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U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D. C. 20555

Perry Nuclear Power Plant
Docket No. 50-440
Semiannual Radioactive
Effluent Release Report

Gentlemen:

We are hereby submitting the Semiannual Radioactive Effluent Release Report for the Perry Nuclear Power Plant, Unit 1 for the period of January 1 to June 30, 1991. This report meets the requirements of Regulatory Guide 1.21, as applicable to the Perry Technical Specification, Section 6.9.1.7. All effluent releases were within the concentration and release limits specified in the Radiological Effluent Technical Specifications.

At the time this report was generated, the second quarter analysis results for Strontium-89/90 and Iron-55 were not available. An addendum will be generated when the results become available.

Also, on June 5, 1991, it was determined that the effluent system flow rate monitor for the Turbine Building/Heater Bay Building vent radiation monitor had been inoperable during two fan operation since the summer of 1988 (refer to Attachment 9, Licensee Event Report 91-012). As a result, a revision to the Semiannual Radiological Effluent Report will be submitted for the time periods when the flow monitor reading differed from the actual flow reading by greater than ten percent.

If you have any questions, please feel free to call.

Sincerely,

Michael D. Lyster

MDL:AHL:njc

Attachment

cc: NRC Project Manager
NRC Resident Office
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S. Focht - ANI



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1/1

# THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

## PERRY NUCLEAR POWER PLANT
## UNIT 1

## SEMIANNUAL RADIOACTIVE EFFLUENT
## RELEASE REPORT

## 1991: QUARTERS 1 & 2

Approved By:

S. F. KENSICKI

Designated Alternate Date

Director, Perry Nuclear
Engineering Department

General Manager, Perry Nuclear
Power Plant

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## INTRODUCTION

This Semiannual Radioactive Effluent Release Report (SRERR), covering the period of January 1 through June 30, 1991, is submitted in accordance with Section 6.9.1.7 of Appendix "A" (Technical Specifications) to Perry Nuclear Power Plant (PNPP) License No. NPF-58. It is designed to meet the requirements of Regulatory Guide 1.21, as applicable to the PNPP Technical Specifications. Portions of the Technical Specifications applicable to this report, Sections 3/4.3.7.9, 3/4.3.7.10, 3/4.11, 3/4.12, 6.13.2, 6.14.2, and 6.15.1, are known as the Radiological Effluent Technical Specifications (RETS).

During quarters 1 and 2 the plant produced 4,561,638 Megawatt Hours Electric Gross. The net reactor capacity averaged 85.9 percent. The reactor was critical a total of 3927.5 hours.

Liquid and gaseous radioactive effluent releases to the environment during this reporting period were sampled and analyzed in accordance with the requirements of the Technical Specifications. All radioactive effluent releases were within the concentration and release limits specified in the RETS.

Calculations and terms utilized in this report are those outlined in the PNPP Offsite Dose Calculation Manual (ODCM).

The second quarter analysis results for Sr89/90 and Fe55 were not available for the generation of this report. An addendum will be generated when the results become available.

## RADIOLOGICAL IMPACT ON MAN

Sampling and analysis of liquid and gaseous effluents were performed in accordance with the frequencies, types of analysis, and Lower Limit of Detection (LLD) outlined in the PNPP Unit 1 Technical Specifications.

Radioactive material was detected in some of the liquid and gaseous effluent samples analyzed. Dose calculations, using measured effluent flow and meteorological data, resulted in dose to individuals at levels below 10CFR20 and 10CFR50, Appendix I limits. Direct radiation resulting from plant operation, as measured by environmental thermoluminescent dosimeters located around the plant, did not contribute any measurable dose to members of the public for the reporting period and, as there are no other nearby fuel cycle sources, 40CFR190 limits were not exceeded.

Summaries of maximum individual and population doses resulting from liquid and gaseous radioactive effluent releases are given, in Regulatory Guide 1.21 format, in Attachment 1.

Technical Specification 6.9.1.7 requires assessment of radiation doses from radioactive liquid and gaseous effluent to members of the public while onsite. These onsite doses are assessed relative to offsite dose values, and are adjusted for appropriate dilution, dispersion, and occupancy factors.

### ONSITE DOSE FOR LIQUID EFFLUENTS

The onsite liquid effluent pathway of concern for members of the public is shore exposure while fishing along the Lake Erie coast. Occupancy is assumed to be 60 hours per year and the dilution factor for the point of exposure is 10. Ratioing this exposure pathway to doses calculated for offsite locations yields the following onsite dose values.

| | Total Body | Organ |
|---|---|---|
| Quarters 1 & 2 | 3.9 E-01 mrem | 1.5 E-03 mrem (skin) |
| Quarter 1 | 3.8 E-01 mrem | 1.4 E-03 mrem (skin) |
| Quarter 2 | 5.7 E-03 mrem | 1.3 E-04 mrem (skin) |

## ONSITE DOSE FOR GASEOUS EFFLUENTS

Several cases are considered for onsite gaseous effluent exposure to members of the public including traversing a public road within the site boundary, shoreline fishing, non-plant related training, car pooling, and job interviews. The onsite activity with the highest dose potential, relative to gaseous effluents, is shoreline fishing. Occupancy is again assumed to be 60 hours per year. Accounting for this and the difference between annual average dispersion values for the onsite point of concern, 6.6 E-05 $s/m^3$, the following maximum onsite dose values are generated. The maximum onsite doses for gaseous effluents for the first and second quarter may not be cumulative.

| | Total Body | Organ |
|---|---|---|
| Quarters 1 & 2 | 2.8 E-03 mrem | 5.9 E-02 mrem(thyroid) |
| Quarter 1 | 6.3 E-04 mrem | 5.1 E-03 mrem(thyroid) |
| Quarter 2 | 2.8 E-03 mrem | 5.6 E-02 mrem(thyroid) |

## AVERAGE INDIVIDUAL TOTAL BODY DOSES

Average total body dose to individual members of the public is determined for the population that lives within fifty miles of the plant for gaseous effluents (2.42 E+06 persons) and the population that receives drinking water from intakes within fifty miles for liquid effluents (1.82 E+06 persons). These doses are calculated using the total population dose figures found in Attachment 1.

| | Gases | Liquid |
|---|---|---|
| Quarters 1 & 2 | 1.1 E-06 mrem | 1.7 E-03 mrem |
| Quarter 1 | 2.0 E-07 mrem | 1.6 E-03 mrem |
| Quarter 2 | 8.7 E-07 mrem | 3.0 E-05 mrem |

Gaseous and Air Dose calculations at the site boundary were performed for two cases. Attachment 1 provides the calculated maximum site boundary dose values for all sectors including those sectors which are totally over water in which no member of the public resides (These are the W, WNW, NW, NNW, N AND NNE SECTORS). Attachment 2 provides the calculated maximum site boundary dose values for the land based sectors in which members of the public reside.

## SUPPLEMENTAL INFORMATION

### Regulatory Limits

Technical Specifications 3/4.11.1 and 3/4.11.2 outline requirements for release of radioactive liquid and gaseous effluents, respectively. Concentration of radioactive material in liquid effluents and dose or dose commitment resultant thereof are limited in unrestricted areas. Dose and dose rate due to radioactive materials released in gaseous effluents are limited in areas at or beyond the site boundary. Technical Specification limits are listed in Attachment 3.

### Maximum Permissible Concentrations

The Maximum Permissible Concentrations (MPCs) in liquids are those outlined in Technical Specification 3.11.1.1 (10CFR20, Appendix B, Table II, Column 2, with the lower of the soluble and insoluble MPC being used; for dissolved and entrained noble gases, concentrations are limited to 2 E-04 μCi/ml). PNPP Unit 1 Technical Specifications do not contain a concentration requirement for gaseous releases, therefore, MPCs are not used to calculate maximum release rates for radioactive gaseous effluents.

### Average Energy

Average energy requirements for radioactive effluent mixtures do not apply to PNPP Unit 1 Technical Specifications or Off-site Dose Calculation Manual.

### Measurements and Approximations of Total Radioactivity

Analyses of specific radionuclides in effluent samples are used with effluent path flow measurements to evaluate the radioactive composition and concentration of effluents.

## Batch Releases

Liquid effluent releases were considered continuous (runs of Emergency Service Water [ESW] Loops A and B) as well as batch (Liquid Radwaste [LRW] discharges). Although the ESW system is considered to be a continuous release path when in service, it is not run continuously.

All gaseous effluent releases from Perry Nuclear Power Plant were considered continuous.

### LIQUID RELEASES

January 1 - March 31, 1991

| | Batch | Continuous |
|---|---|---|
| Number of Releases | 41 | 63 |
| Total Time of Releases (min) | 8.3 E+03 | 5.9 E+04* |
| Minimum Time for a Release (min) | 1.7 E+02 | 3.0 E+00 |
| Average Time for a Release (min) | 2.0 E+02 | 9.4 E+02 |
| Maximum Time for a Release (min) | 2.4 E+02 | 3.6 E+04 |
| Average Effluent Stream Flow During Periods of Release (l/min) | 2.0 E+05 | 3.2 E+04 |

* - The total of ESW Loop A (5.2 E+04 min) and ESW Loop B (7.3 E+03 min)

April 1 - June 30, 1991

| | Batch | Continuous |
|---|---|---|
| Number of Releases | 58 | 62 |
| Total Time of Releases (min) | 1.1 E+04 | 9.4 E+04* |
| Minimum Time for a Release (min) | 3.0 E+00 | 1.4 E+01 |
| Average Time for a Release (min) | 1.9 E+02 | 1.5 E+03 |
| Maximum Time for a Release (min) | 2.3 E+02 | 4.3 E+04 |
| Average Effluent Stream Flow During Periods of Release (l/min) | 2.8 E+05 | 4.4 E+04 |

* - The total of ESW Loop A (2.7 E+04 min) and ESW Loop B (6.8 E+04 min)

## LIQUID EFFLUENTS

For the first quarter of 1991 there were 41 batch and 63 continuous releases. Batch release total waste volume for the first quarter was 4.8 E+06 liters; total continuous release waste volume was 1.9 E+09 liters; total plant discharge during periods of release was 1.2 E+10 liters.

For the second quarter of 1991 there were 58 batch and 62 continuous releases. Batch release total waste volume for the second quarter was 6.3 E+06 liters; total continuous release waste volume was 4.2 E+09 liters; total plant discharge during periods of release was 2.5 E+10 liters.

Summaries of the radionuclide total curie activities, average diluted concentrations, and percentage of MPC (in Regulatory Guide 1.21 format) are included in Attachment 4.

If a radionuclide was not detected, zero activity was used for that isotope in dose calculations. A zero activity indicates that the radionuclide was not present at a level greater than the Lower Level of Detection (LLD) of the instrumentation used. In all cases, these LLDs were less than the levels required by Technical Specifications. The following are typical LLDs.

| Radionuclide | LLD (µCi/ml) |
|---|---|
| Mn-54 | 2.4 E-08 |
| Fe-59 | 5.8 E-08 |
| Co-58 | 1.9 E-08 |
| Co-60 | 3.4 E-08 |
| Zn-65 | 4.6 E-08 |
| Mo-99 | 2.1 E-07 |
| I-131 | 2.3 E-08 |
| Cs-134 | 2.3 E-08 |
| Cs-137 | 2.6 E-08 |
| Ce-141 | 3.2 E-08 |
| Ce-144 | 1.3 E-07 |
| Sr-89 | 3.0 E-08 |
| Sr-90 | 3.7 E-08 |
| Fe-55 | 5.7 E-09 |
| H-3 | 4.6 E-06 |
| Gross Alpha | 6.0 E-08 |

Estimates of error associated with sample analysis, discharge volume, and dilution volume follow. Analytical error terms are based on split sample analysis results, the majority of which are confirmatory measurements, the others are inter-laboratory comparison results. Discharge and dilution volume (flow rate instrumentation) error is assessed using loop instrumentation accuracy terms.

| | |
|---|---|
| Gamma Analysis | 10% |
| H-3 Analysis | 8% |
| Sr-89/90 Analysis | 10% |
| Fe-55 Analysis | 21% |
| Gross Alpha Analysis | 4% |
| Service Water Volume (Dilution) | 31% |
| Emergency Service Water Volume (Discharge) | 25% |
| Liquid Radwaste Volume | 1% |

## GASEOUS EFFLUENTS

Summaries of the radionuclide total curie activities, average release rates (in Regulatory Guide 1.21 format) are included in Attachment 5.

If a radionuclide was not detected, zero activity was used for that isotope in dose calculations. A zero activity indicates that the radionuclide was not present at a level greater than the Lower Level of Detection (LLD) of the instrumentation used. In all cases, these LLDs were less than the levels required by Technical Specifications. The following are typical LLDs.

| Radionuclide | LLD (μCi/ml) |
|---|---|
| Kr-87 | 1.7 E-08 |
| Kr-88 | 2.3 E-08 |
| Xe-133 | 1.8 E-08 |
| Xe-133m | 5.3 E-08 |
| Xe-135 | 6.4 E-09 |
| Xe-138 | 1.0 E-07 |
| Mn-54 | 2.7 E-13 |
| Fe-59 | 5.6 E-13 |
| Co-58 | 3.2 E-13 |
| Co-60 | 4.6 E-13 |
| Zn-65 | 7.7 E-13 |
| Mo-99 | 2.1 E-12 |
| Cs-134 | 2.1 E-12 |
| Cs-137 | 3.1 E-13 |
| Ce-141 | 3.2 E-13 |
| Ce-144 | 1.5 E-12 |
| I-131 | 2.8 E-13 |
| I-133 | 4.9 E-13 |
| Sr-89 | 3.8 E-14 |
| Sr-90 | 6.8 E-14 |
| H-3 | 3.0 E-10 |
| Gross Alpha | 5.4 E-12 |

Estimates of error associated with sample analysis, sample flow rate, and effluent flow rate follow. Analytical error terms are based on split sample analysis results, the majority of which are confirmatory measurements, the others are interlaboratory comparison results. Flow rate instrumentation error is assessed using loop instrumentation accuracy terms.

| | |
|---|---|
| Noble Gas Analysis | 11% |
| Particulate Analysis | 9% |
| Iodine Analysis | 12% |
| H-3 Analysis | 8% |
| Sr-89/90 Analysis | 10% |
| Gross Alpha Analysis | 4% |
| Sample Flow Rate | 4% |
| Effluent Flow Rate | 4% |

## SOLID WASTE

There were 19 radioactive waste shipments transported from PNPP for the period covered in this report. Four shipments of dry active waste were sent for compaction prior to burial (8960 cubic feet). There were 15 dewatered liners (2730 cubic feet), which were sent in 15 separate shipments. There was 1 dewatered HIC (136 cubic feet) which was sent in 1 shipment. There was no irradiated fuel transported from site. There were no liners solidified. See Attachment 6 for volume and activity values. All radioactive shipments during the reporting period were LSA and shipped in strong type packages or NRC certified packages.

## METEOROLOGICAL DATA

Cumulative joint frequency distribution (JFD) tables of wind speed and direction for each stability class, as well as for all stability classes combined, are given in Attachment 7 for the annual and semiannual period and for each quarter of the semiannual period covered by this report.

These JFD tables are the results obtained from the processing of hourly average meteorological data collected at the PNPP site met tower. It should be noted that the 1-3 mph JFD column includes wind speeds down to 0.1 mph and that hours of 0 wind speed appear only in the totals columns. The separate tallies of periods of calm include wind speeds from 0.0 to <0.7 mph. Differential temperature ($\Delta T$ 60 - 10 meters) is generally used for atmospheric stability classification.

## ABNORMAL RELEASES

There was one abnormal gaseous release during the reporting period. The release occurred due to the loss of the Turbine Building/Heater Bay exhaust fans while the supply fans continued to operate. Under these circumstances, the supply flow would exit the turbine building and heater bay through unmonitored windows, louvers, doorways etc., circumventing the normal radiation monitor, 1D17K850. This event began at approximately 2100 on 3-04-91 and was terminated at 0245 on 3-05-91.

The release is categorized as an Abnormal Release, solely due to the fact that the release was unmonitored. No Technical Specification dose or dose rate limits were exceeded. In addition, The Turbine Building/Heater Bay exhaust is an unfiltered pathway providing no treatment to the effluents and would not require reporting per Technical Specification 3.11.1.5.

Air samples taken in the turbine building and heater bay both verified that any activity present was below the lower limit of detection (LLD) for our counting equipment. Dose and dose rate calculations for this event were based on the results obtained from the weekly filter and charcoal cartridge analysis from the Turbine Building/Heater Bay Ventilation System. The only isotopic value present was I-133 on the charcoal cartridge at a concentration of 5.58 E-12 uCi/cc.

The organ dose for the abnormal release period was 1.60 E-03 mrem constituting 0.11 percent of the annual limit. The dose rate for the abnormal release period was 2.45 mrem/year constituting 0.16 percent of the limit. See Attachment 8.

There were no abnormal liquid effluent releases during the reporting period.

## APPLICABLE TECHNICAL SPECIFICATION REQUIREMENTS

Per PNPP Technical Specifications, certain noncompliance items, changes, and findings are reportable in the Semiannual Radioactive Effluent Release Report.

Radioactive Liquid Effluent Monitoring Instrumentation noncompliance ( PNPP Technical Specification 3.3.7.9, Action b.):

> There was one case in which liquid effluent monitoring instrumentation was not restored to an operable condition within the time required by Technical Specifications.

During the reporting period, one item met the criteria as reportable per Technical Specification 3.3.7.9.b, for inoperability in excess of 30 days.

On August 12, 1990 the Radwaste to ESW liquid effluent radiation monitor was declared inoperable when a High alarm came in isolating a Radwaste discharge which was in progress. The alarm appeared to be due to electrical spiking. The source of the spiking was a grounding problem which was difficult to identify and correct. While attempting to isolate the electrical noise problems, the monitor's sample liner became too contaminated to be effective for further use and testing was suspended until a modified sample liner was installed. After a new sample liner was installed, a grounding problem in the preamplifier was found and corrected. The monitor was declared operable on February 5, 1991. During inoperability period, independent samples were taken per Technical Specifications. This event was also reported in the SRERR for the 3rd and 4th quarters of 1990.

Radioactive Gaseous Effluent Monitoring Instrumentation noncompliance (PNPP Technical Specification 3.3.7.10, Action b.):

There was one case in which gaseous effluent monitoring instrumentation was not restored to an operable condition within the time required by Technical Specifications.

On May 10, 1991, the Turbine Building/Heater Bay ventilation system was changed from one exhaust fan operation (winter mode) to two exhaust fan operation (summer mode). The flow monitor indicated a flow of 280,000 cfm while the expected flow was 345,000 cfm. Due to the discrepancy in expected and indicated flow, the monitor was declared inoperable. Upon further investigation, it was determined that the flow monitor had been inoperable during summer mode operations since the summer of 1988.

The pitot tube array, for the Turbine Building / Heater Bay ventilation system, will be calibrated during the third refueling outage. Until the calibration is complete, a default value of 345,000 cfm will be utilized for dose calculations. See Attachment 9.

Liquid Holdup Tanks noncompliance (PNPP Technical Specification 3.11.1.4, Action a.):

There were no outside temporary tanks containing radioactive liquid on the PNPP site during the reporting period.

Radiological Environmental Monitoring Program (REMP) changes (PNPP Technical Specification 3.12.1, Action c.):

For the reporting period, samples were obtained at their respective locations as required by the specified collection frequencies.

During the reporting period, water sample location 28, food products location 70 and milk sample location 71 were added. Milk and feed/silage location 30, food products location 50 and milk and feed/silage location 52 were deleted. In addition, the REMP location maps in the ODCM were updated. The changes to Locations 28, 30, 50, 52, 70 and the location maps were included in the SRERR for the 3rd and 4th quarters of 1990.

Land Use Census findings (PNPP Technical Specification 3.12.2, Actions a and b.):

During the reporting period there were no changes to the Land Use Census.

Process Control Program (PCP) changes (PNPP Technical Specification 6.13.2):

During the reporting, the Process Control Program (PCP) was revised to Revision 5 to allow for the use of new radwaste processing vendors and the processing of waste from decontamination procedures. See Attachment 10.

