12.0 RADIATION PROTECTION

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

12.1.1 POLICY CONSIDERATIONS

No departures or supplements.

12.1.2 DESIGN CONSIDERATIONS

No departures or supplements.

12.1.3 OPERATIONAL CONSIDERATIONS

The U.S. EPR FSAR includes the following COL Item in Section 12.1.3:

> A COL applicant that references the U.S. EPR design certification will fully describe, at the functional level, elements of the ALARA program for ensuring that occupational radiation exposures are ALARA. This program will comply with provisions of 10 CFR Part 20 and be consistent with the guidance in RGs 1.8, 8.2, 8.7, 8.8, 8.9, 8.10, 8.13, 8.15, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, 8.38, and the applicable portions of NUREG-1736.

This COL Item is addressed as follows:

This section incorporates by reference NEI 07-08, "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)"(NEI, 2007).

12.1.4 REFERENCES

{**NEI, 2007.** Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA), NEI 07-08, Revision 0, Nuclear Energy Institute, September 2007.}

12.2 RADIATION SOURCES

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

12.2.1 CONTAINED SOURCES

No departures or supplements.

12.2.1.1 Reactor Core

No departures or supplements.

12.2.1.2 Reactor Coolant System

No departures or supplements.

12.2.1.3 Chemical and Volume Control System

No departures or supplements.

12.2.1.4 Primary Coolant Purification System

No departures or supplements.

12.2.1.5 Primary Coolant Degasification System

No departures or supplements.

12.2.1.6 Secondary Coolant Cycle

No departures or supplements.

12.2.1.7 Component Cooling Water and Essential Service Water Systems

No departures or supplements.

12.2.1.8 Fuel Pool Cooling and Purification System

No departures or supplements.

12.2.1.9 Liquid Waste Management System

No departures or supplements.

12.2.1.10 Gaseous Waste Processing System

No departures or supplements.

12.2.1.11 Solid Waste Management System

No departures or supplements.

12.2.1.12 Post-LOCA ESF Filters

No departures or supplements.

12.2.1.13 Miscellaneous Sources

The U.S. EPR FSAR includes the following COL Item in Section 12.2.1.13:

A COL applicant that references the U.S. EPR design certification will provide site-specific information for required radiation sources containing byproduct, source, and special nuclear material that may warrant shielding design considerations. This site-specific information will include a listing of isotope, quantity, form, and use of all sources in this latter category that exceed 100 millicuries.

This COL Item is addressed as follows:

The following radiation sources have been identified to be required.

Isotope	Quantity	Form	Use
Cf-252	0.5 Ci	Sealed Source	Primary Start-up Source
Sb-Be	3E+06 Ci	Sealed Source	Secondary Source
Cs-137	400 Ci	Sealed Source	Calibration
{Cs-137	130 mCi	Sealed Source	Calibration}
{Am-241	0.03 μCi	Sealed Source	Calibration}

12.2.2 AIRBORNE RADIOACTIVE MATERIAL SOURCES

No departures or supplements.

12.2.3 REFERENCES

No departures or supplements.

12.3 RADIATION PROTECTION DESIGN FEATURES

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

12.3.1 FACILITY DESIGN FEATURES

No departures or supplements.

12.3.2 SHIELDING

No departures or supplements.

12.3.3 VENTILATION

No departures or supplements.

12.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

No departures or supplements.

12.3.4.1 Area Radiation Monitoring Instrumentation

No departures or supplements.

12.3.4.2 Airborne Radioactivity Monitoring Instrumentation

No departures or supplements.

12.3.4.3 Portable Airborne Monitoring Instrumentation

No departures or supplements.

12.3.4.4 Criticality Accident Monitoring

No departures or supplements.

12.3.4.5 Implementation of Regulatory Guidance

The U.S. EPR FSAR includes the following COL Items in Section 12.3.4.5:

> A COL applicant that references the U.S. EPR design certification will describe the use of portable instruments, and the associated training and procedures, to accurately determine the airborne iodine concentration within the facility where plant personnel may be present during an accident, in accordance with requirements of 10 CFR 50.34(f)(2)(xxvii) and the criteria in Item III.D.3.3 of NUREG-0737. The procedures for locating suspected high-activity areas will be described.
>
> A COL applicant that references the U.S. EPR design certification will provide site-specific information on the extent to which the guidance provided by RG 1.21, 1.97, 8.2, 8.8, and ANSI/HPS-N13.1-1999 is employed in sampling, recording and reporting airborne releases of radioactivity.

These COL Items are addressed as follows:

Procedures detail the criteria and methods for obtaining representative measurement of radiological conditions, including in-plant airborne radioactivity concentrations in accordance with applicable portions of 10 CFR Part 20 (CFR, 2008a) and consistent with the guidance in Regulatory Guides 1.21 Appendix A (NRC, 1974), 1.97 (NRC, 2006), 8.2 (NRC, 1973), 8.8 (NRC, 1978), and 8.10 (NRC,1977b) and ANSI/HPS-N13.1-1999 (ANSI, 1999). Additional discussion of radiological surveillance practices is included in the radiation protection program description provided in Section12.5.

Surveillance requirements are determined by the functional manager in charge of Radiation Protection based on actual or potential radiological conditions encountered by personnel and the need to identify and control radiation, contamination, and airborne radioactivity. These requirements are consistent with the operational philosophy in Regulatory Guide 8.10. Frequency of scheduled surveillances may be altered by permission of the functional manager in charge of Radiation Protection or their designee. Radiation Protection periodically provides cognizant personnel with survey data that identifies radiation exposure gradients in areas resulting from identified components. This data includes recent reports, with survey data, location and component information.

The following are typical criteria for frequencies and types of surveys:

Job Coverage Surveys

- Radiation, contamination, and/or airborne surveys are performed and documented to support job coverage.
- Radiation surveys are sufficient in detail for Radiation Protection to assess the radiological hazards associated with the work area and the intended/specified work scope.
- Surveys are performed commensurate with radiological hazard, nature and location of work being conducted.
- Job coverage activities may require surveys to be conducted on a daily basis where conditions are likely to change.

Radiation Surveys

- Radiation surveys are performed at least monthly in any radiological controlled area (RCA) where personnel may frequently work or enter. Survey frequencies may be modified by the functional manager in charge of Radiation Protection as previously noted.
- Radiation surveys are performed prior to or during entry into known or suspected high radiation areas for which up to date survey data does not exist.
- Radiation surveys are performed prior to work involving highly contaminated or activated materials or equipment.
- Radiation surveys are performed at least semiannually in areas outside the RCA. Areas to be considered include shops, offices, and storage areas.
- Radiation surveys are performed to support movement of highly radioactive material.
- Neutron radiation surveys are performed when personnel may be exposed to neutron emitting sources.

Contamination Surveys

- Contamination surveys are performed at least monthly in any RCA where personnel may frequently work or enter. Survey frequencies may be modified by the functional manager in charge of Radiation Protection as previously noted.
- Contamination surveys are performed during initial entry into known or suspected contamination area(s) for which up to date survey data does not exist.
- Contamination surveys are performed at least daily at access points, change areas, and high traffic walkways in RCAs that contain contaminated areas. Area access points to a High Radiation Area or Very High Radiation Area are surveyed prior to or upon access by plant personnel or if access has occurred.
- Contamination surveys are performed at least semiannually in areas outside the RCA. Areas to be considered include shops, offices, and storage areas.
- A routine surveillance is conducted in areas designated by the functional manager in charge of Radiation Protection or their designee likely to indicate alpha radioactivity. If alpha contamination is identified, frequency and scope of the routine surveillance is increased.

Airborne Radioactivity Surveys

- Airborne radioactivity surveys are performed during any work or operation in the RCA known or suspected to cause airborne radioactivity (e.g., grinding, welding, burning, cutting, hydrolazing, vacuuming, sweeping, use of compressed air, using volatiles on contaminated material, waste processing, or insulation).
- Airborne radioactivity surveys are performed during a breach of a radioactive system, which contains or is suspected of containing significant levels of contamination.
- Airborne radioactivity surveys are performed during initial entry (and periodically thereafter) into any known or suspected airborne radioactivity area.
- Airborne radioactivity surveys are performed immediately following the discovery of a significant radioactive spill or spread of radioactive contamination, as determined by the functional manager in charge of Radiation Protection.
- Airborne radioactivity surveys are performed daily in occupied radiological controlled areas where the potential for airborne radioactivity exists, including containment.
- Airborne radioactivity surveys are performed any time respiratory protection devices, alternative tracking methods such as derived air concentration-hour (DAC-hr), and/or engineering controls are used to control internal exposure.
- Airborne radioactivity surveys are performed using continuous air monitors (CAMs) for situations in which airborne radioactivity levels can fluctuate and early detection of airborne radioactivity could prevent or minimize inhalations of radioactivity by workers. Determination of air flow patterns are considered for locating air samplers.
- Airborne radioactivity surveys are performed prior to use and monthly during use on plant service air systems used to supply air for respiratory protection to verify the air is free of radioactivity.

- Tritium sampling is performed near the spent fuel pit when irradiated fuel is in the pit and in other areas of the plant where primary system leaks occur and tritium is suspected.

Appropriate counting equipment is used based on the sample type and the suspected identity of the radionuclides for which the sample is being done. Survey results are documented, retrievable, and processed per site document control and records requirements consistent with Regulatory Guide 8.2. Completion of survey documentation includes the update of room/area posting maps and revising area or room postings and barricades as needed.

Air samples indicating activity levels greater than a procedure specified percentage of DAC are forwarded to the radiochemistry laboratory for isotopic analysis. Samples which cannot be analyzed onsite are forwarded to a contractor for analysis; or, the DAC percentage may be hand calculated using appropriate values from 10 CFR Part 20, Appendix B.

The responsible Radiation Protection personnel review survey documentation to evaluate if surveys are appropriate and obtained when required, records are complete and accurate, and adverse trends are identified and addressed.

An in-plant radiation monitoring program maintains the capability to accurately determine the airborne iodine concentration in areas within the facility where personnel may be present under accident conditions. This program includes the training of personnel, procedures for monitoring, and provisions for maintenance of sampling and analysis equipment consistent with Regulatory Guides 1.21 (Appendix A) and 8.8. Training and personnel qualifications are discussed in Section 12.5.

A portable monitor system meeting the requirements of NUREG-0737 (NRC, 1980), Item III.D.3.3, is available. The system uses a silver zeolite or charcoal iodine sample cartridge and a single-channel analyzer. The use of this portable monitor is incorporated in the emergency plan implementing procedures. The portable monitor is part of the in-plant radiation monitoring program. It is used to determine the airborne iodine concentration in areas where plant personnel may be present during an accident. Accident monitoring instrumentation complies with applicable parts of 10 CFR Part 50, Appendix A (CFR, 2008b).

Sampling cartridges are removed to a low background area for further analysis. These cartridge samples are purged of any entrapped noble gases, when necessary, prior to being analyzed.

12.3.5 DOSE ASSESSMENT

No departures or supplements.

12.3.5.1 Overall Plant Doses

The U.S. EPR FSAR includes the following COL Item in Section 12.3.5.1:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information on estimated annual doses to construction workers in a new unit construction area as a result of radiation from onsite radiation sources from the existing operating plant(s). This information will include bases, models, assumptions, and input parameters associated with these annual doses.

This COL Item is addressed as follows:

{This section discusses the radiological exposure of construction workers building Nine Mile Point 3 Nuclear Power Plant (NMP3NPP) from the normal operation of Nine Mile Point (NMP) Unit 1 and Unit 2 and James A. FitzPatrick Nuclear Power Plant (JAFNPP).

Site Layout

The physical location of NMP3NPP relative to the existing JAFNPP and NMP Unit 1 and Unit 2 sites is presented in Figure 12.3-4. The NMP3NPP will be located southwest of the existing NMP Unit 1 and Unit 2.

Radiation Sources at NMP Unit 1 and Unit 2 and JAFNPP.

During the construction of NMP3NPP, the construction workers will be exposed to radiation sources from the routine operation of NMP Unit 1 and Unit 2 and JAFNPP. Sources that have the potential to expose construction workers are listed in Table 12.3-1. They are characterized as to location, inventory, shielding, and typical local dose rates. They are also characterized in terms of potential to expose NMP3NPP construction workers. Only those with significant potential are analyzed in detail. Interior, shielded sources are not included. Table 12.3-2 show the location of these sources.

All gaseous effluents flow out of the NMP Unit 1 and Unit 2 and JAFNPP stacks, vents and ground release points. The releases are reported to the NRC. (NMPNS, 2001- 2006.) (JAF, 2001-2006.) Doses to the general population are also reported.

Effluents from the liquid waste disposal system produce small amounts of radioactivity in the discharge to Lake Ontario. They are not significant sources of exposure to NMP3NPP workers . (see Table 12.3-1)

There are three main sources of direct radiation that have a significant impact on NMP3NPP construction workers: gaseous effluents, Independent Spent Fuel Storage Installations (ISFSIs), and Turbine Buildings. These are listed in Table 12.3-1.

Historical Dose Rates

The historical annual dose rates for NMP Unit 1 and Unit 2 and JAFNPP that were used to estimate worker dose as reported to the NRC are presented below.

Off-site Gaseous and Liquid Effluent Historical Measurements

The doses listed in Table 12.3-3 are the historical doses to public due to the release of gaseous and liquid effluents from NMP Unit 1 and Unit 2 and JAFNPP and are calculated in accordance with the existing NMP Unit 1 and Unit 2 Off-site Dose Calculation Manual (ODCM). The maximum individual doses are from historical NMP Unit 1 and Unit 2 Annual Radiological Environmental Operating Reports and, prior to that, the Radiological Environmental Monitoring Program Annual Reports. While these off-site doses provide perspective on the variation of effluent releases through the history of the operation of NMP Unit 1 and Unit 2, on-site workers will be exposed to fewer pathways. For example, workers will not ingest food (edible plants or fish) grown in effluent streams as part of their work activity. Therefore, only external and inhalation pathways will be considered in the calculation of dose to workers.

Projected Dose Rates at NMP3NPP

Dose rates from all sources combined were calculated for each 100 x 100 foot square on the plant grid. These dose rates were in terms of mrem/year. For purposes of dose rate calculations, a 100% occupancy is assumed. (For purposes of collective dose calculations, the occupancy for construction workers is 2,200 hours per year.) The dose rates were the sum of the dose rate from the four main sources; gases, liquids (only on the shoreline), and ISFSI. They are shown in Figure 12.3-7 for the year 2015, the last year of construction. It is this year that the dose rate will be greatest, primarily because the ISFSI will have the largest number of spent fuel storage casks. No credit is taken in the calculations for any additional shielding other than that present in measured doses.

Gaseous Dose Rates

Gaseous effluents flow out of the NMP Unit 1 and Unit 2 and JAFNPP stacks and vents. The releases are reported annually to the NRC. Doses to the general population are also reported annually. It was conservatively assumed that all three units had identical stack heights, equal to the shortest stack height, which is 350 feet. It was also assumed that gaseous effluents from vents were released at ground level.

The annual dose rate from gaseous effluents to construction workers on the NMP3NPP site is bounded by the following equation:

$$\dot{D}(r,j) = \sum_{k=1}^{3}\sum_{i=1}^{2} C_{i,k} f(r_{i,k}) \qquad \text{Equation 12.3-2}$$

where,

D&(r, j)= dose rate of type j, (mrem/yr) at location r (feet),

i = release type (vent, stack),

j= dose type (TEDE, external total body (TB-ext), external skin (Skin-ext), and organ dose from

iodines and particulates (Organ-I&P)),

k= plant (NMP1, NMP2, JAFNPP),

Ci,k(j)= dose type coefficient for the given release type at the given plant, summarized in Table 12.3-10,

ri,k= distance from the given release point to the target = $\sqrt{(N-N_s)^2+(E-E_s)^2}$,

N,E = receptor location in plant grid (feet),

Ns,Es= release source location on plant grid (feet) as given in Table 12.3-2 and

$f_i(r_{i,k})$ = atmospheric dispersion factor, at a point ri,k (sec/m^3)

$f_1\left(r_{1,k}\right) = Ar_{i,k}^{B}$ for Ground Release Equation 12.3-3

$$f_2\left(r_{2,k}\right) = \frac{a + br_{i,k}}{1 + cr_{i,k} + dr_{i,k}^{2}}$$ for Elevated Release Equation 12.3-4

Fitting Parameters: A=175; B=-1.94; a= 9.53E-07; b=3.79E-11; c= -2.00E-04; d=1.07E-07

The dispersion factor models used in the above equations are based on annual average, undecayed, undepleted ground level and elevated χ/Q s from NMPNS and JAFNPP site meteorology for the years 2001 to 2006 as illustrated in Figure 12.3-2 and Figure 12.3-3. The equation also assumes the most limiting gaseous effluent releases from the period 2001 to 2006. The model is based upon 100% occupancy. The χ/Q data for NMPNS and JAFNPP for years 2001 to 2006 that was used in developing the bounding atmospheric dispersion factor models (Equations 12.3-3 and 12.3-4) are given in Table 12.3-11 to Table 12.3-13.

