

EXECUTIVE SUMMARY

Three Mile Island Nuclear - Unit 2
Effluent Monitoring Report
Third Quarter, 1985

The purpose of this report is to summarize the radioactive liquid and gaseous releases and doses to the public resulting from TMI-2 operations for the third quarter of 1985.

Effluent and real time meteorological data and Susquehanna River flow data were used to calculate the maximum postulated dose to any individual and the total population within 50 miles of the plant. Doses for liquid and gaseous discharges were calculated utilizing the guidelines and methodology set forth in USNRC Regulatory Guide 1.109. During the third quarter of 1985, the maximum hypothetical whole body dose received from TMI-2 was $3.3\text{E-}4$ mrem and was attributable to the liquid effluents. The maximum hypothetical dose to any organ as a result of these effluents was $1.05\text{E-}3$ mrem from the gaseous effluents. The dose which could have been received from liquid and gaseous discharges are each less than 0.1% of the applicable federal regulatory limits found in Appendix I of 10 CFR 50. The doses are insignificant when compared to approximately 20 mrems received by each individual from natural background radiation during the quarter. No detectable environmental or health effects are expected from the releases.

During the TMI-2 accident in 1979, large volumes of highly radioactive water were generated. The water was processed through demineralizer systems to remove the contamination. It is being stored on site in large tanks and has not been discharged. Currently the only liquid releases from TMI-2 are those from such areas as waste storage sumps, the air intake tunnel sump, and turbine building sumps.

For liquid discharges during the third quarter of 1985, tritium was the most abundant radionuclide released ($4.51\text{E-}4$ curies). This was followed by unidentified beta (conservatively estimated to be due to strontium-90, $3.1\text{E-}5$ curies) and cesium-137 ($1.5\text{E-}5$ curies).

For gaseous discharges, the most abundant radionuclide was tritium (2.91 curies). A total of $2.74\text{E-}5$ curies of total particulates were released. These particulates included $3.5\text{E-}6$ Ci for unidentified beta/gamma; $2.36\text{E-}5$ Ci of Cs-137 and $2\text{E-}7$ Ci of gross alpha. No noble gases (e.g., krypton-85) were released.

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EFFLUENT SUMMARY
THREE MILE ISLAND UNIT 2 LIQUID AND GASEOUS EFFLUENTS
(Summary of All Releases)

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(4410-85-L-0238)
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| TYPE EFFLUENT | JULY | AUGUST | SEPTEMBER | 3rd QUARTER 1985 |
|---|----------|----------|-----------|------------------|
| I. Liquid Effluent: | | | | |
| A. Fission and activation products (not including H-3, gases & alpha) | | | | |
| 1. Total Release (Ci) (Note 2) | 5.97E-6 | 2.91E-5 | 1.11E-5 | 4.62E-5 |
| 2. Concentration (μCi/cc) | 1.17E-12 | 6.21E-12 | 2.32E-12 | 3.26E-12 |
| B. Tritium | | | | |
| 1. Total release (Ci) | 9.17E-5 | 9.38E-5 | 2.65E-4 | 4.51E-4 |
| 2. Concentration (μCi/cc) | 2.22E-11 | 2.24E-11 | 6.43E-11 | 3.64E-11 |
| C. Dissolved and entrained gases | | | | |
| 1. Total release (Ci) | <LLD | <LLD | <LLD | <LLD |
| 2. Concentration (μCi/cc) | N/A | N/A | N/A | N/A |
| D. Gross alpha radioactivity | | | | |
| 1. Total release (Ci) | Note 3 | Note 3 | Note 3 | Note 3 |
| E. Volume of waste released prior to dilution (liters) (Note 1) | 3.67E4 | 3.41E4 | 4.26E4 | 1.13E5 |
| F. Volume of dilution water (flow to river in liters from NPDES Report) | 4.13E9 | 4.19E9 | 4.12E9 | 1.24E10 |
| G. Number of batch releases: Sumps and sewage | 19 | 21 | 21 | 61 |

- The concentration of radioactive material other than dissolved or entrained noble gases in liquid effluent released to the unrestricted area shall not exceed the values specified in 10CFR 20, Appendix B, Table II.
- Present liquid effluent release limits are 10% of the concentration values specified in 10CFR 20, Appendix B, Table II.
- Liquid effluent releases are also limited to 10CFR 50, Appendix I, not to exceed a dose of 3 mrem total body and 10 mrem to any organ per year.