Offsite Dose Calculation Manual (ODCM) changes (PNPP Technical Specification 6.14.2):

During the reporting period, a TCN became effective incorporating the liquid radwaste dilution flow range and the tables and references for the individual dilution factors for the potable water and fish ingestion pathway. The TCN also reflects the changes made to the REMP program. The new REMP milk location 71 will be added to the ODCM during the 3rd or 4th quarter of 1991. See Attachment 11.

Major Changes to Radioactive Waste Treatment Systems (PNPP Technical Specification 6.15.1):

There were no changes made to the Radioactive Waste Treatment Systems during the reporting period.

Attachment 1

Radiological Impact on Man (Dose Summaries)

Attachment 1 (Page 1 of 3)

**Radiological Impact on Man (Dose Summaries)**

**1991: Quarters 1 & 2**

SUMMARY OF MAXIMUM INDIVIDUAL DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 1 1 1-91 63024
GASEOUS 91 1 1 1-91 63024
AIR 91 1 1 1-91 63024

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | LOCATION DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| LIQUID | TOTAL BODY | 5.40E-02 | ADULT | RECEPTOR 1 | | 1.8E+00 | 3.0E+00 |
| LIQUID | LIVER | 7.77E-02 | TEEN | RECEPTOR 1 | | 7.8E-01 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 3.96E-02 | | 283. | WNW | 4.0E-01 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 5.38E-02 | | 283. | WNW | 2.7E-01 | 2.0E+01 |
| NOBLE GAS | T.BODY | 2.56E-02 | ALL | 283. | WNW | 5.1E-01 | 5.0E+00 |
| NOBLE GAS | SKIN | 6.77E-02 | ALL | 283. | WNW | 4.5E-01 | 1.5E+01 |
| IODINES PARTICULATES | THYROID | 4.84E-01 | INFANT | 283. | WNW | 3.2E+00 | 1.5E+01 |

SUMMARY OF POPULATION DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 1 1 1-91 63024
GASEOUS 91 1 1 1-91 63024

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED POPULATION DOSE (PERSON-REM) |
|---|---|---|
| LIQUID | TOTAL BODY | 3.1E+00 |
| LIQUID | THYROID | 3.7E-02 |
| GASEOUS | TOTAL BODY | 2.6E-03 |
| GASEOUS | THYROID | 1.6E-01 |

## Radiological Impact on Man (Dose Summaries)
## 1991: Quarter 1

SUMMARY OF MAXIMUM INDIVIDUAL DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 1 1 1-91 33124
GASEOUS 91 1 1 1-91 33124
AIR 91 1 1 1-91 33124

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | LOCATION DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| LIQUID | TOTAL BODY | 5.32E-02 | ADULT | RECEPTOR 1 | | 1.8E+00 | 3.0E+00 |
| LIQUID | LIVER | 7.62E-02 | TEEN | RECEPTOR 1 | | 7.6E-01 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 9.02E-03 | | 294. | N | 9.0E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 1.08E-02 | | 294. | N | 5.4E-02 | 2.0E+01 |
| NOBLE GAS | T.BODY | 5.72E-03 | ALL | 294. | N | 1.1E-01 | 5.0E+00 |
| NOBLE GAS | SKIN | 1.47E-02 | ALL | 294. | N | 9.8E-02 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 3.31E-02 | CHILD | 280. | NNW | 2.2E-01 | 1.5E+01 |

SUMMARY OF POPULATION DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 1 1 1-91 33124
GASEOUS 91 1 1 1-91 33124

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED POPULATION DOSE (PERSON-REM) |
|---|---|---|
| LIQUID | TOTAL BODY | 3.0E+00 |
| LIQUID | THYROID | 3.0E-02 |
| GASEOUS | TOTAL BODY | 4.9E-04 |
| GASEOUS | THYROID | 3.8E-03 |

Attachment 1 (Continued - Page 3 of 3)
Radiological Impact on Man (Dose Summaries)
1991: Quarter 2

SUMMARY OF MAXIMUM INDIVIDUAL DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 4 1 1-91 63024
GASEOUS 91 4 1 1-91 63024
AIR 91 4 1 1-91 63024

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST DIR (M) (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|
| LIQUID | TOTAL BODY | 7.86E-04 | ADULT | RECEPTOR 1 | 2.6E-02 | 3.0E+00 |
| LIQUID | LIVER | 1.49E-03 | TEEN | RECEPTOR 1 | 1.5E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 3.96E-02 | | 283. WNW | 4.0E-01 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 5.38E-02 | | 283. WNW | 2.7E-01 | 2.0E+01 |
| NOBLE GAS | T.BODY | 2.56E-02 | ALL | 283. WNW | 5.1E-01 | 5.0E+00 |
| NOBLE GAS | SKIN | 6.77E-02 | ALL | 283. WNW | 4.5E-01 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 4.58E-01 | INFANT | 283. WNW | 3.1E+00 | 1.5E+01 |

SUMMARY OF POPULATION DOSES
LAST ACCUMULATIONS FOR PERIODS:
LIQUID 91 4 1 1-91 63024
GASEOUS 91 4 1 1-91 63024

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED POPULATION DOSE (PERSON-REM) |
|---|---|---|
| LIQUID | TOTAL BODY | 5.4E-02 |
| LIQUID | THYROID | 7.7E-03 |
| GASEOUS | TOTAL BODY | 2.1E-03 |
| GASEOUS | THYROID | 1.6E-01 |

Attachment 2

Radiological Impact on Man (Land Based Sectors)

Attachment 2 (Page 1 of 2)
Radiological Impact on Man (Land Based Sectors)

Quarters 1 & 2

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 7.93E-03 | | 1445. | SSE | 7.9E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 6.39E-03 | | 1420. | S | 3.2E-02 | 2.0E+01 |
| NOBLE GAS | T.BODY | 4.39E-03 | ALL | 1445. | SSE | 8.8E-02 | 5.0E+00 |
| NOBLE GAS | SKIN | 8.14E-03 | ALL | 1445. | SSE | 5.4E-02 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 2.87E-01 | INFANT | 900. | WSW | 1.9E+00 | 1.5E+01 |

Quarter 1

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 2.79E-03 | | 1420. | S | 2.8E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 4.64E-03 | | 1420. | S | 2.3E-02 | 2.0E+01 |
| NOBLE GAS | T.BODY | 1.24E-03 | ALL | 1420. | S | 2.5E-02 | 5.0E+00 |
| NOBLE GAS | SKIN | 3.21E-03 | ALL | 1420. | S | 2.1E-02 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 2.16E-03 | CHILD | 900. | WSW | 1.4E-02 | 1.5E+01 |

## Attachment 2 (Page 2 of 2)
## Radiological Impact on Man (Land Based Sectors)

### Quarter 2

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | LOCATION DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 7.87E-03 | | 1445. | SSE | 7.9E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 3.89E-03 | | 1445. | SSE | 1.9E-02 | 2.0E+01 |
| NOBLE GAS | T.BODY | 4.35E-03 | ALL | 1445. | SSE | 8.7E-02 | 5.0E+00 |
| NOBLE GAS | SKIN | 8.04E-03 | ALL | 1445. | SSE | 5.4E-02 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 2.85E-01 | INFANT | 900. | WSW | 1.9E+00 | 1.5E+01 |

Attachment 3

Technical Specification Limits

Attachment 3 (Page 1 of 1)
# Technical Specification Limits

## LIQUID EFFLUENTS:

| | |
|---|---|
| * Concentration ≤ 10CFR20 Appendix B, Table II, Column 2* | * release rate limit TS 3.11.1.1 |
| * ≤ 1.5 mrem total body<br>≤ 5 mrem any organ | * quarterly dose limit per TS 3.11.1.2 |
| * ≤ 3 mrem total body<br>≤ 10 mrem any organ | * annual dose limit per TS 3.11.1.2 |

## GASEOUS EFFLUENTS:

### Noble Gases

| | |
|---|---|
| * ≤ 500 mrem/yr total body<br>≤ 3000 mrem/yr any organ | * dose rate limit per TS 3.11.2.1 |
| * ≤ 5 mrad air gamma<br>≤ 10 mrad air beta | * quarterly air dose limit per TS 3.11.2.2 |
| * ≤ 10 mrad air gamma<br>≤ 20 mrad air beta | * annual air dose limit per TS 3.11.2.2 |

### I-131, I-133, H-3, Particulates with Halflives >8 Days

| | |
|---|---|
| * ≤ 1500 mrem/yr any organ | * dose rate limit per TS 3.11.2.1 |
| * ≤ 7.5 mrem any organ | * quarterly dose limit per TS 3.11.2.3 |
| * ≤ 15 mrem any organ | * annual dose limit per TS 3.11.2.3 |

* - Dissolved or entrained noble gas concentration is limited to ≤ 2 E-4 μCi/ml.

Attachment 4

Liquid Effluents

Attachment 4 (Page 1 of 2)

Liquid Effluents

QUARTER 1 : START DATE 91010101 END DATE 91033124
QUARTER 2 : START DATE 91040101 END DATE 91063024

EFFLUENT AND WASTE DISPOSAL REPORT

LIQUID EFFLUENTS -- SUMMATION OF ALL RELEASES

| | UNITS | QUARTER 1 | QUARTER 2 |
|---|---|---|---|
| A. FISSION AND ACTIVATION PRODUCTS | | | |
| 1. TOTAL RELEASE (EXCL. TRIT., GASES, ALPHA) | CI | 3.92E-02 | 1.96E-02 |
| 2. AVERAGE DILUTED CONC. DURING PERIOD | UCI/ML | 3.24E-09 | 7.76E-10 |
| 3. PERCENT OF APPLICABLE LIMIT | % | N/A | N/A |
| B. TRITIUM | | | |
| 1. TOTAL RELEASE | CI | 1.01E+00 | 3.07E+00 |
| 2. AVERAGE DILUTED CONC. DURING PERIOD | UCI/ML | 8.37E-08 | 1.22E-07 |
| 3. PERCENT OF APPLICABLE LIMIT | % | 2.79E-03 | 4.06E-03 |
| C. DISSOLVED AND ENTRAINED GASES | | | |
| 1. TOTAL RELEASE | CI | 1.17E-03 | 1.33E-03 |
| 2. AVERAGE DILUTED CONC. DURING PERIOD | UCI/ML | 9.64E-11 | 5.26E-11 |
| 3. PERCENT OF APPLICABLE LIMIT | % | 4.82E-05 | 2.63E-05 |
| D. GROSS ALPHA RADIOACTIVITY | | | |
| 1. TOTAL RELEASE | CI | 9.29E-05 | 0.00E+00 |
| E. VOLUME WASTE RELEASED (PRIOR TO DILUTION) | LITERS | 1.90E+09 | 4.19E+09 |
| F. VOLUME DILUTION WATER USED DURING PERIOD | LITERS | 1.21E+10 | 2.52E+10 |

## Liquid Effluents

QUARTER 1 : START DATE 91010101 END DATE 91033124
QUARTER 2 : START DATE 91040101 END DATE 91063024
DATE OF REPORT: AUG. 7, 1991
PREPARED BY:

| NUCLIDES RELEASED | UNITS | CONTINUOUS MODE QUARTER 1 | CONTINUOUS MODE QUARTER 2 | BATCH MODE QUARTER 1 | BATCH MODE QUARTER 2 |
|---|---|---|---|---|---|
| H3 | CI | 0.00E+00 | 0.00E+00 | 1.01E+00 | 3.07E+00 |
| CR51 | CI | 0.00E+00 | 0.00E+00 | 8.47E-04 | 1.31E-02 |
| MN54 | CI | 0.00E+00 | 0.00E+00 | 2.36E-03 | 1.16E-04 |
| FE55 | CI | 0.00E+00 | 0.00E+00 | 2.79E-03 | 0.00E+00 |
| CO58 | CI | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.66E-04 |
| CO60 | CI | 0.00E+00 | 0.00E+00 | 1.37E-02 | 2.79E-03 |
| ZN65 | CI | 0.00E+00 | 0.00E+00 | 4.96E-03 | 2.58E-03 |
| TC99M | CI | 0.00E+00 | 0.00E+00 | 8.42E-06 | 0.00E+00 |
| AG110M | CI | 0.00E+00 | 0.00E+00 | 2.10E-05 | 7.45E-04 |
| CS134 | CI | 0.00E+00 | 0.00E+00 | 5.94E-03 | 1.55E-05 |
| CS137 | CI | 0.00E+u0 | 0.00E+00 | 8.37E-03 | 1.02E-04 |
| * SB125 | CI | 0.00E+00 | 0.00E+00 | 2.42E-04 | 0.00E+00 |
| TOTAL FOR PERIOD (ABOVE) | CI | 0.00E+00 | 0.00E+00 | 1.05E+00 | 3.09E+00 |
| * XE133 | CI | 0.00E+00 | 0.00E+00 | 1.06E-03 | 1.20E-03 |
| * XE135 | CI | 0.00E+00 | 0.00E+00 | 1.01E-04 | 1.31E-04 |

Attachment 5

Gaseous Effluents

## Attachment 5 (Page 1 of 2)
## Gaseous Effluents

QUARTER 1 : START DATE 91010101 END DATE 91033124
QUARTER 2 : START DATE 91040101 END DATE 91063024

EFFLUENT AND WASTE DISPOSAL REPORT

GASEOUS EFFLUENTS -- SUMMATION OF ALL RELEASES

| | UNITS | QUARTER 1 | QUARTER 2 |
|---|---|---|---|
| **A. FISSION AND ACTIVATION GASES** | | | |
| 1. TOTAL RELEASE | CI | 3.80E+00 | 1.33E+01 |
| 2. AVERAGE RELEASE RATE FOR PERIOD | UCI/SEC | 4.89E-01 | 1.69E+00 |
| 3. PERCENT OF TECHNICAL SPECIFICATION LIMIT | % | N/A | N/A 0 |
| **B. IODINES** | | | |
| 1. TOTAL IODINE-131 | CI | 6.74E-04 | 3.35E-03 |
| 2. AVERAGE RELEASE RATE FOR PERIOD | UCI/SEC | 8.66E-05 | 4.2[illegible]E-04 |
| 3. PERCENT OF TECHNICAL SPECIFICATION LIMIT | % | N/A | N/A |
| **C. PARTICULATES** | | | |
| 1. PARTICULATES WITH HALF LIVES >8 DAYS | CI | 4.87E-05 | 2.76E-07 |
| 2. AVERAGE RELEASE RATE FOR PERIOD | UCI/SEC | 6.27E-06 | 3.51E-08 |
| 3. PERCENT OF TECHNICAL SPECIFICATION LIMIT | % | 0.00E+00 | 0.00E+00 |
| 4. GROSS ALPHA RADIOACTIVITY | CI | 8.96E-06 | 2.62E-05 |
| **D. TRITIUM** | | | |
| 1. TOTAL RELEASE | CI | 0.00E+00 | 0.00E+00 |
| 2. AVERAGE RELEASE RATE FOR PERIOD | UCI/SEC | 0.00E+00 | 0.00E+00 |
| 3. PERCENT OF TECHNICAL SPECIFICATION LIMIT | % | N/A | N/A |

Attachment 5 (Continued - Page 2 of 2)
## Gaseous Effluents

QUARTER 1 : START DATE 91010101 END DATE 91033124
QUARTER 2 : START DATE 91040101 END DATE 91063024
DATE OF REPORT: AUG. 7, 1991
PREPARED BY:

| | | CONTINUOUS MODE | | BATCH MODE | |
|---|---|---|---|---|---|
| NUCLIDES RELEASED | UNITS | QUARTER 1 | QUARTER 2 | QUARTER 1 | QUARTER 2 |
| **1. FISSION AND ACTIVATION GASES** | | | | | |
| KR85M | CI | 0.00E+00 | 1.37E-03 | -------- | -------- |
| KR87 | CI | 2.14E-02 | 6.97E-02 | -------- | -------- |
| KR88 | CI | 7.08E-03 | 3.17E-02 | -------- | -------- |
| XE133 | CI | 3.83E-01 | 1.22E+00 | -------- | -------- |
| XE135M | CI | 8.31E-01 | 5.32E+00 | -------- | -------- |
| XE135 | CI | 2.06E+00 | 5.93E+00 | -------- | -------- |
| XE137 | CI | 2.59E-01 | 2.59E-01 | -------- | -------- |
| XE138 | CI | 2.41E-01 | 4.37E-01 | -------- | -------- |
| TOTAL FOR PERIOD (ABOVE) | CI | 3.80E+00 | 1.33E+01 | -------- | -------- |
| **2. IODINES** | | | | | |
| I131 | CI | 6.74E-04 | 3.35E-03 | -------- | -------- |
| I133 | CI | 1.82E-03 | 6.85E-03 | -------- | -------- |
| TOTAL FOR PERIOD (ABOVE) | CI | 2.49E-03 | 1.02E-02 | -------- | -------- |
| **3. PARTICULATES** | | | | | |
| SR89 | CI | 4.77E-05 | 2.70E-07 | -------- | -------- |
| SR90 | CI | 1.06E-06 | 6.00E-09 | -------- | -------- |
| TOTAL FOR PERIOD (ABOVE) | CI | 4.87E-05 | 2.76E-07 | -------- | -------- |

Attachment 6

Solid Waste

## Solid Waste

Solid Waste Shipped Offsite for Disposal During
Period from January 1 to June 30, 1991

WASTE STREAM:
Resins, Filters, & Evap. Bottoms

| Waste Class | Cu. Feet | Cu. Meters | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 2730.0 | 77.2 | 9.01 E+02 | ± 25% |
| B | 136.0 | 3.8 | 1.14 E+03 | N/A |
| C | 0 | 0 | 0 | N/A |
| ALL | 2866.0 | 81.0 | 2.04 E+03 | ± 25% |

WASTE STREAM:
Dry Active Waste

| Waste Class | Cu. Feet | Cu. Meters | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 8960.0 | 253.5 | 1.41 E+00 | ± 25% |
| B | 0 | 0 | 0 | N/A |
| C | 0 | 0 | 0 | N/A |
| ALL | 8960.0 | 253.5 | 1.41 E+00 | ± 25% |

NOTE: 5120 cubic feet have been shipped for compaction. An 8 to 1 reduction factor is expected. No dry active waste was shipped for direct burial during the reporting period.