The dose rates were calculated for an on-site location with a known χ/Q for the years 2001 through 2006 according to the Regulatory Guide 1.109 method with Total Effective Dose Equivalent (TEDE) calculations according to Federal Guidance Reports 11 and 12. The gaseous releases used in the calculation are shown in Table 12.3-14 to Table 12.3-19. The calculated annual Total Effective Dose Equivalent (TEDE) doses from ground and elevated releases at NMP Unit 1 and Unit 2 and JAFNPP for years 2001 to 2006 are listed in Table 12.3-20.

Liquid Dose Rates

The projected dose at the shoreline to a construction worker with a 2200 hours/year occupancy rate is 2.19 mrem/yr . For a person with a full-time occupancy (8760 hr/yr), the dose rate is 8.73 mrem/yr. This represents the maximum recent year dose contribution from each plant per Table 12.3-21, and is based on releases and dilutions in Table 12.3-22 through Table 12.3-27. Table 12.3-28 through Table 12.3-30 list the individual plant dose contributions by year, with the total contribution from all three plants summarized in Table 12.3-31.

Direct Dose Rates

There are five main direct sources of radiation between the NMP Unit 1 and Unit 2 and JAFNPP reactors. This includes Nitrogen 16 in the turbines of the three BWRs, namely, NMP Unit 1 and Unit 2 and JAFNPP, the Independent Spent Fuel Storage Installation at JAFNPP, which has been operating since 2002, and the proposed Independent Spent Fuel Storage Installation to be built on the Nine Mile Point Nuclear Station (NMPNS) site, which is scheduled to begin fuel loading in 2011. The design of the proposed NMPNS Independent Spent Fuel Storage Installation has yet to be finalized.

The dose rate contribution from each of the four current direct sources (i.e., the N-16 from NMP Unit 1 and Unit 2 and JAFNPP and the JAFNPP Independent Spent Fuel Storage Installation) were estimated using dose-distance relationships of the form:

$$DR(mrem/yr) = c\omega e^{-\mu r}$$ Equation 12.3-5

Where:

$$\omega = \pi(1 - \frac{r}{\sqrt{r^2 + R^2}})$$

Equation 12.3-6

The constants c_j of these equations were found by way of least squares fitting of data from TLDs, i, and sources, j. The total direct dose rate at a specific location would therefore be:

$$DR_i = c_{background} + \sum_{j=1}^{4} c_j \omega_{ij} e^{-\mu_j r}$$

Equation 12.3-7

where TLDs, i, and sources, j. The total direct dose rate at a specific location would therefore be:

$$DR_i = c_{background} + \sum_{j=1}^{4} c_j \omega_{ij} e^{-\mu_j r}$$

Equation 12.3-8

where

ω is the solid angle subtended by the source at the location of interest (Sr)

r is distance from center of source to dose point (ft)

The c coefficients, which are listed in Table 12.3-8 were derived by fitting the dose rate data from 38 TLDs to Equation 12.3-7. The values of μ and R, which are different for each type of source, were fitted empirically to measurement and simulation data. The μ and R values for the Independent Spent Fuel Storage Installation were derived by fitting Equations 12.3-7 and 12.3-8 to dose versus distance curves from an MCNP simulation of a similar Independent Spent Fuel Storage Installation at a different plant. The values of μ and R for the N-16 sources are based on the same general approach. The μ and R values for N-16 in a BWR turbine were derived by fitting Equations 12.3-7 and 12.3-8 to dose versus distance curves from an MCNP simulation of a BWR turbine hall at a different plant**.** The MCNP simulation had been calibrated to field measurements.

It was assumed that the only sources whose contribution varies appreciably with position were the N-16 sources in the turbines and the Independent Spent Fuel Storage Installation sources. All other sources, such as natural background and TLD response from effluent gases, were assumed to be constant over the entire site.

TLD locations and responses that were used in the analysis were taken from. The measurements are listed in Table 12.3-32. The locations of the TLDs, within the state plane coordinate system, are listed in Table 12.3-33. The TLD coordinates were derived by overlaying Table 12.3-2 data with a plan of the site that was marked with a coordinate grid.

The constant term in Equation 12.3-7, $c_{background}$, was estimated at 56.7 mR/year (0.49 mGy/yr). This matched the background measured by TLDs in the vicinity of the site, which is approximately 60 mrem per year as reported. The fit was tested by calculating the dose rates at each TLD based upon the derived set of coefficients and then comparing the calculated to the measured TLD dose rates. Table 12.3-34 shows that the ratio of calculated to measured values for the 38 TLDs ranged between 0.61 and 1.74 for TLDs 3 and I11, respectively.

Time Equation for JAFNPP Independent Spent Fuel Storage Installation

Up to this point in the discussion, the dose rate from the JAFNPP Independent Spent Fuel Storage Installation is for the year 2007 when the TLD measurements were made. Given that more casks are expected to be loaded in the future, a relationship between dose and time for the JAFNPP Independent Spent Fuel Storage Installation was developed based upon historic variations in TLD doses and historic loadings .

The historical measured exposures surrounding the JAFNPP Independent Spent Fuel Storage Installation were used to estimate the projected exposure given the projected addition of casks. The loading history is given in Table 12.3-35. The TLD locations are in Figure 12.3-5. The historical TLD readings and the average of all the Independent Spent Fuel Storage Installation TLDs are given in Figure 12.3-4 and Table 12.3-33 . The historical and anticipated cask loading through the construction period (up to 2015) of the JAFNPP Independent Spent Fuel Storage Installation is given in Table 12.3-5. The term "cask-years" in Table 12.3-5 represents the product of the number of casks by their associated storage time for the loading year of interest (i.e., one cask installed in June would represent 0.5 cask-years). Figure 12.3-7 and Table 12.3-6 show that there is a relationship between dose and cask load (number of casks).

Assuming a background of 56.7 mR/yr, no radioactive decay, and that the exposure (burnup), enrichment, and decay of fuel bundles loaded into casks in subsequent years through 2015 will be comparable to the inventory of casks received to date at the Independent Spent Fuel Storage Installation (between 2001 and 2007), a simple relationship between doses in 2007 and future doses was derived. Namely, the exposure is proportional to the number of casks placed on the Independent Spent Fuel Storage Installation. This results in the ratios of annual exposure in future years to 2007 exposure from the JAFNPP Independent Spent Fuel Storage Installation. These ratios were used to adjust dose rates calculated by the Independent Spent Fuel Storage Installation equation for future years up to 2015. The ratios are presented in Table 12.3-36.

Proposed NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation

The fifth source, an Independent Spent Fuel Storage Installation to serve both the NMP Unit 1 and Unit 2 reactors has yet to be designed and loaded. This facility is anticipated to be loaded with 40 casks starting in the year 2011. It is also assumed that the annual loading rate at NMPNS will be twice that of the JAFNPP Independent Spent Fuel Storage Installation, simply proportional to the number of plants served. The workers will be exposed for a period of years, during which both Independent Spent Fuel Storage Facilities will continue to be loaded with increasing amounts of fuel. It is assumed that the JAFNPP Independent Spent Fuel Storage Installation will be loaded with six new casks every four years, and, given that the NMPNS site serves two BWRs, it was assumed that its Independent Spent Fuel Storage Installation will be loaded with six new casks every two years after the initial load of 40 in 2011.

A model used to estimate the correlation between cask-loading and exposure rate was developed by performing a least squares fit of the annual exposure rates around the JAFNPP ISFSI, as provided in Table 12.3-4, in relation to the cask loading as given in Table 12.3-5. The resulting correlation is:

$$\text{Exposure Rate} = (13.984\ \text{mR/yr})\ (\text{Cask-Loading}) + (71.168\ \text{mR/hr}) + (\text{background})$$

Equation 12.3-9

Table 12.3-6 provides the estimated annual exposure directly surrounding the Independent Spent Fuel Storage Installation and provides ratios of the exposure from its initial 2011 loading.

The estimated annual exposure for the NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation was based on the TLD data from 2001 - 2007 from the JAFNPP Independent Spent Fuel Storage Installation. Values were calculated by multiplying the 13.984 mR/hr (0.12 mGy/hr) per cask-year by the cask loading .

Table 12.3-7 provides the equation coefficients for the proposed NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation assuming 40 casks in the year 2011. The coefficients “u” and “R” were equivalent to those coefficients calculated for the JAFNPP Independent Spent Fuel Storage Installation in Table 12.3-6 The coefficient “c” was adjusted to that coefficient calculation for the JAFNPP Independent Spent Fuel Storage Installation in Table 12.3-8, based on cask loading. The resulting coefficient “c” was calculated as 905.42 mrem/yr (9.05 mSv/yr) [203.72 mrem/yr x (40 casks / 9 casks)].

Construction Worker Dose Estimates

Dose rates from all sources combined were calculated for each 100 x 100 foot square on the plant grid. These dose rates were in terms of mrem/year. For purposes of dose rate calculations a 100% occupancy is assumed. (For purposes of collective dose calculations the occupancy for construction workers is 2,200 hours per year.) The dose rates were the sum of the dose rate from the three main sources; gaseous effluents, the Independent Spent Fuel Storage Facilities, and the Turbine Buildings. The dose rates, assuming full time occupancy, are shown in Figure 12.3-7 for the year 2015, the last year of construction. It is this year that the dose rate will be greatest, primarily because the Independent Spent Fuel Storage Facilities will have the largest number of Independent Spent Fuel Storage casks. In the calculations, no credit is taken for any additional shielding other than that present in measured doses.

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The number of on-site workers (in terms of Full Time Equivalents), their location by zone and associated occupancy fraction are given in Table 12.3-37 and Table 12.3-38. The details of the collective dose calculations are given in the following discussion.

The equation for dose rate during year t at location x, y on the plant grid is:

$$\dot{D}_{x,y} = \dot{D}_{gas} + \dot{D}_{ISFSI} + \dot{D}_{N16} \qquad \text{Equation 12.3-10}$$

where the terms are explained in the ER subsections.

The equation for the average dose rate in a zone is:

$$\overline{\dot{D}}_{Z} = \frac{1}{N_Z} \sum_{(\text{all } x,y \text{ in } Z)} \dot{D}_{x,y} \qquad \text{Equation 12.3-11}$$

where N_z is the number of squares in the zone.

The equation for collective dose for the construction period is:

$$D = \frac{2200}{8760}\sum_{t}\sum_{Z}\bar{\dot{D}}_Z FTE_{Z,t}$$ Equation 12.3-12

where

$\frac{2200}{8760}$ = fraction of work hours per year

$\bar{\dot{D}}_Z$ = average dose rate in zone, Z.

$FTE_{Z,t}$ = Full Time Equivalents in zone Z during year t.

The equation for full time equivalents is:

$$FTE_{Z,t} = P_Z\ Census_t$$ Equation 12.3-13

where P_Z = probability of worker in zone, Z

$Census_t$ = FTE of workers on site in year t.

The probability of a worker in each zone, P_Z, reflects the average construction worker and is based on an approximation of how much time the average worker spends in each zone. For example, the time spent in the parking lot and road is low, in the construction area is high, in the offices is less. These are estimates based on construction experience.

COLLECTIVE DOSES TO NMP3NPP WORKERS

The collective dose is the sum of all doses received by all workers. It is a measure of population risk. The total worker collective dose for the combined years of construction is 72 person-rem. This is a best estimate based upon the worker census, occupancy projections and maximum zone dose rates shown in Table 12.3-37 and Table 12.3-38 and Table 12.3-9. The breakdown of collective dose by construction year and occupancy zone is given in Table 12.3-11. This assumes 2200 hours per year occupancy for each worker.}

12.3.5.2 Post-Accident Access to Radiological Vital Areas

No departures or supplements.

12.3.5.3 Dose to the Public from Direct Radiation Exposure at the Exclusion Area Boundary

No departures or supplements.

12.3.6 MINIMIZATION OF CONTAMINATION

No departures or supplements.

12.3.7 REFERENCES

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Table 12.3-1—{Exterior Source List from NMP Unit 1 and Unit 2 and JAFNPP}

Source	Location	Radioactive Inventory	Shielding	Typical Dose Rates
Stack NMP Unit 1	East of NMP Unit 1 reactor bldg	Gaseous effluents	n.a.- airborne	Off-site dose typically less than a few mrem/yr
Stack NMP Unit 2	North East of NMP Unit 2 reactor bldg	Gaseous effluents	n.a.- airborne	Off-site dose typically less than a few mrem/yr
Stack JAFNPP	South of JAFNPP reactor bldg	Gaseous effluents	n.a.- airborne	Off-site dose typically less than 1 mrem/yr
Emergency Condenser Vents NMP Unit 1	North Side of NMP Unit 1 Reactor Building	Gaseous effluents	n.a.- airborne	Off-site dose typically less than a few mrem/yr
RB/RW Vent NMP Unit 2	West of NMP Unit 2 Reactor Bldg	Gaseous effluents	n.a.- airborne	Off-site dose typically less than a few mrem/yr
Vent JAFNPP	North side of JAFNPP reactor bldg roof (reactor, refuel & turbine bldgs.) and North of Turbine bldg roof (Radwaste bldg)	Gaseous effluents	n.a.- airborne	Off-site dose typically less than 1 mrem/yr
NMP Unit 1 Liquid Discharge	440 ft from shoreline	Liquid effluents	n.a.- waterborne	Off-site dose typically less than a few mrem/yr
NMP Unit 2 Liquid Discharge	1400 ft from shoreline	Liquid effluents	n.a.- waterborne	Off-site dose typically less than a few mrem/yr
JAFNPP Liquid Discharge	1400 ft from shoreline	Liquid effluents	n.a.- waterborne	Off-site dose typically less than 1 mrem/yr
JAFNPP ISFSI	ISFSI Pad at JAFNPP	Spent fuel	Vented concrete bunkers	20 mrem/month at perimeter fence
Turbine Building NMP Unit 1	Middle of NMP Unit 1 Structures	N-16	Variety of shields built into structure	< 20 μrem/hr on outside wall / <10 mrem/hr Roof (2)
Turbine Building NMP Unit 2	West of NMP Unit 2 Containment	N-16	Variety of shields built into structure	< 20 μrem/hr on outside wall wall / <20 mrem/hr Roof (2)
Turbine Building JAFNPP	North of JAFNPP Structures	N-16	Variety of shields built into structure	6 – 8 mRem/yr wall /< 50 mrem/hr Roof (3)
Cold Storage (1)	East of NMP Unit 2 Reactor bldg	Storage of outage equipment	Unknown	~ 0.1 mrem /hr exterior
Condensate Storage (1)	North of NMP Unit 2 reactor bldg			~ 0.1 mrem /hr exterior

Notes:

1. These sources have minimal impact of the NMP3NPP construction area. The source terms for these were averaged in with the much larger ^{16}N and ISFSI sources.

Table 12.3-2—{Radiation Source Locations}

Site	Source	Coordinates N (ft) (m)	Coordinates E (ft) (m)
NMP Unit 1	Stack	1,283,300 (391,150)	545,950 (166,406)
	Vent	1,283,100 (391,089)	545,900 (166,390)
	Turbine Hall	1,283,000 (391,058)	545,900 (166,390)
	ISFSI (Proposed)	1,282,450 (390,891)	545,100 (166,146)
NMP Unit 2	Stack	1,283,775 (391,295)	547,110 (166,759)
	Vent	1,283,150 (391,104)	546,590 (166,601)
	Turbine Hall	1,283,150 (391,104)	546590 (166,601)
	ISFSI (Proposed)	1,282,450 (390,891)	545,100 (166,146)
JAFNPP	Stack	1,283,450 (391,196)	549,200 (167,396)
	Vent	1,283,710 (391,275)	549,180 (167,390)
	Turbine Hall	1,283,850 (391,317)	549,050 (167,350)
	ISFSI	1,283,078 (391,082)	548,628 (167,222)

Note:

These positions were scaled from the sketch given in Figure 12.3-1.

