OFFSITE DOSE CALCULATION MANUAL

FOR

GASEOUS AND LIQUID EFFLUENTS

FROM THE

TURKEY POINT PLANT UNITS 3 AND 4

REVISION 7

CHANGE DATED 01/30/98

Florida Power and Light Company

TURKEY POINT UNIT 3 & 4 OFFSITE DOSE CALCULATION MANUAL

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3.0 Gaseous Effluents

4. Total Dose

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5. Radiological Environmental Monitoring Program

INTRODUCTION

PURPOSE

This manual describes methods which are acceptable for calculating radioactivity concentrations in the environment and potential offsite doses associated with liquid and gaseous effluents from the Turkey Point Nuclear Units. These calculations are performed to satisfy Technical Specifications and to ensure that the radioactive dose or dose commitment to any member of the public is not exceeded.

The radioactivity concentration calculations and dose estimates in this manual are used to demonstrate compliance with the Technical Specifications required by 10 CFR 50.36. The methods used are acceptable for demonstrating operational compliance with 10 CFR 20.1302, 10CFR50 Appendix I, and 40CFR190. Only the doses attributable to Turkey Point Units 3 and 4 are determined in demonstrating compliance with 40CFR190 since there are no other nuclear facilities within 50 miles of the plant. Monthly calculations are performed to verify that potential offsite releases do not exceed Technical Specifications and to provide guidance for the management of radioactive effluents. The dose receptor is described such that the exposure of any member of the public is not likely to be substantially underestimated.

Quarterly and annual calculations of committed dose are also performed to verify compliance with regulatory limits of offsite dose. For these calculations, the dose receptor is chosen on the basis of applicable exposure pathways identified in a land use survey and the maximum ground level atmospheric dispersion factor (χ/Q) at a residence, or on the basis of more conservative conditions such that the dose to any resident near the plant is not likely to be underestimated.

The radioactive effluent controls set forth in this ODCM are designed to allow operational flexibility but still maintain releases and doses "as low as is reasonably achievable"; that is, within the objectives of Appendix I, 10 CFR Part 50 and comply with the limits in 10 CFR 20.1302.

The methods specified in the OFFSITE DOSE CALCULATION MANUAL (ODCM) for calculating doses due to planned or actual releases are consistent with the guidance and methods provided in:

Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1. October 1977.

Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977.

INTRODUCTION, (continued)

Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

The required detection capabilities for radioactive materials in liquid and gaseous waste samples are tabulated in terms of the lower limits of detection (LDD's). Detailed discussion of the LLD and other detection limits, can be found in Currie, L. A., "Lower Limit of Detection: Definition and Elaboration of a Proposed Position for Radiological Effluent and Environmental Measurements," NUREG/CR-4077 (September 1984), in HASL Procedures Manual, HASL300 and in Hartwell, J. "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

2.0 RADIOACTIVE LIQUID EFFLUENTS

CONTROL 2.1 : LIQUID EFFLUENT MONITORING INSTRUMENTATION, OPERABILITY AND ALARM/TRIP SETPOINTS, (continued)

TABLE 2.1-1, (Continued)

TABLE NOTATION

ACTION 2.1.1 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with the surveillance requirement of Control 2.2.1, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve line-up;

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2.1.2 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for gross (beta or gamma) radioactivity at a lower limit of detection of no more than 1×10^{-7} microcuries/ml or analyzed isotopically (Gamma) at a lower limit of detection of at least 5×10^{-7} microcuries/ml :

a. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 microcuries/gram DOSE EQUIVALENT I-131, or

b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 microcuries/gram DOSE EQUIVALENT I-131.

ACTION 2.1.3 With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves may be used to estimate flow.

2.0 RADIOACTIVE LIQUID EFFLUENTS

CONTROL 2.3 : DOSE FROM RADIOACTIVE LIQUID EFFLUENT, (continued)

Example Calculation: Determination of Cumulative Dose from Radioactive Liquid Effluents.

The dose or dose commitment to a member of the public from radioactive liquid effluent shall be calculated on a cumulative quarterly and cumulative annual basis at least once per 31 days.

The dose or dose commitment from radioactive liquid releases at Turkey Point is based on the irradiation of a teenager on the canal shoreline, the most restrictive age group and is calculated using equation 7.

$$D = 0.23 \sum_k \sum_i A_i^{shoreline} \bullet \frac{C_{ik} \bullet F_{lk} \bullet t_k}{V \bullet \lambda_i^e}$$

where:

D = total body or organ dose due to irradiation by radionuclides on the shoreline which originated in a liquid effluent release, (mrem).