WASTE STREAM:
Irradiated Fuel

| Waste Class | Cu. Feet | Cu. Meters | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 0 | 0 | 0 | N/A |
| B | 0 | 0 | 0 | N/A |
| C | 0 | 0 | 0 | N/A |
| ALL | 0 | 0 | 0 | N/A |

WASTE STREAM:
Other Waste

| Waste Class | Cu. Feet | Cu. Meters | Curies Shipped | % Error (Ci) |
|---|---|---|---|---|
| A | 0 | 0 | 0 | N/A |
| B | 0 | 0 | 0 | N/A |
| C | 0 | 0 | 0 | N/A |
| ALL | 0 | 0 | 0 | N/A |

## Solid Waste

Estimates of Major Radionuclides by Waste Type
WASTE TYPE: Resins, Filters, & Evap. Bottoms

| Waste Class | Nuclide Name | Percent Abundance | Curies |
|---|---|---|---|
| A | Fe-55 | 52.146 | 4.70 E+02 |
| | Co-60 | 19.194 | 1.73 E+02 |
| | Zn-65 | 18.084 | 1.63 E+02 |
| | Mn-54 | 5.281 | 4.76 E+01 |
| | Cs-134 | 0.996 | 8.98 E+00 |
| | Co-58 | 0.997 | 8.81 E+00 |
| | Cr-51 | 0.953 | 8.59 E+00 |
| | Cs-137 | 0.641 | 5.78 E+00 |
| | Ni-63 | 0.458 | 4.13 E+00 |
| | Fe-59 | 0.416 | 3.75 E+00 |
| | Ce-144 | 0.336 | 3.03 E+00 |
| | H-3 | 0.258 | 2.33 E+00 |
| | C-14 | 0.114 | 1.03 E+00 |
| | Ag-110m | 0.099 | 8.91 E-01 |
| | Ni-59 | 0.022 | 2.00 E-01 |
| | Sr-90 | 0.021 | 1.86 E-01 |
| | Pu-241 | 0.002 | 1.63 E-02 |
| | Pu-239/40 | 0.000 | 9.51 E-04 |
| | Cm-242 | 0.000 | 5.72 E-04 |
| | Am-241 | 0.000 | 3.93 E-04 |
| | Pu-238 | 0.000 | 1.39 E-04 |
| | Cm-241 | 0.000 | 1.49 E-05 |
| | I-129 | 0.000 | 0.00 E+00 |
| | Nb-94 | 0.000 | 0.00 E+00 |
| | Tc-99 | 0.000 | 0.00 E+00 |

## Solid Waste

Estimates of Major Radionuclides by Waste Type
WASTE TYPE: Resins, Filters, & Evap. Bottoms

| Waste Class | Nuclide Name | Percent Abundance | Curies |
|---|---|---|---|
| B | Fe-55 | 63.623 | 7.25 E+02 |
| | Co-60 | 19.043 | 2.17 E+02 |
| | Zn-65 | 9.214 | 1.05 E+02 |
| | Mn-54 | 3.396 | 3.87 E+01 |
| | Cs-137 | 1.711 | 1.95 E+01 |
| | Cs-134 | 1.439 | 1.64 E+01 |
| | Ag-110m | 0.676 | 7.70 E+00 |
| | Ni-63 | 0.316 | 3.60 E+00 |
| | Co-58 | 0.274 | 3.12 E+00 |
| | Sr-90 | 0.222 | 2.53 E+00 |
| | Ce-144 | 0.067 | 7.69 E-01 |
| | Fe-59 | 0.015 | 1.66 E-01 |
| | H-3 | 0.002 | 2.33 E-02 |
| | Pu-241 | 0.001 | 1.29 E-02 |
| | C-14 | 0.001 | 5.76 E-03 |
| | Tc-99 | 0.000 | 1.57 E-03 |
| | Pu-239/40 | 0.000 | 4.07 E-04 |
| | Pu-238 | 0.000 | 7.42 E-05 |
| | Am-241 | 0.000 | 2.57 E-05 |
| | Cm-242 | 0.000 | 0.00 E+00 |
| | I-129 | 0.000 | 0.00 E+00 |
| | Nb-94 | 0.000 | 0.00 E+00 |
| | Ni-59 | 0.000 | 0.00 E+00 |

Attachment 6 (continued page 4 of 4)

## SOLID WASTE

WASTE TYPE: Dry Active Waste

| Waste Class | Nuclide Name | Percent Abundance | Curies |
|---|---|---|---|
| A | Fe-55 | 84.451 | 1.19 E+00 |
| | Co-60 | 8.587 | 1.21 E-01 |
| | Mn-54 | 6.025 | 8.49 E-02 |
| | Co-58 | 0.295 | 4.15 E-03 |
| | Fe-59 | 0.204 | 2.88 E-03 |
| | Zn-65 | 0.139 | 1.96 E-03 |
| | Cr-51 | 0.076 | 1.08 E-03 |
| | Sb-124 | 0.061 | 8.56 E-04 |
| | Ag-110m | 0.046 | 6.45 E-04 |
| | Ni-63 | 0.044 | 6.22 E-04 |
| | Nb-95 | 0.023 | 3.22 E-04 |
| | Cs-137 | 0.021 | 3.01 E-04 |
| | Ce-144 | 0.014 | 2.01 E-04 |
| | Cs-134 | 0.010 | 1.34 E-04 |
| | Sr-90 | 0.001 | 1.61 E-05 |
| | Pu-241 | 0.000 | 4.51 E-06 |
| | C-14 | 0.000 | 3.57 E-06 |
| | Ni-59 | 0.000 | 2.88 E-06 |
| | H-3 | 0.000 | 2.45 E-06 |
| | Tc-99 | 0.000 | 2.54 E-07 |
| | Cm-243/44 | 0.000 | 1.85 E-07 |
| | Cm-242 | 0.000 | 8.68 E-08 |
| | Pu-238 | 0.000 | 2.65 E-08 |
| | Pu-239/40 | 0.000 | 2.18 E-08 |
| | Am-241 | 0.000 | 9.16 E-09 |

Solid Waste Disposal Summary

| No. of Shipments | Mode of Transportation | Destination |
|---|---|---|
| 8 | Truck | Barnwell |
| 11 | Truck | Richland |
| 0 | N/A | Beatty |
| 0 | N/A | Other |

Attachment 7

Meteorological Data

## Joint Frequency Distribution Tables - 1991: Quarters 1 & 2

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 14 | 94 | 73 | 18 | 0 | 0 | 199 |
| NNE | 19 | 72 | 86 | 1 | 0 | 0 | 179 |
| NE | 36 | 84 | 111 | 46 | 0 | 0 | 278 |
| ENE | 68 | 114 | 129 | 37 | 3 | 0 | 351 |
| E | 99 | 89 | 18 | 0 | 2 | 0 | 208 |
| ESE | 99 | 67 | 29 | 1 | 0 | 0 | 196 |
| SE | 62 | 61 | 35 | 39 | 0 | 0 | 197 |
| SSE | 50 | 76 | 51 | 21 | 0 | 0 | 198 |
| S | 49 | 101 | 80 | 18 | 2 | 0 | 250 |
| SSW | 36 | 154 | 140 | 45 | 2 | 2 | 379 |
| SW | 28 | 144 | 170 | 45 | 2 | 0 | 390 |
| WSW | 21 | 77 | 205 | 143 | 41 | 2 | 489 |
| W | 14 | 101 | 213 | 101 | 11 | 0 | 440 |
| WNW | 15 | 90 | 93 | 26 | 3 | 0 | 227 |
| NW | 16 | 96 | 79 | 16 | 6 | 0 | 213 |
| NNW | 16 | 61 | 67 | 2 | 0 | 0 | 147 |
| TOTAL | 642 | 1481 | 1579 | 559 | 72 | 4 | 4341 |

PERIODS OF CALM(HOURS): 15
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| NNE | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| NE | 1 | 0 | 10 | 16 | 0 | 0 | 27 |
| ENE | 1 | 0 | 0 | 1 | 1 | 0 | 3 |
| E | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| SE | 0 | 1 | 0 | 1 | 0 | 0 | 2 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| SW | 1 | 3 | 0 | 3 | 0 | 0 | 7 |
| WSW | 0 | 1 | 1 | 2 | 0 | 0 | 4 |
| W | 0 | 0 | 5 | 0 | 1 | 0 | 6 |
| WNW | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| NW | 1 | 4 | 1 | 0 | 0 | 0 | 6 |
| NNW | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| TOTAL | 5 | 13 | 25 | 23 | 2 | 0 | 68 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Joint Frequency Distribution Tables - 1991: Quarters 1 & 2

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| NNE | 0 | 0 | 21 | 0 | 0 | 0 | 21 |
| NE | 1 | 1 | 17 | 11 | 0 | 0 | 30 |
| ENE | 1 | 2 | 1 | 1 | 1 | 0 | 6 |
| E | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| ESE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| SSE | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| S | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| SSW | 0 | 3 | 1 | 0 | 0 | 0 | 4 |
| SW | 0 | 1 | 6 | 0 | 0 | 0 | 7 |
| WSW | 0 | 0 | 4 | 6 | 1 | 0 | 11 |
| W | 0 | 3 | 10 | 16 | 4 | 0 | 33 |
| WNW | 1 | 1 | 8 | 2 | 0 | 0 | 12 |
| NW | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 4 | 18 | 72 | 40 | 6 | 0 | 140 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 4 | 9 | 1 | 0 | 0 | 14 |
| NNE | 0 | 6 | 24 | 0 | 0 | 0 | 30 |
| NE | 0 | 12 | 16 | 7 | 0 | 0 | 35 |
| ENE | 0 | 2 | 5 | 4 | 1 | 0 | 12 |
| E | 0 | 1 | 1 | 0 | 1 | 0 | 3 |
| ESE | 0 | 1 | 6 | 0 | 0 | 0 | 7 |
| SE | 0 | 1 | 1 | 4 | 0 | 0 | 6 |
| SSE | 0 | 3 | 2 | 1 | 0 | 0 | 6 |
| S | 0 | 2 | 5 | 0 | 0 | 0 | 7 |
| SSW | 0 | 4 | 1 | 0 | 0 | 0 | 5 |
| SW | 0 | 2 | 9 | 4 | 0 | 0 | 15 |
| WSW | 0 | 3 | 12 | 11 | 3 | 0 | 29 |
| W | 0 | 3 | 41 | 18 | 1 | 0 | 63 |
| WNW | 0 | 2 | 12 | 0 | 0 | 0 | 14 |
| NW | 0 | 5 | 15 | 1 | 0 | 0 | 21 |
| NNW | 0 | 1 | 7 | 0 | 0 | 0 | 8 |
| TOTAL | 0 | 52 | 166 | 51 | 6 | 0 | 275 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Joint Frequency Distribution Tables - 1991: Quarters 1 & 2

### HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 9 | 79 | 62 | 16 | 0 | 0 | 166 |
| NNE | 7 | 54 | 36 | 1 | 0 | 0 | 98 |
| NE | 9 | 61 | 66 | 12 | 0 | 0 | 148 |
| ENE | 4 | 59 | 108 | 31 | 0 | 0 | 202 |
| E | 7 | 33 | 14 | 0 | 1 | 0 | 55 |
| ESE | 4 | 15 | 18 | 1 | 0 | 0 | 38 |
| SE | 2 | 16 | 22 | 28 | 0 | 0 | 68 |
| SSE | 4 | 16 | 37 | 12 | 0 | 0 | 69 |
| S | 3 | 31 | 40 | 13 | 1 | 0 | 88 |
| SSW | 4 | 36 | 79 | 34 | 1 | 1 | 155 |
| SW | 6 | 31 | 97 | 34 | 2 | 0 | 170 |
| WSW | 10 | 53 | 159 | 115 | 36 | 2 | 375 |
| W | 5 | 74 | 154 | 65 | 5 | 0 | 303 |
| WNW | 6 | 77 | 70 | 24 | 3 | 0 | 180 |
| NW | 4 | 75 | 63 | 15 | 6 | 0 | 163 |
| NNW | 8 | 55 | 59 | 2 | 0 | 0 | 124 |
| TOTAL | 92 | 765 | 1084 | 403 | 55 | 3 | 2402 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

### HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 2 | 10 | 0 | 0 | 0 | 0 | 12 |
| NNE | 8 | 11 | 1 | 0 | 0 | 0 | 20 |
| NE | 4 | 9 | 0 | 0 | 0 | 0 | 13 |
| ENE | 14 | 41 | 14 | 0 | 0 | 0 | 69 |
| E | 20 | 37 | 1 | 0 | 0 | 0 | 58 |
| ESE | 10 | 32 | 5 | 0 | 0 | 0 | 47 |
| SE | 7 | 24 | 12 | 3 | 0 | 0 | 46 |
| SSE | 11 | 31 | 11 | 8 | 0 | 0 | 61 |
| S | 16 | 51 | 33 | 5 | 1 | 0 | 106 |
| SSW | 19 | 92 | 58 | 11 | 1 | 1 | 182 |
| SW | 11 | 101 | 58 | 4 | 0 | 0 | 174 |
| WSW | 7 | 19 | 29 | 9 | 1 | 0 | 65 |
| W | 5 | 18 | 3 | 2 | 0 | 0 | 28 |
| WNW | 2 | 10 | 1 | 0 | 0 | 0 | 13 |
| NW | 7 | 8 | 0 | 0 | 0 | 0 | 15 |
| NNW | 5 | 4 | 1 | 0 | 0 | 0 | 10 |
| TOTAL | 148 | 498 | 227 | 42 | 3 | 1 | 919 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Joint Frequency Distribution Tables - 1991: Quarters 1 & 2

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| NNE | 2 | 1 | 1 | 0 | 0 | 0 | 4 |
| NE | 7 | 1 | 1 | 0 | 0 | 0 | 9 |
| ENE | 19 | 6 | 1 | 0 | 0 | 0 | 26 |
| E | 19 | 13 | 0 | 0 | 0 | 0 | 32 |
| ESE | 15 | 15 | 0 | 0 | 0 | 0 | 30 |
| SE | 7 | 10 | 0 | 0 | 0 | 0 | 17 |
| SSE | 10 | 22 | 0 | 0 | 0 | 0 | 32 |
| S | 9 | 10 | 0 | 0 | 0 | 0 | 19 |
| SSW | 5 | 17 | 0 | 0 | 0 | 0 | 22 |
| SW | 8 | 6 | 0 | 0 | 0 | 0 | 14 |
| WSW | 3 | 1 | 0 | 0 | 0 | 0 | 4 |
| W | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| WNW | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| [illegible] | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTAL | 112 | 105 | 3 | 0 | 0 | | 221 |

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91063024
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NNE | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NE | 14 | 0 | 1 | 0 | 0 | 0 | 16 |
| ENE | 29 | 4 | 0 | 0 | 0 | 0 | 33 |
| E | 52 | 2 | 1 | 0 | 0 | 0 | 55 |
| ESE | 70 | 1 | 0 | 0 | 0 | 0 | 71 |
| SE | 46 | 9 | 0 | 0 | 0 | 0 | 55 |
| SSE | 25 | 3 | 0 | 0 | 0 | 0 | 28 |
| S | 21 | 7 | 0 | 0 | 0 | 0 | 28 |
| SSW | 8 | 2 | 0 | 0 | 0 | 0 | 10 |
| SW | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| WSW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| W | 3 | 1 | 0 | 0 | 0 | 0 | 3 |
| WNW | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NW | 2 | 1 | 0 | 0 | 0 | 0 | 3 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL | 281 | 30 | 2 | 0 | 0 | 0 | 316 |

PERIODS OF CALM(HOURS): 14
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Joint Frequency Distribution Tables - 1991: Quarter 1

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 3 | 33 | 51 | 18 | 0 | 0 | 105 |
| NNE | 5 | 35 | 19 | 1 | 0 | 0 | 60 |
| NE | 6 | 33 | 41 | 16 | 0 | 0 | 96 |
| ENE | 9 | 42 | 51 | 15 | 0 | 0 | 117 |
| E | 17 | 49 | 10 | 0 | 0 | 0 | 76 |
| ESE | 23 | 29 | 18 | 0 | 0 | 0 | 70 |
| SE | 11 | 24 | 22 | 12 | 0 | 0 | 69 |
| SSE | 22 | 44 | 40 | 16 | 0 | 0 | 122 |
| S | 17 | 48 | 68 | 16 | 2 | 0 | 151 |
| SSW | 16 | 44 | 105 | 41 | 2 | 2 | 210 |
| SW | 16 | 45 | 112 | 32 | 0 | 0 | 205 |
| WSW | 13 | 39 | 131 | 94 | 29 | 1 | 307 |
| W | 6 | 56 | 105 | 58 | 8 | 0 | 233 |
| WNW | 4 | 51 | 58 | 25 | 3 | 0 | 141 |
| NW | 5 | 41 | 54 | 14 | 6 | 0 | 120 |
| NNW | 8 | 30 | 40 | 0 | 0 | 0 | 78 |
| TOTAL | 181 | 643 | 925 | 358 | 50 | 3 | 2160 |

PERIODS OF CALM(HOURS): 2
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 2 | 4 | 0 | 0 | 6 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ESE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| SW | 0 | 3 | 0 | 3 | 0 | 0 | 6 |
| WSW | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| W | 0 | 0 | 4 | 0 | 1 | 0 | 5 |
| WNW | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| NW | 1 | 2 | 0 | 0 | 0 | 0 | 3 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 1 | 8 | 9 | 10 | 1 | 0 | 29 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

## Joint Frequency Distribution Tables - 1991: Quarter 1

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| NNE | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| NE | 0 | 0 | 3 | 2 | 0 | 0 | 5 |
| ENE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| SSE | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| S | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| SSW | 0 | 3 | 1 | 0 | 0 | 0 | 4 |
| SW | 0 | 0 | 6 | 0 | 0 | 0 | 6 |
| WSW | 0 | 0 | 4 | 5 | 1 | 0 | 10 |
| W | 0 | 2 | 5 | 1 | 3 | 0 | 11 |
| WNW | 0 | 1 | 7 | 2 | 0 | 0 | 10 |
| NW | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 10 | 32 | 14 | 4 | 0 | 60 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 4 | 1 | 0 | 0 | 5 |
| NNE | 0 | 1 | 3 | 0 | 0 | 0 | 4 |
| NE | 0 | 2 | 3 | 3 | 0 | 0 | 8 |
| ENE | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 1 | 5 | 0 | 0 | 0 | 6 |
| SE | 0 | 0 | 1 | 2 | 0 | 0 | 3 |
| SSE | 0 | 2 | 2 | 1 | 0 | 0 | 5 |
| S | 0 | 1 | 5 | 0 | 0 | 0 | 6 |
| SSW | 0 | 3 | 1 | 0 | 0 | 0 | 4 |
| SW | 0 | 1 | 9 | 2 | 0 | 0 | 12 |
| WSW | 0 | 2 | 9 | 6 | 3 | 0 | 20 |
| W | 0 | 2 | 10 | 4 | 0 | 0 | 16 |
| WNW | 0 | 1 | 7 | 0 | 0 | 0 | 8 |
| NW | 0 | 0 | 8 | 0 | 0 | 0 | 8 |
| NNW | 0 | 0 | 6 | 0 | 0 | 0 | 6 |
| TOTAL | 0 | 16 | 76 | 19 | 3 | 0 | 114 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

Joint Frequency Distribution Tables - 1991: Quarter 1

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 2 | 31 | 47 | 16 | 0 | 0 | 96 |
| NNE | 3 | 32 | 13 | 1 | 0 | 0 | 49 |
| NE | 2 | 29 | 33 | 7 | 0 | 0 | 71 |
| ENE | 2 | 24 | 45 | 15 | 0 | 0 | 86 |
| E | 4 | 19 | 8 | 0 | 0 | 0 | 31 |
| ESE | 1 | 10 | 11 | 0 | 0 | 0 | 22 |
| SE | 0 | 9 | 14 | 4 | 0 | 0 | 27 |
| SSE | 0 | 11 | 29 | 7 | 0 | 0 | 47 |
| S | 1 | 24 | 34 | 11 | 1 | 0 | 71 |
| SSW | 2 | 15 | 59 | 31 | 1 | 1 | 109 |
| SW | 6 | 12 | 59 | 24 | 0 | 0 | 101 |
| WSW | 7 | 31 | 110 | 75 | 24 | 1 | 248 |
| W | 2 | 44 | 84 | 52 | 4 | 0 | 186 |
| WNW | 3 | 45 | 42 | 23 | 3 | 0 | 116 |
| NW | 1 | 33 | 46 | 14 | 6 | 0 | 100 |
| NNW | 7 | 28 | 33 | 0 | 0 | 0 | 68 |
| TOTAL | 43 | 397 | 667 | 280 | 39 | 2 | 1428 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 1 | 2 | 0 | 0 | 0 | 0 | 3 |
| NNE | 1 | 2 | 0 | 0 | 0 | 0 | 3 |
| NE | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| ENE | 4 | 13 | 2 | 0 | 0 | 0 | 19 |
| E | 5 | 22 | 1 | 0 | 0 | 0 | 28 |
| ESE | 6 | 13 | 2 | 0 | 0 | 0 | 21 |
| SE | 3 | 7 | 7 | 2 | 0 | 0 | 19 |
| SSE | 9 | 18 | 8 | 8 | 0 | 0 | 43 |
| S | 12 | 20 | 27 | 5 | 1 | 0 | 65 |
| SSW | 8 | 21 | 43 | 10 | 1 | 1 | 84 |
| SW | 6 | 29 | 38 | 3 | 0 | 0 | 76 |
| WSW | 4 | 5 | 8 | 6 | 1 | 0 | 24 |
| W | 3 | 7 | 2 | 1 | 0 | 0 | 13 |
| WNW | 1 | 4 | 0 | 0 | 0 | 0 | 5 |
| NW | 3 | 3 | 0 | 0 | 0 | 0 | 6 |
| NNW | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| TOTAL | 69 | 170 | 139 | 35 | 7 | 1 | 417 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| ENE | 2 | 1 | 1 | 0 | 0 | 0 | 4 |
| E | 6 | 7 | 0 | 0 | 0 | 0 | 13 |
| ESE | 3 | 4 | 0 | 0 | 0 | 0 | 7 |
| SE | 3 | 7 | 0 | 0 | 0 | 0 | 10 |
| SSE | 6 | 10 | 0 | 0 | 0 | 0 | 16 |
| S | 2 | 1 | 0 | 0 | 0 | 0 | 3 |
| SSW | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| SW | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| WSW | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| W | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 32 | 32 | 1 | 0 | 0 | 0 | 65 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91010101-91033124
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 1 | 3 | 0 | 0 | 0 | 0 | 4 |
| E | 2 | 0 | 1 | 0 | 0 | 0 | 3 |
| ESE | 13 | 0 | 0 | 0 | 0 | 0 | 13 |
| SE | 5 | 1 | 0 | 0 | 0 | 0 | 6 |
| SSE | 7 | 2 | 0 | 0 | 0 | 0 | 9 |
| S | 2 | 2 | 0 | 0 | 0 | 0 | 4 |
| SSW | 5 | 1 | 0 | 0 | 0 | 0 | 6 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 36 | 10 | 1 | 0 | 0 | 0 | 47 |

