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Generic FSAR Template Guidance for Radiation Protection Program Description

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Nuclear Energy Institute

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NOTICE

EXECUTIVE SUMMARY

NEI 07-03, Generic FSAR Template Guidance for Radiation Protection Program Description, Revision 1, 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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GENERIC FSAR TEMPLATE GUIDANCE FOR RADIATION PROTECTION PROGRAM DESCRIPTION

12.5 RADIATION PROTECTION PROGRAM

A radiation protection program is developed, documented, and implemented commensurate with the scope and extent of licensed activities, sufficient to ensure compliance with the provisions of 10 CFR Parts 19, 20, 50, 52, and 71 and consistent with the guidance in Regulatory Guides 1.8, 8.2, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.13, 8.15, 8.20, 8.26, 8.27, 8.28, 8.29, 8.32, 8.34, 8.35, 8.36, and 8.38, the consolidated guidance in NUREG-1736, and Nuclear Energy Institute Report No. NEI 06-14, *Quality Assurance Program Description (QAPD)*.

In accordance with 10 CFR 20, Subpart B, the purpose of the radiation protection program is to maintain occupational and public doses below regulatory limits and as low as reasonably achievable (ALARA). To achieve this, the program will include:

I. a documented management commitment to keep exposures ALARA;

II. a trained and qualified organization with sufficient authority and well-defined responsibilities; and

III. adequate facilities, equipment, and procedures to effectively implement the program.

The radiation protection program is implemented in stages consistent with the following milestones:

1. Prior to initial receipt of by-product, source, or special nuclear materials (excluding Exempt Quantities as described in 10 CFR 30.18), and thereafter, when such radioactive materials are possessed under this license, the following radiation protection program elements will be in place:

    a. Organization – A radiation protection supervisor and at least one (1) radiation protection technician, each selected, trained and qualified consistent with the guidance in Regulatory Guide 1.8.

    b. Facilities – A facility or facilities to support the receipt, storage and control of non-exempt radioactive sources in accordance with 10 CFR 20.1801, 20.1802, and 20.1906.

    c. Instrumentation and Equipment –Adequate types and quantities of instrumentation and equipment will be selected, maintained, and used to provide for the appropriate detection capabilities, ranges, sensitivities, and accuracies to conduct radiation surveys and monitoring (in accordance with 10

CFR 20.1501 and 20.1502) for the types and levels of radiation anticipated for the non-exempt sources possessed under this license.

d. Procedures – Procedures will be established, implemented and maintained sufficient to maintain adequate control over the receipt, storage, and use of radioactive materials possessed under this license and as necessary to assure compliance with 10 CFR 19.11 and 19.12 and 10 CFR Part 20, commensurate with the types and quantities of radioactive materials received and possessed under this license.

e. Training – Initial and periodic training will be provided to individuals responsible for the receipt, control or use of non-exempt radioactive sources possessed under this license in accordance with 10 CFR 19.12 and consistent with the guidance in Regulatory Guides 1.8, 8.13, 8.27, and 8.29.

2. Prior to receiving reactor fuel under this license, and thereafter, when reactor fuel is possessed under this license, plant procedures on criticality accident requirements will be established, implemented and maintained and radiation monitoring will be provided in accordance with 10 CFR 50.68, in addition to the radiation protection program elements specified under item 1, above.

3. Prior to initial loading of fuel in the reactor, the radiation protection program described in this section will be fully implemented, with the exception of the organization, facilities, equipment, instrumentation, and procedures necessary for transferring, transporting or disposing of radioactive materials in accordance with 10 CFR Part 20, Subpart K, and applicable requirements in 10 CFR Part 71. In addition, the position of radiation protection manager (as described in section 12.5.2.3) will be filled and at least one (1) radiation protection technician, selected, trained and qualified consistent with the guidance in Regulatory Guide 1.8, will be onsite and on duty when fuel is initially loaded in the reactor, and thereafter, whenever fuel is in the reactor.

4. Prior to initial transfer, transport or disposal of radioactive materials, the organization, facilities, equipment, instrumentation, and procedures will be in place as necessary to assure compliance with 10 CFR Part 20, Subpart K, and applicable requirements in 10 CFR Part 71.

The radiation protection program content and effectiveness of implementation are reviewed periodically (at least annually) as part of an ongoing quality assurance program consistent with the guidance in NEI 06-14 (QAPD).