Table 12.3-3—{Historical Off-site Doses for NMP Unit 1, Unit 2 and James A. Fitzpatrick NPP Site and Comparison to 40 CFR 190 Limits}

	Dose in mrem/year			Dose as Fraction of 40CFR190 Limits		
Year	Whole Body[a]	Thyroid	Limiting Organ	Whole Body	Thyroid	Limiting Organ
2007	1.52E+00	9.32E-02	9.32E-02[c]	6.08E-02	1.24E-03	3.73E-03
2006	2.01E+00	9.28E-02	9.28E-02[c]	8.04E-02	1.24E-03	3.71E-03
2005	1.51E+00	1.55E-01	1.55E-01[c]	6.04E-02	2.07E-03	6.20E-03
2004	1.80E-01	1.12E-01	1.12E-01[c]	7.20E-03	1.49E-03	4.48E-03
2003	1.90E+00	4.21E-02	4.21E-02[c]	7.60E-02	5.61E-04	1.68E-03
2002	3.60E-02	6.10E-02	6.10E-02[c]	1.44E-03	8.13E-04	2.44E-03
2001	2.45E-01	3.25E-01	3.25E-01[c]	9.80E-03	4.33E-03	1.30E-02
2000	5.90E-01	6.10E-01	6.10E-01[c]	2.36E-02	8.13E-03	2.44E-02
1999	4.20E-02	4.20E-02	4.20E-02[c]	1.68E-03	5.60E-04	1.68E-03
1998	8.70E-02	9.20E-02	9.20E-02[c]	3.48E-03	1.23E-03	3.68E-03
1997	7.60E-02	8.30E-02	8.30E-02[c]	3.04E-03	1.11E-03	3.32E-03
1996	7.22E-02	8.24E-02	8.24E-02[c]	2.89E-03	1.10E-03	3.30E-03
1995	7.79E-02	7.05E-02	7.05E-02[c]	3.12E-03	9.40E-04	2.82E-03
1994	2.55E-02	6.14E-02	6.14E-02[c]	1.02E-03	8.19E-04	2.46E-03
1993	3.97E-02	1.67E-01	1.67E-01[c]	1.59E-03	2.23E-03	6.68E-03
1992	7.62E-02	1.31E-01[b]	1.31E-01[d]	3.05E-03	1.75E-03	5.24E-03
1991	2.57E-02	1.92E-01	1.92E-01[c]	1.03E-03	2.56E-03	7.68E-03
1990	1.50E-02	6.78E-02	6.78E-02[c]	6.00E-04	9.04E-04	2.71E-03
1989	3.61E-02	4.86E-02[f]	4.86E-02[e]	1.44E-03	6.48E-04	1.94E-03
1988	1.30E-02	2.00E-01	2.00E-01[c]	5.20E-04	2.67E-03	8.00E-03

Notes:

a Direct radiation is included in Whole Body dose.
b The maximum organ dose for this year was to the bone. This dose was conservatively also assigned to the thyroid, which was not given in the report.
c The limiting organ for this year was the thyroid.
d The limiting organ for this year was the bone.
e The limiting organ for this year was the liver.
f The maximum organ dose for this year was to the child liver. This dose was conservatively also assigned to the thyroid, which was not given in the report.

Table 12.3-4—{Average Annual JAFNPP ISFSI TLD Exposures (mR/yr)}

Mean TLD Exposures by Year Digitized from 7 of 2005 REMP Report (mRoentgen/30 days) (These are historical values and are listed as reported, in English units)		
Year	**ISFSI**	**Control**
1990	3.96	N/A
1991	3.95	4.11
1992	4.28	4.40
1993	3.99	4.19
1994	4.73	4.63
1995	5.14	4.69
1996	5.01	4.20
1997	5.56	4.31
1998	6.20	4.56
1999	6.07	4.47
2000	5.72	3.88
2001	6.88	4.15
2002	7.23	4.48
2003	8.46	4.60
2004	8.27	4.51
2005	8.14	4.02

Note:

1990 through 1992 provide baseline data before spent fuel stored at ISFSI in 1993.

Table 12.3-5—{Calculation of JAFNPP ISFSI Cask Loading}

Year	Cask Loading (Cask-Years)
2001	0
2002	2
2003	3
2004	3
2005	5
2006	9
2007	9
2008	9
2009	12
2010	15
2011	15
2012	15
2013	18
2014	21
2015	21

Table 12.3-6—{Estimate Exposure from NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation}

Year	Cask Loading (cask-years)	Estimated Annual Exposure (mR/yr)	Ratio of Exposure compared to 2011 Exposure	Value of "c"
2011	40	559.4	1.00	905.42
2012	40	559.4	1.00	905.42
2013	46	643.3	1.15	1041.23
2014	46	643.3	1.15	1041.23
2015	52	727.2	1.30	1177.05

Table 12.3-7—{Coefficients for Proposed NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation (Year 2011)}

Coefficient	NMP Unit 1 and Unit 2 Independent Spent Fuel Storage Installation (40 Casks)
C (mrem/yr)	905.42
μ (1/ft)	0.002056
R (ft)	116.52

Table 12.3-8—{Coefficients for Equation 12.3-8}

Coefficient	9 cask JAFNPP ISFSI	N-16			Background
		JAFNPP	NMP Unit 2	NMP Unit 1	
c (mrem/yr)	203.72	1005.1	184.51	217.23	56.67
μ (1/ft)	0.002056	0.0008825	0.0008825	0.0008825	n.a.
R (ft)	116.52	260.82	260.82	260.82	n.a.

Table 12.3-9—{Collective Whole Body Doses (person-rem/yr) to NMP3NPP Construction Workers (person-mSv/yr) }

Zone	Description	2010	2011	2012	2013	2014	2015	Total (ZONE)
B	Batch Plant	1.43E-03 (1.43E-02)	3.54E-03 (3.54E-02)	4.33E-03 (4.33E-02)	5.04E-03 (5.04E-02)	5.04E-03 (5.04E-02)	4.27E-03 (4.27E-02)	2.36E-02 (2.36E-01)
C	Construction on Main Structures	4.69E-01 (4.69E+00)	8.74E-01 (8.74E+00)	1.07E+00 (1.07E+01)	1.21E+00 (1.21E+01)	1.21E+00 (1.21E+01)	9.89E-01 (9.89E+00)	5.81E+00 (5.81E+01)
L	Laydown	2.60E-02 (2.60E-01)	4.81E-02 (4.81E-01)	5.89E-02 (5.89E-01)	6.82E-02 (6.82E-01)	6.73E-02 (6.73E-01)	5.59E-02 (5.59E-01)	3.24E-01 (3.24E+00)
O	Office/Trailer	8.92E-02 (8.92E-01)	1.58E-01 (1.58E+00)	1.94E-01 (1.94E+00)	2.17E-01 (2.17E+00)	2.17E-01 (2.17E+00)	1.77E-01 (1.77E+00)	1.05E+00 (1.05E+01)
P	Parking	9.21E-03 (9.21E-02)	1.60E-02 (1.60E-01)	1.95E-02 (1.95E-01)	2.18E-02 (2.18E-01)	2.18E-02 (2.18E-01)	1.77E-02 (1.77E-01)	1.06E-01 (1.06E+00)
R	Roads	1.65E-02 (1.65E-01)	4.58E-02 (4.58E-01)	5.61E-02 (5.61E-01)	6.60E-02 (6.60E-01)	6.60E-02 (6.60E-01)	5.64E-02 (5.64E-01)	3.07E-01 (3.07E+00)
S	Shoreline	2.90E-01 (2.90E+00)	5.01E-01 (5.01E+00)	6.14E-01 (6.14E+00)	6.84E-01 (6.84E+00)	6.84E-01 (6.84E+00)	5.55E-01 (5.55E+00)	3.33E+00 (3.33E+01)
T	Tower/Basin	7.17E-02 (7.17E-01)	2.21E-01 (2.21E+00)	2.70E-01 (2.70E+00)	3.21E-01 (3.21E+00)	3.21E-01 (3.21E+00)	2.76E-01 (2.76E+00)	1.48E+00 (1.48E+01)
W	Warehouse	1.61E-03 (1.61E-02)	2.84E-03 (2.84E-02)	3.47E-03 (3.47E-02)	3.88E-03 (3.88E-02)	3.88E-03 (3.88E-02)	3.16E-03 (3.16E-02)	1.88E-02 (1.88E-01)
Total (Year)		1.0 (10)	1.9 (19)	2.3 (23)	2.6 (26)	2.6 (26)	2.1 (21)	12.5 (125)

Table 12.3-10—{Gaseous Dose Rate Type and Coefficients (mrem-m^3/sec-yr)}

Regulation		10 CFR 20	10 CFR 50 Appendix I			40 CFR 190		
Plant	**Release**	**TEDE**	**WB-x**	**Skin-x**	**Organ-I**	**WB**	**Organ**	**Thyroid**
NMP Unit 1	**Stack**	1.22E+05	6.53E+04	7.69E+04	7.68E+04	6.72E+04	7.69E+04	6.95E+05
	Vent	2.73E+03	4.50E+01	5.36E+01	3.76E+03	3.76E+03	3.76E+03	3.76E+03
NMP Unit 2	**Stack**	2.70E+04	3.16E+04	4.44E+04	3.12E+03	3.30E+04	3.34E+04	3.34E+04
	Vent	2.25E+04	1.21E+04	1.43E+04	1.43E+04	1.23E+04	1.43E+04	1.23E+04
JAFNPP	**Stack**	4.67E+05	5.82E+05	9.89E+05	4.67E+03	5.82E+05	5.86E+05	5.86E+05
	Vent	5.43E+04	6.76E+04	1.89E+05	3.12E+03	6.79E+04	6.91E+04	6.91E+04

Table 12.3-11—{Historical Annual Average Ground Release χ/Q (sec/m^3) 2001-2006}

Dist (miles)	0.06	0.12	0.31	0.50	0.62	0.75	0.93	1.24	1.5	1.55	1.86	2.49	2.50	3.50	4.50
Dist (m)	**100**	**200**	**500**	**805**	**1,000**	**1,200**	**1,500**	**2,000**	**2,414**	**2,500**	**3,000**	**4,000**	**4,023**	**5,633**	**7,242**
Dist (ft)	**328**	**656**	**1,640**	**2,640**	**3,282**	**3,937**	**4,921**	**6,562**	**7,920**	**8,202**	**9,843**	**13,123**	**13,200**	**18,480**	**23,760**
SSE	2.07E-04	5.64E-05	1.04E-05	4.39E-06	2.97E-06	2.15E-06	1.21E-06	5.83E-07	3.66E-07	3.35E-07	2.21E-07	1.15E-07	1.14E-07	5.85E-08	3.67E-08
S	2.37E-04	6.47E-05	1.20E-05	5.08E-06	3.44E-06	2.49E-06	1.41E-06	6.76E-07	4.25E-07	3.89E-07	2.56E-07	1.34E-07	1.32E-07	6.78E-08	4.26E-08
SSW	3.02E-04	8.18E-05	1.54E-05	6.57E-06	4.47E-06	3.25E-06	1.83E-06	8.80E-07	5.53E-07	5.06E-07	3.32E-07	1.73E-07	1.71E-07	8.72E-08	5.45E-08
SW	3.96E-04	1.07E-04	2.05E-05	8.78E-06	5.99E-06	4.36E-06	2.46E-06	1.18E-06	7.44E-07	6.81E-07	4.48E-07	2.33E-07	2.30E-07	1.18E-07	7.35E-08
WSW	3.19E-04	8.70E-05	1.68E-05	7.23E-06	4.95E-06	3.60E-06	2.04E-06	9.82E-07	6.19E-07	5.67E-07	3.74E-07	1.96E-07	1.93E-07	9.94E-08	6.24E-08
W	4.66E-04	1.29E-04	2.49E-05	1.07E-05	7.31E-06	5.31E-06	3.01E-06	1.46E-06	9.20E-07	8.43E-07	5.58E-07	2.94E-07	2.91E-07	1.51E-07	9.54E-08
WNW	8.77E-04	2.44E-04	4.71E-05	2.02E-05	1.37E-05	9.97E-06	5.65E-06	2.74E-06	1.74E-06	1.59E-06	1.05E-06	5.58E-07	5.52E-07	2.88E-07	1.83E-07
NW	1.51E-03	4.25E-04	8.20E-05	3.51E-05	2.38E-05	1.72E-05	9.77E-06	4.75E-06	3.02E-06	2.77E-06	1.84E-06	9.78E-07	9.68E-07	5.09E-07	3.25E-07
NNW	1.28E-03	3.61E-04	6.98E-05	2.99E-05	2.02E-05	1.47E-05	8.32E-06	4.05E-06	2.57E-06	2.36E-06	1.57E-06	8.36E-07	8.26E-07	4.35E-07	2.78E-07

Table 12.3-12—{Historical Annual Average Elevated Release χ/Q (sec/m³) 2001-2006[a]}

Dist (miles)	0.06	0.12	0.31	0.50	0.62	0.75	0.93	1.24	1.5	1.55	1.86	2.49	2.50	3.50	4.50
Dist (m)	**100**	**200**	**500**	**805**	**1,000**	**1,200**	**1,500**	**2,000**	**2,414**	**2,500**	**3,000**	**4,000**	**4,023**	**5,633**	**7,242**
Dist (ft)	**328**	**656**	**1,640**	**2,640**	**3,281**	**3,937**	**4,921**	**6,562**	**7,920**	**8,202**	**9,843**	**13,123**	**13,200**	**18,480**	**23,760**
SSE	7.25E-18	7.05E-10	1.64E-07	1.09E-07	9.24E-08	7.68E-08	5.51E-08	6.70E-08	5.20E-08	4.94E-08	3.88E-08	3.19E-08	3.16E-08	2.28E-08	1.56E-08
S	5.78E-20	1.79E-10	1.20E-07	8.43E-08	8.32E-08	7.14E-08	5.28E-08	7.30E-08	5.80E-08	5.53E-08	4.43E-08	3.88E-08	3.85E-08	2.90E-08	2.01E-08
SSW	2.14E-19	1.75E-10	7.62E-08	6.48E-08	6.96E-08	6.60E-08	5.38E-08	7.16E-08	5.97E-08	5.73E-08	4.76E-08	4.86E-08	4.82E-08	3.14E-08	2.19E-08
SW	1.10E-21	8.19E-12	1.34E-08	1.40E-08	1.77E-08	1.97E-08	1.91E-08	2.49E-08	2.42E-08	2.38E-08	2.26E-08	2.63E-08	2.61E-08	2.31E-08	1.84E-08
WSW	2.24E-22	2.31E-12	1.69E-09	2.75E-09	3.15E-09	3.57E-09	3.75E-09	5.77E-09	6.61E-09	6.72E-09	7.36E-09	7.44E-09	7.44E-09	6.79E-09	6.25E-09
W	4.19E-22	2.81E-12	2.76E-09	3.43E-09	3.78E-09	4.24E-09	4.46E-09	5.20E-09	5.76E-09	5.82E-09	6.24E-09	6.20E-09	6.20E-09	5.63E-09	4.89E-09
WNW	1.68E-23	3.70E-12	7.48E-09	8.39E-09	9.14E-09	1.01E-08	1.02E-08	1.11E-08	1.17E-08	1.17E-08	1.19E-08	1.11E-08	1.10E-08	9.38E-09	7.82E-09
NW	2.82E-22	1.38E-11	2.31E-08	2.58E-08	2.64E-08	2.73E-08	2.56E-08	2.57E-08	2.60E-08	2.59E-08	2.58E-08	2.33E-08	2.32E-08	1.93E-08	1.59E-08
NNW	3.50E-22	1.27E-11	1.76E-08	2.40E-08	2.57E-08	2.66E-08	2.39E-08	2.24E-08	2.21E-08	2.19E-08	2.16E-08	1.96E-08	1.95E-08	1.65E-08	1.38E-08

Note:

a. Calculated using a stack height of 350 ft, which is the lowest of the stack heights for NMP Unit 1, NMP Unit 2 and JAFNPP.

