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Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description

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Nuclear Energy Institute

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

NEI 07-09, *Generic FSAR Template Guidance for the Offsite Dose Calculation Manual (ODCM) Program Description*, Revision 4, provides a complete generic program description for use in developing construction and operating license (COL) applications. The document reflects contemporary Nuclear Regulatory Commission (NRC) guidance, including Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants," and industry-NRC discussions regarding the applicable standard review plan section. A main objective of this program description is to assist in expediting NRC review and issuance of the combined license.

This generic template fully describes, at the functional level, elements of the process and effluent monitoring and sampling programs required by 10 CFR 50, Appendix I and 10 CFR 52.79 (a)(16). Consequently, applicants for combined licenses (COL) or design certifications may reference this generic template as an alternative to providing the full programs for the ODCM, and Radiological Environmental Monitoring Program (REMP) at the time of the application, as requested in the Standard Review Plans for FSAR Chapter 11 and Regulatory Guide 1.206, C.I.13.4. If the programs are implemented as described in this generic template they do not require implementation of inspections, tests, analyses and acceptance criteria (ITAAC) in the COL application.

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1 INTRODUCTION

The Process and Effluent Monitoring and Sampling program consists of four component programs:

- Radiological Effluent Technical Specifications/Standard Radiological Effluent Controls (RETS/SREC)
- Offsite Dose Calculation Manual (ODCM)
- Radiological Environmental Monitoring Program (REMP)
- Process Control Program (PCP)

The PCP is provided as a separate document, and portions of the RETS/SREC are provided in the plant technical specifications. This document (NEI 07-09) provides program descriptions for the ODCM and the REMP, and portions of the RETS/SREC that are not in the plant technical specifications.

The ODCM is a supporting document of the facility's technical specifications and contains the REMP. Since the ODCM contains the REMP and major portions of the RETS/SREC, these components of the Process and Effluent Monitoring and Sampling program will hereafter be referred to as the ODCM.

This document provides an acceptable template that may be used by a Combined License (COL) applicant to fully describe the ODCM. The program description addressed in this document is not a substitute for the complete ODCM; it is a description of the full program. Typical timing for development and implementation of the full ODCM is in the FSAR section 13.4. Information within double parentheses (( )) will be provided by licensee in the full ODCM.

The ODCM described in this document conforms to 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to members of the public from radioactive effluents as low as is reasonably achievable, and includes remedial actions to be taken whenever the program limits are exceeded.

The methodology is provided to calculate offsite doses resulting from radioactive gaseous and liquid effluents, to calculate gaseous and liquid effluent monitoring alarm/trip setpoints, and to conduct the REMP. Requirements are established for the annual radiological effluent report required by 10 CFR 50.36a.

The equations and methods used in this ODCM program description are based on those presented in NUREG-0133, Regulatory Guide 1.109, Regulatory Guide 1.111, Regulatory Guide 1.113 and NRC regulatory requirements and guidance identified in the reference section of this document..

2 PURPOSE

This template applies to the Radioactive Effluent and Environmental Monitoring Programs. It provides an acceptable format that may be used by a Combined License (COL) applicant to fully describe the ODCM.

3 SCOPE

This template applies to licensee's Radioactive Effluent and Environmental Monitoring Programs. It provides program descriptions for the ODCM and the REMP, and portions of the RETS/SREC that are not in the plant technical specifications.

4 DEFINITIONS

Channel Calibration

A channel calibration shall be the adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. The channel calibration shall encompass all devices in the channel required for channel OPERABILITY. The channel calibration may be performed by means of any series of sequential, overlapping, or total channel steps.

Channel Check

A Channel Check shall be qualitative assessment, by observation, of channel behavior during operation. This assessment includes, where possible, comparison of the channel indication and status with other indications or status derived from independent instrumentation channels measuring the same parameter.

Channel Operational Test

A Channel Operational Test (COT) shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that setpoints are within the necessary range and accuracy. The COT may be performed by means of any series of sequential, overlapping, or total channel steps.

Critical Organ

That organ, which has been determined to be the maximum exposed organ based on an effluent pathway analysis, thereby ensuring the dose and dose rate limitations to any organ will not be exceeded. Dose calculations to the critical organ will be evaluated in accordance with Technical Specifications dose rate limits specified for any organ to verify these limits have not been exceeded.

Dose Equivalent I-131

The dose equivalent I^{131} is that concentration of I^{131} (μCi/gram) that alone would produce the same thyroid dose as the quantity and isotopic mixture of I^{131}, I^{132}, I^{133}, I^{134}, and I^{135} actually present. The thyroid dose conversion factors used for this calculation are listed in Table III of TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites. Thyroid dose conversion factors from Table E-7 to E-14 of NRC Regulatory Guide 1.109, Revision 1, may be used.

Frequency Notations

NOTE: Frequencies are allowed a maximum extension of 25 percent.

NOTATION	FREQUENCY
S – Once per shift	At least once per 12 hours
D – Daily	At least once per 24 hours
W – Weekly	At least once per 7 days
M – Monthly	At least once per 31 days
Q – Quarterly	At least once per 92 days
SA – Semi-annually	At least once per 184 days
R – Refueling	At least once per 18 -24 months (Based on a plants nominal refueling cycle)
S/U – Start-up	Prior to each reactor start-up
P – Prior to release	Completed prior to each release
NA – Not applicable	Not applicable
DR – During the release	At least once during each release

Gaseous Waste Management System

A system that reduces radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing delay or holdup to reduce total radioactivity prior to release to the environment.

General Nomenclature

X = Chi: concentration at a point at a given instant (curies per cubic meter)

D = Deposition: quantity of deposited radioactive material per unit area (curies per square meter)

Q = Source strength (instantaneous; grams, curies)

Q = Emission rate (continuous; grams per second, curies per second)

Q = Emission rate (continuous line source; grams per second per meter)

Liquid Waste Management System

A system designed and installed to reduce radioactive materials in liquid effluents by systematic collection, retention, and processing prior to release to the environment.

Lower Limit of Detection (LLD)

The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that can be detected with 95 percent probability with only five percent probability of falsely concluding that a blank observation represents a "real" signal.

Members of the Public

Individuals who, by virtue of their occupational status, have no formal association with the site. This category includes non-employees of the licensee who are permitted to use portions of the site for recreational, occupational, or other purposes not associated with site functions. This category does not include non-employees such as vending machine servicemen or postal workers who, as part of their formal job function, occasionally enter an area that is controlled by the licensee to protect individuals from exposure to radiation and radioactive materials.

Operable - Operability

A system, subsystem, train, component, or device is operable or has operability when it is capable of performing its specified functions and all necessary, attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its functions are also capable of performing their related support functions.

Purge - Purging

The controlled discharge of air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, so that replacement air or gas is required to purify the confinement.

Rated Thermal Power

Total reactor core heat transfer rate to reactor coolant.

Site Boundary

That line beyond which the licensee does not own, lease, or otherwise control the land.

Source Check

A qualitative assessment of channel response when a channel sensor is exposed to a source of increased radioactivity.

Special Report

A report to NRC to comply with Subsections 6.2, 6.3, or 6.5 of this template.

Thermal Power

Total reactor core heat transfer rate to the reactor coolant.

