

**NEI 07-09 Generic FSAR Template Guidance for  
Offsite Dose Calculation Manual (ODCM)  
Program Description**

**August 29, 2007**

## **EXECUTIVE SUMMARY**

NEI 07-09, Generic FSAR Template Guidance for the Offsite Dose Calculation Manual (ODCM) Program Description, Revision 0, provides a complete generic program description for use in developing construction and operating license (COL) applications. The document reflects contemporary NRC guidance, including Regulatory Guide 1.206 (Draft Guide DG-1145), “COL Applications for Nuclear Power Plants (LWR Edition),” 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.

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## 1.0 INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used in the calculation of offsite doses from radioactive liquid and gaseous effluents, in the calculation of liquid and gaseous effluent monitoring instrumentation alarm/ trip setpoints, and in the conduct of the radiological environmental monitoring program (REMP). The ODCM also describe the radioactive effluent controls program, environmental monitoring activities, and includes the Standard Radiological Effluent Controls (SREC) . Requirements are established for the Annual Radiological Environmental Operating Report and the Annual Radioactive Effluent Release Report required by station Technical Specifications.

This ODCM generic template contain the methodology and generic parameters to demonstrate the calculation of offsite dose utilizing guidance based on NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants and 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.

This ODCM program description documents how a licensee control, monitor, perform radiological evaluations of all releases, and document and report all radiological effluents discharged to the environment. This ODCM template is submittal information to meet DCD Section 11.5 will be updated prior to fuel load by the power reactor licensee with site specific information on the following:

- Installed radiological instrumentation and their alarm and actuation functions used to monitor and control effluent release,
- Meteorology data used to determine atmospheric dispersion and deposition factors for gaseous and particulate release and dilution factors for liquid effluents.
- Identification and location of dose receptors and the land use census survey used as selection basis.
- The administrative and operational procedures associated with the implementation of the ODCM.

The above information will result in site specific dose projections and updating of the site specific instrumentation and processes used for surveillance and monitoring .The methodology used by power reactor licensees and the program for surveillance and monitoring effluent discharges are well established.

## 2.0 LIQUID EFFLUENTS

### 2.1. Limits of Operation

The following sections implement recommended Effluent Controls and Surveillances defined by NUREG-1301 for PWR's (Reference 10) and NUREG-1302 for BWR's (Reference 11) for liquid radioactive waste effluents. .

In accordance with the licensee's Technical Specification Section 5 Administrative Controls, the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from each unit to UNRESTRICTED AREAS [Site specific Figure] is limited to:

- During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ and
- During any calendar year to less than or equal to 3 mrem to the whole body and to less than or equal to 10 mrems to any organ..

The Controls Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of the above NUREGS (Reference 10 and 11) as follow:

Liquid Effluent Monitoring Instrument Operability – Sections 3/4/B.3.3.10

Liquid Effluent Concentration – Section 3/4/B.11.1.1

Liquid Effluent Dose – Sections 3/4/B.11.1.2

Liquid Radwaste Treatment System – Sections 3/4/B.11.1.3

### 2.2. Liquid Waste Management System

Liquid waste concentrations discharged from the Station will not exceed the following limits:

- 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.
- For dissolved or entrained noble gases, concentrations will not exceed  $2E-4$   $\mu\text{Ci/ml}$ .

### 2.3. Liquid Effluent Monitor Setpoints

#### 2.3.1. General Provisions

Liquid monitor setpoints calculated in accordance with the methodology presented in the Addendum to NUREG -0133 (Reference 1) will be regarded as upper bounds for the actual high alarm setpoints. That is, a lower value for the high alarm setpoint may be established or retained on the monitor, if desired. Intermediate level setpoints should be established at an appropriate

level to give sufficient warning prior to reaching the high alarm setpoint. If no release is planned for a particular pathway, or if there is no detectable activity in the planned release, the monitor setpoint should be established as close to background as practical to prevent spurious alarms, and yet alarm should an inadvertent release occur.

#### 2.3.2. Overview of Method

Liquid Waste Management System effluent line radioactivity monitors are intended to provide alarm and automatic termination of release prior to exceeding the limits specified in Section 2.1. at the point of release of the diluted effluent into the UNRESTRICTED AREA. Therefore, their alarm/trip setpoints are established for compliance calculated using site specific parameters with the equations from NUREG-0133 reference 1.

