

PART 52, OFFSITE DOSE CALCULATION MANUAL (ODCM)

PROGRAM APPLICABILITY: IMC 2504 Appendix B

83746-01 INSPECTION OBJECTIVE

Regulatory Basis and Background. The Offsite Dose Calculation Manual (ODCM) provides the procedural details that implement the Technical Specifications and specifies the methodologies a licensee will use to attain and retain compliance with **Title 10 of the Code of Federal Regulations** (10 CFR) 20.1301 and 20.1302, 10 CFR **Part 50**, Appendix I, and 40 CFR 190.

The ODCM details the licensee's controls, compensatory actions, and surveillance requirements for the liquid and gaseous effluent monitoring instrumentation. It describes the methods that are used for monitoring of, and controlling releases from, the liquid and gaseous waste treatment systems. Additionally, it describes the Radiological Environmental Monitoring Program (REMP). It contains the methodology for calculating radionuclide discharge quantities in effluents and the effluent monitoring alarm points and trip set points. The manual should also describe the details of the offsite dose calculation methods used by the licensee, and the reporting information required for both special and periodic reporting basis. A separate inspection procedure directs the inspection of the REMP. Because the ODCM is a specific component of the REMP, several of the inspection requirements of the two inspections overlap. Inspectors should be mindful of this overlap and closely coordinate the inspections of the REMP and ODCM.

The ODCM inspection focuses on the manual's readiness for use by plant personnel and contains five inspection objectives.

01.01 To determine if the programs for monitoring and controlling liquid and gaseous effluents are adequate to ensure public doses from effluents are below the design objectives of Appendix I to 10 CFR **Part 50**.

01.02 To determine if the methods for quantifying effluent releases, establishing effluent release monitor set points, and calculating offsite doses are adequate and meet their intended objectives.

01.03 To determine if the licensee has an acceptable program to identify unplanned releases or leaks and spills to the environment, including groundwater.

01.04 To determine if the ODCM has correct descriptions of the information that should be included in the Annual Radiological Environmental Operating, Annual Radiological Effluent Release, and Special Reports.

01.05 To determine if the program has the proper management procedures in place to make revisions, verify quality objective, ensure periodic maintenance and inspection, identify and capture program deficiencies, resolve deficiencies, and document the process.

83746-02 INSPECTION REQUIREMENTS AND GUIDANCE

General Inspection Guidance

If the unit being constructed is at a site with existing operational units for which the same program will be used at all units, then this program may not require the same level of inspection as that required for units being constructed at sites with no operational units. This is consistent with the Baseline Inspection Program requirements identified in Inspection Manual Chapter (IMC) 2506, "Construction Reactor Oversight Process General Guidance and Basis Document." At sites with an operating unit where the licensee has chosen to take credit for similar operational programs as those that are already in use, the inspectors shall focus on the differences between the program already in use and the newly developed program. The operational program inspection should focus on those steps in the IMC 2504 inspection procedures (IP) where the inspectors cannot verify that the operational program, equipment, and components are the same, or substantially similar to, that of the operating unit. If the operational program, equipment, and components are the same, or substantially similar to, the operating unit, then the following minimum inspection requirements shall be completed, and all other inspection requirements may be omitted:

10 CFR Part 52 Licensees Collocated with an Existing Operational Plant

- a. Verify that the Part 52 licensee has incorporated the operational plant's procedures for monitoring and controlling liquid and gaseous effluents into their program.
- b. Verify, on a smart sampling basis, that liquid and gaseous effluent monitors identified in the ODCM are installed, calibrated, and operable, using Section 02.01, Instrumentation, as guidance. (Walkdowns) (Note: This inspection should not duplicate the efforts of other preoperational inspections. If adequate inspection of the installation, calibration, and operability of the radiation monitors is being addressed under other preoperational inspections, this item may be omitted.)
- c. Verify, on a smart sampling basis, that laboratory instruments used to quantify liquid and gaseous effluent releases are installed, calibrated, and operable, using Section 02.01, Instrumentation, as guidance. (Walkdowns)
- d. Verify that the ODCM contains adequate site-specific equations, models, and parameters used to calculate radiological effluent concentrations and offsite doses, using Section 02.02, Radioactive Effluents, as guidance.