Unrestricted Area

Any area at or beyond the site boundary, access to which is neither limited nor controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the site boundary used for residential quarters or for industrial, commercial, institutional and/or recreational purposes.

Ventilation Exhaust Treatment System

Any system designed and installed to reduce radioactive releases to the environment. The system typically consists of charcoal absorbers and filters for the purpose of removing iodine and particulates from the gaseous effluent prior to release to the environment.

5 RESPONSIBILITIES

The organizations responsibility for implementation are identified in the licensee FSAR Section 13.1 Organization, Section 13.2 Training, Section 13.4 Operational Programs, and as-applicable, Sections 17.1, 17.2, 17.3 and 17.5 for Quality Assurance.

6 INSTRUCTIONS

Meteorological, liquid, and gaseous pathway analyses are presented in Meteorological, Liquid, and Gaseous Pathway Analysis (Attachment 13).

6.1 SAMPLING AND MONITORING CRITERIA

6.1.1 Surveys, sampling, and analyses shall use instruments calibrated for the type and range of radiation monitored and the type of discharge monitored.

6.1.2 Installed monitoring systems shall be calibrated for the type and range of radiation or parameter monitored.

6.1.3 A sufficient number of survey points shall be used or samples taken to adequately assess the status of the discharge monitored.

6.1.4 Samples shall be representative of the volume and type of discharge monitored.

6.1.5 Surveys, sampling, analyses, and monitoring records shall be accurately and legibly documented, and sufficiently detailed that the meaning and intent of the records are clear.

6.1.6 Surveys, analyses, and monitoring records shall be reviewed for trends, completeness, and accuracy.

6.2 LIQUID RADIOACTIVE WASTE EFFLUENTS

6.2.1 Liquid Effluent Concentration Limitations

a. Liquid waste concentrations discharged from the site shall not exceed the following limits:

   1. For radionuclides (other than dissolved or entrained noble gases), liquid effluent concentrations released to unrestricted areas shall not exceed ten times the effluent concentration values specified in 10 CFR 20, Appendix B, Table 2, Column 2.

   2. For dissolved or entrained noble gases, concentrations shall not exceed 2E-4 μCi/ml total activity.

b. If the concentration of liquid effluent exceeds the limits in Step 6.2.1.a., promptly reduce concentrations to within limits.

c. Concentrations of radioactive materials in liquid waste released to unrestricted areas shall be calculated as follows:
   ((Define Equation)) ((Define Terms))

   NOTE: This calculation defines how liquid effluent concentrations will be restricted to within the 10 CFR 20 Appendix B limits, considering the volume of liquid effluents and the volume of dilution water.

6.2.2 Liquid Monitoring Instrumentation

a. Radioactive Liquid Effluent Monitoring Instrumentation

Radioactive liquid effluent monitoring instrumentation channels shown on Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) shall be operable with their alarm/trip setpoints set to ensure that Step 6.2.1.a. limits are not exceeded.

1. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.2.2.d., Setpoint Calculations.
2. If a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.2.2.a., perform one of the following:

   (a). Promptly suspend release of radioactive liquid effluents monitored by the affected channel
   (b). Declare the channel inoperable
   (c). Change the setpoint to an acceptable, conservative value

b. Radioactive Liquid Effluent Monitoring Instrumentation Operability

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated operable by performing a Channel Check, Source Check, Channel Calibration, and Channel Operational Test at the frequencies shown in Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 2).

1. If the number of operable channels is less than the minimum required by the tables in Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) perform the action shown in those tables.
2. Attempt to return the instruments to operable status within 30 days. If unsuccessful and the channel is required to be in service, then explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. Applicable Monitors

Liquid effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
((Release point noun description**))**	((Equipment **ID))**

d. Setpoint Calculations

Maximum setpoint values shall be calculated by:

((Define Equation)) **((**Define Terms))

NOTE: The setpoint calculation should take into consideration the fraction of the effluent concentration limit for the monitor used to implement 10CFR20 for the site, the maximum design pathway effluent flow rate, the dilution water flow rate, and the radiation monitor calibration response for the nuclide mix.

((Provide a flow schematic of the liquid radioactive waste effluent system from the treatment system to the point of release.))

6.2.3 Liquid Effluent Dose Limit

a. Requirement

At least once per 31 days, perform the dose calculations in Step 6.2.3.c. to ensure the dose or dose commitment to the maximum exposed member of the public from radioactive materials in liquid releases (from each reactor unit) to unrestricted areas is limited to:

1. During any calendar quarter:
   (a). Less than or equal to 1.5 mrem to the total body
   (b) Less than or equal to 5 mrem to the critical organ
2. During any calendar year:
   (a) Less than or equal to 3 mrem to the total body
   (b) Less than or equal to 10 mrem to the critical organ

b. Action

If the calculated dose from release of radioactive materials in liquid effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report that identifies causes for exceeding limits and defines corrective actions taken to reduce releases of radioactive materials in liquid effluents to ensure that subsequent releases will be in compliance with the above limits.

c. Dose Contribution Calculations

Dose contribution (total body and critical organ)shall be calculated for all radionuclides identified in liquid effluents released to unrestricted areas based on:

((Define Equation**))** **((**Define Terms**))**

NOTE: This calculation should consider for each significant pathway, the dose commitment factors of each nuclide for each age group of interest, the critical organ, the time period, and the average concentration.

d. Quarterly Composite Analyses

For radionuclides not determined in each batch or weekly composite, dose contribution to current monthly or calendar quarter cumulative summation may be approximated by assuming an average monthly concentration based on previous monthly or quarterly composite analyses. However, for reporting purposes, calculated

dose contribution shall be based on the actual composite analyses.

6.2.4 Liquid Waste Management System

Historical data pertaining to the volumes and radioactivity of liquid effluents released in connection with specific site functions, such as maintenance or refueling outages, shall be used in projections as appropriate.

a. Requirement

1. The liquid waste management system shall be used to reduce the radioactive materials in liquid waste prior to discharge when projected dose due to liquid effluent, from each reactor unit, to unrestricted areas would exceed 0.06 mrem to total body or 0.2 mrem to the critical organ in a 31-day period.
2. Doses due to liquid releases shall be projected at least once per 31 days.

b. Action

If radioactive liquid waste is discharged without treatment and in excess of the above limits prepare and submit to the NRC, within 30 days, a special report that includes the following:

1. An explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or sub-system, and the reason for the inoperability.
2. Actions taken to restore inoperable equipment to operable status.
3. Summary description of actions taken to prevent recurrence.

c. Projected Total Body Dose Calculation

((Define the process for projecting total body dose from liquid effluents consistent with the method identified in step 6.2.3. c))

d. Projected Critical Organ Dose Calculation

((Define the process for projecting Critical Organ dose from liquid effluents consistent with the method identified in step 6.2.3.c.**))**

6.2.5 Liquid Sampling

Radioactive liquid wastes shall be sampled and analyzed according to the requirements in Radioactive Liquid Waste Sampling and Analysis Program (Attachment 3).