#### 2.4. Liquid Effluent Dose Calculations

The Offsite Dose Calculation Manual methodology and parameters used in the calculation of alarm/trip setpoints utilize guidance based on NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (Reference 1) and 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 (Reference 2)

#### 2.5. Liquid Effluent Dose Projections

In order to meet the requirements for operation of the Liquid Waste Management System dose projections must be made at least once every 31 days. This applies during periods in which a discharge to UNRESTRICTED AREAS of liquid effluents containing radioactive materials occurs or is expected. The Liquid Radwaste Treatment System is to be used to reduce the radioactive materials in liquid waste prior to discharge when projected dose due to liquid effluent to unrestricted areas would exceed 0.06 mrem to total body or 0.2 mrem to the critical organ in a 31-day period.

### **3.0 GASEOUS EFFLUENTS**

#### 3.1. Limits of Operation

The following Limits of Operation implement requirements established by the licensee's Technical Specifications Section 5 Administrative Controls Dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY will be limited to:

- For noble gases: a dose rate  $\leq 500$  mrem/year to the total body and  $\leq 3000$  mrem/year to the skin, and
- For iodine-131, iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: a dose rate  $\leq 1500$  mrem/year to any organ.

Control on Gaseous Effluent Dose to a member of the public will be in accordance with Technical Specifications Section 5 Administrative Controls. The dose to a member of the public from iodine-131, iodine-133, for tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released from each unit to areas at and beyond the SITE BOUNDARY will be limited to the following:

- During any calendar quarter: Less than or equal to 5 mrem total body and less than or equal to 7.5 mrems to any organ and
- During any calendar year: Less than or equal to 15 mrem to any organ.
- A Dose rate  $\leq 1500$  mrem per year to any organ.

In accordance with Technical Specifications Section 5 Administrative Controls, the air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY will be limited to the following

- A dose rate  $\leq 500$  mrem per year to the whole body and a dose rate  $\leq 3000$  mrem per year to the skin.
- During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.
- During any calendar quarter: Less than or equal to 5 mrads for gamma and less than or equal to 10 mrads for beta.

The Controls Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of NUREG-1301 for PWR's (Reference 10) and NUREG- 1302 for BWR's (Reference 11) for gaseous radioactive waste effluents as follow:

Gaseous Effluent Monitoring Instrument Operability – Sections 3/4/B.3.3.11

Gaseous Effluent Dose Rate – Section 3/4/B.11.2

Gaseous Effluent Dose -Noble Gas – Sections 3/4/B.11.2.2

Gaseous Effluent Dose – I-131, I-133, Tritium, and All particulates -Sections 3/4/B.11.2.3

Gaseous Radwaste Treatment System – Sections 3/4/B.11.2.4.



### 3.2. Gaseous Waste Management System

The objective of the Gaseous Waste Management System is to process and control the release of gaseous radioactive effluents to the site environs so as to maintain the exposure of persons in unrestricted areas to radioactive gaseous effluents as low as reasonably achievable according to 10 CFR 50, Appendix I and 10 CFR 50.34a. This is accomplished while maintaining occupational exposure as low as reasonably achievable without limiting plant operation or availability.

### 3.3. Gaseous Effluent Monitor Setpoints

#### 3.3.1. General Provisions Regarding Noble Gas Monitor Setpoints

Noble gas radioactivity monitor setpoints calculated in accordance with the methodology presented in NUREG-0133 (Reference 1) section are intended to ensure that the limits of Section 3.1. are not exceeded. They will be regarded as upper bounds for the actual high alarm setpoints. That is, a lower high alarm setpoints may be established or retained on the monitor, if desired. Intermediate level setpoints should be established at an appropriate level to give sufficient warning prior to reaching the high alarm setpoints.

#### 3.3.2. Gaseous Effluent Compliance Calculations

Because the dose rate limits for areas at and beyond the SITE BOUNDARY specified in Section 3.1. are *site* Limits applicable at any instant in time, the summations extend over all simultaneously active gaseous final release pathways at the *plant site*. The licensee identified the gaseous final release pathways at the plant site in the DCD. The alarm/trip setpoints are established for compliance and calculated using site specific parameters with the equations from NUREG -0133 reference 1

The methods and parameters utilized for calculation of gaseous effluent pathway dose are based on NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, 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 and Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.