Note 1) Includes only those releases which were found to contain radioisotopic concentration >LLD.
 Note 2) Includes Industrial Waste and Sanitary Waste.
 Note 3) These activities are to be verified by composite sampling.

1985 EFFLUENT SUMMARY
THREE MILE ISLAND UNIT 2 LIQUID AND GASEOUS EFFLUENTS (Continued)
(Summary of All Releases)

| TYPE EFFLUENT | JULY | AUGUST | SEPTEMBER | 3rd QUARTER 1985 |
|---|---|---------------|---------------|------------------|
| | <u>Unit 2</u> | <u>Unit 2</u> | <u>Unit 2</u> | |
| II. Gaseous Effluent | | | | |
| A. Fission & activation gases | | | | |
| 1. Total release (Ci) | <LLD | <LLD | <LLD | <LLD |
| 2. Release rate (μ Ci/sec) | N/A | N/A | N/A | N/A |
| B. Iodine-131 released (Ci): | As of 01/01/81 there was less than $1E-15$ curies of I-131 left in Unit 2 therefore, no release of I-131 can be detected. | | | |
| C. Particulates with half-lives >8 days: | | | | |
| 1. Total releases (not including α)(Ci) | 1.57E-5 | 1.09E-5 | 5.75E-7 | 2.72E-5 |
| 2. Release rate (μ Ci/sec) | 5.85E-6 | 4.06E-6 | 2.22E-7 | 3.42E-6 |
| 3. Gross alpha radio-activity (Ci) | 3.07E-9 | 2.34E-7 | 1.96E-9 | 2.39E-7 |
| D. Tritium | | | | |
| 1. Total release (Ci) | 7.18E-1 | 6.06E-1 | 1.59E0 | 2.91E0 |
| 2. Release rate (μ Ci/sec) | 2.68E-1 | 2.26E-1 | 6.13E-1 | 3.66E-1 |
| E. Seconds in period reported | 2.6784E6 | 2.6784E6 | 2.5920E6 | 7.9488E6 |
| F. Number of batch releases | 0 | 0 | 0 | 0 |

- The concentration of radioactive material in gaseous effluents released to the unrestricted area shall not exceed the values specified in 10CFR 20, Appendix B, Table II.
- 10CFR 50 dose to individual for: a) 10 mRad/yr, gamma radiation; b) 20 mRad/yr, beta radiation; and c) 15 mrem/yr to any organ.

1985 UNIT 2 LIQUID RADIONUCLIDE RELEASES BY ISOTOPE (Ci)

| RADIONUCLIDE | JULY | AUGUST | SEPTEMBER | 3rd QUARTER 1985 |
|---|---------|---------|-----------|------------------|
| Fission and activation products (not including alpha, H-3 & gases) | <LLD | <LLD | <LLD | <LLD |
| Ag-110m | <LLD | <LLD | <LLD | <LLD |
| Ce-144 | <LLD | <LLD | <LLD | <LLD |
| Co-58 | <LLD | <LLD | <LLD | <LLD |
| Co-60 | <LLD | <LLD | <LLD | <LLD |
| Cs-134 | <LLD | <LLD | <LLD | <LLD |
| Cs-137 | 1.54E-6 | 1.09E-5 | 2.46E-6 | 1.49E-5 |
| I-131 | <LLD | <LLD | <LLD | <LLD |
| Sr-90 | * | * | * | * |
| Unidentified Beta | 4.43E-6 | 1.82E-5 | 8.60E-6 | 3.12E-5 |
| TOTAL | 5.97E-6 | 2.91E-5 | 1.11E-5 | 4.62E-5 |
| H-3 | 9.17E-5 | 9.38E-5 | 2.65E-4 | 4.51E-4 |
| Tc-99m - Medical Administration** | 5.45E-6 | N/A | N/A | N/A |

*These activities are to be verified by composite sampling.

**Released via sanitary sewage which received this isotope excreted by a person who had undergone medical treatment at a physician's office.