Table 12.3-13—{Historical Annual Average Elevated Release Gamma χ/Q (sec/m^3) 2001 – 2006[a]}

Dist (miles)	0.06	0.12	0.31	0.50	0.62	0.75	0.93	1.24	1.5	1.55	1.86	2.49	2.50	3.50	4.50
Dist (m)	**100**	**200**	**500**	**805**	**1,000**	**1,200**	**1,500**	**2,000**	**2,414**	**2,500**	**3,000**	**4,000**	**4,023**	**5,633**	**7,242**
Dist (ft)	**328**	**656**	**1,640**	**2,640**	**3,280**	**3,937**	**4,921**	**6,562**	**7,920**	**8,202**	**9,843**	**13,123**	**13,200**	**18,480**	**23,760**
SSE	3.36E-07	3.40E-07	3.71E-07	2.70E-07	2.30E-07	1.88E-07	1.26E-07	1.03E-07	7.27E-08	6.79E-08	4.94E-08	3.35E-08	3.32E-08	2.12E-08	1.44E-08
S	3.22E-07	3.25E-07	3.57E-07	2.76E-07	2.65E-07	2.20E-07	1.47E-07	1.25E-07	8.83E-08	8.25E-08	6.03E-08	4.17E-08	4.13E-08	2.68E-08	1.83E-08
SSW	4.04E-07	4.05E-07	4.36E-07	3.47E-07	3.18E-07	2.68E-07	1.82E-07	1.41E-07	1.01E-07	9.45E-08	6.98E-08	5.24E-08	5.20E-08	3.14E-08	2.15E-08
SW	3.14E-07	3.10E-07	3.27E-07	2.73E-07	2.44E-07	2.07E-07	1.42E-07	9.76E-08	7.13E-08	6.70E-08	5.06E-08	3.84E-08	3.81E-08	2.66E-08	1.95E-08
WSW	2.39E-07	2.35E-07	2.42E-07	1.99E-07	1.63E-07	1.38E-07	9.32E-08	6.12E-08	4.46E-08	4.19E-08	3.17E-08	2.05E-08	2.04E-08	1.32E-08	1.00E-08
W	2.38E-07	2.35E-07	2.42E-07	1.98E-07	1.62E-07	1.36E-07	9.23E-08	5.57E-08	4.05E-08	3.81E-08	2.88E-08	1.86E-08	1.84E-08	1.19E-08	8.74E-09
WNW	2.87E-07	2.85E-07	2.98E-07	2.48E-07	2.04E-07	1.73E-07	1.18E-07	7.20E-08	5.27E-08	4.96E-08	3.77E-08	2.45E-08	2.43E-08	1.57E-08	1.15E-08
NW	5.27E-07	5.28E-07	5.58E-07	4.58E-07	3.77E-07	3.20E-07	2.18E-07	1.33E-07	9.75E-08	9.17E-08	6.97E-08	4.51E-08	4.48E-08	2.89E-08	2.10E-08
NNW	5.36E-07	5.37E-07	5.64E-07	4.58E-07	3.76E-07	3.19E-07	2.16E-07	1.31E-07	9.53E-08	8.96E-08	6.76E-08	4.35E-08	4.32E-08	2.77E-08	2.02E-08

Note:

a. Calculated using a stack height of 350 ft, which is the lowest of the stack heights for NMP Unit 1, NMP Unit 2 and JAFNPP.

Table 12.3-14—{Historical Gaseous Release Data for NMP Unit 1 Stack (2001-2006) [Ci/yr (Bq/yr)]}

Nuclide	2001	2002	2003	2004	2005	2006
H 3	8.29E+01	2.33E+01	2.18E+01	3.37E+01	4.19E+01	2.91E+01
	(3.07E+12)	(8.61E+11)	(8.07E+11)	(1.25E+12)	(1.55E+12)	(1.08E+12)
Cr 51	3.30E-04	0.00E+00	3.16E-04	6.77E-04	2.11E-04	0.00E+00
	(1.22E+07)	(0.00E+00)	(1.17E+07)	(2.50E+07)	(7.80E+06)	(0.00E+00)
Mn 54	2.36E-03	3.68E-04	8.19E-04	1.15E-03	2.97E-04	8.23E-05
	(8.72E+07)	(1.36E+07)	(3.03E+07)	(4.25E+07)	(1.10E+07)	(3.05E+06)
Co 58	3.23E-04	6.70E-05	1.08E-04	1.68E-04	8.42E-05	1.45E-04
	(1.20E+07)	(2.48E+06)	(4.00E+06)	(6.23E+06)	(3.12E+06)	(5.37E+06)
Co 60	6.54E-03	1.00E-03	3.03E-03	4.12E-03	2.89E-03	2.01E-03
	(2.42E+08)	(3.71E+07)	(1.12E+08)	(1.52E+08)	(1.07E+08)	(7.44E+07)
Fe 55	3.15E-03	1.35E-03	1.02E-03	8.30E-04	2.06E-04	1.71E-03
	(1.16E+08)	(5.00E+07)	(3.77E+07)	(3.07E+07)	(7.62E+06)	(6.33E+07)
Fe 59	1.18E-04	0.00E+00	3.65E-05	6.55E-05	0.00E+00	0.00E+00
	(4.37E+06)	(0.00E+00)	(1.35E+06)	(2.42E+06)	(0.00E+00)	(0.00E+00)
Zn 65	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-04
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(6.25E+06)
Kr 85m	1.38E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(5.11E+08)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Sr 89	1.22E-03	6.55E-04	1.62E-04	5.25E-05	0.00E+00	1.63E-05
	(4.50E+07)	(2.42E+07)	(5.99E+06)	(1.94E+06)	(0.00E+00)	(6.03E+05)
Sr 90	1.32E-04	1.56E-06	0.00E+00	0.00E+00	0.00E+00	5.20E-06
	(4.90E+06)	(5.76E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(1.92E+05)
I 131	2.70E-03	1.62E-03	4.13E-04	6.28E-04	1.26E-03	1.19E-03
	(9.99E+07)	(5.99E+07)	(1.53E+07)	(2.32E+07)	(4.65E+07)	(4.38E+07)
I 133	1.83E-02	7.30E-03	1.32E-04	3.99E-04	2.92E-03	4.33E-03
	(6.77E+08)	(2.70E+08)	(4.88E+06)	(1.48E+07)	(1.08E+08)	(1.60E+08)
Xe 133	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.41E+01
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.20E+11)
Xe 135	9.21E-01	0.00E+00	3.44E-01	1.54E+00	6.35E-01	8.34E-01
	(3.41E+10)	(0.00E+00)	(1.27E+10)	(5.70E+10)	(2.35E+10)	(3.09E+10)
Xe 138	0.00E+00	2.90E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(1.07E+11)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Cs 137	5.24E-06	2.66E-05	2.49E-05	3.12E-05	1.62E-05	1.66E-05
	(1.94E+05)	(9.85E+05)	(9.22E+05)	(1.16E+06)	(5.98E+05)	(6.14E+05)
Ba 140	1.99E-05	1.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(7.36E+05)	(6.15E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Nd 147	2.59E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(9.58E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)

Table 12.3-15—{Historical Gaseous Release Data for NMP Unit 1 Vent (2001-2006) [Ci/yr (Bq/yr)]}

Nuclide	2001	2002	2003	2004	2005	2006
H 3	4.35E+01	8.04E+00	1.63E+02	1.31E+01	9.27E+00	5.27E+00
	(1.61E+12)	(2.97E+11)	(6.03E+12)	(4.85E+11)	(3.43E+11)	(1.95E+11)
Cr 51	3.32E-09	0.00E+00	2.23E-08	0.00E+00	0.00E+00	0.00E+00
	(1.23E+02)	(0.00E+00)	(8.25E+02)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Mn 54	5.95E-08	0.00E+00	2.28E-06	2.58E-08	0.00E+00	0.00E+00
	(2.20E+03)	(0.00E+00)	(8.43E+04)	(9.55E+02)	(0.00E+00)	(0.00E+00)
Co 58	1.51E-08	0.00E+00	3.93E-07	3.06E-08	0.00E+00	0.00E+00
	(5.58E+02)	(0.00E+00)	(1.45E+04)	(1.13E+03)	(0.00E+00)	(0.00E+00)
Co 60	4.39E-07	0.00E+00	4.34E-06	8.10E-08	0.00E+00	0.00E+00
	(1.62E+04)	(0.00E+00)	(1.61E+05)	(3.00E+03)	(0.00E+00)	(0.00E+00)
Fe 55	3.15E-03	1.35E-03	1.02E-03	0.00E+00	2.06E-04	1.71E-03
	(1.16E+08)	(5.00E+07)	(3.77E+07)	(0.00E+00)	(7.62E+06)	(6.33E+07)
Fe 59	1.79E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(6.62E+02)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Sr 89	4.28E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(1.58E+03)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Sr 90	5.36E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(1.98E+02)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
I 131	0.00E+00	0.00E+00	0.00E+00	1.32E-08	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(4.88E+02)	(0.00E+00)	(0.00E+00)
I 133	1.02E-08	0.00E+00	0.00E+00	1.20E-07	0.00E+00	0.00E+00
	(3.77E+02)	(0.00E+00)	(0.00E+00)	(4.44E+03)	(0.00E+00)	(0.00E+00)
Xe 133	4.24E-05	1.05E-04	1.35E-02	1.23E-03	0.00E+00	1.26E-03
	(1.57E+06)	(3.89E+06)	(4.98E+08)	(4.56E+07)	(0.00E+00)	(4.66E+07)
Xe 133m	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Xe 135	1.94E-03	2.63E-04	5.92E-03	1.67E-03	5.68E-05	2.48E-05
	(7.18E+07)	(9.73E+06)	(2.19E+08)	(6.17E+07)	(2.10E+06)	(9.18E+05)
Cs 137	0.00E+00	0.00E+00	2.04E-07	1.74E-09	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(7.55E+03)	(6.44E+01)	(0.00E+00)	(0.00E+00)

Table 12.3-16—{Historical Gaseous Release Data for NMP Unit 2 Stack (2001-2006) [Ci/yr (Bq/yr)]}

(Page 1 of 2)

Nuclide	2001	2002	2003	2004	2005	2006
H 3	2.36E+01	2.44E+01	4.32E+01	3.92E+01	6.43E+01	3.09E+01
	(8.72E+11)	(9.02E+11)	(1.60E+12)	(1.45E+12)	(2.38E+12)	(1.14E+12)
Ar 41	4.47E-01	5.52E-01	4.56E-01	2.09E-01	1.78E-01	5.12E-03
	(1.65E+10)	(2.04E+10)	(1.69E+10)	(7.73E+09)	(6.60E+09)	(1.89E+08)
Cr 51	0.00E+00	0.00E+00	2.08E-04	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(7.70E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Mn 54	4.00E-05	1.82E-05	8.20E-05	1.11E-06	0.00E+00	2.88E-05
	(1.48E+06)	(6.75E+05)	(3.03E+06)	(4.11E+04)	(0.00E+00)	(1.07E+06)
Co 58	0.00E+00	3.72E-06	2.35E-05	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(1.38E+05)	(8.70E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Co 60	9.99E-05	1.37E-04	1.96E-04	3.95E-05	5.96E-05	4.26E-05
	(3.70E+06)	(5.05E+06)	(7.24E+06)	(1.46E+06)	(2.21E+06)	(1.58E+06)
Fe 55	8.31E-05	4.01E-05	0.00E+00	0.00E+00	0.00E+00	2.47E-04
	(3.07E+06)	(1.48E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(9.13E+06)
Fe 59	0.00E+00	0.00E+00	3.66E-05	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(1.35E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Zn 65	5.01E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(1.85E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Kr 85m	3.52E+00	5.04E+00	4.29E+01	1.35E+01	4.82E+01	1.66E+01
	(1.30E+11)	(1.86E+11)	(1.59E+12)	(5.00E+11)	(1.78E+12)	(6.13E+11)
Kr 87	4.57E-01	1.74E-01	1.36E+00	0.00E+00	1.67E+00	6.67E-01
	(1.69E+10)	(6.44E+09)	(5.03E+10)	(0.00E+00)	(6.18E+10)	(2.47E+10)
Kr 88	3.83E+00	2.19E+00	4.50E+01	1.41E+01	6.08E+01	2.19E+01
	(1.42E+11)	(8.11E+10)	(1.66E+12)	(5.20E+11)	(2.25E+12)	(8.10E+11)
Sr 89	1.39E-05	7.54E-06	0.00E+00	0.00E+00	0.00E+00	1.55E-05
	(5.14E+05)	(2.79E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.73E+05)
Sr 90	4.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.24E-06
	(1.68E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(8.29E+04)
Zr 95	0.00E+00	1.97E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(7.29E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Ag 110m	2.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(7.55E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
I 131	5.79E-04	3.18E-04	3.05E-04	9.86E-05	4.22E-04	2.63E-04
	(2.14E+07)	(1.18E+07)	(1.13E+07)	(3.65E+06)	(1.56E+07)	(9.75E+06)
I 133	4.43E-03	1.65E-03	5.75E-04	3.14E-04	3.21E-03	4.99E-04
	(1.64E+08)	(6.11E+07)	(2.13E+07)	(1.16E+07)	(1.19E+08)	(1.85E+07)
Xe 133	8.70E-02	1.16E+00	1.40E+02	2.71E+01	6.38E+01	3.30E+01
	(3.22E+09)	(4.29E+10)	(5.17E+12)	(1.00E+12)	(2.36E+12)	(1.22E+12)
Xe 133m	0.00E+00	0.00E+00	4.40E-01	0.00E+00	0.00E+00	1.57E-01
	(0.00E+00)	(0.00E+00)	(1.63E+10)	(0.00E+00)	(0.00E+00)	(5.81E+09)
Xe 135	7.50E-01	6.65E-01	1.17E+01	8.15E-01	0.00E+00	2.92E+00
	(2.78E+10)	(2.46E+10)	(4.33E+11)	(3.02E+10)	(0.00E+00)	(1.08E+11)
Xe 135m	1.44E+00	5.40E-01	1.31E+00	1.82E-01	0.00E+00	5.69E-01
	(5.34E+10)	(2.00E+10)	(4.85E+10)	(6.73E+09)	(0.00E+00)	(2.11E+10)
Xe 137	9.89E+00	1.97E+00	2.48E+00	4.14E-02	0.00E+00	0.00E+00
	(3.66E+11)	(7.30E+10)	(9.18E+10)	(1.53E+09)	(0.00E+00)	(0.00E+00)
Xe 138	5.78E+00	1.64E+00	4.69E+00	1.23E-01	0.00E+00	7.72E-01
	(2.14E+11)	(6.08E+10)	(1.74E+11)	(4.55E+09)	(0.00E+00)	(2.86E+10)

Table 12.3-16—{Historical Gaseous Release Data for NMP Unit 2 Stack (2001-2006) [Ci/yr (Bq/yr)]}

(Page 2 of 2)

Nuclide	2001	2002	2003	2004	2005	2006
Cs 134	0.00E+00	0.00E+00	0.00E+00	2.30E-06	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(8.51E+04)	(0.00E+00)	(0.00E+00)
Mo 99	1.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(6.33E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Xe 138	5.78E+00	1.64E+00	4.69E+00	1.23E-01	0.00E+00	7.72E-01
	(2.14E+11)	(6.08E+10)	(1.74E+11)	(4.55E+09)	(0.00E+00)	(2.86E+10)
Cs 134	0.00E+00	0.00E+00	0.00E+00	2.30E-06	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(8.51E+04)	(0.00E+00)	(0.00E+00)
Mo 99	1.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(6.33E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)

Table 12.3-17—{Historical Gaseous Release Data for NMP Unit 2 Vent (2001-2006) [Ci/yr (Bq/yr)]}