PERIODS OF CALM(HOURS): 2
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0

## Joint Frequency Distribution Tables - 1991: Quarter 2

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 11 | 61 | 22 | 0 | 0 | 0 | 94 |
| NNE | 14 | 37 | 67 | 0 | 0 | 0 | 119 |
| NE | 30 | 51 | 70 | 30 | 0 | 0 | 182 |
| ENE | 59 | 72 | 78 | 22 | 3 | 0 | 234 |
| E | 82 | 40 | 8 | 0 | 2 | 0 | 132 |
| ESE | 76 | 38 | 11 | 1 | 0 | 0 | 126 |
| SE | 51 | 37 | 13 | 27 | 0 | 0 | 128 |
| SSE | 28 | 32 | 11 | 5 | 0 | 0 | 76 |
| S | 32 | 53 | 12 | 2 | 0 | 0 | 99 |
| SSW | 20 | 110 | 35 | 4 | 0 | 0 | 169 |
| SW | 12 | 99 | 58 | 13 | 2 | 0 | 185 |
| WSW | 8 | 38 | 74 | 49 | 12 | 1 | 182 |
| W | 8 | 45 | 108 | 43 | 3 | 0 | 207 |
| WNW | 11 | 39 | 35 | 1 | 0 | 0 | 86 |
| NW | 11 | 55 | 25 | 2 | 0 | 0 | 93 |
| NNW | 8 | 31 | 27 | 2 | 0 | 0 | 69 |
| TOTAL | 461 | 838 | 654 | 201 | 22 | 1 | 2181 |

PERIODS OF CALM(HOURS): 13
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| NNE | 0 | 0 | 3 | 0 | 0 | 0 | 3 |
| NE | 1 | 0 | 8 | 12 | 0 | 0 | 21 |
| ENE | 1 | 0 | 0 | 1 | 1 | 0 | 3 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| WSW | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| W | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 2 | 1 | 0 | 0 | 0 | 3 |
| NNW | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| TOTAL | 4 | 5 | 16 | 13 | 1 | 0 | 39 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Attachment 7 (Continued - Page 10 of 12)
## Joint Frequency Distribution Tables - 1991: Quarter 2

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 18 | 0 | 0 | 0 | 18 |
| NE | 1 | 1 | 14 | 9 | 0 | 0 | 25 |
| ENE | 1 | 1 | 1 | 1 | 1 | 0 | 5 |
| E | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| ESE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| WSW | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| W | 0 | 1 | 5 | 15 | 1 | 0 | 22 |
| WNW | 1 | 0 | 1 | 0 | 0 | 0 | 2 |
| NW | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 4 | 8 | 40 | 26 | 2 | 0 | 80 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 4 | 5 | 0 | 0 | 0 | 9 |
| NNE | 0 | 5 | 21 | 0 | 0 | 0 | 26 |
| NE | 0 | 10 | 13 | 4 | 0 | 0 | 27 |
| ENE | 0 | 2 | 2 | 4 | 1 | 0 | 9 |
| E | 0 | 1 | 1 | 0 | 1 | 0 | 3 |
| ESE | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| SE | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| SSE | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| S | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SSW | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| SW | 0 | 1 | 0 | 2 | 0 | 0 | 3 |
| WSW | 0 | 1 | 3 | 5 | 0 | 0 | 9 |
| W | 0 | 1 | 31 | 14 | 1 | 0 | 47 |
| WNW | 0 | 1 | 5 | 0 | 0 | 0 | 6 |
| NW | 0 | 5 | 7 | 1 | 0 | 0 | 13 |
| NNW | 0 | 1 | 1 | 0 | 0 | 0 | 2 |
| TOTAL | 0 | 36 | 90 | 32 | 3 | 0 | 161 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

Attachment 7 (Continued - Page 11 of 12)
<u>Joint Frequency Distribution Tables - 1991: Quarter 2</u>

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 7 | 48 | 15 | 0 | 0 | 0 | 70 |
| NNE | 4 | 22 | 23 | 0 | 0 | 0 | 49 |
| NE | 7 | 32 | 33 | 5 | 0 | 0 | 77 |
| ENE | 2 | 35 | 63 | 16 | 0 | 0 | 116 |
| E | 3 | 14 | 6 | 0 | 1 | 0 | 24 |
| ESE | 3 | 5 | 7 | 1 | 0 | 0 | 16 |
| SE | 2 | 7 | 8 | 24 | 0 | 0 | 41 |
| SSE | 4 | 5 | 8 | 5 | 0 | 0 | 22 |
| S | 2 | 7 | 6 | 2 | 0 | 0 | 17 |
| SSW | 2 | 21 | 20 | 3 | 0 | 0 | 46 |
| SW | 0 | 19 | 38 | 10 | 2 | 0 | 69 |
| WSW | 3 | 22 | 49 | 40 | 12 | 1 | 127 |
| W | 3 | 30 | 70 | 13 | 1 | 0 | 117 |
| WNW | 3 | 32 | 28 | 1 | 0 | 0 | 64 |
| NW | 3 | 42 | 17 | 1 | 0 | 0 | 63 |
| NNW | 1 | 27 | 26 | 2 | 0 | 0 | 56 |
| TOTAL | 49 | 368 | 417 | 123 | 16 | 1 | 974 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | WIND SPEED(MPH) 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 1 | 8 | 0 | 0 | 0 | 0 | 9 |
| NNE | 7 | 9 | 1 | 0 | 0 | 0 | 17 |
| NE | 2 | 7 | 0 | 0 | 0 | 0 | 9 |
| ENE | 10 | 28 | 12 | 0 | 0 | 0 | 50 |
| E | 15 | 15 | 0 | 0 | 0 | 0 | 30 |
| ESE | 4 | 19 | 3 | 0 | 0 | 0 | 26 |
| SE | 4 | 17 | 5 | 1 | 0 | 0 | 27 |
| SSE | 2 | 13 | 3 | 0 | 0 | 0 | 18 |
| S | 4 | 31 | 6 | 0 | 0 | 0 | 41 |
| SSW | 11 | 71 | 15 | 1 | 0 | 0 | 98 |
| SW | 5 | 72 | 20 | 1 | 0 | 0 | 98 |
| WSW | 3 | 14 | 21 | 3 | 0 | 0 | 41 |
| W | 2 | 11 | 1 | 1 | 0 | 0 | 15 |
| WNW | 1 | 6 | 1 | 0 | 0 | 0 | 8 |
| NW | 4 | 5 | 0 | 0 | 0 | 0 | 9 |
| NNW | 4 | 2 | 0 | 0 | 0 | 0 | 6 |
| TOTAL | 79 | 328 | 88 | 7 | 0 | 0 | 502 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

## Joint Frequency Distribution Tables - 1991: Quarter 2

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| | WIND SPEED(MPH) | | | | | | |
| N | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| NNE | 2 | 1 | 1 | 0 | 0 | 0 | 4 |
| NE | 5 | 1 | 1 | 0 | 0 | 0 | 7 |
| ENE | 17 | 5 | 0 | 0 | 0 | 0 | 22 |
| E | 13 | 6 | 0 | 0 | 0 | 0 | 19 |
| ESE | 12 | 11 | 0 | 0 | 0 | 0 | 23 |
| SE | 4 | 3 | 0 | 0 | 0 | 0 | 7 |
| SSE | 4 | 12 | 0 | 0 | 0 | 0 | 16 |
| S | 7 | 9 | 0 | 0 | 0 | 0 | 16 |
| SSW | 4 | 16 | 0 | 0 | 0 | 0 | 20 |
| SW | 4 | 6 | 0 | 0 | 0 | 0 | 10 |
| WSW | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| W | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| WNW | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NW | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| TOTAL | 80 | 73 | 2 | 0 | 0 | 0 | 156 |

PERIODS OF CALM(HOURS): 1
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91040101-91063024
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| | WIND SPEED(MPH) | | | | | | |
| N | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NNE | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| NE | 14 | 0 | 1 | 0 | 0 | 0 | 16 |
| ENE | 28 | 1 | 0 | 0 | 0 | 0 | 29 |
| E | 50 | 2 | 0 | 0 | 0 | 0 | 52 |
| ESE | 57 | 1 | 0 | 0 | 0 | 0 | 58 |
| SE | 41 | 8 | 0 | 0 | 0 | 0 | 49 |
| SSE | 18 | 1 | 0 | 0 | 0 | 0 | 19 |
| S | 19 | 5 | 0 | 0 | 0 | 0 | 24 |
| SSW | 3 | 1 | 0 | 0 | 0 | 0 | 4 |
| SW | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| WSW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| W | 2 | 1 | 0 | 0 | 0 | 0 | 3 |
| WNW | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| NW | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL | 245 | 20 | 1 | 0 | 0 | 0 | 269 |

PERIODS OF CALM(HOURS): 12
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 3

Attachment 8

Abnormal Gaseous Release

OM12A: CHI-54
Page : 43 - LAST
Rev. : 1

Attachment 13
Form: OM12A: CHI-54-11

Abnormal Gaseous Effluent Release Data Sheet

Start/End Dates 03-04-91 / 03-05-91 9103042100 - 9103050245

Meteorological Data/area(s) of concern (Attach Joint Frequency Distribution Tables): See attached

Source of Material (include Vent): Loss of MVI, Stm leaks in TB - used HVAC estimated flowrate and weekly average iodine levels in building

Remarks Lost all mvl exhaust fans HVAC supplied flowrates of supply fans, isotopic from weekly analysis. Condition Report 91-555 documents event.

1.60E-3 mrem / 5.75 hrs x 8760 hrs / yr = 2.44 mrem/yr dose rate

| A | B | C | D | E = B X C X D | F |
|---|---|---|---|---|---|
| Isotope | Concentration (uCi/cc) | Flow Rate (cfm) | Conversion Factor | Release Rate (uCi/sec) | Activity (Ci) |
| I-133 | 5.58E-12 | 198,000 | 472 | 5.2E-4 | 10.8 |
| N/A | | | 472 | | |
| | | | 472 | | |
| | | | 472 | | |
| | | | 472 | | |
| | | | 472 | | |
| | | | 472 | | |
| | | | 472 | | |

10CFR20 Compliance (T.S.3.11.2.1)

| (mrem/yr) | Dose Rate | LIMIT |
|---|---|---|
| Noble Gas Total Body | Ø | 500 |
| Noble Gas Skin | Ø | 3000 |
| Organ | 2.44E0 | 1500 |

10CFR50 App. I Compliance (T.S.3.11.2.2 & 3)

| (mrad or mrem) | Release | Qtr (1) | Qtr LIMIT | Annual | Ann LIMIT |
|---|---|---|---|---|---|
| NG Air γ | Ø | 9.02E-3 | 5.0 | 9.02E-3 | 10.0 |
| NG Air β | Ø | 1.08E-2 | 10.0 | 1.08E-2 | 20.0 |
| Organ | 1.60E-3 | 4.47E-3 | 7.5 | 4.47E-3 | 15.0 |
| Total Body* | Ø | 5.72E-3 | 2.5 | 5.72E-3 | 5.0 |

* Not a TS limit; 5mrem/yr is 10CFR50, Appendix I dose limit

(1) Doses thru 3/10/91 2400 hrs

Performed By Jim R-tiker Date 3/11/91

Reviewed By Chris Shult Date 3/12/91

1 7892 0450

SITE: PERRY 03/11/91 14:48

USER: JR

SUMMARY OF MAXIMUM INDIVIDUAL DOSES
LAST ACCUMULATIONS FOR PERIODS:

GASEOUS 91 3 421-91 3 5 3
AIR 91 3 421-91 3 5 3

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | LOCATION DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 0.00E+00 | | 273. | N | 0.0E+00 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 0.00E+00 | | 273. | N | 0.0E+00 | 2.0E+01 |
| NOBLE GAS | T.BODY | 0.00E+00 | ALL | 5. | N | 0.0E+00 | 5.0E+00 |
| NOBLE GAS | SKIN | 0.00E+00 | ALL | 5. | N | 0.0E+00 | 1.0E+01 |
| IODINE& PARTICULATES | THYROID | 1.60E-03 | CHILD | 283. | WNW | 1.1E-02 | 1.0E+01 |

SITE: PERRY

USER: JR

03/11/91 15:08

SUMMARY OF MAXIMUM INDIVIDUAL DOSES
LAST ACCUMULATIONS FOR PERIODS:

GASEOUS - 91 1 1 1-91 31024
AIR 91 1 1 1-91 31024

| EFFLUENT | APPLICABLE ORGAN | ESTIMATED DOSE (MREM) | AGE GROUP | LOCATION DIST (M) | LOCATION DIR (TOWARD) | % OF APPLICABLE LIMIT | LIMIT (MREM) |
|---|---|---|---|---|---|---|---|
| NOBLE GAS | AIR DOSE (GAMMA-MRAD) | 9.02E-03 | | 294. | N | 9.0E-02 | 1.0E+01 |
| NOBLE GAS | AIR DOSE (BETA-MRAD) | 1.08E-02 | | 294. | N | 5.4E-02 | 2.0E+01 |
| NOBLE GAS | T.BODY | 5.72E-03 | ALL | 294. | N | 1.1E-01 | 5.0E+00 |
| NOBLE GAS | SKIN | 1.47E-02 | ALL | 294. | N | 9.8E-02 | 1.5E+01 |
| IODINE& PARTICULATES | THYROID | 4.47E-03 | CHILD | 280. | NNW | 3.0E-02 | 1.5E+01 |

SITE: PERRY UNIT: UNIT 1 03/11/91 14:50

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND SPEED(MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|
| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY　　UNIT: UNIT 1　　03/11/91 14:50

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:50

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91030421-91030503

STABILITY CLASS: C DT/DZ

ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PERIODS OF CALM(HOURS): 0

VARIABLE DIRECTION 0

HOURS OF MISSING DATA: 0

ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:50

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:50

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL | 1 | 1 | 0 | 0 | 0 | 0 | 2 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:51

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [&O] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:51

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| SSE | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 4 | 0 | 0 | 0 | 0 | 0 | 4 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

SITE: PERRY UNIT: UNIT 1 03/11/91 14:51

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 91030421-91030503
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED:SPD10P DIRECTION:DIR10P LAPSE:DT50M

WIND SPEED(MPH)

| WIND DIRECTION | 1-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ENE | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ESE | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| SE | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| SSE | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| S | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| WSW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| W | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| WNW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NNW | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| TOTAL | 6 | 1 | 0 | 0 | 0 | 0 | 7 |

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA: 0
ENTER: [RETURN] CONTINUE, [SO] START OVER, [EX] TO EXIT

ENTER: [1] STABILITY TABLE A
[2] STABILITY TABLE B
[3] STABILITY TABLE C
[4] STABILITY TABLE D
[5] STABILITY TABLE E
[6] STABILITY TABLE F
[7] STABILITY TABLE G
[8] SUMMARY OF ALL TABLES
[9] PRINT EACH TABLE SEPARATELY
[RETURN] GO BACK TO PREVIOUS OPTION

ENTER: [N] SPEED SENSOR NUMBER,
[RETURN] GO BACK TO PREVIOUS OPTION

ENTER: [1] REG. 1.21 FORMAT
[2] NON REG. 1.21 FORMAT INCLUDING AVE WIND SPEED
[RETURN] GO BACK TO PREVIOUS OPTION

ENTER: [1] ONE SET OF DATES,
[2] MULTIPLE START AND END DATES
[RETURN] EXITS PROGRAM

Attachment 9

Gaseous Effluent Monitoring Instrumentation

NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

# LICENSEE EVENT REPORT (LER)



FACILITY NAME (1): Perry Nuclear Power Plant, Unit 1

DOCKET NUMBER (2): 0 5 0 0 0 4 4 0

PAGE (3): 1 OF 0 5

TITLE (4): Program Deficiencies Resulted in an Inoperable Effluent Flow Monitor Without the Required Compensatory Actions Taken, Resulting in a Technical Specification Violation

| EVENT DATE (5) | | | LER NUMBER (6) | | | REPORT DATE (7) | | | OTHER FACILITIES INVOLVED (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAMES | DOCKET NUMBER(S) |
| | | | | | | | | | | 0 5 0 0 0 |
| 0 6 | 0 5 | 9 1 | 9 1 | 0 1 2 | 0 0 | 0 7 | 0 3 | 9 1 | | 0 5 0 0 0 |

OPERATING MODE (9): 1

POWER LEVEL (10): 1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

| | | | |
|---|---|---|---|
| 20.402(b) | 20.405(c) | 50.73(a)(2)(iv) | 73.71(b) |
| 20.405(a)(1)(i) | 50.36(c)(1) | 50.73(a)(2)(v) | 73.71(c) |
| 20.405(a)(1)(ii) | 50.36(c)(2) | 50.73(a)(2)(vii) | OTHER (Specify in Abstract below and in Text, NRC Form 366A) |
| 20.405(a)(1)(iii) | X 50.73(a)(2)(i) | 50.73(a)(2)(viii)(A) | |
| 20.405(a)(1)(iv) | 50.73(a)(2)(ii) | 50.73(a)(2)(viii)(B) | |
| 20.405(a)(1)(v) | 50.73(a)(2)(iii) | 50.73(a)(2)(x) | |

LICENSEE CONTACT FOR THIS LER (12)

NAME: Henry L. Hegrat, Compliance Engineer, Extension 5185

TELEPHONE NUMBER: AREA CODE 2 1 6 | 2 5 9 - 3 7 3 7

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO NPRDS |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) — X NO

EXPECTED SUBMISSION DATE (15): MONTH DAY YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On June 5, 1991, it was determined that the effluent system flow rate monitor for the Turbine Building/Heater Bay Building (TB/HB) vent radiation monitor had been inoperable during two fan operation since the summer of 1988. During this time, the effluent flow rate was not estimated every four hours in violation of Technical Specif ication 3.3.7.10.

The causes of this event were program deficiencies. The preoperational testing program did not fully test the accuracy of the vent effluent flow monitors. The current program does not verify the accuracy of this flow sensing device, or adequately compensate for deviations in air temperature.

All other vent effluent flow monitors were evaluated for similar flow degradation with no problem found. This pitot tube array will be calibrated by capping individual pitot tubes as required and possible degradation will be investigated. The calibration instructions for the TB/HB vent and similar effluent flow monitors will be revised to evaluate the performance of the flow sensing device. Prior to restoring the flow monitor to operable status during two fan operation, a mechanism for temperature compensation will be established. This event will be discussed as part of the licensed operator requalification program.



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NRC FORM 366A (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

| FACILITY NAME (1) | DOCKET NUMBER (2) | LER NUMBER (6) YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | PAGE (3) |
|---|---|---|---|---|---|
| Perry Nuclear Power Plant, Unit 1 | 0 5 0 0 0 4 4 0 | 9 1 | — 0 1 2 | — 0 0 | 0 2 OF 0 5 |

TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. Introduction

On June 5, 1991, it was determined that the effluent system flow rate monitor for the Turbine Building/Heater Bay Building (TB/HB) vent radiation monitor had been inoperable during two fan operation since the summer of 1988. During this time, the effluent flow rate was not estimated every four hours in violation of Technical Specification 3.3.7.10. At the time of the discovery the plant was in Operational Condition 1 (Power Operation) at 100 percent power with the Reactor Pressure Vessel [RPV] at 1025 psi and saturated conditions.