12.5.1 MANAGEMENT POLICY

Plant management will issue written policy on radiation protection that is consistent with the guidance in Regulatory Guides 8.8 and 8.10, including management's commitment to:

I. Assure that the plant is designed, constructed, and operated such that occupational and public radiation exposures and releases of licensed radioactive materials are ALARA;

II. Comply with regulatory radiation requirements, dose limits, and limits on release of radioactive materials;

III. Implement and maintain a radiation protection program to keep radiation doses below regulatory limits and ALARA;

IV. Assure that each manager and supervisor in the plant organization understands and is held accountable for implementing his or her responsibility to integrate appropriate radiation protection controls into work activities;

V. Assure that each individual working at the facility understands and accepts the responsibility to follow radiation protection procedures and instructions provided by radiation protection staff and to maintain his or her dose ALARA;

VI. Provide the radiation protection manager the delegable authority to stop work or order an area evacuated (in accordance with approved procedures) when, in his or her judgment, the radiation conditions warrant such an action and such actions are consistent with plant safety;

VII. Establish a direct reporting chain of the Radiation Protection Manager to the Plant Manager that is at the same reporting level as, but independent of the reporting chains for Operations and Maintenance.

VIII. Establish an ALARA Committee with delegated authority from the Plant Manager that includes, at a minimum, the managers of Operations, Maintenance, Work Control, Engineering and Radiation Protection to help assure effective implementation of line organization responsibilities for maintaining worker doses ALARA.]

12.5.2 ORGANIZATION

Qualification and training criteria for site personnel are consistent with the guidance in Regulatory Guide 1.8 and are described in FSAR Chapter 13. Specific radiation protection responsibilities for key positions within the plant organization are described below.

12.5.2.1 Plant Manager

The Plant Manager will have overall responsibility for the safe operation of the plant, including the responsibility for occupational and public radiation safety. Radiation protection responsibilities of the Plant Manager are consistent with the guidance in Regulatory Guides 8.8 and 8.10, including the following:

I. Ensure implementation of management radiation protection policy throughout the plant organization;

II. Ensure the overall commitment to radiation protection by the plant organization;

III. Interact with and support the Radiation Protection Manager on implementation of the radiation protection program;

IV. Support identification and implementation of cost-effective modifications to plant equipment, facilities, procedures and processes to improve radiation protection controls and reduce exposures;

V. Establish plant goals and objectives for radiation protection;

VI. Assure that exposures to site personnel are maintained ALARA;

VII. Support timely identification, analysis and resolution of radiation protection problems (e.g., through the plant corrective action program);

VIII. Assure that site personnel are properly trained on radiation protection in accordance with 10 CFR Part 19.

IX. Establish an ALARA Committee with delegated authority from the Plant Manager that includes, at a minimum, the managers of Operations, Maintenance, Work Control, Engineering and Radiation Protection to help assure effective implementation of line organization responsibilities for maintaining worker doses ALARA.]

12.5.2.2 Plant Organizational Managers and Supervisors

Managers and supervisors within the plant organization are responsible for establishing goals and expectations for his or her organization and to reinforce behaviors that promote radiation protection. Specifically, managers and supervisors are responsible for the following, as applicable to their position within the plant organization:

I. Interface directly with radiation protection staff to assure that radiation protection measures are considered and integrated into plant procedures and design documents and into the planning, scheduling, conduct, and assessment of operations and work;

II. Notify radiation protection personnel promptly when radiation protection problems occur or are identified, take corrective actions, and resolve deficiencies associated with operations, procedures, systems, equipment, and work practices;

III. Ensure that site personnel receive training on radiation protection, and are periodically retrained, in accordance with 10 CFR Part 19 and are properly instructed and briefed for entry into restricted areas;

IV. Periodically observe and correct, as necessary, radiation worker practices;

V. Support the RPM in implementing the radiation protection program;

VI. Assure that exposures to site personnel are maintained ALARA.

12.5.2.3 Radiation Protection Manager

The Radiation Protection Manager (RPM) will have the direct responsibility for assuring adequate protection of the health and safety of personnel working at the plant and members of the public during all aspects of activities covered within the scope and extent of the license. Qualifications and experience of the RPM are consistent with Regulatory Guide 1.8. Radiation protection responsibilities of the RPM are consistent with the guidance in Regulatory Guides 8.8 and 8.10, including the following:

I. Manage the radiation protection organization;

II. Establish, implement, and enforce the radiation protection program;

III. Provide radiation protection input to facility design, including plant modifications, and work planning;

IV. Track and analyze trends in radiation work performance and take necessary actions to correct adverse trends;

V. Support the plant emergency preparedness program and assign emergency duties and responsibilities within the radiation protection organization;

VI. Delegate authority to appropriate radiation protection staff to stop work or order an area evacuated (in accordance with approved procedures) when, in his or her judgment, the radiation conditions warrant such an action and such actions are consistent with plant safety;

VII. Participate as a member of the plant ALARA committee.

12.5.2.4 Radiation Protection Technicians

Radiation protection technicians (RPTs) will directly carry out responsibilities defined in the radiation protection program and procedures. RPTs will perform the major portion of the radiation protection work for the station. At least one RPT is supplied onsite to each operating shift at all times commencing with initial loading of fuel in any reactor at the site (i.e., at least one RPT is required per site).