Nuclide	2001	2002	2003	2004	2005	2006
H 3	5.15E+00	6.07E+00	2.30E+01	3.75E+01	6.97E+01	1.83E+01
	(1.90E+11)	(2.25E+11)	(8.52E+11)	(1.39E+12)	(2.58E+12)	(6.79E+11)
Cr 51	4.86E-04	0.00E+00	0.00E+00	6.60E-05	0.00E+00	0.00E+00
	(1.80E+07)	(0.00E+00)	(0.00E+00)	(2.44E+06)	(0.00E+00)	(0.00E+00)
Mn 54	6.97E-04	7.48E-04	1.65E-04	3.39E-04	2.91E-05	6.96E-05
	(2.58E+07)	(2.77E+07)	(6.10E+06)	(1.25E+07)	(1.08E+06)	(2.58E+06)
Co 58	1.02E-04	2.13E-05	8.22E-06	0.00E+00	0.00E+00	0.00E+00
	(3.77E+06)	(7.89E+05)	(3.04E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Co 60	9.70E-04	1.19E-03	5.14E-04	8.18E-04	3.15E-04	2.38E-04
	(3.59E+07)	(4.38E+07)	(1.90E+07)	(3.03E+07)	(1.16E+07)	(8.80E+06)
Fe 55	3.44E-03	9.81E-04	3.28E-04	0.00E+00	0.00E+00	2.18E-03
	(1.27E+08)	(3.63E+07)	(1.21E+07)	(0.00E+00)	(0.00E+00)	(8.08E+07)
Fe 59	2.38E-04	3.90E-05	4.58E-05	2.41E-05	0.00E+00	0.00E+00
	(8.80E+06)	(1.44E+06)	(1.69E+06)	(8.92E+05)	(0.00E+00)	(0.00E+00)
Zn 65	1.08E-04	1.34E-04	0.00E+00	0.00E+00	0.00E+00	7.87E-05
	(4.00E+06)	(4.95E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.91E+06)
Kr 85	0.00E+00	2.83E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(1.05E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Sr 89	2.67E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.07E-05
	(9.88E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(1.51E+06)
Sr 90	3.29E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.42E-06
	(1.22E+06)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.75E+05)
Ag 110m	1.86E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(6.88E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
I 131	0.00E+00	4.45E-05	4.80E-06	1.29E-04	1.85E-05	1.57E-05
	(0.00E+00)	(1.65E+06)	(1.78E+05)	(4.77E+06)	(6.83E+05)	(5.81E+05)
I 133	0.00E+00	3.76E-05	0.00E+00	0.00E+00	3.34E-05	0.00E+00
	(0.00E+00)	(1.39E+06)	(0.00E+00)	(0.00E+00)	(1.24E+06)	(0.00E+00)
Xe 133m	0.00E+00	0.00E+00	2.62E-01	6.13E+00	0.00E+00	5.78E-01
	(0.00E+00)	(0.00E+00)	(9.69E+09)	(2.27E+11)	(0.00E+00)	(2.14E+10)
Cs 134	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.97E-06
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.58E+05)
Cs 137	4.47E-06	2.79E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(1.65E+05)	(1.03E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Mo 99	0.00E+00	8.85E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(3.27E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)

Table 12.3-18—{Historical Gaseous Release Data for JAFNPP Stack (2001-2006) [Ci/yr (Bq/yr)]}

(Page 1 of 2)

Nuclide	2001	2002	2003	2004	2005	2006
H 3	4.08E+00	3.12E+00	4.17E+00	2.93E+00	2.63E+00	2.96E+00
	(1.51E+11)	(1.15E+11)	(1.54E+11)	(1.08E+11)	(9.72E+10)	(1.10E+11)
Ar 41	2.51E+01	2.16E+01	1.38E+01	1.38E+01	9.61E+00	7.59E+00
	(9.28E+11)	(7.99E+11)	(2.36E+12)	(5.11E+11)	(3.56E+11)	(2.81E+11)
Cr 51	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-05	1.56E-06
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.81E+05)	(5.77E+04)
Mn 54	3.41E-07	2.50E-06	3.52E-07	0.00E+00	6.69E-07	8.83E-07
	(1.26E+04)	(9.27E+04)	(1.30E+04)	(0.00E+00)	(2.48E+04)	(3.27E+04)
Co 60	2.63E-07	6.14E-07	0.00E+00	0.00E+00	0.00E+00	4.34E-07
	(9.72E+03)	(2.27E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(1.61E+04)
Kr 85	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E+01
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.00E+11)
Kr 85m	3.63E+00	8.59E+00	3.50E+00	2.02E+02	5.12E+02	1.87E+02
	(1.34E+11)	(3.18E+11)	(1.29E+11)	(7.48E+12)	(1.89E+13)	(6.92E+12)
Kr 87	5.53E-01	1.66E+01	4.99E-01	2.06E+01	4.20E+02	1.22E+01
	(2.05E+10)	(6.15E+11)	(1.85E+10)	(7.64E+11)	(1.55E+13)	(4.50E+11)
Kr 88	1.09E+00	1.97E+01	2.61E+00	2.18E+02	8.22E+02	1.69E+02
	(4.03E+10)	(7.29E+11)	(9.67E+10)	(8.06E+12)	(3.04E+13)	(6.24E+12)
Kr 89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.53E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.05E+11)
Sr 89	3.89E-06	2.87E-06	2.12E-06	2.02E-04	2.21E-04	4.36E-04
	(1.44E+05)	(1.06E+05)	(7.84E+04)	(7.49E+06)	(8.19E+06)	(1.61E+07)
Sr 90	1.11E-07	6.61E-04	5.13E-08	6.30E-07	5.31E-07	1.51E-06
	(4.11E+03)	(2.45E+07)	(1.90E+03)	(2.33E+04)	(1.96E+04)	(5.60E+04)
Nb 95	2.24E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(8.29E+05)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
I 131	2.24E+00	1.24E-04	3.30E-05	8.95E-04	7.00E-03	1.24E-03
	(8.29E+10)	(4.60E+06)	(1.22E+06)	(3.31E+07)	(2.59E+08)	(4.58E+07)
I 133	6.98E-06	8.71E-04	1.59E-05	2.29E-03	2.44E-02	2.27E-03
	(2.58E+05)	(3.22E+07)	(5.88E+05)	(8.48E+07)	(9.03E+08)	(8.39E+07)
I 135	0.00E+00	9.52E-04	0.00E+00	5.00E-04	1.41E-02	1.47E-03
	(0.00E+00)	(3.52E+07)	(0.00E+00)	(1.85E+07)	(5.23E+08)	(5.45E+07)
Xe 133	1.55E+00	3.76E+00	7.60E-01	3.01E+02	3.61E+02	2.07E+02
	(5.75E+10)	(1.39E+11)	(2.81E+10)	(1.11E+13)	(1.33E+13)	(7.66E+12)
Xe 133m	0.00E+00	0.00E+00	0.00E+00	1.43E+00	4.13E-01	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.29E+10)	(1.53E+10)	(0.00E+00)
Xe 135	5.06E-01	2.67E+01	4.44E-01	4.52E+01	7.82E+02	5.93E+00
	(1.87E+10)	(9.87E+11)	(1.64E+10)	(1.67E+12)	(2.89E+13)	(2.19E+11)
Xe 135m	4.09E-01	2.44E+00	2.21E-01	1.21E+01	2.49E+02	2.28E+01
	(1.51E+10)	(9.01E+10)	(8.19E+09)	(4.48E+11)	(9.20E+12)	(8.44E+11)
Xe 137	0.00E+00	1.61E-01	0.00E+00	2.33E+01	8.52E+01	1.13E+02
	(0.00E+00)	(5.96E+09)	(0.00E+00)	(8.63E+11)	(3.15E+12)	(4.19E+12)
Xe 138	1.16E+00	7.98E+00	8.14E-01	3.78E+01	7.88E+01	6.85E+01
	(4.29E+10)	(2.95E+11)	(3.01E+10)	(1.40E+12)	(2.92E+12)	(2.53E+12)
Cs 136	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.23E-07	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.31E+04)	(0.00E+00)
Cs 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.09E-07	1.09E-06
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.25E+04)	(4.02E+04)

Table 12.3-18—{Historical Gaseous Release Data for JAFNPP Stack (2001-2006) [Ci/yr (Bq/yr)]}

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Nuclide	2001	2002	2003	2004	2005	2006
Ce 144	0.00E+00	3.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(1.40E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)
Ba 140	0.00E+00	0.00E+00	0.00E+00	5.80E-05	1.76E-04	2.12E-04
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.14E+06)	(6.51E+06)	(7.85E+06)
As 76	0.00E+00	1.63E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	(0.00E+00)	(6.03E+04)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)

Table 12.3-19—{Historical Gaseous Release Data for JAFNPP Vent (2001-2006) [Ci/yr (Bq/yr)]}
(Page 1 of 2)

Nuclide	2001	2002	2003	2004	2005	2006
H 3	2.42E+01	2.07E+01	1.41E+01	1.42E+01	1.45E+01	1.41E+01
	(8.96E+11)	(7.65E+11)	(5.22E+11)	(5.24E+11)	(5.37E+11)	(5.20E+11)
Cr 51	0.00E+00	2.61E-05	0.00E+00	1.63E-05	0.00E+00	0.00E+00
	(0.00E+00)	(9.66E+05)	(0.00E+00)	(6.03E+05)	(0.00E+00)	(0.00E+00)
Mn 54	2.41E-06	4.11E-05	4.66E-05	9.54E-05	1.28E-06	6.23E-06
	(8.92E+04)	(1.52E+06)	(1.72E+06)	(3.53E+06)	(4.74E+04)	(2.31E+05)
Co 57	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-06	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(4.00E+04)	(0.00E+00)
Co 58	0.00E+00	3.90E-06	1.48E-05	3.37E-05	0.00E+00	0.00E+00
	(0.00E+00)	(1.44E+05)	(5.47E+05)	(1.25E+06)	(0.00E+00)	(0.00E+00)
Co 60	1.01E-06	1.66E-05	2.10E-05	2.92E-05	0.00E+00	3.41E-06
	(3.74E+04)	(6.14E+05)	(7.78E+05)	(1.08E+06)	(0.00E+00)	(1.26E+05)
Fe 59	0.00E+00	1.70E-05	5.63E-06	7.75E-06	0.00E+00	0.00E+00
	(0.00E+00)	(6.29E+05)	(2.08E+05)	(2.87E+05)	(0.00E+00)	(0.00E+00)
Zn 65	2.13E-06	5.76E-06	2.05E-05	1.47E-04	0.00E+00	7.66E-06
	(7.88E+04)	(2.13E+05)	(7.60E+05)	(5.44E+06)	(0.00E+00)	(2.83E+05)
Kr 87	0.00E+00	0.00E+00	0.00E+00	2.56E+00	7.26E+00	6.76E-02
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(9.47E+10)	(2.69E+11)	(2.50E+09)
Kr 88	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.89E-01	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(3.29E+10)	(0.00E+00)
Sr 89	5.09E-05	3.33E-05	1.63E-05	5.84E-04	2.05E-03	7.10E-04
	(1.88E+06)	(1.23E+06)	(6.01E+05)	(2.16E+07)	(7.60E+07)	(2.63E+07)
Sr 90	7.39E-06	1.41E-05	6.67E-07	4.97E-06	2.07E-06	4.75E-06
	(2.73E+05)	(5.23E+05)	(2.47E+04)	(1.84E+05)	(7.66E+04)	(1.76E+05)
Sb 124	0.00E+00	1.27E-06	0.00E+00	4.68E-07	0.00E+00	0.00E+00
	(0.00E+00)	(4.70E+04)	(0.00E+00)	(1.73E+04)	(0.00E+00)	(0.00E+00)
I 131	6.00E-05	1.58E-04	1.38E-05	4.53E-03	2.35E-03	2.54E-03
	(2.22E+06)	(5.86E+06)	(5.10E+05)	(1.68E+08)	(8.68E+07)	(9.39E+07)
I 133	9.47E-05	3.79E-04	4.87E-06	6.33E-03	7.90E-03	2.35E-03
	(3.50E+06)	(1.40E+07)	(1.80E+05)	(2.34E+08)	(2.92E+08)	(8.70E+07)
I 135	0.00E+00	0.00E+00	0.00E+00	8.16E-04	4.49E-04	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(3.02E+07)	(1.66E+07)	(0.00E+00)
Xe 133	0.00E+00	0.00E+00	0.00E+00	2.44E+00	1.38E+01	1.10E+01
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(9.04E+10)	(5.12E+11)	(4.06E+11)
Xe 135	2.60E-01	0.00E+00	0.00E+00	6.82E+00	2.60E+01	1.25E+01
	(9.62E+09)	(0.00E+00)	(0.00E+00)	(2.52E+11)	(9.61E+11)	(4.63E+11)
Xe 135m	0.00E+00	0.00E+00	0.00E+00	1.52E+01	6.17E+01	4.96E+01
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(5.63E+11)	(2.28E+12)	(1.84E+12)
Xe 137	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.56E+01	2.16E+02
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.43E+12)	(8.01E+12)
Xe 138	0.00E+00	0.00E+00	0.00E+00	6.52E+01	1.77E+02	1.86E+02
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(2.41E+12)	(6.56E+12)	(6.87E+12)
Cs 134	0.00E+00	0.00E+00	0.00E+00	3.50E-05	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(1.30E+06)	(0.00E+00)	(0.00E+00)
Cs 136	0.00E+00	0.00E+00	0.00E+00	2.94E-06	0.00E+00	0.00E+00
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(1.09E+05)	(0.00E+00)	(0.00E+00)

Table 12.3-19—{Historical Gaseous Release Data for JAFNPP Vent (2001-2006) [Ci/yr (Bq/yr)]}

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Nuclide	2001	2002	2003	2004	2005	2006
Cs 137	2.35E-06	0.00E+00	0.00E+00	1.89E-05	0.00E+00	0.00E+00
	(8.70E+04)	(0.00E+00)	(0.00E+00)	(6.99E+05)	(0.00E+00)	(0.00E+00)
Ba 140	0.00E+00	0.00E+00	0.00E+00	2.34E-04	1.04E-03	6.34E-04
	(0.00E+00)	(0.00E+00)	(0.00E+00)	(8.65E+06)	(3.86E+07)	(2.35E+07)

Table 12.3-20—{Total Effective Dose Equivalent (TEDE) from All Gaseous Effluent Releases (mrem/yr)}

Facility	Year	TEDE		
		Stack	Vent	Total
JAFNPP	2001	2.45E-03	3.95E-03	6.40E-03
	2002	6.57E-03	6.15E-03	1.27E-02
	2003	1.66E-03	5.95E-03	7.61E-03
	2004	3.75E-02	1.51E-01	1.89E-01
	2005	1.63E-01	4.25E-01	5.89E-01
	2006	3.45E-02	4.75E-01	5.10E-01
NMP Unit 1	2001	9.26E-02	2.56E-02	1.18E-01
	2002	1.50E-02	4.68E-03	1.97E-02
	2003	4.25E-02	9.79E-02	1.40E-01
	2004	5.81E-02	7.70E-03	6.58E-02
	2005	4.04E-02	5.40E-03	4.58E-02
	2006	2.82E-02	3.07E-03	3.13E-02
NMP Unit 2	2001	3.15E-03	4.60E-01	4.63E-01
	2002	2.46E-03	5.56E-01	5.58E-01
	2003	1.38E-02	2.43E-01	2.57E-01
	2004	3.98E-03	3.89E-01	3.93E-01
	2005	1.47E-02	1.69E-01	1.84E-01
	2006	5.78E-03	1.17E-01	1.23E-01

Table 12.3-21—{Total of Maximum Shoreline Doses}

Plant	LADTAPII mrem/yr (mSv/yr) (12 hr/yr occupancy)	Worker mrem/yr (mSv/yr) (2,200 hr/yr occupancy)	Full mrem/yr (Sv/yr) (8,760 hr/yr occupancy)
NMP Unit 1	2.28E-03 (2.28E-05)	4.18E-01 (4.18E-03)	1.66E+00 (1.66E-02)
NMP Unit 2	9.53E-03 (9.53E-05)	1.75E+00 (1.75E-02)	6.96E+00 (6.96E-02)
JAFNPP	1.43E-04 (1.43E-06)	2.62E-02 (2.62E-04)	1.04E-01 (1.04E-03)
Total	1.20E-02 (1.20E-04)	2.19E+00 (2.19E-02)	8.73E+00 (8.73E-02)

Table 12.3-22—{Historical NMP Unit 1 Liquid Releases}

Isotope	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)
Co-58	**	**	1.11E-07 (4.11E+03)	5.36-E08 (1.98E+03)
Co-60	**	**	1.67E-06 (6.18E+04)	1.27-E06 (4.70E+04)
Cs-137	**	**	5.79E-08 (2.14E+03)	**
Fe-55	4.74E+00 (1.75E+11)	6.21E-01 (2.30E+10)	**	**
H-3	1.52E+01 (5.62E+11)	2.72E+01 (1.00E+12)	6.03E-02 (2.23E+09)	4.86E-02 (1.80E+09)
Mn-54	**	**	8.11E-07 (3.00E+04)	5.15E-07 (1.91E+04)