## 4.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

### 4.1. Limits of Operation

#### 4.1.1. The Radiological Environmental Monitoring Program (REMP)

The REMP required by this control provides representative measurements of radiation and of radioactive materials in those exposure pathways, and for those radionuclides, which lead to the highest potential radiation exposure of MEMBERS OF THE PUBLIC resulting from the plant operation. The REMP implements Section IV.B.2, Appendix I, 10 CFR 50, and thereby supplements the radiological effluent monitoring program by measuring concentrations of radioactive materials and levels of radiation, which may then be compared with those expected on the basis of the effluent measurements and modeling of the environmental exposure pathways.

The Controls, Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of NUREG-1301 for PWR's (Reference 10) and NUREG-1302 for BWR's (Reference 11) for radiological environmental monitoring as follow:

Radiological Environmental monitoring program –Section 3/4/B 12.1

#### 4.1.2. Land Use Census

Land use census shall be conducted and shall identify the following within a distance of 5 miles in each of the 16 meteorological sections: the location of the nearest milk animal, the nearest permanent residence, and the nearest garden of greater than 500 square feet producing broad leafy vegetation. This control is provided to ensure that changes in the use of UNRESTRICTED AREAS are identified and that modifications to the REMP are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

The Controls, Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of NUREG-1301 for PWR's (Reference 10) and NUREG-1302 for BWR's (Reference 11) for radiological environmental monitoring as follow:

Land Use Census –Section 3/4/B 12.2.

#### 4.1.3. Inter-laboratory Comparison Program Analyses

This analysis is performed on radioactive materials supplied as part of an Inter-laboratory Comparison Program that satisfies the requirements of Regulatory Guide 4.15.

The requirement for participation in an approved Inter-laboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring, in order to demonstrate that the results are reasonably valid for the purposes of Section IV.B.2, Appendix I, 10 CFR 50

The Controls, Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of NUREG-1301 for PWR's (Reference 10) and NUREG-1302 for BWR's (Reference 11) for radiological environmental monitoring as follow:

Interlaboratory comparison program –Section 3/4/B 12.3.

#### 4.1.4. Quality Assurance

Quality assurance is necessary to ensure that all radiological and non-radiological measurements that support the REMP are reasonably valid and of a defined quality. All steps of the monitoring process, which include but are not limited to, calibration of effluent monitoring instrumentation, sampling, shipment of samples, receipt of samples in a laboratory, preparation of samples, radiological measurements, data reduction, data evaluation, reporting of the measurements, monitoring results, record keeping, performance of assessments/audits, and preventive and corrective actions shall be in accordance with written standard operating procedures and policies, and in accordance with Reg Guide 4.15.

#### 4.1.5. Groundwater Monitoring

The licensee site procedure will establish action levels and reporting criteria for communications with State/Local officials and for documentation of accidental radioactive spills, leaks, or any other type of unplanned radioactivity releases to the environment which could affect groundwater both onsite and/or offsite. The groundwater sample results and a description of any significant onsite leaks/spills into groundwater will be reported in the Annual Radiological Environmental Operating Report and/ or Radioactive Effluent Release Report and/or licensee NRC approved report.

## 5.0 TOTAL DOSE DETERMINATIONS

### 5.1. Limits of Operation

In accordance with Technical Specification Section 5 Administrative Controls ,

the dose or dose commitment to any Member of the Public over a calendar year, due to releases of radioactivity and to radiation from uranium fuel cycle sources, will be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which will be limited to less than or equal to 75 mrem.

The Controls Surveillances and Bases are to be implemented consistent with sections 3.0 Controls, 4.0 Surveillances and B Bases of NUREG-1301 for PWR's (Reference 10) and NUREG-1302 for BWR's (Reference 11) for radioactive effluents as follow:

Total dose – Sections 3/4/B.11.4

## 5.2. Demonstration of Compliance

Each licensee will identify if there are any other uranium fuel cycle facilities within 5 miles of the plant site. If not, for the purpose of demonstrating compliance with the limits of Section 5.1, the total dose to a Member of the Public in the vicinity of the plant site due to uranium fuel cycle sources shall be determined. If other uranium fuel cycle facilities are within 5 miles, all sources are evaluated to determine compliance with the limits of Section 5.1.

## **6.0 POTENTIAL DOSE TO MEMBERS OF THE PUBLIC DUE TO THEIR ACTIVITIES INSIDE THE SITE BOUNDARY**

### 6.1. Requirements for Calculation

To support the reporting requirements of Section 7.2.2., an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY shall be performed as specified in Section 6.2, at least once per calendar year.