6.3 GASEOUS RADIOACTIVE WASTE EFFLUENTS

6.3.1 Gaseous Effluent Dose Rate Limitation

a. Requirement

Dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to:

1 The dose rate limit for noble gases shall be less than or equal to 500 mrem/year to the total body and less than or equal to 3000 mrem/year to the skin.
2. The dose rate limit for I^{131}, I^{133}, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days shall be less than or equal to 1500 mrem/year to the critical organ.

b. Action

1. If dose rates exceed Step 6.3.1.a. limits, promptly decrease the release rate to within the above limits.

2.Dose rates due to noble gases in gaseous effluents shall be determined, continuously, to be within Step 6.3.1.a. limits.

3. Dose rates due to I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents shall be determined to be within the above limits by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in the Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4).

c. **Calculations of Gaseous Effluent Dose Rates**

1. The dose rate limit for noble gases shall be determined to be within the limit by limiting the release rate to the lesser of:

   ((Define equation)) less than or equal to 500 mrem/yr to the total body

   ((Define equation terms))

   OR

   ((Define equation)) less than or equal to 3000 mrem/yr to the skin

   ((Define equation terms))

   NOTE: The equations includes for each release point of interest, assessment of:

   (a)Release source terms for nuclide i (Each building vent for ground, elevated, or mixed mode release.)
   (b) Dose factors for nuclide i (Total body, skin, and air dose factors in Att. 5)
   (c) Atmospheric dispersions at location of interest for the identified dose receptor.

2. The dose rate limit for I^{131}, I^{133}, tritium, and for all radionuclides in particulate form

with half-lives greater than 8 days, shall be determined to be within the limit by restricting the release rate to:

((Define equation)) less than or equal to 1500 mrem/yr to the critical organ

((Define equation terms**))**

NOTE: The equations includes for each release point of interest, assessment of:

(a) Release source terms for nuclide i (Each building vent for ground, elevated, or mixed mode release.)
(b) Dose factors for nuclide i (Inhalation dose factors, see Att. 5)
(c) Atmospheric dispersions and deposition at location of interest for the identified dose receptor

6.3.2 Gaseous Monitoring Instrumentation

a. Requirement

1. The radioactive gaseous effluent monitoring instrumentation channels shown in Radioactive Gaseous Effluent Monitoring Instrumentation (Attachment 6) shall be operable with alarm/trip setpoints set to ensure that Step 6.3.1.a. noble gas limits are not exceeded. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.3.2.d.

2. Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated operable by Channel Checks, Source Checks, Channel Calibrations, and Channel Operational Tests at the frequencies shown in Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 7).

b. Action

1. If a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.3.2.a.1, promptly:

   (a) Suspend the release of radioactive gaseous effluents monitored by the affected channel **and** declare the channel inoperable, or
   (b) Change the setpoint so it is acceptably conservative

2. If the number of operable channels is less than the minimum required by tables in Radioactive Gaseous Effluent Monitoring Instrumentation (Attachment 6) take the action shown in those tables.

3. Return instruments to operable status within 30 days. If unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. Applicable Monitors

Radioactive gaseous effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
((Release point noun description))	((Equipment ID))

d. Setpoint Calculations

1. Setpoint calculations for each monitor listed in Step 6.3.2.c. shall maintain this relationship:

   ((Define Equation)) **((**Define equation terms))

   NOTE: This equation indicates the summation of doses from all release points will be less than or equal to the dose limits that implement 10CFR20.

2. Setpoint values shall be determined by:

   ((Define Equation**)) ((**Define equation terms))

   NOTE: This equation should consider the release pathway's effluent concentration limit implementing 6.3.1.a. for the site, the release rate limit for the pathway determined from methodology in step 6.3.1.c. using Xe-133 or other nuclide identified by the licensee as the nuclide to be released, and the maximum flow rate for the release point.

   NOTE: According to NUREG-0133, the radioactive effluent radiation monitor alarm/trip setpoints should be based on the radioactive noble gases. It may not be practicable to apply instantaneous alarm/trip setpoints to integrating monitors sensitive to radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases.

   ((Provide flow schematics of airborne effluent radioactivity release points from all building ventilation systems and plant process vents.))

6.3.3 Noble Gas Effluent Air Dose Limit

a. Requirement

   1. The air dose in unrestricted areas due to noble gases released in gaseous effluents from each unit at or beyond the site boundary shall be limited to:

(a) During any calendar quarter less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation
(b) During any calendar year less than or equal to10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation

2. Cumulative dose contributions for noble gases for the current calendar quarter and current calendar year shall be determined in accordance with Step 6.3.3.c. at least once per 31 days.

b. Action

If the calculated air dose from radioactive noble gases in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report that identifies the causes for exceeding the limits and defines corrective actions that have been taken to reduce releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the limits in Step 6.3.3.a.

c. Noble Gas Effluent Air Dose Calculation

The air dose to areas at or beyond the site boundary due to noble gases shall be determined by the following:

For gamma radiation:

((Define Equation)) ((Define equation terms))

NOTE: The equations include for each release point of interest, assessments of the following:

(a) Release source terms for nuclide i , (Each building vent for ground, elevated, or mixed mode release.)
(b) Dose factors for nuclide i, (Gamma air dose factors in Att. 5)
(c) Atmospheric dispersions at locations of interest for the identified dose receptor.

For beta radiation:
((Define Equation)) ((Define equation terms))

NOTE: The equations include for each release point of interest, assessments of the following:

(a) Release source terms for nuclide i, (Each building vent for ground, elevated, or mixed mode release.)
(b) Dose factors for nuclide i, (Beta air dose factors in Att. 5)
(c) Atmospheric dispersions at locations of interest for the identified dose receptor.

6.3.4 I-131, I-133, H-3 & Radionuclides In Particulate Form Effluent Dose Limit

a. Requirement

1. Methods shall be implemented to ensure that the dose to any organ of a member of the public from I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released from the site to unrestricted areas from each reactor unit shall be:

   (a) During any calendar quarter less than or equal to 7.5 mrem to the critical organ
   (b) During any calendar year less than or equal to 15 mrem to the critical organ

2. Cumulative dose contributions to a member of the public from I^{131}, I^{133}, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released to unrestricted areas for the current calendar quarter and current calendar year shall be determined at least once per 31 days in accordance with Step 6.3.4.c.

b. Action

   If the calculated dose from the release of I^{131}, I^{133}, tritium, and radionuclides in particulate form, with half-lives greater than 8 days, in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC within 30 days, a special report that contains:

   1. Cause(s) for exceeding limits.

   2. Corrective action(s) taken to reduce releases.

   3. Proposed corrective action(s) to be taken to assure that subsequent releases will be in compliance with limits stated in Step 6.3.4.a.

c. Dose Calculations

   Gaseous releases associated with anticipated operational occurrences and unplanned and unmonitored releases shall be included in the determination of a release. Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection to specific plant functions, such as containment purges, shall be used in the estimates as appropriate.

   1. The dose to the maximum exposed member of the public, attributable to gaseous effluents at and beyond the site boundary, that contain I^{131}, I^{133}, tritium, and particulate-form radionuclides with half-lives greater than 8 days, shall be determined by:

      ((Define equation**))** **((**Define equation terms**))**

NOTE: This equation should consider the release source term, the dose factors in Attachment 8 for the effluent pathways, and the dispersion at location of interest.