Note:

** Concentrations less than the lower limit of detection of the counting system.

Table 12.3-23—{Historical NMP Unit 2 Liquid Releases}

Isotope	2001 Ci (Bq)	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2006 Ci (Bq)
Ag-110m	2.41E-03 (8.90E+07)	1.32E-03 (4.87E+07)	**	3.75E-04 (1.39E+07)	**
Au-199	1.08E-03 (3.99E+07)	**	**	**	**
Ba-140	**	**	1.61E-04 (5.96E+06)	**	**
Co-58	1.84E-03 (6.82E+07)	2.39E-03 (8.84E+07)	2.57E-03 (9.51E+07)	**	**
Co-60	2.51E-02 (9.28E+08)	4.36E-02 (1.61E+09)	4.56E-02 (1.69E+09)	1.19E-02 (4.39E+08)	4.32E-04 (1.50E+07)
Cr-51	6.88E-03 (2.55E+08)	4.39E-03 (1.62E+08)	6.15E-03 (2.28E+08)	**	**
Cs-136	2.72E-05 (1.01E+06)	**	**	**	**
Cu-64	2.86E-03 (1.06E+08)	1.46E-03 (5.39E+07)	6.02E-04 (2.23E+07)	**	1.94E-05 (7.19E+05)
Fe-55	8.01E-03 (2.96E+08)	1.70E-02 (6.31E+08)	**	3.91E-03 (1.45E+08)	1.17E-04 (4.34E+06)
Fe-59	8.99E-03 (3.33E+08)	6.83E-03 (2.53E+08)	5.00E-03 (1.85E+08)	5.81E-05 (2.15E+06)	**
H-3	3.11E+01 (1.15E+12)	1.88E+01 (6.97E+11)	9.30E+00 (3.44E+11)	5.80E+00 (2.15E+11)	6.89E+00 (2.55E+11)
Mn-54	6.83E-02 (2.53E+09)	5.58E-02 (2.06E+09)	2.81E-02 (1.04E+09)	4.83E-03 (1.79E+08)	6.30E-06 (2.33E+05)
Mo-99	1.12E-05 (4.14E+05)	**	**	**	**
Nb-95	1.43E-05 (5.29E+05)	3.61E-05 (1.34E+06)	**	**	**
Sb-124	5.05E-04 (1.87E+07)	3.51E-04 (1.30E+07)	1.81E-04 (6.70E+06)	**	**
Sr-89	5.08E-05 (1.88E+06)	**	**	**	**
Sr-90	3.50E-05 (1.30E+06)	2.96E-06 (1.10E+05)	**	**	**
Zn-65	4.60E-03 (1.70E+08)	5.21E-03 (1.93E+08)	4.27E-03 (1.58E+08)	3.97E-04 (1.47E+07)	**
Zn-69m	3.79E-05 (1.40E+06)	**	4.02E-05 (1.49E+06)	**	**
Zr-95	**	4.02E-05 (1.49E+06)	**	**	**
Tc-99m	1.18E-05 (4.36E+05)	**	**	**	**

Note:

** Concentrations less than the lower limit of detection of the counting system.

Table 12.3-24—{Historical JAFNPP Liquid Releases }

Isotope	2002 Ci (Bq)	2003 Ci (Bq)	2004 Ci (Bq)	2005 Ci (Bq)	2006 Ci (Bq)
Co-60	8.44E-04 (3.12E+07)	**	**	**	1.59E-05 (5.88E+05)
Cs-137	3.14E-05 (1.16E+06)	**	**	**	**
Fe-55	6.32E-04 (2.34E+07)	**	**	**	2.02E-04 (7.47E+06)
Fe-59	1.88E-04 (6.96E+06)	**	**	**	**
H-3	6.25E-01 (2.31E+10)	2.772E-03 (1.02E+08)	5.06E-03 (1.87E+08)	1.01E-02 (3.72E+08)	3.81E+00 (1.41E+11)
Mn-54	9.76E-04 (3.61E+07)	**	**	**	1.04E-04 (3.85E+06)
Sr-89	2.74E-07 (1.01E+04)	**	**	**	**
Sr-90	5.47E-07 (2.02E+04)	**	**	**	7.06E-06 (2.61E+05)
Zn-65	7.88E-05 (2.92E+06)	**	**	**	3.83E-05 (1.42E+06)

Note:

** Concentrations less than the lower limit of detection of the counting system.

Table 12.3-25—{Historical NMP Unit 1 Dilutions}

Year	1st Quarter L (ft^3)	2nd Quarter L (ft^3)	3rd Quarter L (ft^3)	4th Quarter L (ft^3)	Total L (ft^3)	Release Duration hr	Flow Rate L/hr (ft^3/sec)
2001	No Releases	No Releases	8.32E+10 (2.94E+09)	No Releases	8.32E+10 (2.94E+09)	2190	3.80E+07 (3.73E+02)
2002	4.49E+10 (1.59E+09)	9.45E+10 (3.34E+09)	9.02E+10 (3.19E+09)	No Releases	2.30E+11 (8.12E+09)	6570	3.49E+07 (3.43E+02)
2003	No Releases	2.04E+05 (7.20E+03)	5.11E+05 (1.80E+04)	No Releases	7.15E+05 (2.52E+04)	32.1	2.23E+04 (2.19E-01)
2004	7.33E+02 (2.59E+01)	No Releases	No Releases	No Releases	7.33E+02 (2.59E+01)	1.03	7.12E+02 (6.98E-03)
2005	No Releases				No Releases	No Releases	No Releases
2006	No Releases				No Releases	No Releases	No Releases

Table 12.3-26—{Historical NMP Unit 2 Dilutions}

Year	1st Quarter L (ft^3)	2nd Quarter L (ft^3)	3rd Quarter L (ft^3)	4th Quarter L (ft^3)	Total L (ft^3)	Release Duration hr	Flow Rate L/hr (ft^3/sec)
2001	1.66E+08 (5.86E+06)	3.85E+08 (1.36E+07)	7.79E+08 (2.75E+07)	6.58E+08 (2.32E+07)	1.99E+09 (7.02E+07)	285	6.98E+06 (6.85E+01)
2002	2.42E+08 (8.55E+06)	4.30E+08 (1.52E+07)	1.56E+08 (5.51E+06)	3.17E+08 (1.12E+07)	1.15E+09 (4.04E+07)	185	6.19E+06 (6.07E+01)
2003	No Releases	No Releases	4.12E+08 (1.45E+07)	No Releases	4.12E+08 (1.45E+07)	51.1	8.06E+06 (7.91E+01)
2004	No Releases	1.54E+08 (5.44E+06)	1.89E+07 (6.67E+05)	3.34E+07 (1.18E+06)	2.06E+08 (7.29E+06)	35.0	5.89E+06 (5.78E+01)
2005	No Releases				No Releases	No Releases	No Releases
2006	No Releases	1.10E+08 (3.88E+06)	2.39E+08 (8.44E+06)	No Releases	3.49E+08 (1.23E+07)	53.1	6.57E+06 (6.45E+01)

Table 12.3-27—{Historical JAFNPP Dilutions}

Year	1st Quarter L (ft^3)	2nd Quarter L (ft^3)	3rd Quarter L (ft^3)	4th Quarter L (ft^3)	Total L (ft^3)	Release Duration hr	Flow Rate L/hr (ft^3/sec)
2001	No Releases				No Releases	No Releases	No Releases
2002	No Releases	No Releases	No Releases	2.17E+08 (7.66E+06)	2.17E+08 (7.66E+06)	27	8.04E+06 (7.88E+01)
2003	5.72E+07 (2.02E+06)	3.73E+08 (1.32E+07)	7.64E+07 (2.70E+06)	2.62E+08 (9.25E+06)	7.69E+08 (2.72E+07)	73	1.05E+07 (1.03E+02)
2004	1.04E+08 (3.67E+06)	4.74E+08 (1.67E+07)	3.46E+08 (1.22E+07)	1.68E+08 (5.93E+06)	1.09E+09 (3.86E+07)	779	1.40E+06 (1.37E+01)
2005	2.77E+08 (9.78E+06)	1.34E+08 (4.73E+06)	3.47E+08 (1.23E+07)	1.63E+08 (5.76E+06)	9.21E+08 (3.25E+07)	1560	5.90E+05 (5.79E+00)
2006	1.51E+08 (5.33E+06)	2.47E+08 (8.72E+06)	2.32E+08 (8.19E+06)	2.57E+09 (9.08E+07)	3.20E+09 (1.13E+08)	46	6.95E+07 (6.82E+02)

Table 12.3-28—{Historical NMP Unit 1 Shoreline Dose}

Year	LADTAPII mrem/yr (mSv/yr) (12 hr/yr occupancy)	Worker mrem/yr (mSv/yr) (2,200 hr/yr occupancy)	Full mrem/yr (Sv/yr) (8,760 hr/yr occupancy)
2001	0 (0)	0 (0)	0 (0)
2002	0 (0)	0 (0)	0 (0)
2003	9.76E-05 (9.76E-07)	1.79E-02 (1.79E-04)	7.12E-02 (7.12E-04)
2004	2.28E-03 (2.28E-05)	4.18E-01 (4.18E-03)	1.66E+00 (1.66E-02)
2005	0 (0)	0 (0)	0 (0)
2006	0 (0)	0 (0)	0 (0)

Table 12.3-29—{Historical NMP Unit 2 Shoreline Dose}

Year	LADTAPII mrem/yr (mSv/yr) (12 hr/yr occupancy)	Worker mrem/yr (mSv/yr) (2,200 hr/yr occupancy)	Full mrem/yr (Sv/yr) (8,760 hr/yr occupancy)
2001	5.31E-03 (5.31E-05)	9.74E-01 (9.74E-03)	3.88E+00 (3.88E-02)
2002	9.53E-03 (9.53E-05)	1.75E+00 (1.75E-02)	6.96E+00 (6.96E-02)
2003	7.33E-03 (7.33E-05)	1.34E+00 (1.34E-02)	5.35E+00 (5.35E-02)
2004	2.59E-03 (2.59E-05)	4.75E-01 (4.75E-03)	1.89E+00 (1.89E-02)
2005	0 (0)	0 (0)	0 (0)
2006	8.18E-05 (8.18E-05)	1.50E-02 (1.50E-04)	5.97E-02 (5.97E-04)

Table 12.3-30—{Historical JAFNPP Shoreline Dose}

Year	LADTAPII mrem/yr (mSv/yr) (12 hr/yr occupancy)	Worker mrem/yr (mSv/yr) (2,200 hr/yr occupancy)	Full mrem/yr (Sv/yr) (8,760 hr/yr occupancy)
2001	0 (0)	0 (0)	0 (0)
2002	1.43E-04 (1.43E-06)	2.62E-02 (2.62E-04)	1.04E-01 (1.04E-03)
2003	0 (0)	0 (0)	0 (0)
2004	0 (0)	0 (0)	0 (0)
2005	0 (0)	0 (0)	0 (0)
2006	4.18E-07 (4.18E-09)	7.66E-05 (7.66E-07)	3.05E-04 (3.05E-06)

Table 12.3-31—{Historical Total (summed for all 3 plants) Shoreline Dose}

Year	LADTAPII mrem/yr (mSv/yr) (12 hr/yr occupancy)	Worker mrem/yr (mSv/yr) (2,200 hr/yr occupancy)	Full mrem/yr (Sv/yr) (8,760 hr/yr occupancy)
2001	5.31E-03 (5.31E-05)	9.74E-01 (9.74E-03)	3.88E+00 (3.88E-02)
2002	9.67E-03 (9.67E-05)	1.77E+00 (1.77E-02)	7.04E+00 (7.04E-02)
2003	7.43E-03 (7.43E-05)	1.36E+00 (1.36E-02)	5.42E+00 (5.42E-02)
2004	4.87E-03 (4.87E-05)	8.93E-01 (8.93E-03)	3.55E+00 (3.55E-02)
2005	0 (0)	0 (0)	0 (0)
2006	8.22E-05 (8.22E-07)	1.51E-02 (1.51E-04)	6.00E-02 (6.00E-04)

Table 12.3-32—{TLD Measurements for NMPNS/JAFNPP 2007}

TLD #	Q1/month	Q2/month	Q3/month	Q4/month	mR/yr
3	13.39	14.78	12.73	12.55	160.35
4	4.11	5.25	4.65	4.86	56.61
5	4.04	5.34	4.89	4.93	57.60
6	3.32	4.70	4.42	4.59	51.09
7	3.17	4.39	3.95	4.18	47.07
24	3.98	5.36	4.99	4.85	57.54
27	20.54	21.83	20.24	19.80	247.23
29	26.47	24.81	24.59	21.49	292.08
39	8.62	9.14	10.15	9.58	112.47
75	7.83	8.81	8.47	8.80	101.73
76	5.16	6.28	5.89	6.18	70.53
77	6.15	7.18	6.65	7.09	81.21
79	3.35	4.56	4.40	4.62	50.79
80	3.43	4.76	4.46	4.67	51.96
81	3.53	4.63	4.56	4.56	51.84
82	3.46	4.36	4.26	4.58	49.98
83	3.39	4.10	4.04	4.33	47.58
84	3.56	4.78	4.46	4.75	52.65
87	7.51	9.02	7.80	8.32	97.95
101	3.32	4.27	4.20	4.45	48.72
103	4.05	4.86	4.72	4.84	55.41
106	4.51	5.74	5.78	5.54	64.71
107	4.22	5.41	5.54	5.83	63.00
109	4.21	4.66	4.57	4.76	54.60
I1	21.4	21.13	21.62	19.99	252.42
I2	22.76	22.06	21.69	20.93	262.32
I3	22.99	21.62	22.42	20.69	263.16
I4	31.46	28.61	30.21	27.85	354.39
I5	29.79	29.02	29.57	27.42	347.40
I6	24.29	23.64	24.47	23.38	287.34
I7	18.91	18.56	18.65	17.55	221.01
I8	19.32	18.36	18.51	18.48	224.01
I9	14.52	14.33	14.14	14.28	171.81
I10	14.75	14.29	14.37	13.68	171.27
I11	12.26	11.82	11.64	11.42	141.42
I12	18.53	18.52	17.95	17.61	217.83

Table 12.3-33—{Locations of TLDs}

TLD #	East (ft)	North (ft)
3	548,030.6	1,283,636
4	547,846.9	1,281,586
5	546,714.3	1,281,368
6	545,285.7	1,281,076
7	543,642.9	1,281,846
24	550,949	1,282,772
27	548,520.4	1,284,291
29	548,795.9	1,284,229
30	548,449	1,284,271
39	545,928.6	1,283,625
75	546,653.1	1,283,729
76	546,969.4	1,283,782
77	547,193.9	1,283,865
79	551,898	1,280,025
80	552,020.4	1,277,372
81	549,581.6	1,275,114
82	546,673.5	1,275,010
83	544,214.3	1,277,175
84	542,755.1	1,279,276
87	546,459.2	1,283,677
100	552,020.4	1,281,669
101	551,959.2	1,278,028
103	544,673.5	1,283,095
106	545,112.2	1,283,313
107	545,071.4	1,283,261
109	552,091.8	1,281,857
I1	548,471.5	1,282,887
I2	548,471.5	1,282,978
I3	548,471.5	1,283,047
I4	548,551.4	1,283,071
I5	548,589.5	1,283,071
I6	548,614.3	1,283,071
I7	548,719.9	1,283,047
I8	548,719.9	1,282,978
I9	548,719.9	1,282,887
I10	548,621.9	1,282,866
I11	548,589.5	1,282,866
I12	548,541.9	1,282,866

Table 12.3-34—{Ratio of Calculated to Measured values for TLDs}

TLD	C/M
3	0.612357
4	1.055028
5	1.037492
6	1.136643
7	1.214858
24	1.041949
27	0.682619
29	1.149521
30	1.049439
39	0.89817
75	0.954799
76	1.161867
77	0.916045
79	1.117241
80	1.090749
81	1.093206
82	1.13389
83	1.191186
84	1.076759
87	1.088409
100	1.059946
101	1.163381
103	1.13272
106	1.135842
107	1.149522
109	1.044032
I1	0.745061
I2	0.915188
I3	0.825769
I4	0.819163
I5	0.896842
I6	1.063221
I7	1.002247
I8	1.041555
I9	1.087114
I10	1.396526
I11	1.744081
I12	1.043879