II. Event Description

On May 10, 1991, the Turbine Building/Heater Bay Building ventilation system was changed from one fan operation (winter mode) to two fan operation (summer mode). Subsequent Technical Specification channel check taken on the TB/HB vent effluent flow monitor indicated a flow rate of 280,000 cubic feet per minute (cfm). The difference between the monitor reading and the expected flow of 345,000 cfm was considered to be excessive and the flow monitor was declared inoperable. Extensive troubleshooting of the flow monitor revealed no instrumentation deficiencies. On May 30, 1991, the low flow reading on the TB/HB vent effluent flow monitor was confirmed when a flow measurement over the stack outlet with a hot-wire anemometer found the actual flow to be 324,000 cfm. On June 5, 1991 further research into the history of this equipment found that during preoperational testing the vent effluent flow monitor was never verified to indicate the actual effluent flow in the summer mode. A review of operating data shows a degradation in indicated flow beginning in 1986, with the indicator considered to have been inoperable since the summer of 1988. Additionally, this data may have contributed to nonconservative reporting of dose as part of the Semiannual Effluent Report.

III. Cause Analysis

The reason that the TB/HB vent effluent flow monitor indicates lower than the actual stack flow in the summer mode is due to one or more of the following factors. The pitot tube is located such that excessive turbulence in the duct could cause negative pressure areas in the pitot tube region with both fans running. With only one fan operating in the winter mode, the turbulence region does not extend into the pitot tube array, allowing it to accurately sense stack flow in this mode of operation. Blocked or leaking total pressure port sensing lines in the pitot tube array could cause an indicated artificially low flow. The same response would occur if the flow element tubing were partially blocked with dirt. Additionally, the flow instrumentation can not automatically compensate for changing air flow temperature. The exact failure mechanism is unknown at this time.

The failure to identify the degradation in indicated stack flow was due to program deficiencies. The preoperational testing program did not fully test the accuracy of the vent effluent flow monitors. The current surveillance program



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does not verify the accuracy of this flow sensing device, or adequately compensate for deviations in air temperature. A discussion of each of these factors is provided in the following paragraphs.

During preoperational testing, all of the pitot tube arrays associated with flow monitors included in the plant Heating, Ventilation and Air Condition (HVAC) Systems were verified to indicate the actual eff'uent flow rate. In some cases the flow sensing element was calibrated (selected pitot tubes capped) to assure that the monitor indicated the actual duct flow rates. Although pitot tubes do not normally require calibration, due to the location of these devices some were modified to obtain the correct flow indication. To confirm the effluent flow rate design criteria, TB/HB vent effluent flow was determined to be 345,000 cfm with two fans running. This value, however, was never compared to the TB/HB vent effluent flow monitor indication. Operator readings taken from this flow monitor during the summer of 1986 were approximately 330,000 cfm. While a five percent deviation between the flow monitor indication and the testing value is within the expected accuracy of the pitot tube array, it shows the monitor may never have indicated the actual effluent flow.

Tech Spec 4.3.7.10 requires a quarterly functional test and an eighteen month calibration of these monitors. Both of these requirements are satisfied by a combined functional and calibration on a quarterly frequency. However, there is currently no method to identify deviations in pitot tube output to the flow monitor. The current effluent flow, as measured on May 30, 1991 with a hot-wire anemometer, of 324,000 cfm is a decrease of six percent from the 345,000 cfm flow measured during preoperational testing. This decrease could be due to dirt/dust in the duct work or a gradual fan flow degradation. The current reading of 280,000 cfm is a fifteen percent decrease from the operator log readings of approximately 330,000 cfm taken during the summer of 1986. The fact that the effluent flow monitor indication has decreased at a greater rate than the actual effluent flow, indicates a possible degradation of the flow sensing element.

The TB/HB vent effluent flow monitor measures the velocity pressure in inches of water. A conversion scale is placed on the monitor indication to convert this value to a volumetric flow rate in cubic feet per minute. The conversion used considers the air to be at 70 degrees Fahrenheit and 29.92 inches of Mercury. Actual TB/HB vent effluent temperatures average approximately 125 degrees Fahrenheit in the summer months. This 55 degree difference in temperature can alter the indicated volumetric flow rate by as much as five percent. Changes in barometric pressure have less of an impact on the indicated flow. This variation can also partially explain why lower than expected flow rates are noted in the summer months and that indicated flow has degraded over time as the heat rate in the plant has increased.



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IV. Corrective Action

All other vent effluent flow monitors were evaluated for similar problems. The remaining three effluent pitot tube arrays are installed in long straight ducts; the turbulence region does not extend into the pitot tube arrays to cause inaccurate flow measurements. These effluents are all filtered discharge pathways, in which the particulates which could degrade the pitot tube are removed. Additionally, the air temperature of these effluents does not deviate excessively from the calibrated value and therefore does not affect the accuracy of the indicated flow rates. With all of these factors considered, the TB/HB vent effluent flow monitor is the only one which deviates from the expected flow value.

This pitot tube array will be calibrated before the end of the third refuel outage, by capping individual pitot tubes as required. The condition of the pitot tube array will be investigated to determine the cause of any degradation. The TB/HB ventilation system will be cleaned in an effort to restore system flow. The calibration instructions for the Turbine Building/Heater Bay Building vent and similar effluent flow monitors will be revised to evaluate the performance of the flow sensing device, by comparing actual flow values to a predetermined acceptance criteria. Prior to restoring the flow monitor to operable status during two fan operation, a mechanism for temperature compensation will be established.

Until the pitot tube array can be calibrated, the monitor will remain inoperable during two fan operation, and the default value of 345,000 cfm will be used for calculating dose reported in the Semiannual Radiological Effluent Release Report. A revision to the Semiannual Radiological Effluent Release Report will be submitted for the time periods when the flow monitor reading differed from the actual flow reading by greater than ten percent. This event will be discussed as part of the licensed operator requalification program to stress the value of channel checks in evaluating plant performance.

V. Safety Analysis

The radioactive gaseous effluent instrumentation is provided to monitor the release of radioactive materials in gaseous effluents during actual or potential releases. The operability and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, 64 and 100 of Appendix A to 10 CFR Part 50. The flow monitor portion of this instrumentation is used in calculating the offsite dose. Although the err[illegible] in flow was in the nonconservative direction, the total plant eff[illegible]ent doses during the time this instrument was inoperable were significantly less than Technical Specification limits. Applying appropriate correction factors to the non-conservative contribution of TB/HB effluents would not result in total effluent doses exceeding the Technical Specification limits. This event is not considered to be safety significant.

Two incidents involving flow estimates not being performed when the vent effluent flow instrument was inoperable were reported by LER 86004 and 86011. Both of these events were attributed to personnel error, and the corrective actions of training those personnel involved would not have prevented this event. Another event involving improper calibration of liquid effluent flow instrumentation due to procedural deficiency was reported by LER 90019. In that event the flow sensing element improperly calibrated is a turbinemeter, was improperly calibrated as a result of inadequate calibration instruction. The corrections made to its calibration instruction would not be applicable to any of the vent effluent flow monitors.

Energy Industry Identification System Codes are identified in the text as [XX].



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Attachment 10

Process Control Program (PCP) Changes

The Cleveland Electric Illuminating Company

PERRY OPERATIONS MANUAL

Process Control Program

TITLE: PROCESS CONTROL PROGRAM (PCP)

REVISION: 5 EFFECTIVE DATE: ~~6/3/91~~ 6-6-91 ~~5-31-91~~

PERRY CONTROLLED
COPY No.
032

PREPARED: James T. Ratchen *James T. Ratchen* 5-9-91
Date

REVIEWED: *[signature]* 5/10/91
Date

PORC REVIEW AND RECOMMENDATION FOR APPROVAL MEETING NUMBER: 91-030
DATE: 5-16-91

APPROVED: *[signature]* 5/23/91
Date

# Process Control Program (PCP)

## Table of Contents

10CFR50.59 Applicability Check

| | Yes | No |
|---|---|---|
| 1. Is there a change to the plant as described in the USAR? Reason: This is an instruction and does not change the plant. | ☐ | ☒ |
| 2. Is there a change to a procedure/instruction as described in the USAR? Reason: This instruction does not change a procedure/instruction as described in the USAR. Ref. Section 11.4 The USAR describes an interface controlled by this instruction. | ☐ | ☒ |
| 3. Is there a test or experiment not described in the USAR that might affect the safe operation of the plant? Reason: This is not a test or experiment. It is an instruction. | ☐ | ☒ |
| 4. Is there a change to the Technical Specifications or Operating License? Reason: This instruction will not change Technical Specifications or the Operating License. | ☐ | ☒ |
| 5. Is there an effect on the environment or change to the Environmental Protection Plan? Reason: This instruction will not effect the environment or change the EPP. Performance of this instruction does not create a release to the environment | ☐ | ☒ |

☒ Answers to all questions are "No", no potential for an Unreviewed Safety or Environmental Question exists, no further review required.

☐ Answers to Questions 1, 2, or 3 marked "YES", preparation of a safety evaluation is required. Safety Evaluation No. ______

☐ Answer to Question 4 marked "YES", preparation of a license amendment is required. Letter No. ______

☐ Answer to Question 5 marked "YES", preparation of an environmental evaluation is required. Environmental Eval. No. ______

| Prepared/Date | Reviewed/Date | Manager Approved/Date |
|---|---|---|
| [signature] Randall L. Wolf 5-10-91 | [signature] 5/10/91 | [signature] 5/13/91 |

SCOPE OF REVISION:

Rev. 5 - 1. TC's from previous revision that were evaluated for incorporation - TCN-1 and 2.
2. Revised in its entirety, no rev. bars needed.
3. The Revision allows for the utilization of new processing vendors and the processing of waste from chemical decontamination.

# PROCESS CONTROL PROGRAM (PCP)

## 1.0 INTRODUCTION

The Process Control Program (PCP) is designed to provide administrative control and guidance for the solidification, dewatering and other processing of applicable forms of radwaste for ultimate disposal. The PCP contains information pertaining to the current formula (mixing ratio), sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of radioactive wastes, based on demonstrated processing of actual or simulated wet solid wastes, will be accomplished in such a way as to ensure compliance with 10CFR20, 10CFR61, 10CFR71, Federal and State regulations, burial ground requirements and other requirements governing the disposal of radioactive waste.

The PCP is applicable to the plant installed and Pacific Nuclear Co., Chem-Nuclear and Scientific Ecology Group (SEG) supplied mobile radwaste systems for solidification and dewatering of applicable waste forms. The PCP is not applicable for intermediary processing at offsite vendors.

Numerous features have been incorporated into the design of the solid radioactive waste system and the building housing this system to insure that exposures of operating personnel to radiation will be kept within ALARA guidelines.

## 1.1 Definitions

The following definitions are applicable to the sections that follow:

ACCEPTABLE ENVELOPE: (of solidification\dewatering): specific properties of wastes that fall within the limits of the parameters required for solidification. These parameters are established within the test solidification instruction for each applicable waste type.

BATCH: the volume of isolated waste contained in a tank that will be processed for solidification or dewatering.

CONTAINER: the physical container in which the final waste product is deposited.

HIGH INTEGRITY CONTAINER (HIC): an approved container for burial having an expected life of 300 years. All HIC's must have an approved Certificate of Compliance.

SOLIDIFICATION: the conversion of radioactive materials from liquid and solid systems to a monolithic, immobilized solid with a definite volume and shape, bounded by a stable surface of distinct outline on all sides (free standing), with a free water content of less than 0.5% by volume.

## 2.0 WASTE TYPES

There are numerous types of radioactive material expected to be generated at the Perry Plant that will require processing, including solidification or dewatering, prior to their disposal. These radwaste types can be categorized based on their chemical and physical properties. The waste types expected at PNPP are evaporator concentrates (bottoms), bead resins, filter demineralizer media sludge, traveling belt filter cake, filter cartridges, oily waste, and dry active waste (DAW).

The following waste types (other than DAW) may be solidified individually or in combination, with the provision that the chemistry of the waste falls within the acceptable envelope for solidification.

### 2.1 Evaporator Concentrates (Bottoms)

Evaporator concentrates (bottoms) result from the processing of the chemical waste tanks which contain condensate demineralizer regeneration solutions and/or low concentrations of the following: trisodium phosphate, minute amounts of other chemicals used for chemistry analyses, or decontamination solutions. They will normally be in the range of 5% to 25% sodium sulfate by weight.

### 2.2 Bead Resins

Bead resins are collected from the condensate, liquid radwaste, and suppression pool demineralizers and stored in the spent resin tank. Bead resins are also collected from chemical decontamination processes.

### 2.3 Filter Demineralizer Media Sludge

Sludge is the waste product generated by the backwash of the condensate filters, the reactor water cleanup filter/demineralizers, and the fuel pool filter/demineralizers. Sludge may consist of powdered ion exchange resin at varying degrees of exhaustion, fibrous filter media, and small concentrations of various solids and corrosion products. The media are decanted prior to solidification/dewatering in the appropriate settling tank.

2.4 Traveling Belt Filter Cake

This is the product remaining on the liquid radwaste traveling belt filters used to process waste water streams. It consists of one or more of the following; diatomaceous earth or powdered resin, various solids, dirt, and corrosion products in small concentrations.

2.5 Filter Cartridges

Filter cartridges from the detergent drain tank system, CRD pump suction and discharge filters, and any other disposable-type filter cartridge that may be used in permanent or temporary, plant or vendor systems are included in this category.

2.6 Oily Waste

Oily waste is that oil collected in liquid radwaste systems as a resulting from leakage and maintenance on various lubrication and hydraulic systems.

2.7 Dry Active Waste (DAW)

Contaminated air filters, paper, rags, clothing, tools, equipment and parts, that cannot be effectively decontaminated are contained in this category. Also included are laboratory wastes.

2.8 Other Materials

Various other materials not specifically identified above, will be evaluated for solidification or dewatering on a case-by-case basis.

3.0 PROCESS DESCRIPTION

The following process descriptions apply to both plant and vendor supplied systems. Any differences between the two have been noted.

3.1 Filling of Tanks

Once it is determined that a liquid radwaste system batch tank is to be processed, it will be recirculated to ensure a homogeneous mixture. Eductors inside the tanks enhance the mixing capabilities. The tank will be isolated using the plant's tagout program to ensure that no additional waste is added.

## 3.2 Sampling/Analysis

Samples will be obtained and analyzed for each batch of waste in accordance with OM12C: CHI-42, OM12A: CHI-78, and OM1A: PAP-1102, respectively for the plant system, or vendor procedures and PCP for vendor supplied systems. Prior to sampling, tanks will undergo sufficient mixing and/or recirculation to ensure representative sampling. At a minimum, for solidification, analyses will be performed for radionuclide content, pH, oil content, and settled solids (oil and concentrates only). At a minimum, for devatering, analyses will be performed for radionuclide and oil content. These analyses are necessary to ensure that the waste falls within the acceptable envelopes for solidification/devatering.

## 3.3 Preconditioning

Waste preconditioning is the chemical or physical adjustment of the waste to bring it within an established acceptability envelope to ensure solidification. The need for and type of preconditioning shall be determined using sample analysis results and will be performed in accordance with OM12A: CHI-78 or vendor procedures and PCP. Upon completion of waste preconditioning, additional samples shall be obtained, as required, to determine solidification mixing ratios.

Oily wastes may require special preconditioning. Handling of oily wastes will be conducted in accordance with burial ground requirements.

## 3.4 Mixing Ratios

Mixing ratios give the respective amounts of waste and solidification agents required for acceptable solidification. The determination of mixing ratios shall be performed for each batch of waste to be solidified. Solidification mixing ratios are dependent upon percent settled solids and sodium sulfate concentration. The waste type and ratios of cement, waste, sodium sulfate (for Class A waste), and water are determined in OM12A: CHI-78 or vendor procedures and PCP.

## 3.5 Devatering

Devatering is the removal of water from solid material to a concentration of less than 0.5% or 1.0% by volume, as applicable to containers used and burial site limits. Devatering of radioactive spent resins, filter sludges and traveling belt filter cake shall be performed in accordance with approved operating procedures which are based upon documented test data demonstrating the ability to achieve drainable water limits as specified in applicable regulations.

## 3.6 Solidification Processing

### 3.6.1 Description of Plant Processing System

Solidification and/or dewatering of wet solid radioactive waste will be processed by Chem-Nuclear's Rapid Dewatering System, NUPAC Services Division's Resin Drying System or by SEG's Mobile System. These systems are discussed in Section 3.6.2. The following description applies to the plant installed solid radwaste system that will interface with the vendor equipment (See Figure 1).

(INTENTIONALLY BLANK)

## Solid Radioactive Waste Processing System

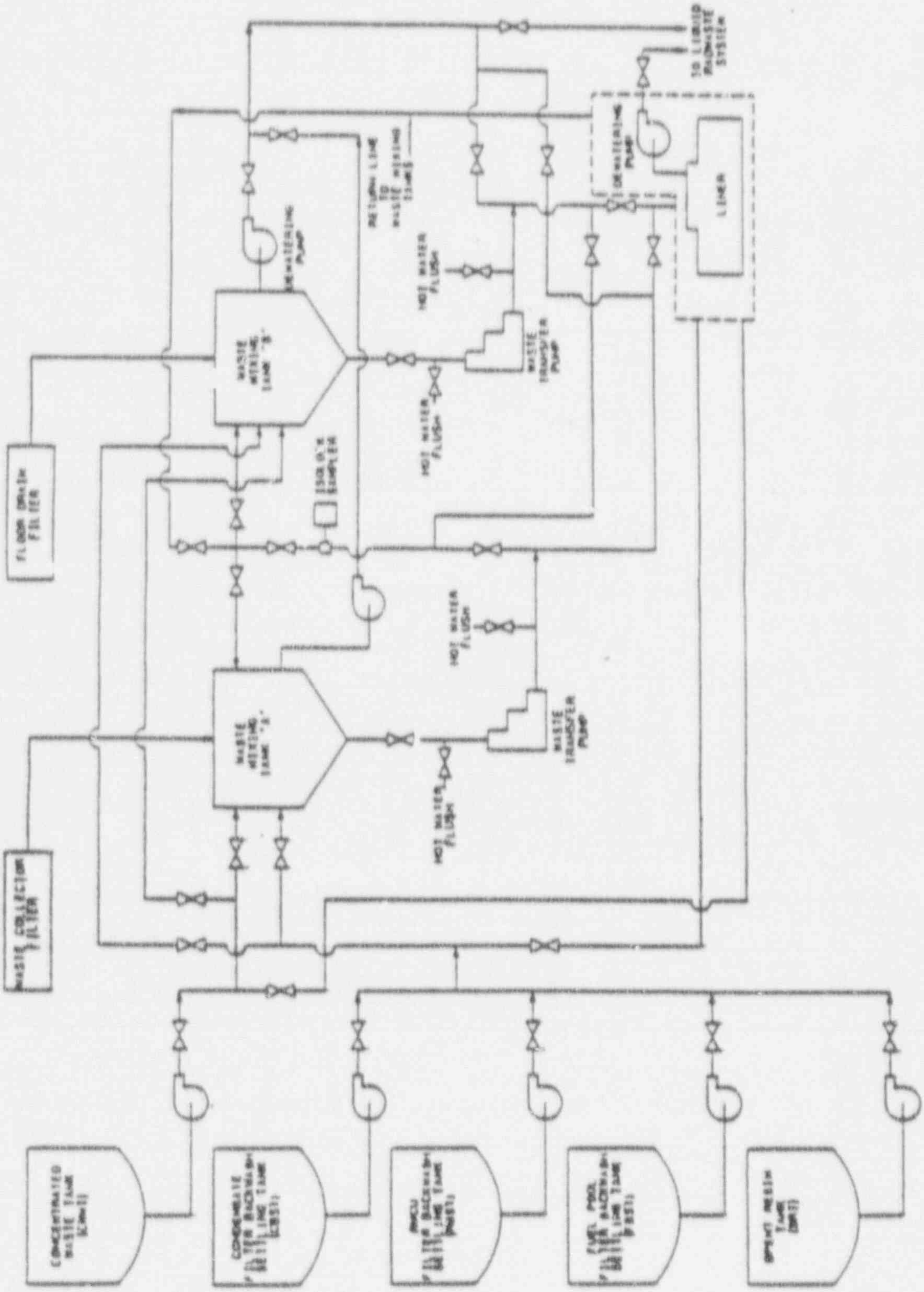


Figure 1

After the proper amount of waste has been accumulated in a settling or waste tanks or has been transferred to the waste mixing tank, the tank is decanted to remove excess free water (except when the waste being handled is traveling belt filter cake, in which case a predetermined amount of water or other approved aqueous solution is added to the tank for slurry transfer of the contents). The waste slurry is transferred at a preset rate to the vendor's equipment, in accordance with OM13A: RWI-G51-(SRW), where it is either dewatered or solidified with cement. The waste mixing tanks and settling tanks have recirculation capabilities where a representative sample can be drawn. If needed, a dewatering connection is available which is routed to the liquid radwaste system. An additional connection has been provided back to the waste mixing tank for use in the event of a liner overfill condition. Hot water flush connections are provided to thoroughly flush the plant and the vendor equipment into the liner used for processing. The waste transfer line and dewatering return lines are located behind a two foot thick shield wall to reduce exposure to the operator during processing.

