by a factor of more than 1.5 for field exposure geometries. Any significant over-response at TLD locations near the plant (within one mile) would have occurred after the first day, when releases were not as important in estimating maximum doses or population doses.

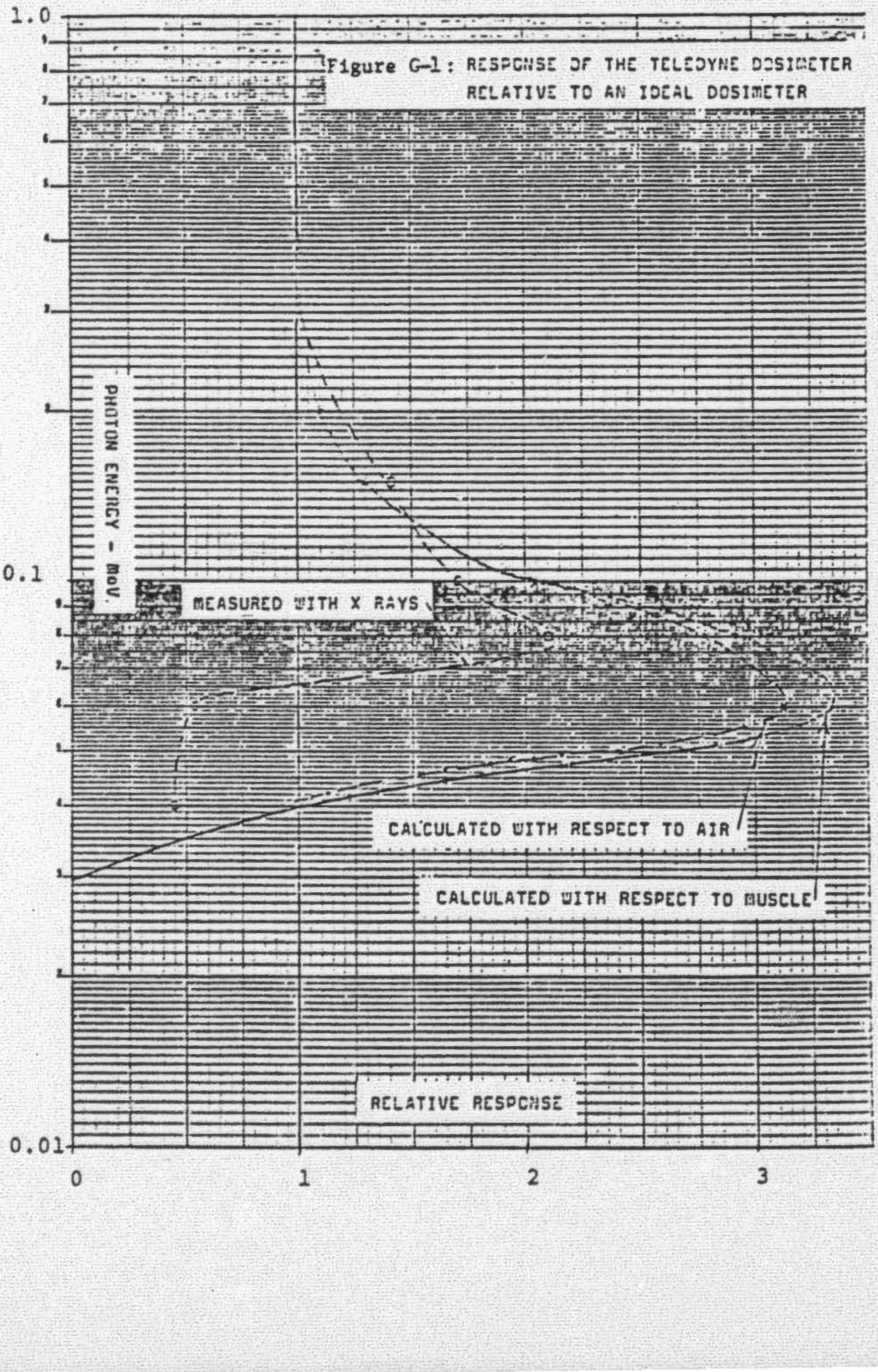

Figure G-1: RESPONSE OF THE TELEDYNE DOSIMETER RELATIVE TO AN IDEAL DOSIMETER

Table G-1

Radiations Emitted by Xenon-135 and Xenon-133

Type		Mean Energy Per Particle (Mev)	Mean Number Per Disintegration
Xenon-133:[1]	gamma	0.38	0.0002
		0.08	0.37
	X rays	0.03	0.47
		0.004	0.08
	beta	0.10	0.98
		0.075	0.016
	internal con. elect.	0.08	0.11
		0.04	0.53
	Auger electrons	0.03	0.06
		0.003	0.49
Xenon-135:[2]	gamma	0.61	0.03
		0.25	0.97
	beta	0.91	0.97
		0.55	0.03

(1) MIRD Pamphlet No. 10, p. 83

(2) Lederer, et al, Table of Isotopes, 6th ed, 1968, p. 283