Table 12.3-35—{Past and Future Cask Loading of the JAFNPP ISFSI}

3 Casks	Spring 2002
6 Casks	Summer/Fall 2005
6 Casks	Summer 2009
6 Casks	Summer every four years thereafter (indefinitely)

Table 12.3-36—{Ratio of Annual Exposure to 2007 Exposure from JAFNPP ISFSI}

Year	Calculated ISFSI Exposure (mR/hr)	JAFNPP ISFSI Exposure Ratio to 2007 Exposure
2001	0.0	0.00
2002	28.0	0.22
2003	42.0	0.33
2004	42.0	0.33
2005	69.9	0.56
2006	125.9	1.00
2007	125.9	1.00
2008	125.9	1.00
2009	167.8	1.33
2010	209.8	1.67
2011	209.8	1.67
2012	209.8	1.67
2013	251.7	2.00
2014	293.7	2.33
2015	293.7	2.33

Table 12.3-37—{Occupancy by Construction Zone}

Zone Description	Zone Code	Conservative Occupancy Fractions Used in Calculation
Batch Plant	B	0.001
Construction on main structures	C	0.665
Laydown	L	0.020
Office/Trailer	O	0.160
Parking	P	0.020
Roads	R	0.020
Shoreline	S	0.066
Tower/Basin	T	0.066
Warehouse	W	0.003
	TOTAL	**1.021**

Table 12.3-38—{Projected Construction Worker Census 2010 to 2015}

Year	On Site Workers
2010	1700
2011	2900
2012	3550
2013	3950
2014	3950
2015	3200

Table 12.3-39—{Worker Doses for 2015 with 2200 hour Occupancy Times}

Zone	Description	Whole Body (mrem/yr) (mSv/yr)	Organ (mrem/yr) (mSv/yr)	Thyroid (mrem/yr) (mSv/yr)	TEDE (mrem/yr) (mSv/yr)
Regulation			**40 CFR 190**		**10 CFR 20**
B	Batch Plant	5.15 (5.15E-02)	5.18 (5.18E-02)	5.15 (5.15E-02)	5.22 (5.22E-02)
C	Construction on Main Structures	0.99 (9.92E-03)	1.02 (1.02E-02)	1.00 (9.96E-03)	1.03 (1.03E-02)
L	Laydown	22.93 (2.29E-01)	23.05 (2.30E-01)	23.00 (2.30E-01)	22.37 (2.24E-01)
O	Office/Trailer	0.40 (3.97E-03)	0.41 (4.13E-03)	0.40 (4.00E-03)	0.42 (4.19E-03)
P	Parking	0.30 (2.95E-03)	0.31 (3.08E-03)	0.30 (2.98E-03)	0.31 (3.11E-03)
R	Roads	10.64 (1.06E-01)	10.68 (1.07E-01)	10.65 (1.06E-01)	10.73 (1.07E-01)
S	Shoreline	2.68 (2.68E-02)	2.70 (2.70E-02)	2.68 (2.68E-02)	2.71 (2.71E-02)
T	Tower/Basin	6.51 (6.51E-02)	6.55 (6.55E-02)	6.52 (6.52E-02)	6.59 (6.59E-02)
W	Warehouse	0.36 (3.64E-03)	0.38 (3.79E-03)	0.37 (3.67E-03)	0.38 (3.85E-03)
MAXIMUM		23 (2.29E-01)	23 (2.30E-01)	23 (2.3E-01)	22 (2.2E-01)
LIMIT		25 (2.5E-01)	25 (2.5E-01)	75 (7.5E-01)	100 (1.0E+00)

Figure 12.3-1—{NMP3NPP Site Layout}

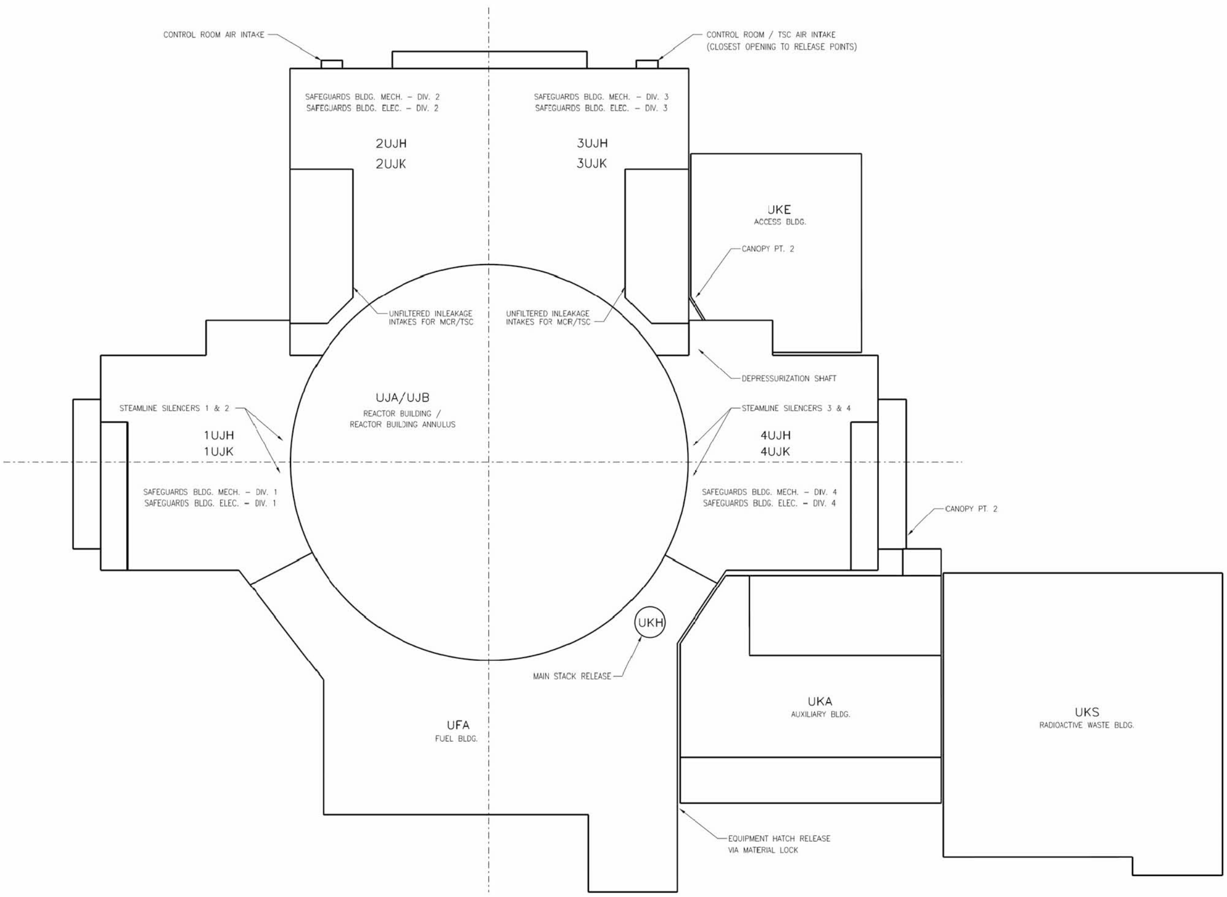


Figure 12.3-2—{Ground Release Dispersion Factors with Bounding Mode}

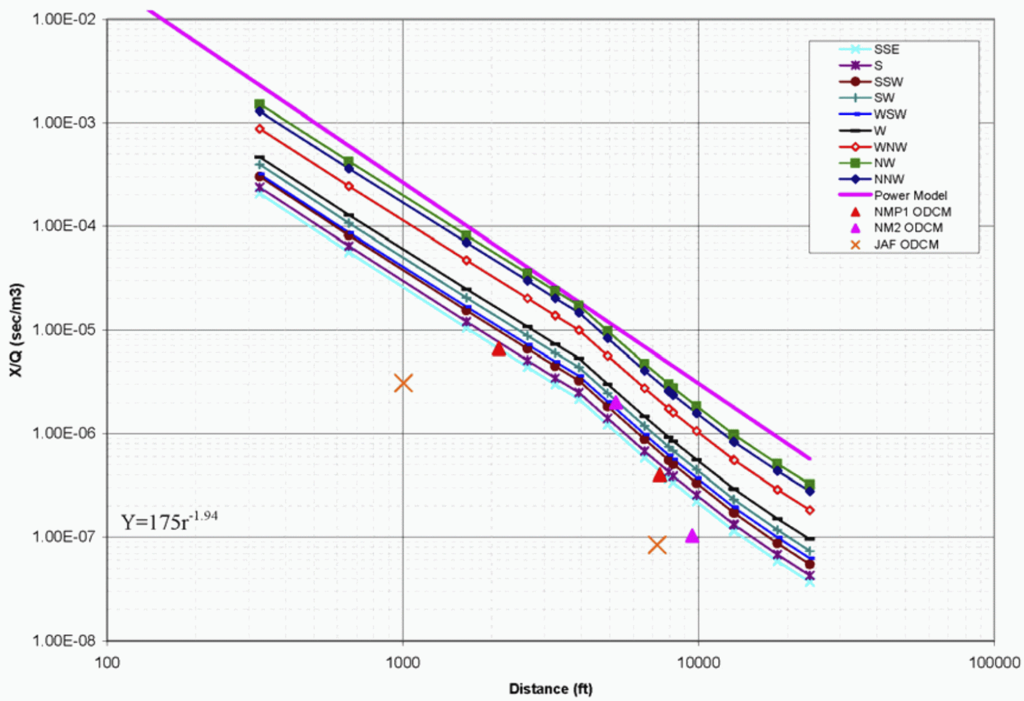
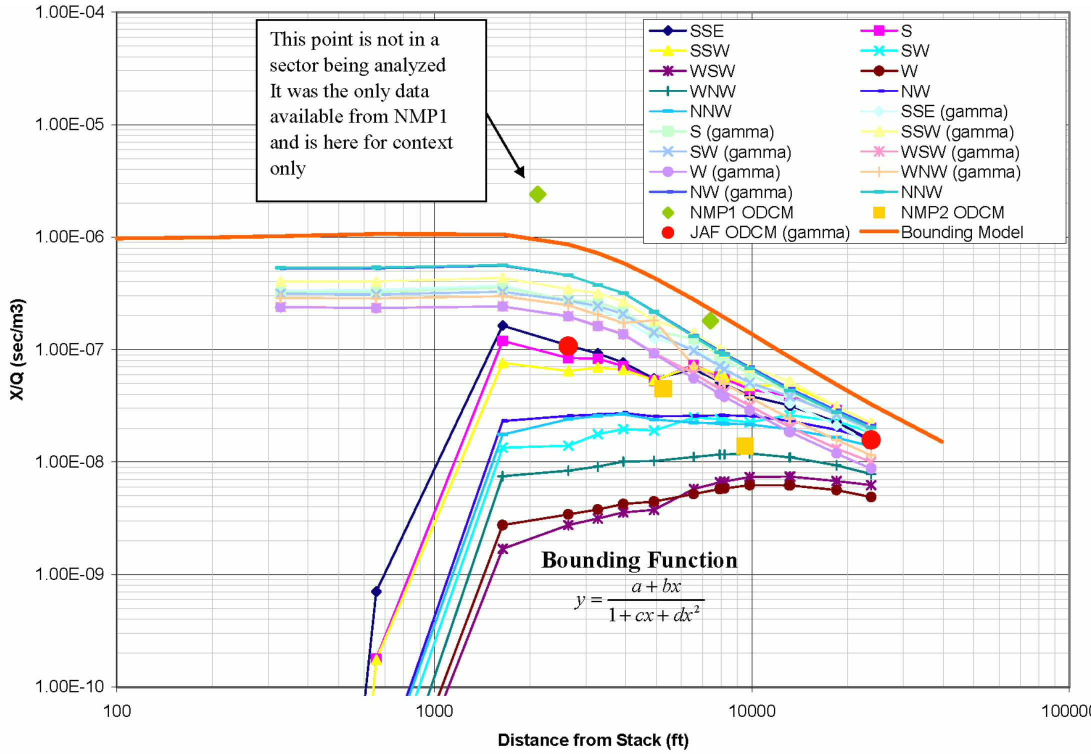