3.6.2 Description of the Vendor's Waste Processing System

The wet solid radioactive waste will be transferred to the vendor's equipment to be dewatered or solidified in accordance with site approved procedures. Table 1 lists the Topical Reports, procedures and any comments for each vendor.

The vendor's equipment is located in the Radwaste Building in the fill aisle, storage area, and truck bay (see Figure 2). Normal processing of radioactive waste will be performed in the fill aisle with only the vendor's cement transfer equipment being located in the cement silo room. Periodically, when determined prudent, waste will be processed in the truck bay. When this is performed several restrictions will be imposed to minimize the potential for radioactive spill and ensure the principles of ALARA are maintained. These include; all processing to be performed in an NRC approved cask, all hosing and associated connections to be placed in hose bags, truck bay access doors to have temporary curbing placed in front of them, and locking all access areas to the truck bay. The areas where the processing takes place are specifically designed to handle the movement, storage, and processing of radioactive waste. Concrete walls and floors in these areas have protective coatings and shield/ cask walls are provided between the vendors equipment and potential radioactive sources to keep personnel exposures ALARA. The storage area is large enough to contain 15 liners. This provides adequate storage before it is shipped to a burial site.

## Vendor Procedures for Radwaste Processing

| Vendor | Topical Report | Operating Procedures | Comments |
|---|---|---|---|
| Chem-Nuclear | Radioactive Waste Dewatering System, RDS-25506-01-P-A | Setup and Operating Procedure for the RDS-1000 Unit, FO-OP-032 | 1. Test solidifications will be run on each batch of the same waste type. |
| | Mobile Cement Solidification System, CMSI-2 | Operating Procedure for the Mobile Cement Solidification Unit No. 221, SD-OP-050 | |
| Pacific-Nuclear | Nuclear Packaging Dewatering System, TP-02-P-A | Resin Drying (Dewatering) System, OM-43-NS | |
| | Pacific Nuclear Systems Radwaste Solidification System, TP-05 | Operation and Maintenance Manual for the NUPAC Radwaste Solidification System, OM-114 | 1. Test solidifications will be run on each batch of the same waste type. |
| | | System Description of Pacific Nuclear System's Radioactive Waste Volume Reduction System RVR-400 | |
| | | Operation Procedure for RVR-400 Liquid Volume Reduction System, OM-0022-NS | |
| Scientific Ecology Group | Stock Equipment Co. Quick Dry Process for Dewatering of Bead Resin and Filter Sludge, SRS-003 | Process Control Program for Dewatering Bead or Powdered Resin with Quick Dry Dewatering System No. 2893, DW-004 | 1. Test solidifications will be run on each batch of the same waste type. |
| | Radwaste Solidification System, PS-53-0378 | SEG Solidification System, SS-001 | 2. Waste will be supplied to the SEG equipment at 20 gpm instead of 40 gpm due to pump limitations. |

Table 1

Vendor Mobile Solidification Equipment Layout

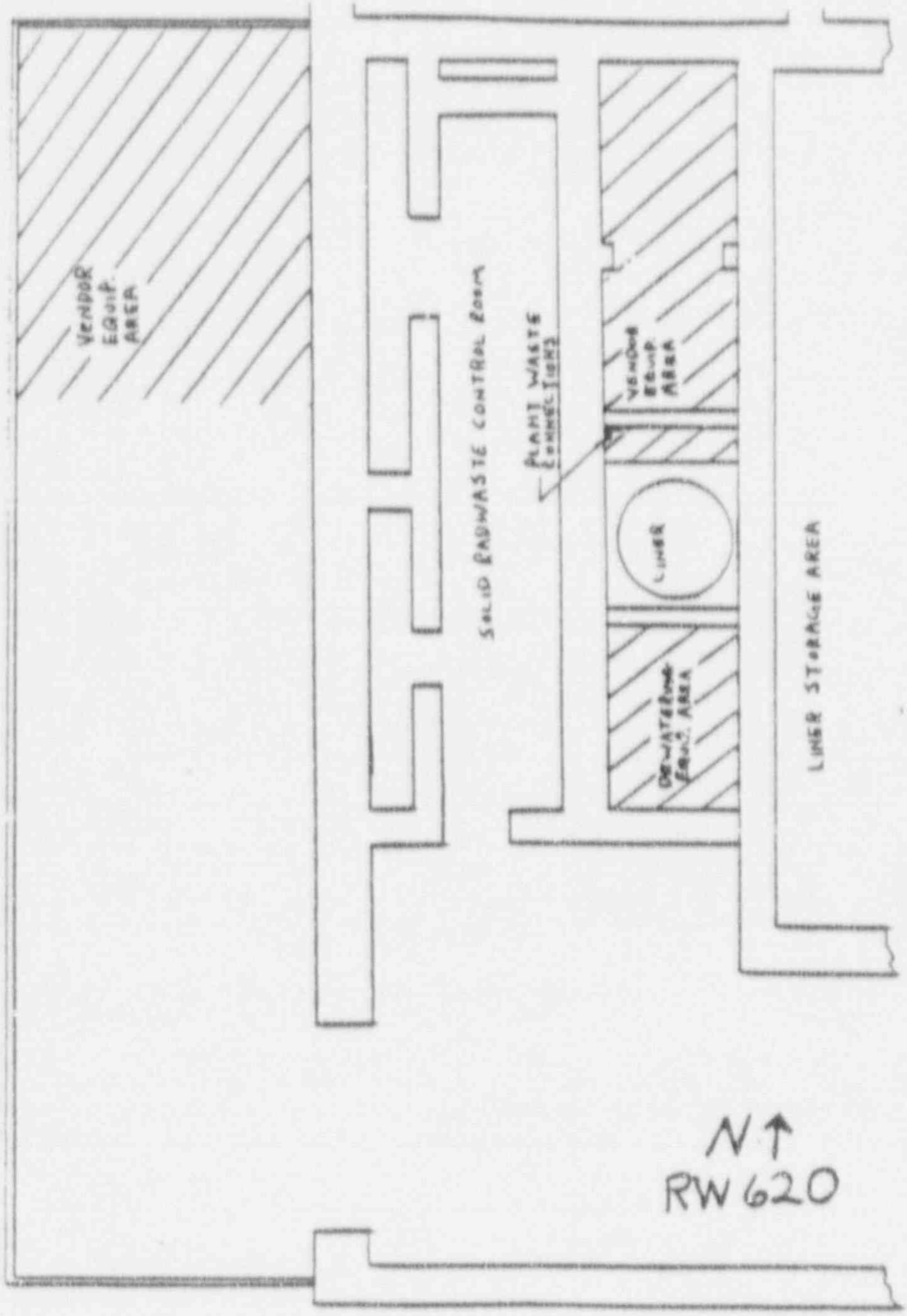


Figure 2

3.6.3 Radiological Effluent Controls and Monitoring

All processing with the vendor's equipment will be performed in a room with a volume sufficient to contain any postulated spill. A floor drain, routed to the liquid radwaste system, provides drainage in this area. All liquid radwaste discharges are sampled and monitored prior to their release to the environment.

Gaseous discharges from liners are processed through the vendor's off-gas blower system as described in the vendor's Topical Report. Ventilation from the areas housing the radwaste treatment and processing equipment, including the vendor's off-gas blower system, is routed through HEPA filters and charcoal beds prior to release to the environment via the Unit 1 Vent. Radiological monitoring is provided for Regulatory Guide 1.21 compliance to meet applicable Federal Code requirements.

3.6.4 Health Physics Support

Health Physics personnel will provide radiological control during the solidification and dewatering process. All work will be conducted under a Radiation Work Permit to keep personnel exposures ALARA.

3.6.5 Plant Utility Support

1. Fire Protection

   Fire suppression is provided above the processing and storage area to protect against fires. A fire hose is available in the truck bay for miscellaneous uses.

2. Two-Way Communication

   A two-way communication system will be used for communication between the plant operator and the vendor equipment operator. This will facilitate smooth coordination between the different segments of the waste processing system.

3. Heating and Ventilation

   The Radwaste Building Ventilation System will maintain a negative pressure in the processing and storage area. Heating is provided by the building heating system whose heat source is the plant auxiliary boiler.

4. Overhead Crane

An overhead crane will be used to transfer equipment between the storage and processing area and the truck bay. The crane has a 15 ton capacity which is fully capable of handling dewatered and solidified liners.

5. Closed Circuit Television

Closed Circuit Television will be used, where applicable, for remote viewing of the processing and storage areas. The overhead crane has an independent camera for viewing all lifting and placing operations.

## 3.7 Cartridge Filters

Cartridge filters may be disposed of by encapsulation in a cement matrix in steel drums or liners. The encapsulation of cartridge filters shall be performed using approved procedures that provide reasonable assurance that the final waste form will meet the stability criteria of the Branch Technical Position on Waste Form. Cartridge filters may also be disposed of by placement in HIC's that are certified by the land disposal facility's State Agency.

## 3.8 Dry Active Waste

Potentially contaminated dry wastes will be collected in containers located throughout the radiologically controlled areas within the plant. The waste will be periodically collected and transported to a temporary storage area prior to waste segregation (as per OM1A: PAP-1901). Waste segregation will be performed to reduce waste volume and to recover reusable materials.

In order to reduce the waste volume, compressible waste will be compacted into shipping containers in accordance with OM13A: RWI-G51-(SRWC). Caution will be taken to avoid items that would cause free water formation as well as other compressibility hazards. Noncompressible waste will be loaded manually into suitable shipping containers.

# 4.0 PRODUCT CONTROL

Dewatering/Solidification processes will be conducted by qualified PNPP or vendor personnel in accordance with approved plant and/or vendor operating instructions and procedures.

PAP-0525, Solid Radwaste Administration will ensure appropriate documentation and compliance with this program.

## 4.1 Test Solidification

Test solidifications are performed on waste stream samples to verify plant and/or vendor calculated solidification formulae. Test shall be performed to support solidification mixing formulae as follows: (1) every batch of the same waste type; (2) when sampling analysis falls outside the normal established envelope and preconditioning is ineffective, (3) following any liner of the same waste type where solidification has been determined to be unacceptable; (4) when it is believed that some unexpected or abnormal containment may be present; or (5) when requested by Chemistry Supervision. A batch that requires test solidification shall not be processed until such time as the test solidification proves acceptable. <L00415>

Upon failure of a test solidification, additional samples shall be obtained and testing will continue until a successful solidification has been performed with revised mixing ratios as determined by Chemistry Supervision. Solidification of the batch may then be continued using the alternate solidification parameters defined by testing.

## 4.2 Product Quality

Solidification process product quality shall be ensured by the use of predetermined mixing ratios of waste and solidification agents. Mixing ratios are based upon laboratory testing of non-radioactive waste materials and are supported by (1) the test solidifications performed periodically, as mentioned above; (2) periodic checks, visual and physical, of actual processed containers filled with solidified waste; and (3) once every two years requalification of the waste form. Requalification includes testing for compressibility in accordance with ASTM C-39-84, following an appropriate immersion period.

## 4.3 Acceptability

The acceptability of the solidified product shall be verified by ensuring that less than 0.5% free standing water exists and that the solidified product appears to be able to hold its shape if it were to be removed form the container.

Unacceptable solidified waste shall be handled as follows: (1) if the reason for unacceptability is free standing water, the free standing water will be removed or extra cement/sodium silicate will be added to solidify the free water; (2) if all or portions of the product did not solidify, the waste container will be capped and placed in a storage location in the Radwaste facility and periodically checked until such time that the product is acceptable or it is determined that additional solidification agents can be added to achieve satisfactory solidification. This will be determined by Chemistry Supervision. The handling of unacceptable solidified waste will be on a case-by-case basis.

Adherence to approved dewatering operating procedures ensure the final product will meet or exceed the standing water requirements of 10CFR61.

Dewatering of radioactive bead resin, filter demineralizer media sludge, and traveling belt filter cake shall be performed in accordance with approved operating procedures which are based upon documented test data demonstrating the ability to remove free water volumes below the applicable regulatory limits.

## 5.0 WASTE CLASSIFICATION, CHARACTERIZATION AND MANIFEST REQUIREMENTS

### 5.1 Waste Classification

All wastes shall be classified in accordance with the requirements of 10CFR61 as implemented by OM1A: PAP-1309 and OM1E: RAP-1102 and performed by the RADMAN computer code. Analyses shall be performed on the waste streams at least annually (biannually for Class A waste), to determine the isotopic abundance of non-gamma emitting isotopes in the streams. Scaling factors, for the non-gamma emitting and transuranic constituents, will be developed from these analyses. Prior to the establishment of an acceptable data, estimated isotopic concentrations will be those obtained from the "Data Base Analysis Report" prepared by Waste Management Group.

The activity of each radionuclide in the radioactive waste shall be determined by a calculational method employing the isotopic analysis of the waste and scaling factors or a dose-to-curie conversion as to be determined by RPS supervision. For DAW, a dose-to-curie conversion factor, percent fraction of the radionuclides, and scaling factors will be used to determine activity.

### 5.2 Waste Characteristics and Manifest Requirements

All wastes shall meet the characteristic requirements of 10CFR61.56 (a) and (b), as applicable, and waste packages shall be marked to identify the waste class. The manifesting requirements of 10CFR20.311 shall be implemented by OM1A: PAP-1309 and performed by the RADMAN computer code. Records are maintained in accordance with 10CFR71.91.

## 6.0 ADMINISTRATIVE CONTROLS

Compliance with applicable state and federal regulations, and with burial site criteria is ensured by compliance with the solid radioactive waste surveillance instructions, OM7A: SVI-G51-T5284. The implementing instructions and procedures for radioactive waste solidification, dewatering, and segregation describe the requirements which must be met prior to processing radioactive waste, as well as the expected condition of the resultant waste form. Test solidifications, full scale calculations and operation of solidification, dewatering and segregation equipment shall be performed by qualified plant staff and vendor personnel. Plant staff personnel shall provide Health Physics and Quality Assurance coverage, operate plant radioactive waste systems, collect waste stream samples, and perform isotopic analyses. Copies of all referenced documents are available onsite for use by personnel engaged in waste processing activities.

Any changes to the Process Control Program shall be reviewed by the Plant Operations Review Committee (PORC) and shall be detailed in the Semiannual Radioactive Effluent Release Report covering that period.

## 7.0 QUALITY ASSURANCE

Quality Assurance related activities for the solid radwaste program are implemented as described in the Perry Nuclear Power Plant Quality Assurance Plan. To prevent unacceptable solidified waste from being released for shipment, test samples will be verified for acceptability by Chemistry Supervision. These activities shall provide verification that all solid radioactive waste meets applicable State and Federal regulations and burial site criteria. A flow chart illustrating the sequence of events for a waste solidification process is provided in Figure 3.

The Quality Assurance Plan also includes a management review of vendor's Topical Report. This will ensure that the vendor's operations and requirements are compatible with the responsibilities and operations of the plant.

Training and qualification of operators will be performed per Regulator Guide 1.8 and ANSI N18.1 - 1971.

For accountability of filled waste containers, a clearly legible storage diagram will be permanently displayed near the radwaste control panel. It will show the position of containers holding wastes, the date the wastes were processed, and their dose rate(s). The storage diagram will be updated to reflect any changes, additions, or deletions to storage.

## Radwaste Process Flow Chart

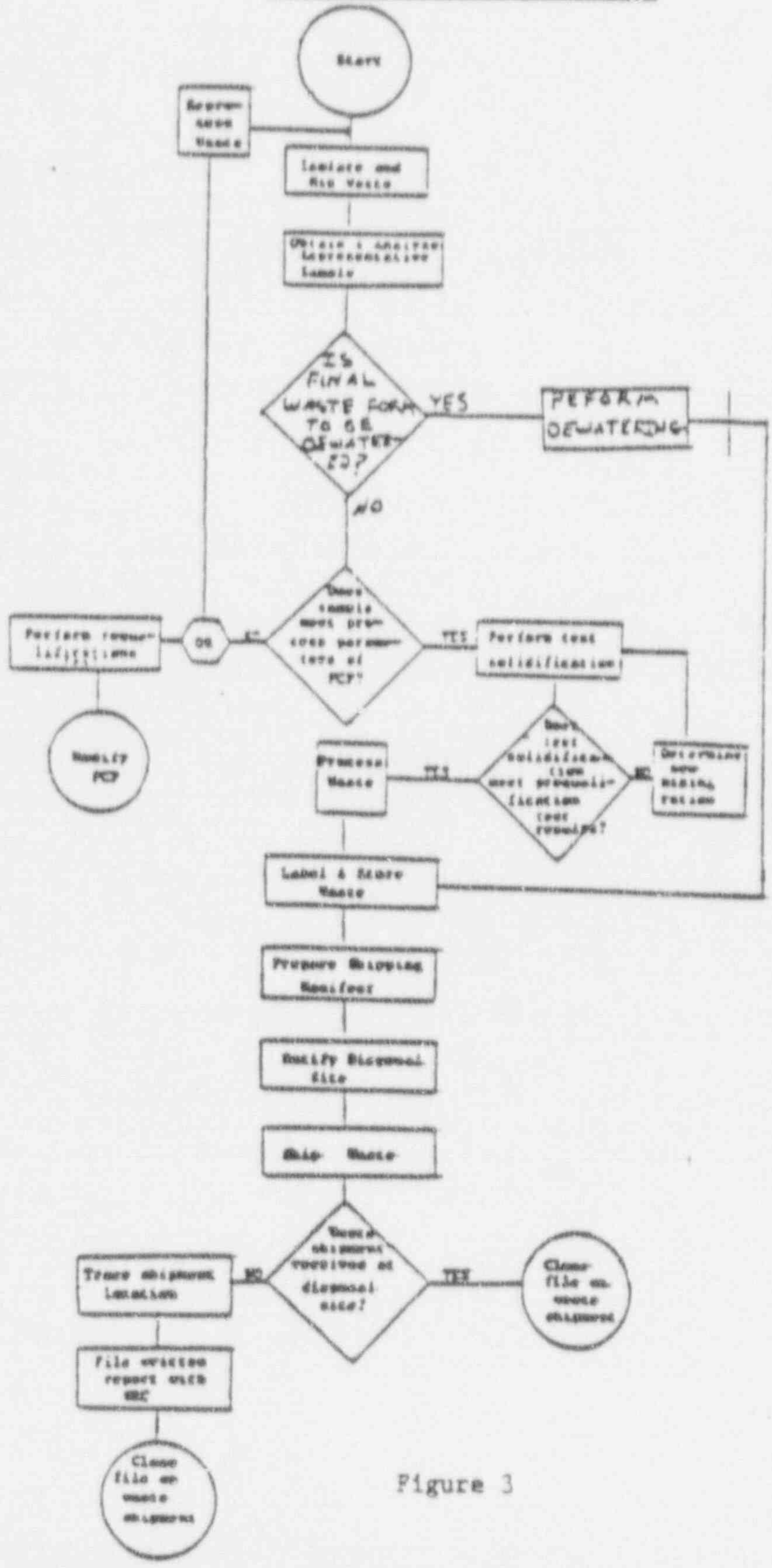


Figure 3

8.0 RECORDS

The following records are generated by this program:

Quality Assurance Records

None

Non Quality Records

None

9.0 ATTACHMENTS

None

10.0 REFERENCES

10.1 Commitments

The following commitments are wholly or in part met by this document:

B00301 F01412 F01464 L00415 S00245

# REFERENCES

1. Title 10, "Energy", Chapter 1, Code of Federal Regulations, Parts 20, 50, 61, and 71, U.S. Government Printing Office, Washington, D.C. 20402, January 1, 1984.