The qualifications and experience of RPTs are consistent with the guidance contained in Regulatory Guide 1.8. RPTs are trained and qualified under a program that is established, implemented and maintained in accordance with 10 CFR 50.120. As assigned by the RPM or radiation protection supervisory staff, RPTs are trained and qualified to implement specific radiation protection responsibilities, including the following:

Some of the responsibilities listed below may be assigned to trained and qualified staff in Radiation Protection (as described in section 12.5.2.5) other than RPTs (e.g., a health physicist or a radiological engineer) or to trained and qualified staff assigned to another department.

I. As delegated authority by the RPM, stop work or order an area evacuated (in accordance with approved procedures) when, in his or her judgment, the radiation conditions warrant such an action and such actions are consistent with plant safety;

II. Provide coverage and monitor radiation conditions for jobs potentially involving significant radiation exposure;

III. Conduct surveys, assess radiation conditions and establish radiation protection requirements for access to and work within restricted, radiation, high radiation, very high radiation, airborne radioactivity areas, and areas containing radioactive materials;

IV. Identify, post, and establish appropriate controls for access to restricted, radiation, high radiation, very high radiation, airborne radioactivity areas, and areas containing radioactive materials;

V. Provide control over the receipt, storage, movement, use, and shipment of licensed radioactive materials;

VI. Maintain, operate, and calibrate fixed and portable equipment and instrumentation for monitoring or taking samples to assess levels of radiation, radioactivity, and/or dose;

VII. Perform monitoring and assessment of radioactivity in solid radioactive waste, effluents and in the plant environs;

VIII. Review work packages, proposed design modifications, and operations and maintenance procedures to assure integration of adequate radiation protection controls and dose-reduction measures;

IX. Review and oversee implementation of plans for the use of temporary shielding or other engineered radiation protection controls to minimize dose rates;

X. Review and oversee implementation of plans for the use of process or other engineering controls to limit the concentrations of radioactive materials in the air

XI. Provide personnel monitoring and bioassay services;

XII. Maintain, prescribe and oversee the use of respiratory protection equipment;

XIII. Perform assigned emergency response duties.

12.5.2.5 Radiation Protection Supervisory and Technical Staff

Radiation protection supervisory and technical staff are included within the radiation protection organization as needed to support the RPM in carrying out his or her assigned duties and responsibilities and to oversee and support the work of the RPTs. A specific supervisor or technical staff member, knowledgeable in the respective functional area and trained and qualified consistent with the guidance in Regulatory Guide 1.8, is assigned overall responsibility for each of the following functional areas (one individual may be responsible for more than one functional area):

Responsibility for some of the functional areas listed below may be assigned outside of the RP department. However, the criteria for experience, training and qualification of staff responsible for the program will remain as described above.

I. Respiratory Protection

II. Personnel Dosimetry

III. Bioassay

IV. Instrument Calibration and Maintenance

V. Radioactive Source Control

VI. Effluents and Environmental Monitoring and Assessment

VII. Radioactive Waste Shipping

VIII. Radiation Work Permits

IX. Job Coverage

X. Radiation Monitoring and Surveys

12.5.3 FACILITIES, INSTRUMENTATION AND EQUIPMENT

Adequate facilities, instrumentation and equipment are provided to support implementation of the radiation protection program during routine operations, refueling and other outages, abnormal occurrences, and accident conditions. The types and characteristics of facilities, instrumentation, and equipment provided are consistent with the guidance in Regulatory Guides 1.97 (Revision 3), 8.2, 8.4, 8.6, 8.8, 8.9, 8.10, 8.15, 8.20, 8.26, 8.28, and 8.32 and the criteria in NUREG-0737, Items II.B.3 and III.D.3.3.

12.5.3.1 Facilities

[Note: Facility descriptions that were previously reviewed in an applicable design control document (DCD) may be incorporated by reference in this section of the FSAR.]

[Note: Based on company and site-specific information, the section below may be modified to indicate facilities that may be located off site and functions that may be carried out at another location or through a vendor.]