Inspection Guidance: Verification of procedure incorporation should include a review of procedure cover sheet information (e.g., procedure titles and site applicability, management approvals, revision history, etc.), and a limited review of the procedure itself for applicability to the 10 CFR Part 52 site. The licensee may have developed specific procedures due to differences in plant design or layout. If so, review the site-specific design differences for conformance with the Final Safety Analysis Report (FSAR) and review procedures for adequate inclusion of the site-specific design differences. Applicable guidance can be found throughout IP 84528. Where

applicable, these inspection activities should be reviewed for compliance with 10 CFR Part 20, 10 CFR Part 52, and the FSAR.

02.01 Instrumentation. Determine that all release points which release more than 10% of the liquid or gaseous effluent quantities to the unrestricted area are monitored. Ascertain that groundwater monitoring is provided to detect unplanned liquid releases. Verify that the licensee has in place the controls, compensatory actions and surveillance requirements required by the Commission and follows the procedures in the ODCM. Determine that the equations and parameters used to calculate liquid and gaseous effluent monitoring alarms and trip set-points are correct. Verify that all likely release points are identified and the licensee has evaluated their significance.

- a. Inspection of liquid and gaseous effluent, and radwaste system instrumentation should include the following:
 1. Verification that all significant effluent discharge points are monitored. Based on site characteristics, plant design and operations, determine if the licensee has identified and evaluated all likely offsite release points in terms of the need for monitoring. Walk-down the liquid and gaseous radwaste treatment systems and compare them to the systems described in the Safety Analysis Report (SAR) Sections 11.2, 11.3, and 11.4 and the ODCM. Determine that the actual treatment systems are consistent with the ODCM and SAR. During system walk-down, evaluate the potential for unmonitored release points using the guidance contained in NRC IE Bulletin 80-10, NRC Circular Nos. 79-21, 80-14, and Information Notice Nos. 91-40 and 91-56.
 2. Observe the actual release monitors and samplers and determine if they are operational, are appropriate for their intended use, (i.e., routine effluents versus accident range monitors) and adequate for the radionuclide energies being measured. Technical guidance can be found in [American National Standards Institute \(ANSI\)/ Health Physics Society \(HPS\) N13.1-1999](#), [ANSI N42.18-2004](#), [ANSI N323D-2002](#), [ANSI N545-1975](#), [Regulatory Guide 1.21](#), and [Standard Review Plan, Section 11.5 \(NUREG-0800\)](#). Compare the actual monitors to the monitoring system described in SAR Section 11.5 and the ODCM.
 3. Review the licensee's Standard Operating Procedures (SOPs) for the operation and use of instruments and samplers to ensure that the procedures are appropriate. Verify that the staff has been trained on the SOPs by reviewing the training records and conducting staff interviews.
 4. Review the instrument calibration methods. Compare the calibration methods and frequency of calibrations with the guidance in [Regulatory Guides 1.21](#), [1.33](#), and [4.15](#). Determine if effluent monitoring systems have sufficient sensitivity to detect and quantify effluents. Review the change in instrument responses and calibrations between normal operation, operational occurrences, and post-accident conditions to verify that the instruments provide accurate responses under all conditions. Note that the calibration of effluent monitors and the alarm set points used for accident release assessment should consider the radioactive source term expected during accident conditions. [NUMARC 007](#) and [ANSI N320-1993](#) provide guidance in this area since the calibration and alarm set

points may be used for Emergency Action Levels (EALs). Determine that the initial calibration adequately represents the plant's presumed isotopic mix.