6.3.5 Gaseous Waste Management System

Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection with specific plant functions, such as containment purges shall be used to calculate projected doses, as appropriate.

a. Requirement

1. The gaseous waste management system shall be used to reduce radioactive material in gaseous waste before its discharge, when projected gaseous effluent air doses due to gaseous effluent releases from each unit to areas at and beyond the site boundary would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation, averaged over 31 days.

2. The gaseous waste management system shall be used to reduce radioactive materials in gaseous waste before its discharge, when the projected doses due to gaseous effluent releases from each unit to areas at and beyond the site boundary, would exceed 0.3 mrem to the critical organ, averaged over 31 days.

3. Doses due to gaseous releases from the site shall be projected at least once per 31 days, when the gaseous waste management system is not being fully utilized, based on the calculations in Step 6.3.5.c.

b. Action

If gaseous waste that exceeds the limits in Step 6.3.5.a. is discharged without treatment, prepare and submit to the NRC within 30 days, a special report that includes:

1. An explanation why gaseous radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability.

2. Actions taken to restore the inoperable equipment to operable status.

3. Summary description of actions taken to prevent recurrence.

c. Projected Gamma Dose

Determine the projected 31-day gamma air dose using the equation derived in Section 6.3.3.c for gamma radiation and the ratio of estimated gaseous effluent radioactivity in the current 31-day period to that released in the previous 31-day period..

d. Projected Beta Dose

Determine the projected 31-day beta air dose using the equation derived in Section 6.3.3.c for beta radiation and the ratio of estimated gaseous effluent radioactivity in the current 31-day period to that released in the previous 31-day period.

e. Projected Maximum Exposed Member of the Public Dose

Determine the projected maximum exposed member of the public using the equation derived in Section 6.3.4.c and the ratio of estimated effluent radioactivity due to radioiodines, tritium, and radioactive material in particulate form with half-lives greater than 8 days in the current 31-day period to that released in the previous 31-day period..

((Define equation)) ((Define equation terms))

6.4 RADIOACTIVE LIQUID AND GASEOUS RELEASE PERMITS

The licensee shall maintain procedures for liquid and gaseous release permits to ensure effluent dose limits are not exceeded when making releases.((Identify responsible organization and release permit system for type of release applicable to site based on examples in step 6.4))

6.4.1 Liquid Waste Batch Release Permits

Site implementing procedures control batch releases of radioactive liquids. Examples of batch releases include:
((List all systems with expected batch releases))

Liquid releases associated with anticipated operational occurrences and unplanned and unmonitored releases shall be characterized using sampling and analytical procedures to assess the amounts of radioactivity released or currently being released to the environment and for determining doses to offsite receptors.

6.4.2 Continuous Release Permit

Site implementing procedures control continuous releases of radioactive liquids.

Continuous Releases

A Continuous Release Permit is required for:

((List all expected continuous release pathways**))**

6.4.3 Waste Gas Release Permits

Site implementing procedures control initiating waste gas releases.

6.4.4 Reactor Containment Release Permits

Site implementing procedures control initiating containment purges Release Permits shall be valid from start of purge until:

(a) Routine termination
(b) Terminated for cause
(c) Receipt of radiation monitoring system (RMS) high alarm

6.4.5 Miscellaneous Gaseous Release Permit

Gaseous releases associated with anticipated operational occurrences and unplanned and unmonitored releases shall be characterized using sampling and analytical procedures to assess the amounts of radioactivity released or currently being released to the environment and for determining doses to offsite receptors.

((List all expected system release pathways))

6.4.6 Radioactive Liquid and Gaseous Release Controls

a. Notifications of pending releases shall be made by responsible section and a request to initiate the appropriate release permit prior to any release.

b. A representative sample shall be obtained of the source to be released.

c. Site implementing procedures control the performance of required sample collection and analyses.

d. The calculation and recording of the maximum authorized release rate, percent of ODCM/Technical Specification limits, and applicable conditions or controls pertaining to each release on the release permit.

e. Site implementing procedures control notifications of responsible personnel or if it is determined that a release may not be within the effluent dose limits.

f. The release permit will include:

   1. Verification that the correct source is authorized for release.

   2. Identification of maximum authorized release rate.

   3. The percent of ODCM/Technical Specifications limits the release represents.

   4. Identification of any indicated controls or conditions applicable to the release.

g. Site implementing procedures control in initiating the release and identify information as appropriate, such as:

1. Date and time release was started
2. Starting tank/sump level
3. Beginning pressure
4. Release flow rate
5. Dilution water or air flow rate

h. Site implementing procedures control terminating the release and identify information needed for completing permit, for example:

1. Date and time release was stopped
2. Tank/sump ending level
3. Release flow rate just prior to termination
4. Ending pressure
5. Volume released

6.5 TOTAL DOSE LIMIT TO PUBLIC FROM URANIUM FUEL CYCLE SOURCES

6.5.1 Requirement

The annual (calendar year) dose or dose commitment to a real individual due to releases of radioactivity and radiation from uranium fuel cycle sources shall not exceed 25 mrem to the total body or the critical organ (except the thyroid, which shall not exceed 75 mrem).

6.5.2 Action

a. If the calculated doses from release of radioactive materials in liquid or gaseous effluents exceed twice the limits in Steps 6.2.3.a., 6.3.3.a., or 6.3.4.a., calculate (including direct radiation contribution from the units and from outside storage tanks) whether limits in Step 6.5.1 have been exceeded.

b. If the limits in Step 6.5.1 have been exceeded, prepare and submit to the NRC within 30 days, a special report that defines the corrective action to be taken to reduce subsequent releases and to prevent recurrence, and includes a schedule for achieving conformance with the limits. Special reports, as defined in 10 CFR 20.2203(a) (4), shall include:

1. An analysis that estimates the radiation exposure (dose) to a real individual from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the releases covered by the report.
2. A description of the levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations.
3. If the estimated dose exceeds the limits in Step 6.5.1, and if the release condition that violates 40 CFR 190 has not already been corrected, the special report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

6.6 RADIOLOGICAL ENVIRONMENTAL MONITORING

6.6.1 Monitoring Program

a. Requirement

1. The Radiological Environmental Monitoring Program shall be conducted as specified in Radiological Environmental Monitoring Program (Attachment 9).

2. Samples shall be collected from specific locations specified in Environmental Sampling Locations (Attachment 10).

3. Samples shall be analyzed in accordance with:

(a) Radiological Environmental Monitoring Program (Attachment 9) requirements
(b) Detection capabilities required by Detection Capabilities for Environmental Sample Analysis (Attachment 11)
(c) Guidance of the Radiological Assessment Branch Technical Position on Environmental Monitoring dated November, 1979, Revision No. 1 or latest guidance

b. Action

1. If the Radiological Environmental Monitoring Program is not being conducted as required in Step 6.6.1.a., report the situation by preparing and submitting to the NRC, in the Annual Radiological Environmental Operating Report required by Technical Specifications Section 5.0 Administrative Controls a description of the reasons for not conducting the program as required, and the plan for precluding recurrence.