### 6.2. Calculation Method

For the purpose of performing the calculations required in Section 6.1, the dose to a member of the public inside the SITE BOUNDARY will be determined at the locations, and for the receptor age groups, defined in Table 6-1, Attributes of Member of the Public Receptor Locations Inside the Site Boundary, [Visitors Center – Later]

## **7.0 REPORTS**

### 7.1. Annual Radiological Environmental Operating Report

#### 7.1.1. Requirement for Report

In accordance with Technical Specification Section 5 Administrative Controls, the Annual Radiological Environmental Operating Report covering the REMP activities during the previous calendar year will be submitted before May 15 of each year. The material provided will be consistent with the objectives outlined in section 4.1 and section 7.1.2 of the ODCM, and in Sections IV.B.2, IV.B.3, and IV.C of Appendix I to 10 CFR Part 50.

#### 7.1.2. Report Contents

The materials specified in the following sub-sections will be included in each Annual Radiological Environmental Operating Report:

##### 7.1.2.1. Data

The report includes the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in Section 4.0 REMP, as well as summarized and tabulated results of these analyses and measurements taken during the report period, in a format similar to that contained in Table 3 of the Radiological Assessment Branch Technical Position (Reference 16); the results for any additional samples are also reported. In the event that some individual results are not available for inclusion with the report, the report is submitted noting and explaining the reasons for the missing results. The missing data is submitted in a supplementary report as soon as possible. The results for naturally-occurring radionuclides not included in plant effluents need not be reported.

##### 7.1.2.2. Evaluations

Interpretations and analyses of trends of the results shall be included in the report, including the following (as appropriate):

- Comparisons with pre-operational studies, operational controls, and previous environmental reports; and
- An assessment of any observed impacts of the plant operation on the environment.

If the measured level of radioactivity in an environmental sampling medium exceeding the reporting levels of Table 4-2 [Later] is not the result of plant effluents, the condition is described as required by Section 4.1.

##### 7.1.2.3. Programmatic Information

Also included in each report are the following:

- A summary description of the REMP;
- Maps of all sampling/measurement locations;
- The results of land use censuses required by Section 4.1.2; and
- Results of licensee participation in the Inter-laboratory Comparison Program required by Section 4.1.3.

#### 7.1.2.4. Descriptions of Program Deviations

Discussions of deviations from the established program must be included in each report.

## 7.2. Radioactive Effluent Release Report

### 7.2.1. Requirement for Report

In accordance with Technical Specification Section 5 Administrative Controls the Radioactive Effluent Release Report covering the operation of the unit during the previous year will be submitted prior to May 1 of each year in accordance with 10 CFR 50.36a. The report will include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR Part 50, Appendix I, Section IV.B.1.

### 7.2.2. Report Contents

The materials specified in the following sub-sections will be included in each Radioactive Effluent Release Report:

#### 7.2.2.1. Quantities of Radioactive Materials Released

The report includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit as outlined in NRC 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," Revision 1, June 1974 (Reference 14). Liquid and gaseous effluent data are summarized on a quarterly basis while solid radioactive waste data is summarized on a semiannual basis following the format of Appendix B of the Reg Guide. Unplanned releases of radioactive materials in gaseous and liquid effluents from the site to UNRESTRICTED AREAS are included in the report, tabulated either by quarter or by event. For gamma emitters released in liquid and gaseous effluents, in addition to the principal gamma emitters for which

MDCs are specifically established, other peaks which are measurable and identifiable are also identified and reported.

#### 7.2.2.2. Metrological Data

The report will include an annual summary of hourly meteorological data collected over the previous year. This annual summary may be either in the form of an hour-by-hour listing of wind speed, wind direction, and atmospheric stability, and precipitation (if measured) on magnetic tape; or in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability. In lieu of submission with the Radioactive Effluent Release Report, the licensee has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

#### 7.2.2.3. Dose Assessments

The report will include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit during the previous calendar year. Historical annual average meteorology conditions concurrent with the time of release of radioactive materials in gaseous effluents (as determined by sampling frequency and measurement) will be used for determining the gaseous pathway doses. If a determination is required by Section 5.1, the report will also include an assessment of radiation doses to the likely most exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous calendar year to show conformance with 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operation; this dose assessment must be performed in accordance with Chapter 5. The report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period; this assessment must be performed in accordance with Chapter 6. All assumptions used in making these assessments (i.e., specific activity, exposure time, and location) shall be included in the report.