5. Review the methodology for calculating liquid and gaseous effluent monitoring alarms, set-points, and release rates in the ODCM and determine whether the method is appropriate. Verify that the ODCM includes appropriate equations and parameter values including volumes, flow rates, atmospheric dispersion and deposition, dilution factors (in-plant and at each point of discharge), and activity conversions. Determine if effluent monitor alarm set-point bases, including the assumptions for the radionuclide (noble gas) mix, are delineated in the ODCM as required in 10CFR50.36 for Technical Specifications.
6. Compare the liquid effluent monitoring instrument controls, compensatory actions, and surveillance requirements in the ODCM to the guidance given in Sections 3.3.3.10 and 4.3.3.10 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls in the ODCM should include the number of operable instruments, appropriate remedial actions when instruments fail to perform, appropriate instrument checks, calibrations, and operational tests. Verify that the ODCM contains reporting provisions consistent with NUREG-1301 or 1302 guidance. Supplementary guidance can be found in NUREG-0133, and Regulatory Guides 1.21, 4.1, and 4.8.
7. Compare the gaseous effluent monitoring instrument controls, compensatory actions, and surveillance requirements in the ODCM to the guidance given in Sections 3.3.3.11 and 4.3.3.11 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls in the ODCM should include the number of operable instruments, appropriate remedial actions when instruments fail to perform, appropriate instrument checks, calibrations, and operational tests. Verify that the ODCM contains reporting provisions consistent with NUREG-1301 or 1302 guidance. Supplementary guidance can be found in NUREG-0133, and Regulatory Guides 1.21, 4.1, and 4.8.
8. Determine that the license's procedures for obtaining representative samples, required detection limits, and measuring of difficult to detect radionuclides are appropriate. Supplementary guidance can be found in Regulatory Guides 1.21, 4.1, and 4.15.

02.02 Radioactive Effluents. Determine that the equations, models and parameters used to calculate radiological effluent concentrations and offsite doses are adequate and appropriate. Ascertain that the ODCM contains the methodology to keep discharges from the liquid and gaseous waste treatment systems below control levels. Verify that the licensee has in place the appropriate controls, compensatory actions, and surveillance requirements specified by the Commission in the ODCM.

a. Liquid Effluents

1. Compare the liquid effluent controls, compensatory actions and surveillance requirements in the ODCM to those in Sections 3.11.1.1 and 4.11.1.1 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls specified in the ODCM should include the allowable release concentration limits, sampling and analysis frequency, types of analysis, and lower limit of detection for

analysis. The review should include the licensee's methods for obtaining representative samples in holdup tanks and batch or continuous release streams. Supplementary guidance can be found in NUREG-0133, and Regulatory Guides 1.21, 4.1, and 4.8.

2. Compare the liquid effluent dose controls, compensatory actions, and surveillance requirements in the ODCM to those in Sections 3.11.1.2 and 4.11.1.2 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls specified in the ODCM should include the allowable quarterly and yearly dose limits to the whole body and organ, the total dose controls, actions, and requirements in Sections 3.11.4 and 4.11.4. Verify that the ODCM contains a provision for special reporting when the licensee exceeds effluent control limits.
3. Compare the liquid radwaste treatment system's use controls, compensatory actions and surveillance requirements in the ODCM to those in Sections 3.11.1.3, and 4.11.1.3 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls specified in the ODCM should include treatment system use criteria such as a 31-day dose limits to the whole body and organ. Verify that the ODCM contains a provision for special reporting when the licensee exceeds effluent control limits.