0.23 = units conversion constant = $\frac{1Ci}{10^6 uCi} \times \frac{60 \min}{hr} \times \frac{3785ml}{gal}$

A_i = transfer factor relating a unit aqueous concentration of radionuclide i (μCi) to dose commitment rate to specific organs and the total body of an exposed person tabulated in Appendix A, (mrem/Ci . min/gal).

C_{ik} = the concentration of radionuclide in the undiluted liquid waste to be discharged that is represented by sample k, (uCi/ml).

F_{lk} = liquid waste discharge flow during release represented by sample k, (gal/min)

V = cooling canal effective volume, approximately 3.75 x 10^9 gallons.

t_k = period of time (hours) during which liquid waste represented by sample k is discharged.

λ_i^e = effective decay constant ($\lambda_i + F_3/V$, minute $^{-1}$).

where:

λ_i = the radioactive decay constant

F_3 = canal-ground water interchange flow, approximately 2.25 x 10^5 gal/min

[illegible]

3.0 RADIOACTIVE GASEOUS EFFLUENTS

OBJECTIVES & SYSTEM DESCRIPTION (continued)

B. BASIS, (continued)

A mixed mode release is selected since the majority of the releases made from the site fit the mixed mode release model as described in Regulatory Guide 1.111.

Compliance for beta and gamma dose limits at and beyond the site boundary for noble gas effluents is determined by assessing the dose rate and/or dose at the location where the minimum atmospheric dispersion occurs at the site boundary since the atmospheric dispersion will be higher at all other points off-site. This minimum dispersion occurs at the site boundary 1950 meters SSE of the plant where the dispersion factor is 5.8×10^{-7} sec/m^3 (see figure 3-2). This value was extrapolated from the tables in Appendix 3A and are periodically evaluated against actual meteorological data to ensure the validity of these tables.

The dose rate due to tritium, I-131, I-133, and radioactive particulates with half lives greater than 8 days at and beyond the site boundary is assessed by determining the dose rate to a hypothetical infant's thyroid via the inhalation pathway. The basis for this approach is NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants" which states: the dose factors are dependent on the specific organ and on the age group. The infant is the most restrictive age group for the dose rate calculations and the most restrictive organ is the thyroid via either the inhalation or grass-cow-milk pathway. The dose from tritium, I-131, I-133, and particulate is calculated by assuming a cow on pasture 4.5 miles west of the plant unless there is a milk producer in a more conservative location. At that location the reference atmospheric deposition factor, D/Q, is equal to 5×10^{-10} m^{-2} (see figure 3-2). This value was extrapolated from the tables in Appendix 3A and are periodically evaluated against actual meteorological data to ensure the validity of these tables.

Sampling and analysis is performed as outlined in ODCM Table 3.2-1. Principle gamma emitters for batch gaseous effluents, from Gas Decay Tanks or Containment Purges, which are released via the Plant Vent are Noble Gases only. The iodines and particulates are collected on filter elements in the effluent monitors and are considered continuous releases. This method of accounting for iodine and particulate in batch releases is performed to proclude over accounting for these emmissions since the ventillation path is the same as for continuous releases.

3.0 RADIOACTIVE GASEOUS EFFLUENT

CONTROL 3.1 : Radioactive Gaseous Effluent Monitoring Instrumentation; Operability and Alarm/Trip Setpoints, (continued)

METHOD 3.1.2 : ESTABLISHING GASEOUS EFFLUENT MONITOR ALARM AND TRIP SETPOINTS, (continued)

Other miscelleaneous radiation monitor alarm/trip setpoints are determined as outlined below:

Channel	Setpoint Determination
3/4-R-11	Determined from Technical Specifications
3/4-R-12	Determined from Technical Specifications
R-14	Determined prior to each batch release or from ODCM Method 3.1.2
3/4-R-15	Between 2 and 5 times the monitor background at the time of Calibration
3/4-R-17A/B	Between 2 and 5 times the monitor background at the time of Calibration
R-18	Determined prior to each batch release or from ODCM Method 2.1.2
3/4-R-19	Determined after each response check
3/4-R-20	Between 2 and 5 times the monitor background at the time of Calibration
SPINGS	
ch. 1,2,3,6	From ODCM Method 3.1.2 or default maximum (Channels 1&2 abandoned on the SJAE SPING monitors)
ch. 5,7,9	From ODCM Method 3.1.2

Monitor setpoints may be changed from between 2 and 5 times the monitor background at the time of calibration in the event of system in leakage, changes in background radiation levels, or other events that would necessitate further monitoring of the channel without recieving alarms.