2. If, when averaged over any calendar quarter, radioactivity exceeds the reporting levels of Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 12) prepare and submit to the NRC within 30 days, a special report that:

(a) Identifies the causes for exceeding the limits, and
(b) Defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a member of the public is less than the calendar year limits of Steps 6.2.3a, 6.3.3a, and 6.3.4a.

When more than one of the radionuclides listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 12) are detected in the sampling medium, the report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} \ldots \text{etc.} \text{ is greater than or equal to } 1.0$$

3. When radionuclides other than thoselisted in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 12) are detected and are the result of plant effluents, the report shall be submitted if the potential annual dose to a member of the public is equal to or greater than the calendar year limits of Steps 6.2.3a, 6.3.3a, and 6.3.4a. The report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, report and describe the condition in the Annual Radiological Environmental Operating Report.

4. If milk or fresh leafy vegetable samples are unavailable from one or more of the sample locations required by Environmental Sampling Locations (Attachment 10), identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Identify the cause of the unavailability of samples and identify the new locations for obtaining replacement samples in the next Annual Radioactive Effluent Release Report. Include in the report a revised figure and table for the ODCM to reflect the new locations.

6.6.2 Land Use Census

a. Requirement

1. A land use census shall be conducted and shall identify, within a distance of 8 km (5 miles), the location in each of the 16 meteorological sectors of the following:

(a) Nearest milk animal
(b) Nearest residence
(c) Nearest garden greater than 50 m^2 (500 ft^2) that produces broad leaf vegetation

2. The land use census shall be conducted during the growing season, at least once per 12 months, using methods that will provide the best results (e.g., door-to-door survey, aerial survey, local agriculture authorities). Land use census results shall be included in the Annual Radiological Environmental Operating Report.
3. In lieu of the garden census, broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted ground deposition (D/Qs). Specifications for broad leaf vegetation sampling in Radiological Environmental Monitoring Program (Attachment 9) shall be followed, including analysis of control samples.

b. Action

1. If a land use census identifies locations that yield a calculated dose or dose commitment greater than the values currently being calculated in 6.3.4.a.2,

identify the new locations in the next Annual Radioactive Effluent Release Report.

2. If a land use census identifies locations that yield a calculated dose or dose commitment (via the same exposure pathway) ((specify percentage)) greater than at a location from which samples are currently being obtained, add the new locations to the Radiological Environmental Monitoring Program within 30 days. Sampling locations, excluding the control station location, that have the lowest calculated dose or dose commitments (via the same exposure pathway) may be deleted from the monitoring program. Identify new locations in the next Annual Radioactive Effluent Release Report and include in the report revised figures and tables reflecting the new locations.

6.6.3 Interlaboratory Comparison Program

a. Requirement

Radioactive materials (which contain nuclides produced at the site), supplied as part of an Interlaboratory Comparison Program, shall be analyzed, given the environmental media identified in Attachment 9.

b. Action

Analyses shall be performed at least semiannually as follows:

((Define frequency, media, and analysis to be performed))

If analyses are not performed as required by Step 6.6.3.b., report in the Annual Radiological Environmental Operating Report the corrective actions taken to prevent recurrence.

c. Results

Results shall be reported in the Annual Radiological Environmental Monitoring Report. The discussion of acceptance criteria and corrective actions for any analysis that do not meet the acceptance criteria should be included.

6.7 REPORTING REQUIREMENTS

6.7.1 Annual Radiological Environmental Operating Report

Routine Radiological Environmental Operating Reports covering the operation of the units during the previous calendar year shall be submitted prior to May 1 of each year. A single submittal may be made for the site's. Radiological Environmental Operating Reports shall include:

a. Summaries, interpretations, and analysis of trends of results of radiological environmental surveillance activities for the report period, including:

   1. A comparison (as appropriate) with preoperational studies, operational controls, and previous environmental surveillance reports
   2. An assessment of the observed impacts of the plant operation on the environment
   3. Results of land use census per Step 6.6.2

b. Results of analysis of radiological environmental samples and of environmental radiation measurements taken per Step 6.6.1, Monitoring Program. Results shall be summarized and tabulated in the format of the table in the Radiological Assessment Branch Technical Position on Environmental Monitoring.

   1. If some individual results are not available for inclusion with the report, the report shall be submitted, noting and explaining reasons for missing results.

   2. Missing data shall be submitted in a supplementary report as soon as possible.

c. A summary description of the radiological environmental monitoring program.
d. At least two legible maps covering sampling locations, keyed to a table giving distances and directions from the centerline of one reactor. One map shall cover sampling locations near the site boundary; a second shall include more distant sampling locations.
e. Results of the site participation in the Interlaboratory Comparison Program, per Step 6.6.3.
f. Discussion of deviations from the site's environmental sampling schedule per Radiological Environmental Monitoring Program (Attachment 9).
g. Discussion of analyses in which the lower limit of detection (LLD) required by Detection Capabilities for Environmental Sample Analysis (Attachment 11) was not achievable.
h. Any sample results from any groundwater wells described in the environmental program, whether the results were required by the environmental program or not.

6.7.2 Annual Radioactive Effluent Release Report

a. Requirement

Radioactive Effluent Release Reports covering operation of the units during the previous 12 months of operation shall be submitted before May 1 of each year. A single submittal may be made for the site and should combine those sections that are common to all units. Radioactive Effluent Release Reports shall include:

1. A summary of quantities of radioactive liquid and gaseous effluents and solid waste released. Data shall be summarized on a quarterly basis following

the format of Regulatory Guide 1.21, Appendix B, for liquid and gaseous effluents. Data shall be summarized on an annual basis following the format of Regulatory Guide 1.21, Appendix B, for solid waste.

2. An assessment of radiation doses to the maximum exposed members of the public due to the radioactive liquid and gaseous effluents released from the site during the previous calendar year. This assessment shall be in accordance with Step 6.7.2.b.
3. A list and description of unplanned and/or unmonitored releases from the site to unrestricted areas, during the reporting period, which meet the following criteria:
   ((Define site specific criteria))
4. Major changes to radioactive liquid, gaseous, and solid waste treatment systems during the reporting period.
5. Changes to the Offsite Dose Calculation Manual.
6. A listing of new locations for dose calculations or environmental monitoring identified by the land use census (See Step 6.6.2).
7. A summary of radioactive leaks or spills meeting the following criteria:

   (a) An unintended spill or leak with the potential to reach groundwater, as defined in NEI 07-07, **and**
   (b) The spill or leak must be greater than 100 gallons in volume or the volume cannot be quantified but is estimated to be greater than 100 gallons; **or**
   (c) Any spill or leak, regardless of volume or activity deemed by the licensee to be reportable.

8. Any groundwater sample results from locations not part of the Radiological Environmental Monitoring Program.

b. Dose Assessment

1. Radiation dose to individuals due to radioactive liquid and gaseous effluents from the site during the previous calendar year shall either be calculated in accordance with this template or in accordance with Regulatory Guide 1.109. Population doses shall not be included in dose assessments.

2. The dose to the maximum exposed member of the public due to radioactive liquid and gaseous effluents from the site shall be incorporated with the dose assessment performed above. If the dose to the maximum exposed member of the public exceeds twice the limits of 6.2.3.a.1, 6.2.3.a.2, 6.3.3.a.1, or 6.3.4.a.1, the dose assessment shall include the contribution from direct radiation.