b. Gaseous Effluents

1. Compare the gaseous effluent release rate controls, compensatory actions, and surveillance requirements in the ODCM to those in Sections 3.11.2.1 through 3.11.2.4 and 4.11.2.1 through 4.11.2.4 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls specified in the ODCM should include the allowable dose rate limits for noble gases, radioactive iodine, tritium, particulate radioactivity, the requirements for sampling and analysis in Table 4.11-2, and the total dose requirement of Sections 3.11.4 and 4.11.4. The review should include the licensee's methods for obtaining representative samples in decay tanks and batch or continuous release streams. Verify that the ODCM contains a provision for special reporting when the licensee exceeds effluent control limits.
2. Compare the gaseous radwaste treatment system's use controls, compensatory actions and surveillance requirements in the ODCM to those in Sections 3.11.2.4, and 4.11.2.4 of NUREG-1301(PWR) or NUREG-1302 (BWR). The requirements and controls specified in the ODCM should include treatment system use criteria, such as a 31-day dose limit to air and organ. Verify that the ODCM contains a provision for special reporting when the licensee exceeds effluent control limits.

c. Effluent Release Concentrations and Dose Calculation Methods

1. Review the methodology for calculating total effluent concentrations in the ODCM and determine whether the method is appropriate. Ensure that the ODCM includes appropriate equations and parameter values including volumes, flow rates, dilution factors, and activity conversions. Technical guidance can be found in Regulatory Guides 1.21, 4.1, 4.8, and 1.113.

2. Review the methodology for calculating offsite doses in the ODCM and determine whether the method is appropriate and the guidance in; Regulatory Guides 1.109, 1.111, 1.113, NUREG/CR-4013 (LADTAP II), and NUREG/CR-4653 (GASPAR II), is considered. Particular attention should be paid to appropriate exposure pathways, air and liquid dilution and dispersion factors, usage and uptake parameters, dose conversion factors, and the accounting for radiological decay, environmental loss, and re-concentration.

02.03 Program Management. Verify that the ODCM requires an annual land use census. Examine the license's programs to determine that they evaluate changes in land use and they incorporate necessary changes to the ODCM. Check that the programs exist and are effective. Verify that all laboratories supplying data to the REMP participate in an inter-laboratory comparison program. Determine that the licensee has the necessary management program to effectively make changes to the manual, verify quality objectives, and document the process.

- a. Review the ODCM program requirements for Quality Assurance/Quality Control measures to the recommendations presented in Regulatory Guides 4.15, 4.8 and 1.21, NUREG-1301 or NUREG-1302, and NUREG-0133. Verify that a program or procedures are in place to periodically review the sampling systems to assure that representative samples continue to be taken.
- b. Verify that the licensee's staff is trained on the ODCM methods of calculating effluent releases and doses. Also verify that the licensee is following appropriate quality control measures specified in the ODCM and the licensee's QA program.
- c. Determine if the laboratories in the licensee's program are following the guidance in Regulatory Guide 4.15. Review the laboratories' programs to determine participate in an inter-laboratory comparison program similar to that described in NUREG-1301 or NUREG-1302 (as appropriate).
- d. Compare the requirements and controls for land use census in the ODCM to the land use census described in NUREG-1301 or NUREG-1302 and NUREG-0133. Verify that the annual census will occur at the appropriate frequency and that important changes (those affecting the location of maximum individual exposure and population dose) will be made to the ODCM.
- e. Confirm that the verification and validation of digital computer software used in radiation monitoring and sampling equipment, including software used to terminate or divert process and effluent streams, is documented. This confirmation includes software developed by the licensee, purchased through a vendor, or software included with the instrumentation.
- f. Review the ODCM descriptions of the information that should be included in the Annual Radiological Environmental Operating, Annual Radiological Effluent Release, and Special Reports. Compare the description to that in NUREG-1301 or 1302, as appropriate.
- g. Verify that licensee has a program to identify unplanned effluent release points for further evaluation, including leaks and spills to onsite groundwater.

- h. Verify that the licensee has a groundwater monitoring program to identify leaks and spills.
- i. Verify that the licensee has alarm response procedures for actions to be taken upon receipt of an alarm from instrumentation.
- j. Verify that the licensee has a mechanism, system or procedure for identifying and capturing ODCM deficiencies. Verify that the program provides an appropriate priority for deficiency resolution.