2. Title 49, "Transportation", Chapter 1, Code of Federal Regulations, Parts 170-178, U.S. Government Printing Office, Washington, D.C. 20402, November 1, 1983.

3. U.S. Nuclear Regulatory Commission, "Standard Radiological Effluent Technical Specifications for Boiling Water Reactors", USNRC NUREG-0473, Revision 3, Washington, D.C. 20555, September 1982.

4. U.S. Nuclear Regulatory Commission, "Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification," Revision 0, May 1983.

5. U.S. Nuclear Regulatory Commission, "Branch Technical Position on Waste Form", Revision 0, May 1983.

6. "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens" ASTM C39-84, American Society for Testing and Materials, Philadelphia, Pennsylvania 19103, 1984.

7. Regulatory Guide 1.8, "Personnel Selection and Training", U.S. Nuclear Regulatory Commission, Washington D.C. 20555, September, 1975.

8. "Selection and Training of Nuclear Power Plant Personnel", ANSI-N18.1-1971, American National Standards Institute, New York, New York 10018, 1971.

9. "Radman - A Computer Code to Classify and Document Packaged LLW in Accordance with 10CFR Part 61 Regulations", WMG-NP-A, Waste Management Group, Inc. Croton-on-the-Hudson, New York 10521, May 1983.

10. "Data Base Analysis Report - Perry Nuclear Power Station", Waste Management Group, Inc., Croton-on-the-Hudson, New York, New York 10521, May 1983.

11. SEG Process Control Program for Dewatering Bead or Powdered Resin with Quick Dry Dewatering System No. 2893, DW-004.

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17. Perry Nuclear Power Plant Operations Manual, "Radioactive Shipment Criteria", OM1A: PAP-1304, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

18. Perry Nuclear Power Plant Operations Manual, "Shipment of Radioactive Waste For Disposal", OM1A: PAP-1309, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

19. Perry Nuclear Power Plant Operations Manual, "Dry Radioactive Waste Volume Reduction Program", OM1A: PAP-1901, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

20. Perry Nuclear Power Plant Operations Manual, "Plant Chemistry Control Program", OM1A: PAP-1102, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

21. Perry Nuclear Power Plant Operations Manual, "10CFR61 Compliance Sampling", OM1E: RAP-1102, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

22. Perry Nuclear Power Plant Operations Manual, "Miscellaneous Sampling Systems", OM12C: CHI-42, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

23. Perry Nuclear Power Plant Operations Manual, "PCP Test Solidification", OM12A: CHI-78, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

24. Perry Nuclear Power Plant Operations Manual, "Solid Radwaste Solidification System", OM13A: RWI-G51-SRW, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

25. Perry Nuclear Power Plant Operations Manual, "Solid Radwaste Compaction System", OM13A: RWI-G51-SRWC, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

26. Perry Nuclear Power Plant Operations Manual, "Process Control Program Solidification", OM7A: SVI-G51-T5284, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.

## REFERENCES

27. "Barnwell Waste Management Facility Site Disposal Criteria", Document S20-AD-010, Revision B, Barnwell, South Carolina 29812, January 1, 1982.

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30. Homer, J. C. and Lutz, G. P., "Stock "Quick Dry" Vacuum Compression System for Dewatering and Volume Reduction of Filter Sludge - Summary of Test Results", Stock Equipment Company, 1986.

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34. Chem-Nuclear Topical Report for Mobile Cement Solidification System, CNSI-2.

35. Setup and Operating Procedure for the RDS-1000 Unit, FO-OP-032.

36. Operating Procedure for the Mobile Cement Solidification Unit No. 221, SD-OP-050.

37. Topical Report covering Pacific Nuclear Systems Radwaste Solidification System, TP-05.

38. Operation and Maintenance Manual for the NUPAC Radwaste Solidification System, OM-114.

39. System Description of Pacific Nuclear Systems' Radioactive Waste Volume Reduction System, RVR-800.

40. Operation Procedure for RVR-800 Liquid Volume Reduction System, OM-0022-NS.

Attachment 11

Offsite Dose Calculation Manual (ODCM) Changes

# NON-INTENT INSTRUCTION TEMPORARY CHANGE

PNPP No. 7308 Rev. 5/90 — PAP-0522

| | |
|---|---|
| TEMPORARY CHANGE NO. | TCN- 9 |
| INSTRUCTION NO. | OM12D: ODCM |
| REV. | 3 |
| INSTRUCTION TITLE | Offsite Dose Calculation Manual |
| CANCELS TCN(S) | NA |
| LIST EACH ATTACHED PAGE | IV, 12, 28a, 28b, 79, 81, 86, 87, 88, 89, 90, 91, 113 |
| PREPARER | James T Ratchen [signature] |
| DATE | 2-27-91 |
| ADMIN. USE ONLY | CONTROLLED COPY NO. 032 |

REASON

Remp Locations 30, 50, and ~~72~~ 52 (JTR 2-27-91) are deleted

Remp Locations 28 & 70 are added

The liquid radwaste dilution flow range is added to Section 2.3

Table 2.3-13 is added to include individual dilution factors for each potable water intake within 50 miles of PNPP

Table 2.3-14 is added to include individual dilution factors for each grid location for the fish ingestion pathway

References for tables 2.3-13 and 2.3-14 are added.

Figures 5.1-1, 5.1-2, 5.1-3, Remp maps

☑ CONDITIONAL APPROVAL

| PLANT MANAGEMENT STAFF | DATE | SS or US | DATE |
|---|---|---|---|
| [signature] | 2/27/91 | [signature] | 2/27/91 |

☐ FINAL APPROVAL ONLY

| INDEPTH REVIEWER | DATE |
|---|---|
| NA | |

FINAL APPROVAL

| APPROVED | DATE | APPROVED | DATE |
|---|---|---|---|
| [signature] | 3/11/91 | NA | |
| NA | | NA | |

| PORC MTG. NO. | PORC MTG. DATE | RECOMMENDED FOR | EFFECTIVE DATE |
|---|---|---|---|
| 91-014 | 2-28-91 | ☒ APPROVAL ☐ DISAPPROVAL | 2/27/91 |

FOR CONDITIONAL TC'S ONLY:

DISAPPROVAL

| DISAPPROVED | DATE |
|---|---|
| | |

REASON FOR DISAPPROVAL

List of Tables



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List of Tables (Cont.)

$B_{ip}$ = the equilibrium biaccumulation factor for radionuclide i in pathway p, expressed as the ratio of the concentration in biota (in pCi/kg) to the radionuclide concentration in water (in pCi/l), from Table 2.3-4, in l/kg;

$D_{aipj}$ = the dose factor, specific to a given age group "a", radionuclide "i", pathway "p", and organ "j", which can be used to calculate the radiation dose from an intake of a radionuclide, in mrem/pCi; or from exposure to a given concentration of a radionuclide in sediment, expressed as a ratio of the dose rate, in mrem/h, and the areal radionuclide concentration, in pCi/m$^2$, from Tables 2.3-5 through 2.3-9;

F = the flow rate of the liquid effluent in ft$^3$/s;

NOTE: The normal dilution flow will be between 30,000 and 61,500 gpm (USAR 11.2.3.2) TC 9

$M_p$ = the dilution factor at the midpoint of exposure (or the point of withdrawal of drinking water or point of harvest of aquatic food), from Table 2.3-10, dimensionless;

$Q_i$ = the release of radionuclide "i", in Ci;

$t_b$ = the period of time for which the sediment or soil is exposed to the contaminated water, 1.75 x 10$^5$ h (20 years);

$T_i$ = the halflife of radionuclide "i", in days;

$t_p$ = the average transit time required for radionuclides to reach the point of exposure, from Table 2.3-11; for internal dose, $t_p$ is the total time elapsed between release of the radionuclides and the ingestion of food or water, in h;

$U_{ap}$ = the usage factor that specifies the exposure time or intake rate for an individual of age group a associated with pathway "p", from Table 2.3-12, in h/yr, l/hr, or kg/hr;

W = the shoreline width factor, 0.3 (from Regulatory Guide 1.109);

$\lambda_i$ = the radioactive decay constant of radionuclide "i", in h$^{-1}$;

1100 = a factor to convert from (Ci/yr)/(ft$^3$/s) to pCi/l;

Table 2.3-13
Dilution Factors for Each of the Potable Water Intakes
Within 50 Miles of PNPP

The total population dilution factor of 314 is population weighted using dilution factors for each of the potable water intakes within 50 miles of PNPP.

| Intake | Dist. (Mi) | Dir | Population | Fraction of Pop | Dilution Factor | Weighted Dil. Factor |
|---|---|---|---|---|---|---|
| Ohio American Water Serv. Co. | 20 | ENE | 38,500 | 2.12E-2 | 187.7 | 3.98E+0 |
| Conneaut | 33 | ENE | 13,500 | 7.43E-3 | 238.2 | 1.77E+0 |
| Avon Lake | 50 | WSW | 99,500 | 5.48E-2 | 388.5 | 2.13E+1 |
| Cleveland | 35 | SW | 1,437,000 | 7.92E-1 | 326.7 | 2.59E+2 |
| Fairport Harbor | 7 | WSW | 3,200 | 1.76E-3 | 154.2 | 2.71E-1 |
| Lake County East | 3.5 | WSW | 10,258 | 5.65E-3 | 107.4 | 6.07E-1 |
| Lake County West | 15 | WSW | 85,000 | 4.68E-2 | 220.0 | 1.03E+1 |
| Ohio Water Serv. | 10 | WSW | 60,000 | 3.30E-2 | 181.9 | 6.00E+0 |
| Painesville | 7.5 | WSW | 27,000 | 1.49E-2 | 159.3 | 2.37E+0 |
| Kent County Water Supply | 50 | NW | 42,000 | 2.31E-2 | 388.5 | 8.97E+0 |
| TOTALS | | | 1,815,958 | 1.00E+0 | TOTAL D.F | 3.14E+2 |

Dist, Dir Population - distance, direction, and population values obtained from the 1989 Engineering Report "Lake Erie Potable Water Facilities and Intakes Within 50 Miles of PNPP" (Ref. SO-11552 "E").

Fraction of Population - The ratio of the population receiving drinking water from that intake to the total population number for all drinking water intakes located within 50 miles of PNPP.

Dilution Factor - Values obtained from the Perry Environmental Report - Operating License Stage, Table 5.1-10 "Annual Average Dilution Factors for Lake Water Intakes Within 50 Miles of PNPP" and Q&R Page 2.1-2. Lake County West dilution factor per interpolation. Kent County Water Supply dilution factor was estimated.

The Weighted Dilution Factor = (Fraction of Population) x (Dilution Factor), based on the population for each drinking water intake; the sum of which is to be used as the potable water total population dilution factor for radioactive liquid effluent releases from PNPP.

Table 2.3-14
Dilution Factors for the Fish Ingestion Pathway Individual
Grid Locations

The total population dilution factor of 77.4 is catch distance and volume weighted using dilution factors at those locations. Fish harvest is based on Ohio Department of Natural Resources the total angler catch (1987 annual) values for Lake Erie within 50 mile of PNPP.

| Grid | No. of Fish | Fraction of Fish | Dist. (mi) | Dilution Factor | (FracFish)x (DilFactor) |
|---|---|---|---|---|---|
| 617 | 52823 | 3.91E-7 | 29 | 92 | 3.60E+0 |
| 618 | 76004 | 5.63E-2 | 36 | 100 | 5.63E+0 |
| 714 | 102522 | 7.59E-2 | 9 | 52 | 3.96E+0 |
| 715 | 10743 | 7.95E-3 | 9 | 52 | 4.13E-1 |
| 716 | 19817 | 1.47E-2 | 11 | 56 | 8.21E-1 |
| 717 | 73401 | 5.43E-2 | 24 | 83 | 4.51E+0 |
| 718 | 118676 | 8.78E-2 | 33 | 95 | 8.34E+0 |
| 809 | 0 | 0.00E+0 | 48 | 115 | 0.00E+0 |
| 810 | 3953 | 2.93E-3 | 39 | 105 | 3.07E-1 |
| 811 | 13648 | 1.01E-2 | 30 | 92 | 9.29E-1 |
| 812 | 33923 | 2.51E-2 | 22 | 78 | 1.96E+0 |
| 813 | 182663 | 1.35E-1 | 13 | 61 | 8.25E+0 |
| 814 | 164369 | 1.22E-1 | 4 | 34 | 4.14E+0 |
| 909 | 80753 | 5.98E-2 | 50 | 116 | 6.93E+0 |
| 910 | 43800 | 3.24E-2 | 42 | 110 | 3.57E+0 |
| 911 | 117430 | 8.69E-2 | 33 | 95 | 8.26E+0 |
| 912 | 256529 | 1.90E-1 | 24 | 83 | 1.58E+1 |
| TOTAL | 1351054 | 1.00E+0 | | TOTAL D.F. | 7.74E+1 |

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No. of Fish - Total angler catch (1987 annual) for each grid location; per letter from Michael R. Rawson, Fairport Fisheries Research Station, Ohio Department of Natural Resources to Richard Cochnar (6/20/88). Commercial harvest data were not used as they were differentiated by harbor location only, not by geographical grid location.

Fraction of Fish - The ratio of the fish caught in that grid to the total number of fish caught in all grids located within 50 miles of PNPP.

Distance - Distance to the center of that grid from PNPP, in miles.

Dilution Factor - Derived, for the appropriate distance (center of each grid), from annual average dilution factor data (non-adjusted), per Perry Environmental Report - Operating License Stage, Table 5.1-10 "Annual Average Dilution Factors for Lake Water Intakes Within 50 Miles of PNPP".

(Fraction of Fish) x (Dilution Factor) - The weighted dilution factor, based on catch, for each grid; the sum of which is to be used as the fish ingestion total population dilution factor for radioactive liquid effluent releases from PNPP.

Table 5.1-1

?MPP Radiological Environmental Monitoring Program

| Sample Media | Locations* | Sampling Frequency | Analysis Type | Analysis Frequency |
|---|---|---|---|---|
| Airborne radioiodine and particulates | 1, 3, 4, 5, 6, 7, 35 | Continuous sampler operation with collection weekly or as required by dust loading, whichever is more frequent | Radioiodine I-131 | Weekly following canister change |
| | | | Particulates Gross Beta(a) | Weekly following filter change |
| | | | Gamma Isotpic(b) | Composite, by location quarterly |
| Direct Radiation (3 TLDs/location) | 1 through 24, 35, 36 41, 42, 43, 45, 53, 54, 55, 56, 58 | Continuous sampling, one TLD exchanged quarterly | Gamma Dose | Quarterly |
| | | Continuous sampling, one TLD exchanged annually | Gamma Dose | Annually |
| | | Continuous sampling, one TLD exchanged quarterly or under emergency situations | Gamma Dose | Quarterly or under emergency situations |
| Waterborne surface drinking(d) | 28, 34, 36, 59, 60 68 | Composite(c) | H-3 | Composite, by location, quarterly |
| | | | Gross Beta | Monthly |
| | | | Gamma Isotopic | Monthly |
| Sediment from shoreline | 25, 26, 27, 32, 63 64, 65 | Semiannually — Spring and Fall as weather permits | Gamma Isotopic | Semiannually |
| Soil(e) | 1, 2, 4, 6, 12, 14, 18, 20 | Quarterly | Gamma Isotopic Sr-89/90 | Quarterly |

See footnotes at end of table.

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Table 5.1-1 (Cont.)

PNPP Radiological Environmental Monitoring Program

| Sample Media | Locations* | Sampling Frequency | Analysis Type | Analysis Frequency |
|---|---|---|---|---|
| Ingestion | | | | |
| Milk(f) | 29, 31, 47, 51 57, 61, 69 | Monthly when animals are not on pasture | I-131, Gamma Isotopic | Monthly |
| | | Semimonthly when animals are on pasture | I-131, Gamma Isotopic | Semimonthly |
| Fish | 25, 32 | Semiannually — Spring and Fall as weather permits | Gamma Isotopic (edible portion) | Semiannually |
| Food Products | | | | |
| Human Consumption | 39, 62, 67, 70 | Monthly during growing season | I-131, Gamma Isotopic | Monthly during growing season |
| Animal Consumption | 29, 31, 47, 51, 57, 69, 61 | Annually, location determined by annual milk animal and garden census | I-131, Gamma Isotopic | Annually |
| Vegetation | 6, 7, 35, 44, 48 | Monthly during growing season | I-131, Gamma Isotopic | Monthly during growing season |
| Precipitation(e) | 3, 4, 6, 7, 12, 35 | Monthly | Gamma Isotopic, Gross Beta, Tritium | Monthly |

Sampling locations were selected on the basis of local ecology, meteorology, physical charactizations of the region, and demographic and land use features of the site vicinity. Other factors considered were applicable regulatory guidelines (Appendix I to 10CFR50, Regulatory Guides 4.1, 4.2, and 4.8), population distribution (from environmental report), ease of access to sampling stations, security, future program integrity (e.g., not placing TLD's near areas under construction or where the potential for vandalism is high, and the NRC Radiological Assessment Branch Technical Position on radiological environmental monitoring as revised in Revision 1, November 1979 (reference 1). In addition, certain locations where PNPP operations are unlikely to affect levels of radiation or radioactivity were selected as control locations.

Table 5.1-4 (Cont.)
Sampling Locations and Media for Environmental Monitoring
Perry Nuclear Power Plant



| Location No. | Description | (Miles) | Distance Direction | Media(1) |
|---|---|---|---|---|
| 15 | Madison Substation (Eagle Street), On utility pole inside substation fence | 5.1 | ESE | TLD |
| 16 | Dayton Road (north of Interstate 90) on pole #572203 on left after dirt driveway which is just after the sharp left on Dayton Road | 5.0 | SE | TLD |
| 17 | Chadwick Road (cul de sac south of Interstate 90) on pole #276222/1182011; last pole on left | 5.2 | SSE | TLD |
| 18 | Blair Road on pole on just after road makes 90° degree left curve down hill heading towards river | 5.0 | S | TLD, SO |
| 19 | Lane Road and South Ridge Road on pole #PC5648, 100 feet north of intersection | 5.3 | SSW | TLD |
| 20 | Nursery Road at Route 2 overpass, on pole #828976 across from entrance to Route 2 | 5.3 | SW | TLD, SO |
| 21 | Hardy Road at Painesville Township Park, on pole #378345, east of park entrance | 5.1 | WSW | TLD |
| 22 | Painesville, on south side of Main Street across from Evergreen Cemetery on tree with white dot 60 feet west of pole #DBPG296 | 6.9 | SW | TLD |
| 23 | Fairport Harbor (High Street and New Street), on pole on near substation facing street | 7.9 | WSW | TLD |
| 24 | St. Clair Avenue Substation (Control), in Mentor, on rear fence corner near railroad tracks | 15.1 | SW | TLD |
| 25 | PNPP Discharge | 0.6 | NNW | SED, FSH |
| 26 | Offshore at Redbird, vicinity of Ohio Water Service Company Intake | 4.2 | ENE | SED |
| 27 | Offshore, vicinity of Fairport Harbor Water Supply System Intake | 7.9 | WSW | SED |
| 28 | (Ashtabula (Control), CEI Generating Station Intake) | 22.0 | ENE | WTR |
| 29 | Milk Farm, Waites residence, Antioch Road, Perry | 1.3 | ESE | MLK, FS |

Table 5.1-4 (Cont.)