   NOTE: NUREG-0543 states: "There is reasonable assurance that sites with up to four operating reactors that have releases within Appendix I design objective values are also in conformance with the EPA Uranium Fuel Cycle Standard, 40 CFR Part 190."

3. Meteorological conditions during the previous calendar year or historical annual average atmospheric dispersion conditions shall be used to determine

gaseous, radioiodines, tritium, and particulates with half-lives greater than 8 days, pathway doses.

((Define the site specific meteorological conditions to be used to determine gaseous pathway doses referring to Attachment 13 for details.))

6.7.3 Annual Meteorological Data

a. Meteorological data collected during the previous year shall be in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.

b. Meteorological data shall be retained in a file on site and shall be made available to NRC upon request.

6.7.4 Changes to the ODCM

In accordance with Technical Specifications Section 5 Administrative Controls, Licensee initiated changes to the ODCM shall be:

a. Reviewed and approved by the appropriate level of management prior to implementation. ((Identify the functional organization and define the level of review and approval))

b. Records of reviews shall be retained as site records. Documentation shall include:

    1. Sufficient information to support changes, together with appropriate analyses or evaluations justifying changes.

    2. A determination that a change will not adversely impact the accuracy or reliability of effluent doses or setpoint calculations, and will maintain the level of radioactive effluent control required by:

        (a) 10 CFR 20 Subpart D
        (b) 40 CFR 190
        (c) 10 CFR 50.36a
        (d) 10 CFR 50, Appendix I

c. Submitted to the NRC in the form of a complete, legible copy of the changed portion of the ODCM as a part of, or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change was made. Each change shall be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and shall indicate the date (e.g., month/year) the change was implemented.

6.7.5 Groundwater Protection Initiative

a. Notifications and Reports

1. Informal communication shall be made to state/local/NRC officials by the end of the next business day for:

   (a) Any spill or leak meeting the requirements of Step 6.7.2.a.7.
   (b) Any groundwater sample result exceeding the reporting levels of Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 12).

2. A 30-day report shall be submitted to the NRC and a copy concurrently forwarded to state and local officials for any groundwater sampling result, whether on site or off site, exceeding the reporting levels of Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 12) and having the potential to reach groundwater or surface water that is or could be used as a source of drinking water. A 30-day report is only required on the initial discovery of a contaminated groundwater plume.

b. Any spill or leak for which an informal notification is made in accordance with Step 6.7.5.a. shall be summarized in the Annual Radioactive Effluent Report.
c. Any groundwater sample result from a groundwater source that is not part of the radiological environmental monitoring program shall be included in the Annual Radioactive Effluent Report.
d. Any groundwater sample result from any groundwater well described in the radiological environmental monitoring program shall be included in the Annual Radiological Environmental Operating Report.

6.8 RECORDS

The licensee shall maintain all records associated with the implementation of the ODCM in accordance with site records management system.

7 REFERENCES

1. 10 CFR Part 20, "Standards for Protection Against Radiation."

   a. 10 CFR 20.1301, "Dose Limits for Individual Members of the Public."

   b. 10 CFR 20.1302, "Compliance with Dose Limits for Individual Members of the Public."

   c. 10 CFR 20.2202, "Notification of Incidents."

   d. 10 CFR 20.2203, "Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Constraints or Limits."

   e. 10 CFR Part 20, Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage."

2. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"

   a. 10 CFR 50.34a, "Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents—Nuclear Power Plants."

   b. 10 CFR 50.36a, "Technical Specifications on Effluents from Nuclear Power Reactors."

   c. 10 CFR 50.72, "Immediate Notification Requirements for Operating Nuclear Power Reactors."

   d. 10 CFR 50.73, "Licensee Event Report System."

   e. 10 CFR Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents."

3. 10 CFR Part 100, "Reactor Site Criteria"

4. 40 CFR, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations" as implemented under 10 CFR Part 20.1301 (e).

5. Generic Letter 89-01 "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications (RETS) in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose calculation Manual or to the Process Control Program" as contained in NUREG-1301 and NUREG-1302

6. IE Bulletin No. 80-10, “Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Release of Radioactivity to Environment,” May 6, 1980.

7. IE Information Notice No. 91-40, “Contamination of Nonradioactive System and Resulting Possibility for Unmonitored, Uncontrolled Release to Environment,” June 19, 1991.

8. Regulatory Guide 1.21, Revision 1, “Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Reactors, U.S. Nuclear Regulatory Commission, June 1974.

9. Regulatory Guide 1.33, “Quality Assurance Program Requirements (Operation).”

10. 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 50, Appendix I,” U.S. Nuclear Regulatory Commission, March 1976.

11. Regulatory Guide 1.109, Revision 1, “Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, U.S. Nuclear Regulatory Commission, October 1977.

12. Regulatory Guide 1.111, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,” U.S. Nuclear Regulatory Commission, March 1976.

13. Regulatory Guide 1.111, Revision 1, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,” U.S. Nuclear Regulatory Commission, July 1977.

14. Regulatory Guide 1.112 Revision 1, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Watercooled Nuclear Power Reactors, March 2007

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

16. Regulatory Guide 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.”

17. Regulatory Guide 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition).”

18. Regulatory Guide 4.1, “Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants.”

19. Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants."

20. Regulatory Guide 4.13, Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications Rev. 1, July 1977

21. Regulatory Guide 4.15, Rev 1 "Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination) - Effluent Streams and the Environment." February 1979 or Regulatory Guide 4.15, Rev2 "Quality Assurance for Radiological Monitoring Programs (Inception Through Normal Operations to License Termination)-Effluent Streams and the Environment." July 2007..

22. Regulatory Guide 8.8, Revision 3, "Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Stations Will Be As Low As Is Reasonably Achievable," June 1978.

23. NUREG-0543, February 1980, Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR Part 190)

24. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, October 1978.

25. NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors." [This NUREG includes Generic Letter 89-01 Supplement No.1.]

26. NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors." [This NUREG includes Generic Letter 89-01.]

27. NUREG-0800, Standard Review Plan, 11.5 "Process and Effluent Radiological Monitoring Instrumentation and sampling Systems" Rev 4 March 2007

28. NUREG/CR-3332, "Radiological Assessment," U.S. Nuclear Regulatory Commission, 1983

29. NUREG/CR-4007, "Lower Limit of Detection: Definition and Elaboration of a Proposed Position of Radiological Effluent and Environmental Measurements," U.S. Nuclear Regulatory Commission, September1984.

30. "Radiological Assessment Branch Technical Position," U.S. Nuclear Regulatory Commission, November 1979 as contained in NUREG-1301 and NUREG-1302.

31. NUREG/CR-4013, "LADTAP II—Technical Reference and User Guide," U.S. Nuclear Regulatory Commission, April 1986.

32. NUREG/CR-4653, "GASPAR II—Technical Reference and User Guide," U.S. Nuclear Regulatory Commission, March 1987.

33. Report of the International Commission on Radiological Protection (ICRP) Committee II on Permissible Dose for Internal Radiation (1959)

34. ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," 1999.