1985 UNIT 2 GASEOUS RADIONUCLIDE RELEASES BY ISOTOPE (Ci)

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| RADIONUCLIDE | JULY | AUGUST | SEPTEMBER | 3rd QUARTER 1985 |
|-------------------------------------|---------------|---------------|---------------|------------------|
| <u>Fission and activation gases</u> | <u>Unit 2</u> | <u>Unit 2</u> | <u>Unit 2</u> | <u>Total</u> |
| Kr-85 | <LLD | <LLD | <LLD | <LLD |

Total

Particulates (half lives >8 days)

| | | | | |
|---------------------------------|---------|---------|---------|---------|
| Unidentified β , γ | 2.07E-6 | 8.85E-7 | 5.75E-7 | 3.53E-6 |
| Cs-137 | 1.36E-5 | 1.0E-5 | <LLD | 2.35E-5 |
| Cs-134 | <LLD | <LLD | <LLD | <LLD |
| Gross alpha | 3.07E-9 | 2.34E-7 | 1.96E-9 | 2.39E-7 |

| | | | | |
|-------------------------|---------|---------|---------|---------|
| TOTAL (including alpha) | 1.57E-5 | 1.11E-5 | 5.77E-7 | 2.74E-5 |
| TOTAL (minus alpha) | 1.57E-5 | 1.09E-5 | 5.75E-7 | 2.72E-5 |

| | | | | |
|--------------------------|---------|---------|--------|--------|
| Tritium (^3H) | 7.18E-1 | 6.06E-1 | 1.59E0 | 2.91E0 |
|--------------------------|---------|---------|--------|--------|

INTERPRETATION OF DOSE SUMMARY TABLE

The Dose Summary Table (Table 1) presents the maximum hypothetical doses to an individual and the general population resulting from the release of gaseous and liquid effluents from TMI-2 during the third quarter reporting period of 1985.

A. Liquid (Individual)

The first two lines of Table 1 present the maximum hypothetical dose to an individual. Presented are the whole body and critical organ doses. Calculations are performed on the four age groups and eight organs recommended in Regulatory Guide 1.109. The pathways considered for TMI are drinking water, consumption of fish, and standing on the shoreline influenced by TMI effluents. The latter two pathways are considered to be the primary recreational activities associated with the Susquehanna River in the vicinity of TMI. The "receptor" would be that individual who consumes water from the Susquehanna River and fish residing in the plant discharge, while occupying an area of shoreline influenced by the plant discharge.

After calculating the doses to all age groups for all eight organs resulting from the three pathways described above, the Dose Summary Table presents the maximum whole body dose and affected age group along with the organ and associated age group that received the largest dose.

For the third quarter of 1985 the calculated maximum whole body dose received by anyone would have been $3.3\text{E-}4$ mrem to an adult. Similarly, the maximum organ dose would have been $8.2\text{E-}4$ mrem to the bone of an adult. (Note: The unidentified beta inventory is treated as Sr-90)

B. Gaseous (Individual)

There are seven major pathways considered in the dose calculation for gaseous effluents. These are: (1) plume, (2) inhalation, consumption of (3) cow milk, (4) goat milk, (5) vegetables, (6) meat, and (7) standing on contaminated ground.

Lines 3 and 4 present the maximum plume exposure at or beyond the site boundary. The notation of "air dose" is interpreted to mean that these doses are not to an individual, but are considered to be the maximum dose that would have occurred at or beyond the site boundary. The Dose Summary Table presents the distance in meters to the location in the affected sector (compass point) where the theoretical maximum plume exposure occurred. It should be noted that real-time meteorology was used in all dose calculations for gaseous effluents.

With respect to the gaseous release for the third quarter of 1985, the plume exposure at or near the site boundary would have been 0 mrad and 0 mrad, gamma and beta dose respectively.

Lines 5 and 6 present the largest calculated dose to a receptor (individual) in the maximally affected sector(s). The location of the receptor is described by both distance (meters) and direction from the site.

Plume exposures to an individual, regardless of age, from gaseous effluents during the second quarter were 0 mrem and 0 mrem, whole body and skin, respectively.

The Iodines and Particulates section described in line 7 represents the maximum exposed organ due to iodine and particulates. This does not include the whole body plume exposure which was separated out by line 5. The doses presented in this section again reflect the maximum exposed organ for the appropriate age group.

The third quarter exposure due to the iodines and particulates would have resulted in a maximum dose of $1.05\text{E-}3$ mrem to the bone of a child residing 750 meters from the site in the SE sector. No other organ of any age group would have received a greater dose.