83746 - 03 RESOURCE ESTIMATES

The staff estimates that approximately 100 hours of direct inspection effort will be required to implement this procedure. An inspection of the ODCM and related procedures and programs will require the following personnel:

- a. a health physicist who is trained in dose calculations, and environmental measurements and monitoring, and
- b. an engineer trained in instrumentation and controls.

The actual hours required to complete the inspection may vary from this estimate. The inspection hours allocated for this inspection are an estimate for budgeting purposes. The hours expended for this inspection should consider plant specific design features and operational programs. The level of effort expended in such inspections should be recorded for the purpose of planning future inspections and updating budget allocations. **If this inspection procedure is performed at a 10 CFR Part 52 licensee collocated with an existing operational unit and the operational program, equipment, and components are the same, or substantially similar to, that of the operating unit, inspection effort is expected to require approximately 80 hours of direct inspection effort. Additional hours may be required if subject matter expert in instrumentation and control is needed.**

83746 - 04 REFERENCES

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

ANSI N42.18-2004, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactivity in Effluents," (Reaffirmation of ANSI N42.18-1980) (Redesignation of ANSI N13.10-1974).

ANSI N320-1993, "Performance Specifications for Reactor Emergency Radiological Instrumentation," (Reaffirmation of ANSI N320-1979).

ANSI N323D-2002, "Installed Radiation Protection Instrumentation."

ANSI N545-1975, "Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry (Environmental Applications)."

IE Bulletin 80-10, "Contamination of Nonradioactive System and Resulting Potential for Unmonitored, Uncontrolled Releases of Radioactivity to the Environment," U.S. NRC Office of Inspection and Enforcement, May 6, 1980.

IE Circular 79-21, "Prevention of Unplanned Releases of Radioactivity," U.S. NRC Fuel Facility and Materials Safety Inspection, October 19, 1979.

IE Circular 80-14, "Radioactive Contamination of Plant Demineralizer Water System and Resultant Internal Contamination of Personnel," U.S. NRC Office of Inspection and Enforcement, June 24, 1980.

IE Circular 80-18, "10 CFR 50.59 Safety Evaluations for Changes to Radioactive Waste Treatment Systems," U.S. NRC Office of Inspection and Enforcement, August 22, 1980.

Information Notice 91-56, "Potential Radioactive Leakage to Tank Vented to Atmosphere," U.S. NRC Office of Reactor Regulation, September 19, 1991.

Information Notice 91-40, "Contamination of Nonradioactive System and Resulting Possibility for Uncontrolled Release to the Environment," U.S. NRC Office of Reactor Regulation, June 19, 1991.

NUREG-0800, Standard Review Plan Section 11.5, "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems."

NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants."

NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," (With Generic Letter 89-01, Supplement 1).

NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors," (With Generic Letter 89-01, Supplement 1).

NUREG/CR-4013, "LADTAP II - Technical Reference and User Guide."

NUREG/CR-4653, "GASPAR II - Technical Reference and User Guide."

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."

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

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

Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants."

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

Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment."

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

83746 - 05 PROCEDURE COMPLETION

This procedure will be closed upon satisfactory inspection results verifying that an OCDM exists and the programs it describes are in place to control offsite dose. The inspection must demonstrate the program can be inspected under the ROP.

END

Attachment:
Revision History for IP 83746

Attachment 1: Revision History for IP 83746

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML080140157 07/29/08 CN 08-021	Initial issue to support inspections of operational programs described in IMC 2504, Construction Inspection Program – Inspection of Construction and Operational Programs. Completed 4-year search of historical CNs and no commitments found.	None	ML072880599
	ML20120A449 05/07/20 CN 20-024	Revises guidance for units being constructed at a site with existing operational units for which the same program will be used at all units and conditionally lowers the Resource Estimate.	None	N/A