35. ANSI N42.18-2004, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," 2004.

36. DOE/TIC-11026, "Radioactive Decay Data Tables," 1981 or other standard reference.

37. FSAR Chapter 17 subsection on non safety related Quality Control Program

38. NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document

39. Dominion VPAP-2103N, Offsite Dose Calculation Manual (North Anna) Rev 13.

    Note: This template is based on the North Anna Unit 1 & 2 ODCM, it may be useful to review its approach and methods applied in deriving doses, dose projection, and determining radiation monitoring instrumentation alarm set-points in developing a plant-specific ODCM.

((List additional Reference documents))

((List commitment documents))

ATTACHMENT 1 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	Minimum Operable Channels	Action
((Define instrumentation))	((Identify min. #))	((Identify action))

((Define Action))

((Define Qualifying Conditions))

ATTACHMENT 2 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Channel Description	Channel Check	Source Check	Channel Calibration	Channel Operational Test
((Define instrumentation))	((Define frequency and qualifiers))	((Define frequency and qualifiers))	((Define frequency))	((Define frequency and qualifiers))

((Define Qualifiers))

ATTACHMENT 3 RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

Radioactive Liquid Waste Sampling and Analysis Program

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)
((List Release Types))	((Define frequency and qualifiers))	((Define frequency and qualifiers))	((Define Analysis and qualifiers))	((Define LLD and qualifiers))

((Define Qualifiers))

ATTACHMENT 4 RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD)
((List Release Types))	((Define frequency and qualifiers))	((Define frequency and qualifiers))	((Define Analysis and qualifiers))	((Define LLD and qualifiers))

((Define Qualifiers))

ATTACHMENT 5 GASEOUS EFFLUENT DOSE FACTORS

(PAGE 1 OF 2)

Gaseous Effluent Radioiodines, Tritium and Particulate Dose Factors

(Gamma and Beta Dose Factors)

Dose Factors for ((Define Mode of Release (i.e. ground level, mixed mode))

Noble Gas Radionuclide	**K_i Total Body mrem/yr per Curie/sec**	**L_i Skin mrem/yr per Curie/sec**	**M_i Gamma Air mrad/yr per Curie/sec**	**N_i Beta Air mrad/yr per Curie/sec**
((Define Nuclide))	((Enumerate Dose Factor))	((Enumerate Dose Factor))	((Enumerate Dose Factor))	((Enumerate Dose Factor))

NOTE: Tables will need to be generated for each mode of release. (i.e. a table for Ground level, Mixed mode, or Elevated releases.) Dose factors are derived from Reg. Guide 1.109 using the appropriate X/Q values for the release types.

NOTE: The licensee will identify the parameter applicable to the site considering the following variables defined as follow:

1. Ki= The total body dose factor for gamma emissions for each identified noble gas radionuclide i in mrem/yr per Curie/sec

2. Li= The skin dose factor due to beta emissions for each identified noble gas radionuclide i, in mrem/yr per Curie/sec

3. Mi = The air dose factor for release due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/sec

4. Ni = The air dose factor for release due to beta emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/sec.

ATTACHMENT 5 (CONTINUED)

(PAGE 2 OF 2)

Gaseous Effluent Radioiodine, Tritium, and Particulate Dose Factors

(Inhalation Pathway Dose Factors)
Dose Factors for ((Define Mode of Release (i.e. ground level, mixed mode))

Radionuclide	**P_i Critical Organ mrem/yr per Curie/sec**
((Define Nuclide))	((Enumerate Dose Factor))

NOTE: Tables will need to be generated for each mode of release. (i.e. a table for Ground level, Mixed mode, or Elevated releases.) Dose factors are derived from Reg. Guide 1.109 using the appropriate X/Q values for the release types.

NOTE: The licensee will identify the parameter applicable to the site considering the following variables defined as follow:

1. Pi = The critical organ dose factor for releases for I^{131}, I^{133} , H^3 , and all radionuclides in particulate form with half-lifes greater than 8 days, for the inhalation pathway in mrem/yr per Curie/sec.

ATTACHMENT 6 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

Radioactive Gaseous Effluent Monitoring Instrumentation

Instrument	Minimum Operable Channels	Action
((Define instrumentation))	((Identify min. #))	((Identify action))

((Define Action))

((Define Qualifying Conditions))

ATTACHMENT 7 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Channel Description	Channel Check	Source Check	Channel Calibration	Channel Operational Test
((Define instrumentation))	((Define frequency and qualifiers))	((Define frequency and qualifiers))	((Define frequency))	((Define frequency and qualifiers))

((Define Qualifiers))

ATTACHMENT 8 CRITICAL ORGAN DOSE FACTORS

Critical Organ Dose Factors

(Critical Pathway Dose Factors)

Radionuclide	**RM_{ivv} mrem/yr per Curie/sec**	**RM_{ipv} mrem/yr per Curie/sec**
((Define Nuclide))	((Enumerate dose factor))	((Enumerate dose factor))

NOTE: Dose factors determined from Reg. Guide 1.109

NOTE: The licensee will identify the parameter applicable to the site considering the following variables defined as follow:

1. RMivv, RMipv = The dose factor for releases for ventilation vents or process vent release due to I^{131}, I^{133}, H^3, and all radionuclides in particulate form with half-lifes greater than 8 days, in mrem/yr per Curie/sec.

ATTACHMENT 9 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

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(NOTE 1)

Exposure Pathway and/or Sample	**Number of Sample and Sample Location** (NOTE 2)	**Collection Frequency**	**Type and Frequency of Analysis**
1. DIRECT RADIATION (NOTE 3)	Forty (40) routine monitoring stations, either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, to be placed as follows: 1) An inner ring of stations, one in each emergency meteorological sector within the site boundary 2) An outer ring of stations, one in each emergency meteorological sector within 6 to 8 km range fromthe site 3) The balance of the stations to be placed in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations	Quarterly	GAMMA DOSE Quarterly

ATTACHMENT 9 (Continued)

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Exposure Pathway and/or Sample	Number of Sample and Sample Location (NOTE 2)	Collection Frequency	Type and Frequency of Analysis
2. AIRBORNE Radioiodines and Particulates	Samples from 5 locations: a) 3 samples from close to the 3 site boundary locations (in different sectors) of the highest calculated historical annual average ground level D/Q b) 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q c) 1 sample from a control location 15-40 km distant and in the least prevalent wind direction	Continuous sampler, operation with sample collection weekly	Radioiodine Canister I_{131} Analysis, weekly Particulate Sampler Gross beta radioactivity analysis following filter change; (NOTE 4) Gamma isotopic analysis sis of composite (by location) quarterly (NOTE 5)
3. WATERBORNE a) Surface	Samples from 3 locations: a) 1 sample upstream b) 1 sample downstream	Grab Monthly composite	Gamma isotopic analysis monthly; (NOTE 5) Composite for tritium analysis quarterly
b) Ground	Sample from 1 or 2 sources only if likely to be affected	Grab Quarterly composite	Gamma isotopic and tritium analysis quarterly (NOTE 5)
c) Sediment	1 sample from downstream area with existing or potential recreational value	Semi-Annually	Gamma isotopic analysis semi-annually (NOTE 5)
d) Drinking	1 sample from the nearest water supply that could be affected by discharge. 1 sample from control location	Monthly composite, bi-weekly when I-131 is present	Gamma isotopic analysis monthly; (NOTE 5,6) I-131 analysis when present Composite for tritium analysis quarterly