Figure 12.3-3—{Elevated Dispersion Parameters and Bounding Model}



a	b	c	d
9.53E-07	3.79E-11	-2.00E-04	1.07E-07

Figure 12.3-4—{TLD Locations}

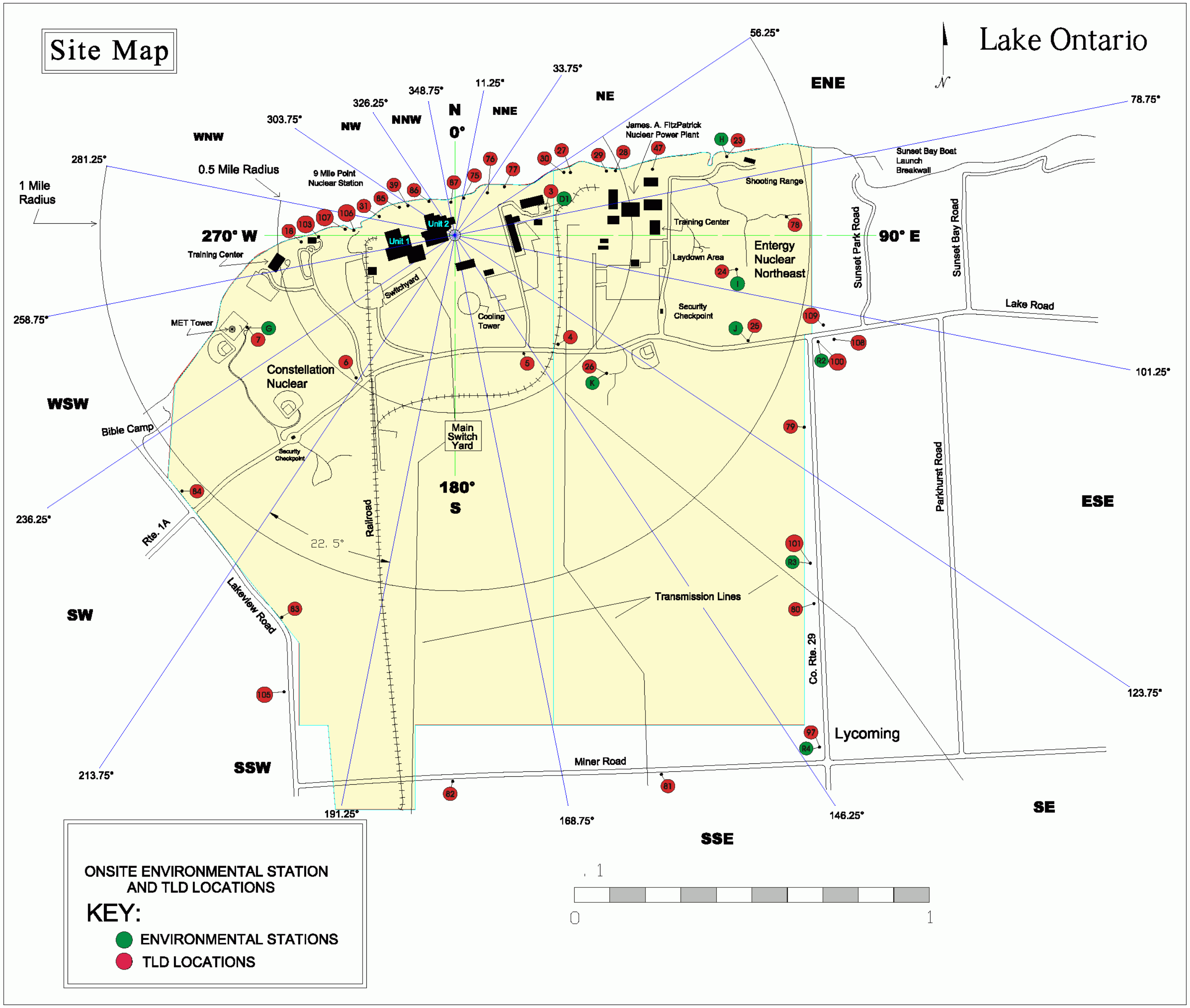


Figure 12.3-5—{On-Site Environmental ISFSI TLD Exposure}

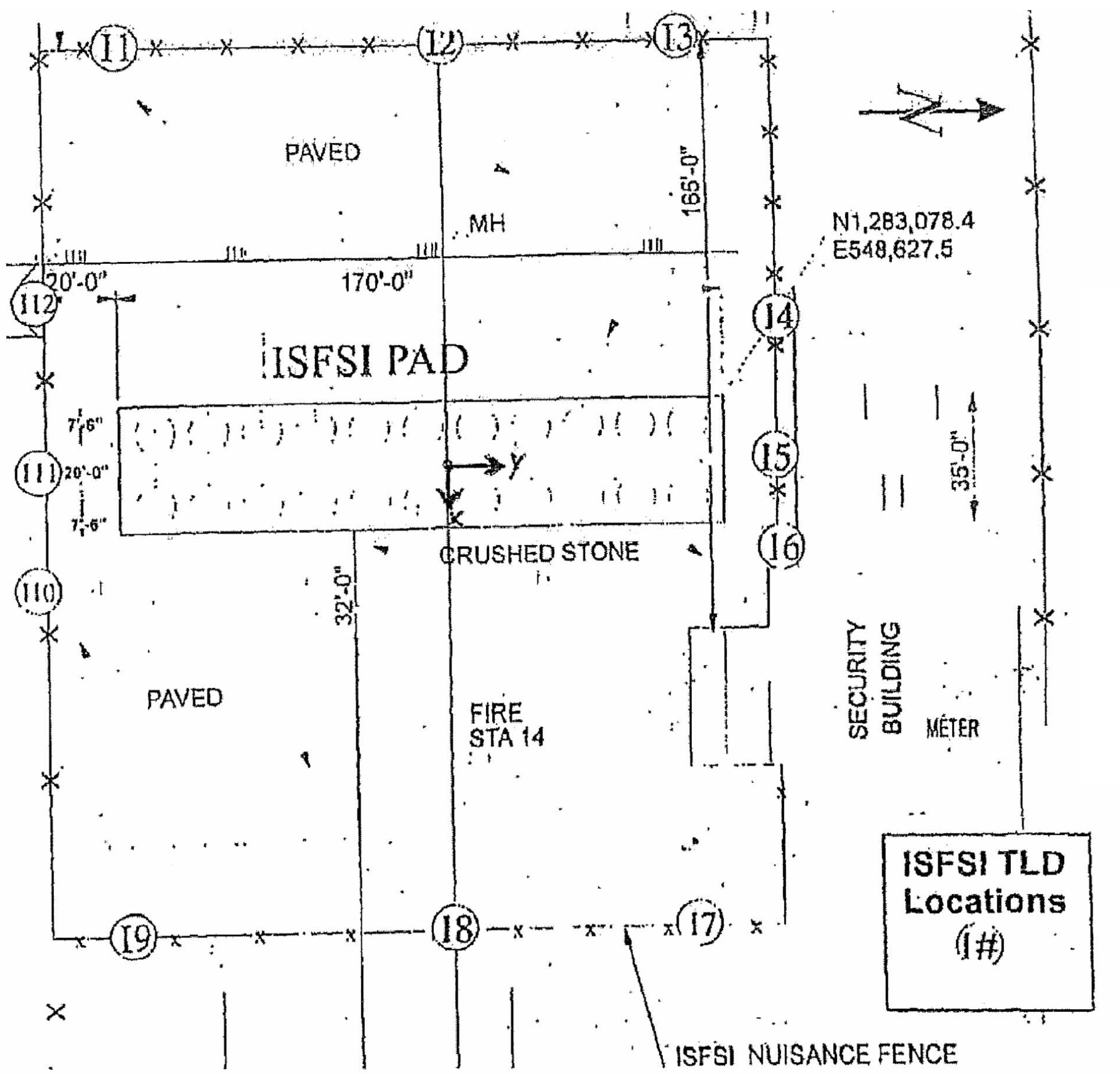


Figure 12.3-6—{Annual Historical JAF ISFSI TLD Exposure}

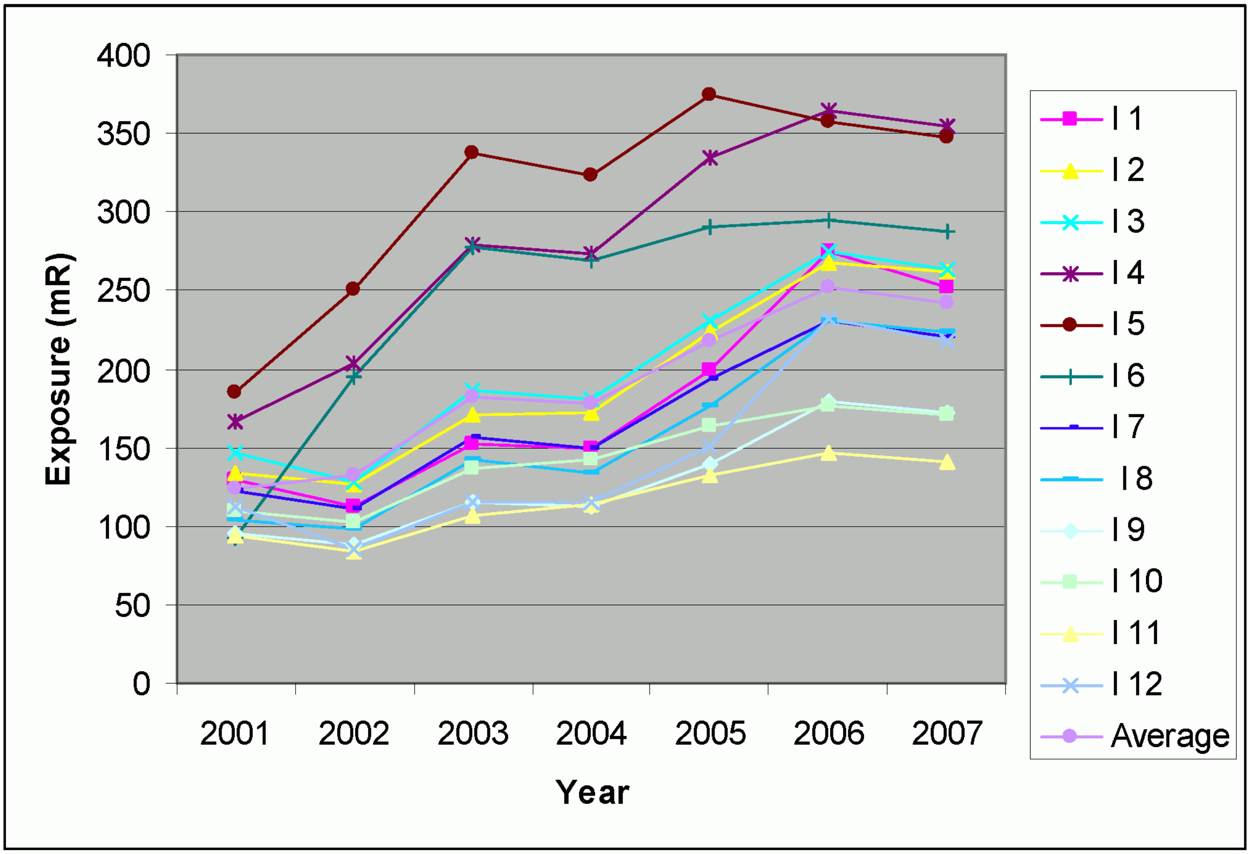


Figure 12.3-7—{Site Plan with Whole Body Dose Contours - Full Time Occupancy Year 2015, mrem/yr}

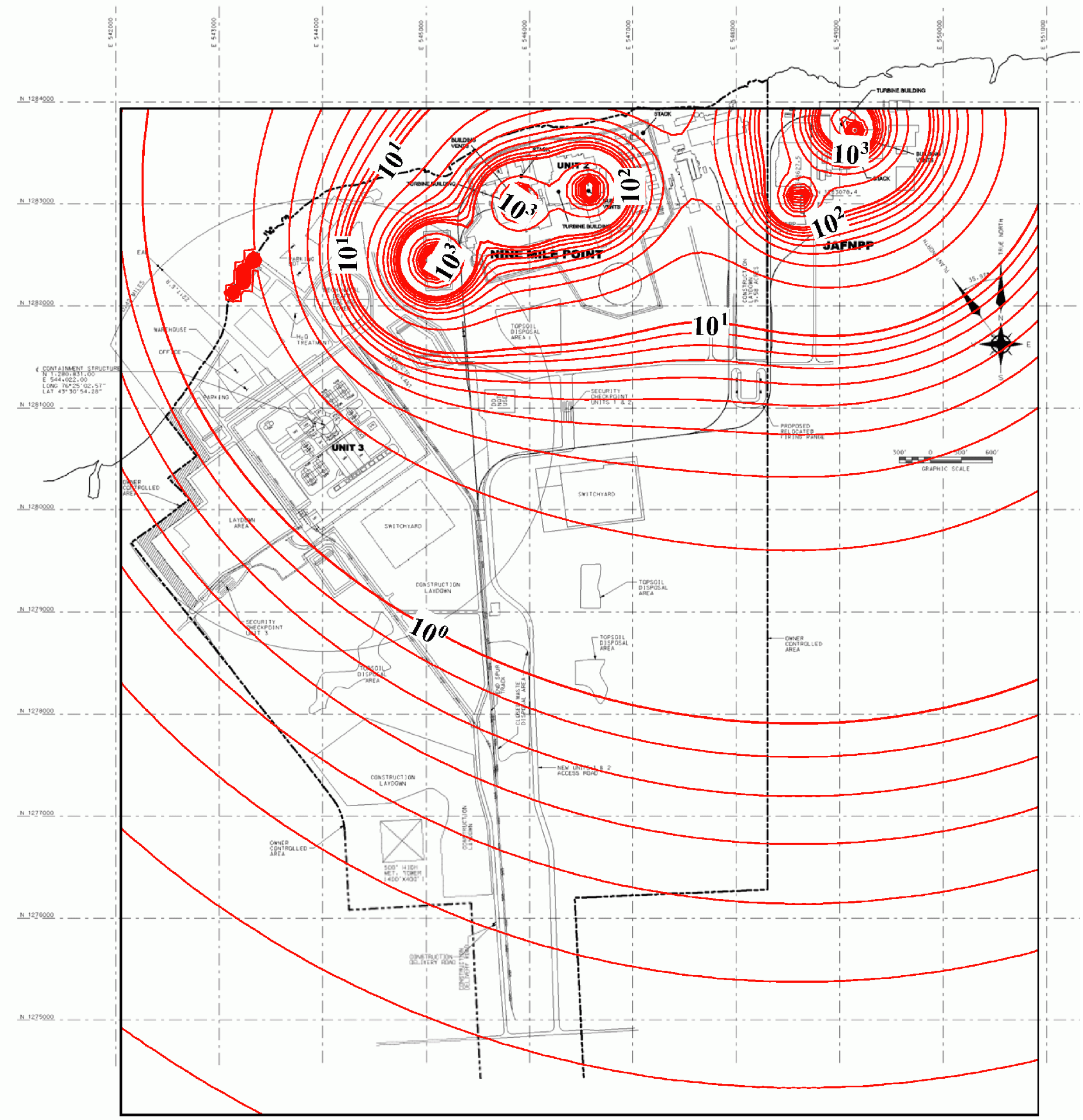


Figure 12.3-8—{Calculated vs. Measured TLD Exposire at the JAF ISFSI}

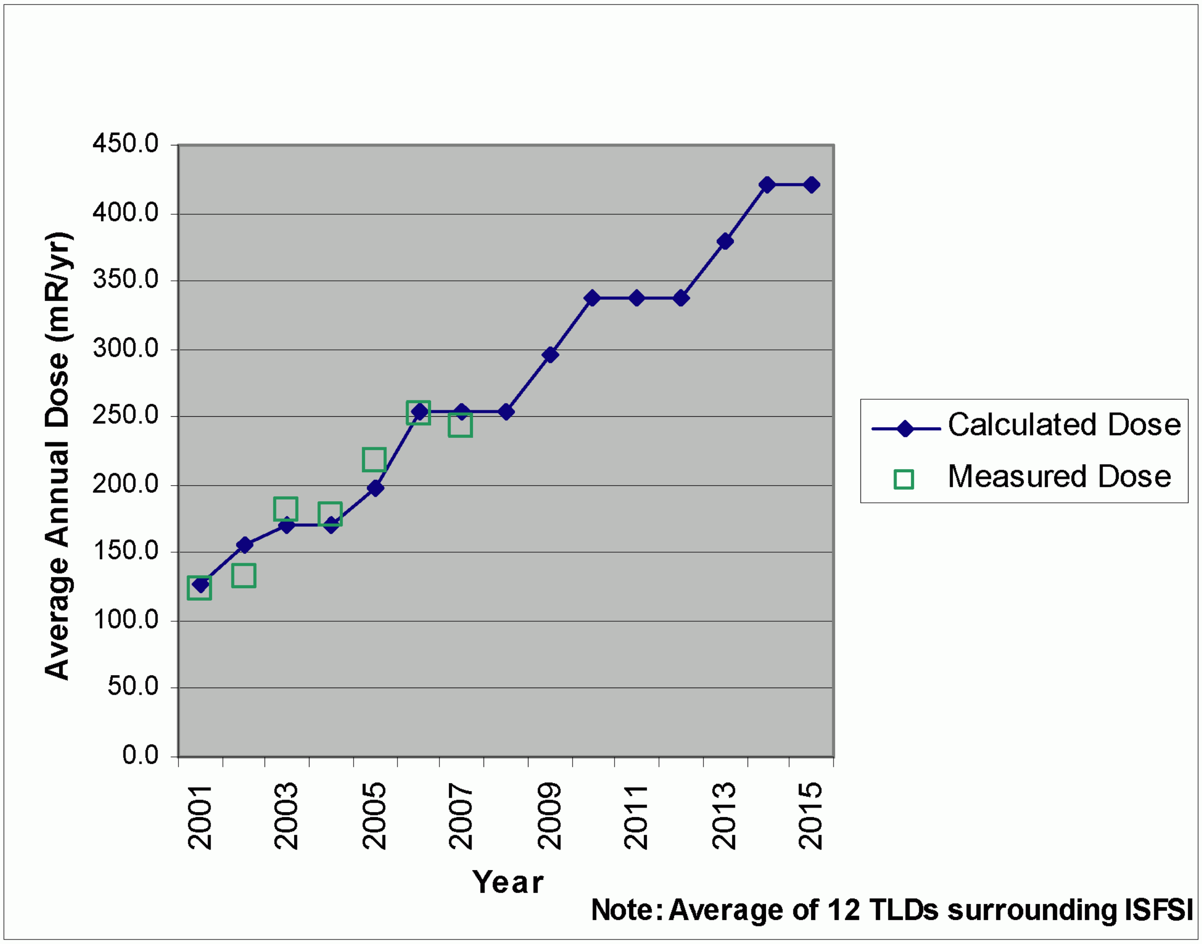


Figure 12.3-9—{Site Worker Occupancies and Usage}

12.4 DOSE ASSESSMENT

This section of the U.S. EPR FSAR is incorporated by reference.

12.5 OPERATIONAL RADIATION PROTECTION PROGRAM

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Item in Section 12.5:

> A COL applicant that references the U.S. EPR design certification will fully describe, at the functional level, elements of the Radiation Protection Program. The purpose of this Radiation Protection Program is to maintain occupational and public doses ALARA. The program description will identify how the program is developed, documented, and implemented through plant procedures that address quality requirements commensurate with the scope and extent of licensed activities. This program will comply with the provisions of 10 CFR Parts 19, 20, 50, 52, and 72 and be consistent with the guidance in RGs 1.8, 8.2, 8.4, 8.5, 8.6, 8.8, 8.9, 8.10, 8.13, 8.15, 8.20, 8.26, 8.27, 8.28, 8.29, 8.32, 8.34, 8.35, 8.36, 8.38, and the consolidated guidance in NUREG-1736.

This COL Item is addressed as follows:

This section incorporates by reference NEI 07-03, "Generic FSAR Template Guidance for Radiation Protection Description" (NEI, 2007).

12.5.1 REFERENCES

{**NEI, 2007.** Generic FSAR Template Guidance for Radiation Protection Program Description, NEI 07-03, Revision 3, Nuclear Energy Institute, October 2007.}