#### 7.2.2.4. Solid radioactive waste data

for each type of solid waste shipped offsite during the report period, the following information shall be included:

- Waste volume,
- Total curie quantity Principal radionuclides,

- Type of waste (e.g., spent resin, compacted dry waste, evaporator bottoms),
- Type of container,
- Solidification agent, and
- Class of solid wastes (as defined by 10 CFR Part 61, Reference 23)

#### 7.2.2.5. Description of Program Deviations

Discussions of deviations from the established program shall be included in each report, as follows:

- The report will include deviations from the liquid and gaseous effluent monitoring instrumentation operability requirements. The report will include an explanation as to why the inoperability of the liquid or gaseous effluent monitoring instrumentation was not corrected within the specified time requirement.
- The report will include a description of the events leading to liquid holdup tanks or gas storage tanks exceeding the limits of Technical Specifications [Later].

#### 7.2.2.6. Major Changes to Radioactive Waste Treatment Systems

In accordance with Technical Specification Section 5 Administrative Controls, the ODCM will contain the methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents, in the calculation of gaseous and liquid effluent monitoring alarm and trip setpoints, and in the conduct of the radiological environmental monitoring program. Major changes to radioactive waste treatment systems (liquid and gaseous) that change the above methodology or parameters will require revision of the ODCM per the Technical Specification.

### 7.3. Revision of The ODCM

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

- Will be documented and records of reviews performed will be retained. This documentation will contain sufficient information to support the change(s) together with the appropriate analyses or evaluations justifying the change(s), and a determination that the change(s) maintain the levels of radioactive effluent control required by 10 CFR 20.1302, 40 CFR 190, 10 CFR 50.36a, and 10 CFR 50, Appendix I, and not adversely impact the accuracy or reliability of effluent, dose, or setpoint calculations;
- Will become effective after approval of the plant manager; and will be 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 Radioactive Effluent Release Report for the period of the report in which



any change in the ODCM was made. Each change will be identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and will indicate the date (i.e., month and year) the change was implemented.

## **8.0 METEOROLOGICAL MODELS**

The models are used to compute the specific values of meteorology-related parameters referenced throughout this ODCM. These models will also be used whenever it is necessary to calculate values of these parameters for new locations of interest. Both atmospheric dispersion and plume depletion will be calculated using the appropriate form of the sector-average Gaussian model in accordance with Reg. Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors. Gaseous release elevations may be considered to be either at ground-level, elevated, or mixed-mode. Site specific information to be provided in final ODCM completed prior to fuel load.

## **9.0 DEFINITIONS OF EFFLUENT CONTROL TERMS**

This section will be updated later.

## 10.0 REFERENCES

1. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, October 1978.
2. 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.
3. 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.
4. 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.
5. 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.
6. Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.
7. 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.
8. 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.
9. Federal Guidance Report (FGR) 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1989 ?
10. 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.]
11. NUREG-1302, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Boiling Water Reactors." [This NUREG includes Generic Letter 89-01.]
12. NUREG-0800, Standard Review Plan, 11.5 "Process and Effluent Radiological Monitoring Instrumentation and sampling Systems" Rev 4 March 2007
13. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities"

14. 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.
15. 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, July 1984.
16. "Radiological Assessment Branch Technical Position," U.S. Nuclear Regulatory Commission, November 1979.
17. DOE/TIC-11026, "Radioactive Decay Data Tables," 1981.
18. NUREG/CR-3332, "Radiological Assessment," U.S. Nuclear Regulatory Commission, 1983.
19. International Commission on Radiological Protection (ICRP) Publication 2, "Permissible Dose for Internal Radiation" (1959)
20. 10 CFR Part 20, "Standards for Protection Against Radiation."
21. 40 CFR, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."
22. Regulatory Guide 4.13, Performance, Testing, and Procedural Specifications for Thermoluminescence Dosimetry: Environmental Applications Rev. 1, July 1977
23. 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Wastes"
24. 10 CFR Part 100, "Reactor Site Criteria"
25. 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"
26. NUREG-0016, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Boiling Water Reactors" (BWR-GALE Code).
27. NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors" (PWR-GALE Code).
28. NUREG-0800, Standard Review Plan, Branch Technical Position 7-10, Guidance on Application of Regulatory Guide 1.97, Rev 5 March 2007
29. 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
30. Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)."
31. Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants."
32. Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an

Accident.” [Additional guidance on the application of Regulatory Guide 1.97 is provided in Standard Review Plan Branch Technical Position 7-10.]

33. Regulatory Guide 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition).”
34. Regulatory Guide 4.1, “Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants.”
35. Regulatory Guide 4.8, “Environmental Technical Specifications for Nuclear Power Plants.”

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