ATTACHMENT 9 (Continued)

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Exposure Pathway and/or Sample	Number of Sample and Sample Location (NOTE 2)	Collection Frequency	Type and Frequency of Analysis
4. INGESTION a) Milk (NOTE 7)	a) Samples from milking animals in 3 locations within 5 km that have the highest potential. If there are none, then 1 sample from milking animals in each of 3 areas between 5 to 8 km where doses are calculated to be greater than 1 mrem per yr (NOTE 6) b) 1 sample from milking animals at a control location (15-30 km in the least prevalent wind direction)	Semimonthly when animals are on pasture; Monthly at other times	Gamma isotopic (NOTE 5)and ^{I131} analysis monthly
b) Fish and Invertebrates	a) 1 sample of commercially and recreationally important species (bass, sunfish, catfish) in vicinity of plant discharge area b) 1 sample of same species in areas not influenced by plant discharge	Semiannually or when in season	Gamma isotopic on edible portions
c) Food Products	a) Samples three different kinds of broad leaf vegetation grown nearest each of two different offsite locations of highest predicted historical annual average ground level D/Q if milk sampling is not performed b) 1 sample of broad leaf vegetation grown 15-30 km in the least prevalent wind direction if milk sampling is not performed c)1 sample of food products from any area that is irrigated by water in which plant liquid effluents have impacted.	Monthly if available, or at harvest	Gamma isotopic (NOTE 5) and ^{I131} analysis

ATTACHMENT 9 (Continued)

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NOTE 1: The number, media, frequency, and location of samples may vary from site to site. See Table 3.12-1 "Radiological Environmental Monitoring Program" of NUREG-1301 or NUREG-1302 for specific guidance on the scope and elements of the program, including qualifying notations on radiological analysis, determination of up and downstream sampling locations from discharge points, composite sampling, groundwater sampling when groundwater is a source of drinking water, and sampling of food products during harvest times. This table presents an acceptable minimum program for a site at which each entry is applicable. Local site characteristics must be examined to determine if pathways not covered by this table may significantly contribute to an individual's dose and be included in the sampling program.

NOTE 2: For each and every sample location in Environmental Sampling Locations (Attachment 10), specific parameters of distance and direction sector from the centerline of the reactor, and additional description where pertinent, shall be provided in Attachment 10. Refer to Radiological Assessment Branch Technical Positions and to NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plant. Deviations are permitted from the required sampling schedule if specimens are unattainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unattainable due to sampling equipment malfunction, every effort shall be made to complete corrective action before the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Step 6.7.1. It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances, suitable alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the radiological environmental monitoring program. In lieu of a Licensee Event Report and pursuant to Step 6.7.2, identify the cause of the unavailability of samples for that pathway and identify the new locations for obtaining replacement samples in the next Annual Radioactive Effluent Release Report, and include revised figures and tables from the ODCM reflecting the new locations in the report.

NOTE 3: One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The number of direct radiation monitoring stations may be reduced according to geographical limitations, e.g., at an ocean site, some sectors will be over water so that the number of dosimeters may be reduced accordingly. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

ATTACHMENT 9 (Continued)

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NOTE 4: Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

NOTE 5: Gamma isotopic analysis is the identification and quantification of gamma-emitting radionuclides that may be attributable to effluents from the facility.

NOTE 6: The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

NOTE 7: If milk sampling cannot be performed, use item 4.c (Page 3 of 5, Radiological Environmental Monitoring Program Attachment 9).

ATTACHMENT 10 ENVIRONMENTAL SAMPLING LOCATIONS

Distance and Direction From ((Define Location))

Sample Media	Location	Station No.	Distance (Miles)	Direction	Collection Frequency
((Define Media))	((Define Location))	((Enumerate Station #))	((Enumerate Distance))	((Define Direction))	((Define Frequency))

NOTE: Add descriptive qualifiers to each sample media required

NOTE: Provide a map showing the points of all identified sampling locations around the plant.

ATTACHMENT 11 DETECTION CAPABILITIES FOR ENVIRONMENTAL ANALYSIS

LOWER LIMIT OF DETECTION (LLD)

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg) (wet)	Milk (pCi/l)	Food Products (pCi/kg) (wet)	Sediment (pCi/kg) (dry)
((Nuclide))	((Enumerate LLD))	((Enumerate LLD))	((Enumerate LLD))	((Enumerate LLD))	((Enumerate LLD))	((Enumerate LLD))

NOTE: Identify the origin of required analysis, media, and values. State the equation, terms, and qualifying conditions, including measurable and identifiable radionuclides other than tabulated above.

NOTE: See NRC guidance on LLD's when a drinking water pathway exists..

ATTACHMENT 12 REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

Analysis	Water (pCi/l)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg, wet)	Milk (pCi/l)	Food Products (pCi/kg, wet)
((Nuclide))	((Define level))	((Define level))	((Define level))	((Define level))	((Define level))

NOTE: See NRC guidance on reporting levels when a drinking water pathway exists.

ATTACHMENT 13 METEROLOGICAL, LIQUID AND GASEOUS PATHWAY ANALYSIS

1.0 METEOROLOGICAL ANALYSIS

1.1 Purpose

The purpose of the meteorological analysis is to determine the annual average X/Q and D/Q values at critical locations around the site for each mode of release. The annual average X/Q and D/Q values were used to perform a dose pathway analysis to determine both the maximum exposed individual at site boundary and member of the public.

1.2 Meteorological Data, Parameters, and Methodology ((Define origin of meteorological data)) ((Define how dispersion and deposition coefficients are calculated))

1.3 Results ((Describe results of Analysis))

2.0 LIQUID PATHWAY ANALYSIS

2.1 Purpose

The purpose of the liquid pathway analysis is to determine the maximum exposed member of the public in unrestricted areas as a result of radioactive liquid effluent releases. The analysis includes a determination of most restrictive liquid pathway, most restrictive age group, and critical organ. This analysis is required for Subsection 6.2.

2.2 Data, Parameters, and Methodology ((Describe analysis methodology, model assumptions and parameters))

2.3 Results ((Describe Results of Analysis))

3.0 GASEOUS PATHWAY ANALYSIS

3.1 Purpose

A gaseous effluent pathway analysis is performed to determine the location that would result in the maximum doses due to noble gases for use in demonstrating compliance with Steps 6.3.1.a. and 6.3.3.a. The analysis includes a determination of the critical pathway, location of maximum exposed member of the public, and the critical organ for the maximum dose due to I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days for use in demonstrating compliance with requirements in Step 6.3.4.a.1. In addition, the analysis includes a determination of the critical pathway, maximum age group, and sector location of an exposed individual through the inhalation pathway from I^{131}, I^{133}, tritium, and particulates with half-lives greater than 8 days to demonstrate compliance with Step 6.3.1.a.

3.2 Data, Parameters, and Methodology ((Describe analysis methodology, model assumptions and parameters))

3.3 Results ((Describe the results))

NOTE: The results of the above analysis may be incorporated by reference to the Environmental Report and/or FSAR.