C. Liquid and Gaseous (Population)

Lines 8 - 11 present the person-rem doses resulting from the liquid and gaseous effluents. These doses are summed over all pathways and the affected populations. Liquid person-rem is based upon the population encompassed within the region from the TMI outfall extending down to the Chesapeake Bay. The person-rem for gaseous effluents are based upon the 1980 population projections of the FSAR and consider the population out to a distance of 50 miles around TMI. Population doses are summed over all distances and sectors to give an aggregate dose.

Based upon the calculations performed for the third quarter, liquid effluents resulted in a whole body population dose of $2.4\text{E-}3$ person-rem with a maximum critical organ population dose to the bone of $9.4\text{E-}3$ person-rem. Gaseous effluents resulted in a whole body population dose of $3.1\text{E-}2$ person-rem with a maximum critical organ population dose to the liver of $2.9\text{E-}2$ person-rem.

UNIT 2
Third Quarter Dose ReportSUMMARY OF MAXIMUM INDIVIDUAL DOSES FOR UNIT FROM
July 1, 1985 through September 30, 1985

| Effluent | Applicable Organ | Estimated Dose (mrem) | Age Group | Location Dist Dir (m) (toward) | % of Applicable Limit | | 10CFR50 App. I Limits (mrem) | |
|---------------------------|-----------------------|-----------------------|-----------|--------------------------------|-----------------------|--------|------------------------------|--------|
| | | | | | Quarterly | Annual | Quarterly | Annual |
| (1) Liquid | Total Body Bone | 3.3E-4 | Adult | Receptor 1 | 2.2E-2 | 1.1E-2 | 1.5 | 3.0 |
| (2) Liquid | | 8.2E-4 | Adult | Receptor 1 | 1.6E-2 | 8.2E-3 | 5.0 | 10.0 |
| (3) Noble Gas | Air Dose (gamma-mrad) | 0 | - | - | - | - | 5.0 | 10.0 |
| (4) Noble Gas | Air Dose (beta-mrad) | 0 | - | - | - | - | 10.0 | 20.0 |
| (5) Noble Gas | Total Body | 0 | - | - | -- | - | -- | 5.0 |
| (6) Noble Gas | Skin | 0 | - | - | -- | - | -- | 15.0 |
| (7) Iodine & Particulates | Bone | 1.05E-3 | Child | 750 SE | 1.4E-2 | 7.0E-3 | 7.5 | 15.0 |

SUMMARY OF MAXIMUM POPULATION DOSES FOR UNIT 2 FROM
July 1, 1985 through September 30, 1985

| <u>Effluent</u> | <u>Applicable Organ</u> | <u>Estimated Population Dose (person-rem)</u> |
|-----------------|-------------------------|---|
| (8) Liquid | Total Body | 2.4E-3 |
| (9) Liquid | Bone | 9.4E-3 |
| (10) Gaseous | Total Body | 3.1E-2 |
| (11) Gaseous | Liver | 2.9E-2 |



GPU Nuclear Corporation
Post Office Box 480
Route 441 South
Middletown, Pennsylvania 17057-0191
717 944-7621
TELEX 84-2386
Writer's Direct Dial Number:

(717) 948-846

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November 27, 1985

Office of Inspection and Enforcement
Attn: Dr. T. E. Murley
Regional Administrator
US Nuclear Regulatory Commission
Region I
631 Park Avenue
King of Prussia, PA 19406

Dear Dr. Murley:

Three Mile Island Nuclear Station, Unit 2 (TMI-2)
Operating License No. DPR-73
Docket No. 50-320
Quarterly Dose Assessment Report - Third Quarter 1985

Per the requirements of Section 5.6.1.C of Appendix B to the Recovery Technical Specifications, the quarterly report of radiological releases and estimated doses is submitted.

Attachment 1 is an executive summary of TMI-2 effluents and doses reported in Attachments 2 through 4. Attachment 2 presents a summary of releases listing estimates of total activity and the time rate of release of each nuclide. Attachment 3 is the interpretation of Attachment 4, the Dose Summary Table, which provides a summary of the maximum hypothetical and/or real doses to individuals and the general population resulting from TMI-2 activities. Doses were extracted from calculational models and represent the bounding doses for all cases. The reporting period includes July 1, 1985 through September 30, 1985.

Sincerely,

F. R. Standerfer
Vice President/Director, TMI-2

FRS/CJD/eml

Attachments

cc: Director - TMI-2 Cleanup Project Directorate, Dr. W. D. Travers
GPU Nuclear Corporation is a subsidiary of the General Public Utilities Corporation

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