Sampling Locations and Media for Environmental Monitoring
Perry Nuclear Power Plant

| Location No. | Description | Distance (Miles) | Direction | Media[1] |
|---|---|---|---|---|
| 30 | Deleted | | | |
| 31 | Milk Farm, Hoffer residence, Antioch Road, Perry | 1.4 | ESE | MLK, FS |
| 32 | Mentor-on-the-Lake (Control) | 15.8 | WSW | FSH, SED |
| 33 | Deleted (Brookglen Farm [Control], Greig Residence, Callow Road, Leroy) | 10.2 | S | MLK, FS |
| 34 | PNPP Intake | 0.7 | NW | WTR |
| 35 | Site Boundary, north of transmission line, next to transformer, follow tree line | 0.6 | E | APT, AI, TLD, [illegible], PR |
| 36 | Painesville Water Supply Intake | 3.9 | WSW | WTR, TLD |
| 37 | Deleted (Ohio Water Service Co. pump station, Green Road, Madison) | 4.1 | ENE | WTR |
| 38 | Deleted (Seith Farm, 2861 Antioch Road, 0.5 miles from North Ridge Road | 1.1 | E | FP |
| 39 | Goldings Farm Stand, 3515 North Ridge Road | 1.8 | SSW | FP |
| 40 | Deleted (2767 Antioch Road) | 1.1 | E | FP |
| 41 | Clark Road one-half mile from Center Road, on pole No. 561969, south side of road | 1.1 | SW | TLD |
| 42 | Parmly Road, one-half mile from Center Road, located on utility pole No. 582923 near southwest corner of plant fence | 0.8 | S | TLD |
| 43 | Parmly Road, approximately 0.6 miles from Center Road next to stream, tree with white dot 50 feet from road, left of stream | 1.0 | SSE | TLD |
| 44 | Parmly Road | 1.0 | SSE | V |
| 45 | Clark Road, approximately 0.2 miles from Center Road on pole No. 561960, south side of road | 0.9 | SSW | TLD |
| 46 | Deleted (Milk Farm, Brill, North Ridge Road) | 1.5 | SE | MLK, FS |
| 47 | Milk Farm, Zoldak residence, Middle Ridge Road, Madison | 6.5 | E | MLK, FS |

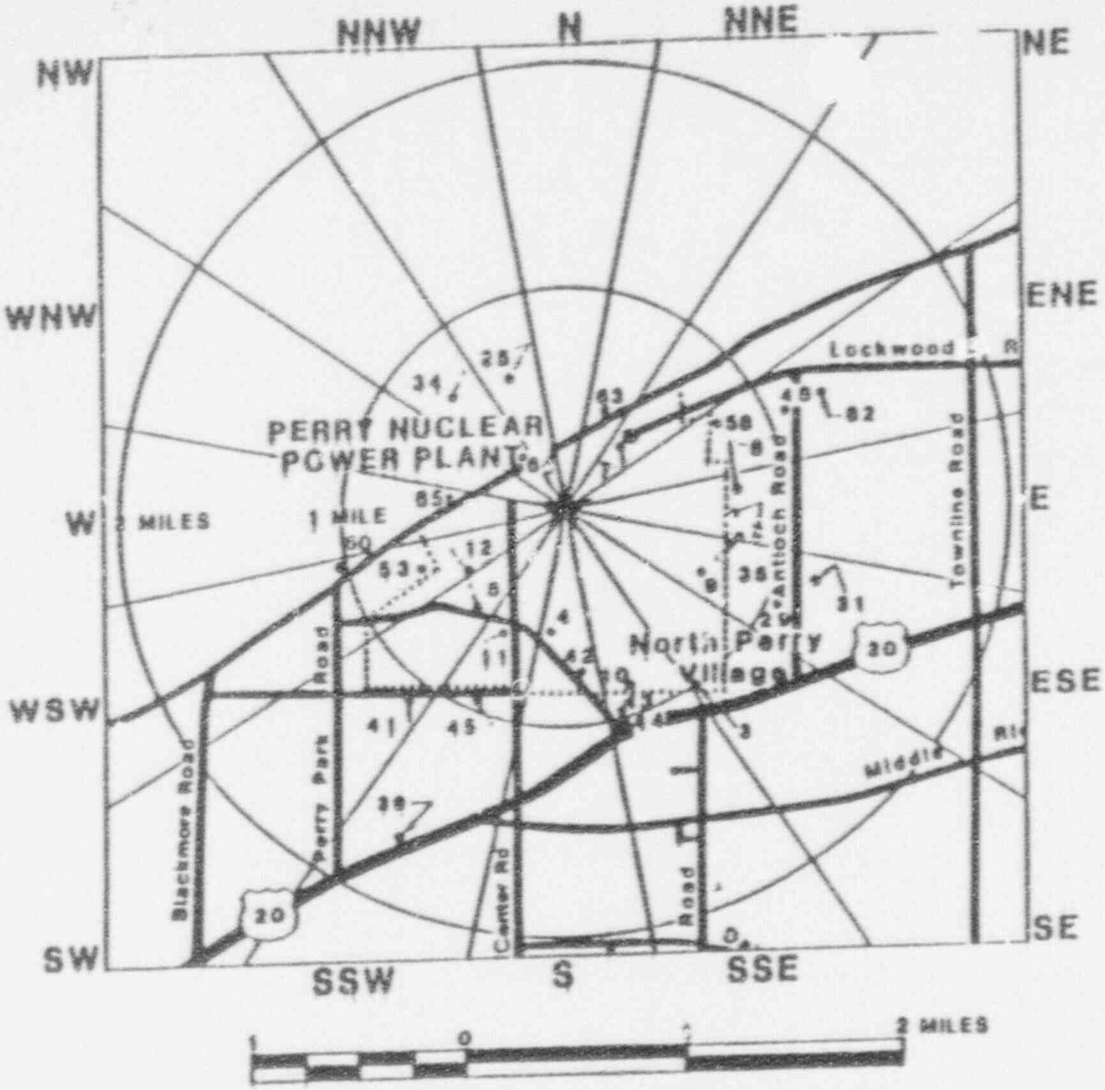
Table 5.1-4 (Cont.)

Sampling Locations and Media for Environmental Monitoring

Perry Nuclear Power Plant

| Location No. | Description | Distance (Miles) | Direction | Media(1) |
|---|---|---|---|---|
| 48 | Antioch Road | 1.1 | ENE | V |
| 49 | Deleted Garden, 4385 Lockwood Road | 0.8 | NE | FP |
| 50 | Deletion | | | |
| 51 | Rettger Farm, (Control), Rettger residence, Painesville-Warren Road, Leroy | 9.6 | S | MLK, PS |
| 52 | Deletion | | | |
| 53 | Neff Perkins, Co., utility pole 50' east of driveway, 200' south of fence | 0.5 | WSW | TLD |
| 54 | Hale Rd. School, pole No. 395910, 2nd from corner on Lee | 4.6 | SW | TLD |
| 55 | Perry School District Offices, on pine in tree line by baseball diamond | 2.5 | S | TLD |
| 56 | Madison High School, 1st clump of pine trees from library | 4.0 | ESE | TLD |
| 57 | Butler Residence, 6244 North Ridge Road | 8.5 | E | MLK, PS |
| 58 | On tree in NW corner of Nursery off Antioch Road, approximately 100 yards north of location #8 | 0.8 | ENE | TLD |
| 59 | Lake shoreline at north end of Green Road | 4.0 | ENE | WTR |
| 60 | Lake shoreline at the retired boat launch area in Perry Park | 1.0 | WSW | WTR |
| 61 | Milk Farm, Keller residence, Dewey Road, Madison | 7.4 | SE | MLK, PS |
| 62 | Shreve Farm, 2431 Antioch Road, commerical produce farm | 1.2 | ENE | FP |
| 63 | Minor stream outlet at Lake Erie | 0.1 | NNE | SED |
| 64 | Northwest impoundment outlet at Lake Erie | 0.1 | NW | SED |
| 65 | Major stream outlet at Lake Erie | 0.2 | W | SED |
| 66 | Deletion | | | |
| 67 | Sabo Farm, 5674 North Ridge Road | 2.9 | E | FP |
| 68 | Ohio American Water Company-Ashtabula Plant (Control) | 19.5 | ENE | WTR |
| 69 | John Rhodes Farm (Control), 11640 Sperry Road, Chester Township | 18.7 | SSW | MLK, PS |
| 70 | Route 6 Chardon (control) H&H Farm Stand | 16.2 | SSW | FP |

(1) AI - Air Iodine; APT - Air Particulate; FS - Feed/Silage; FSH - Fish; MLK - Milk; FP - Food Products; PR - Precipitation; SED - Sediment; SO - Soil; TLD - Ambient Gamma Dose Rate; V - Vegetation; WTR - Water



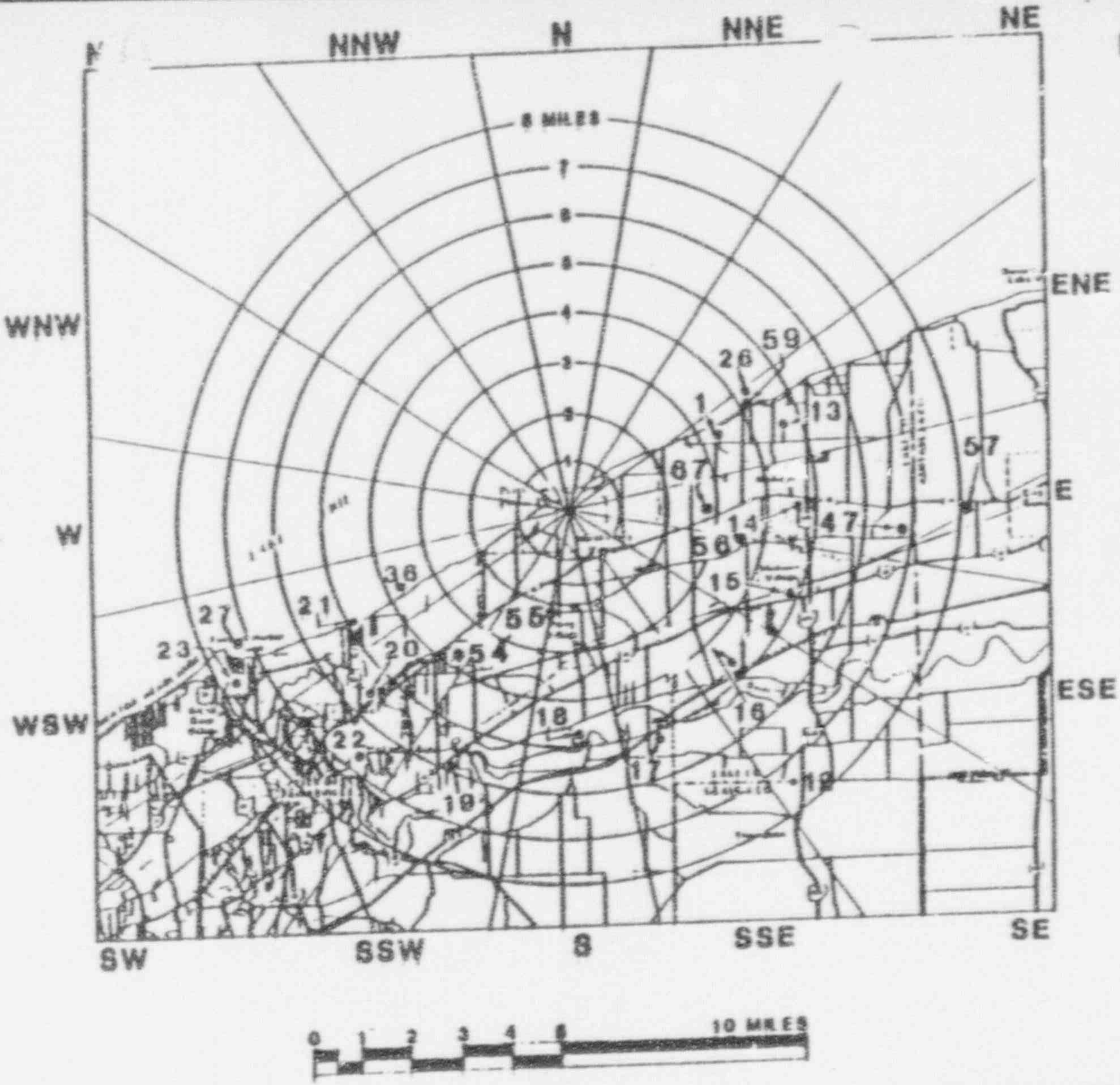

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS APPROXIMATELY 2 MILES FROM SITE

PERRY NUCLEAR POWER PLANT
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 1

## LEGEND:

| STATION NO. | [illegible] | DIRECTION |
|---|---|---|
| 2 | TLD, SO | E |
| 3 | APT, AI, TLD, PR | SE |
| 4 | APT, AI, TLD, SO, PR | S |
| 5 | APT, AI, TLD | SW |
| 7 | APT, AI, TLD, VL, PR | NE |
| 8 | TLD | E |
| 9 | TLD | ESE |
| 10 | TLD | SSE |
| 11 | TLD | SSW |
| 12 | TLD, PR, SO | WSW |
| 25 | SED, FSH | NNW |
| 29 | MILK, FEED/SILAGE | ESE |
| 31 | MILK, FEED/SILAGE | ESE |
| 34 | WTR | NW |
| 35 | APT, AI, TLD, VL, PR | E |
| 38 | FP | SSW |
| 41 | TLD | SW |
| 42 | TLD | S |
| 43 | TLD | SSE |
| 44 | VL | SSE |
| 45 | TLD | SSW |
| 48 | VL | ENE |
| 49 | FP | NE |
| 53 | TLD | WSW |
| 58 | TLD | ENE |
| 60 | WTR | WSW |
| 62 | FP | E |
| 63 | SE | NNE |
| 64 | SE | NW |
| 65 | SE | W |



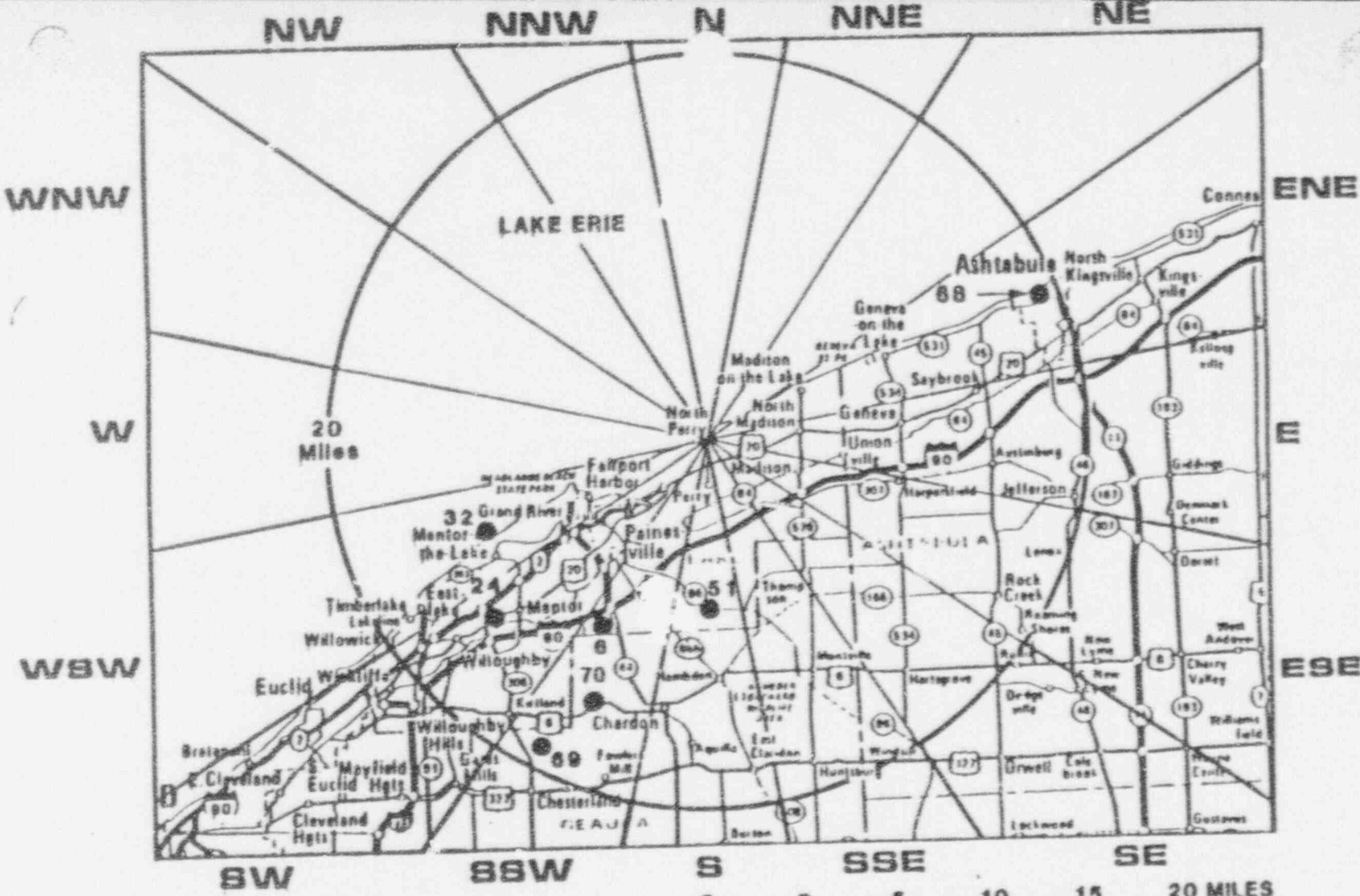

LEGEND :

| STATION NO. | MEDIA | DIRECTION |
|---|---|---|
| 1 | APT, AI, TLD, SO | ENE |
| 13 | TLD | ENE |
| 14 | TLD, SO | E |
| 15 | TLD | ESE |
| 16 | TLD | SE |
| 17 | TLD | SSE |
| 18 | TLD, SO | S |
| 19 | TLD | SSW |
| 20 | TLD, SO | SW |
| 21 | TLD | WSW |
| 22 | TLD | SW |
| 23 | TLD | WSW |
| 26 | SEDIMENT | ENE |
| 27 | SEDIMENT | WSW |
| 38 | WATER, TLD | WSW |
| 47 | MILK, FEED/SILAGE | E |
| 54 | TLD | SW |
| 55 | TLD | S |
| 56 | TLD | ESE |
| 57 | MILK, FEED/SILAGE | E |
| 59 | WTR | ENE |
| 61 | MILK, FEED/SILAG | ESE |
| 67 | FP | E |

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
SAMPLING LOCATIONS APPROXIMATELY 2 TO 8 MILES FROM SITE

PERRY NUCLEAR POWER PLANT
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 2




5 0 5 10 15 20 MILES

1/8" = 1 MILE

## LEGEND:

| STATION NO. | MEDIA | DIRECTION |
|---|---|---|
| 8 | APT, AI, TLD, PR, SO, VL | SSW |
| 24 | TLD | SW |
| 32 | FISH - SEDIMENT | WSW |
| 51 | MILK, FEED/SILAGE | S |
| 68 | WTR | ENE |
| 69 | MILK, FEED/SILAGE | SSW |
| 70 | FP | SSW |

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
CONTROL SAMPLING LOCATIONS
GREATER THAN 10 MILES FROM SITE
PERRY NUCLEAR POWER PLANT
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

FIGURE 3

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18. 1989 Engineering Report "Lake Erie Potable Water Facilities and Intakes Within 50 Miles of PNPP, (Ref. SO_1155? "E").

19. Perry Environmental Report Operating License Stage, Table 5.1-10 "Annual Average Dilution Factors for Lake Water Intakes Within 50 Miles of PNPP and Q&R Page 2.1-2.

20. PNPP Ohio Power Siting Commission application of August 1974, Appendix 1304-C-2, Table IV-A-2.

21. Total Angler Catch (1987 annual) for Each Grid Location; per letter From Michael R. Rawson, Pairport Fisheries Research Station, Ohio Department of Natural Resources (6-20-88).

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