Radiochemistry Laboratory

The radiochemistry laboratory facility is centrally located for receiving, storing, preparing, analyzing, and disposing of solid, liquid, and gaseous sample media. The facility contains a floor drain(s), sink(s), fume hood(s), cabinet(s) with worktop(s), storage locker(s), and emergency shower/eyewash system(s) as needed to support the scope of work performed. Drains are piped to the chemical waste collection system and/or the liquid radioactive waste system. The fume hood exhausts to a monitored building ventilation exhaust system.

The facility includes a counting room for analyzing samples. The counting room is equipped with instrumentation capable of analyzing the various types of samples generated as a result of plant operations, refueling and other outages, abnormal occurrences, and accidents.

The laboratory/counting room facility and instrumentation are sufficiently shielded to maintain low background radiation levels to permit analysis of samples during routine and accident conditions. The configuration of the facility and instrumentation will assure the capability of being able to analyze reactor coolant and containment atmosphere samples obtained under accident conditions consistent with the guidance in NUREG-0737, Item II.B.3.

Access Control Facility

Access control facilities are provided to control the entrance and exit of personnel and materials into and from the radiologically-controlled area (RCA) of the plant. Separate change areas for male and female personnel are located at the access control facility. The

change areas are sufficiently sized to support both routine and typical refueling outage conditions. In addition, the capability is available to set up alternate access control points and change facilities on a temporary basis as necessary to support abnormally large-scale outages, both at access points to the RCA, as well as secondary access points within the plant (e.g., for control of access to the refueling area or the containment).

Personnel Decontamination Area

A personnel decontamination area is established near the primary access control facility. The personnel decontamination area is supplied with sinks and showers with drains that are routed to the liquid radioactive waste system. The personnel decontamination area will include a supply of cleaning agents, decontamination supplies, and a first aid kit.

Radiation Protection Offices

Radiation protection offices sufficient to support staff oversight of access to the RCA are located near the RCA access control point(s). Radiation protection offices sufficient to house the staff and support radiation protection responsibilities are provided at a location(s) suitable for carrying out those responsibilities. The offices include furnished areas for radiation protection staff to perform administrative work, maintain files, etc. Space is also provided for storage and issuance of radiation protection equipment, instrumentation, dosimetry, and supplies.

Portable Instrument Calibration Facility

A portable instrument calibration facility is designed and located such that radiation fields created during calibrations will not unnecessarily expose personnel and will not interfere with low-level monitoring or counting systems. This facility is situated in a low background radiation area so that ambient radiation fields from plant operation will not interfere with low-range instrument calibrations.

Respirator Facility

A facility is established for respirator inventory, inspection, storage, maintenance, repair, control and issuance consistent with the guidance in Regulatory Guide 8.15. Adequate standards of housekeeping and cleanliness are maintained within the respirator facility to efficiently perform these functions. When not in use, the facility is secured to maintain positive control over the issuance of respiratory protection devices. Only non-contaminated respirators will be brought into the respirator facility. Used/contaminated respirators will be decontaminated and cleaned in the Equipment Decontamination Facility prior to being brought to the Respirator Facility.

Equipment Decontamination Facility

Decontamination and cleaning of personnel protective equipment, instrumentation, and small items are performed in a facility set up for that specific purpose. The facility is supplied with special equipment and features to accomplish effective decontamination without spreading contamination outside the facility. Wash-down area and sink drains

are routed to the liquid radioactive waste system and positive air flow is maintained into the decontamination facility and exhausted into a monitored building ventilation system. The facility is provided with coated walls and floors to help assure ease of cleanup and decontamination. Vendor-supplied services may also be utilized for equipment decontamination and cleaning.

Machine Shop for Activated/Contaminated Components and Equipment

A facility is provided for receiving, disassembling, repairing and machining activated or contaminated components and equipment so as to control the spread of contamination.

Storage and Issue Area for Contaminated Tools and Equipment

A facility is provided for the control, storage, issuance and receipt of contaminated tools and equipment so as to minimize the generation of radioactive waste and control the spread of contamination. Clean and contaminated tools and equipment are segregated to avoid cross-contamination.

Radioactive Materials Storage Area

A radioactive materials storage area(s) is established, as needed and in accordance with 10 CFR 20.1801, that provides for secure storage of licensed radioactive materials to prevent unauthorized removal or access.

Facility for Dosimetry Processing and Bioassay

A facility or facilities are provided to support processing of dosimetry and performance of bioassay, including *in-vivo* and *in-vitro* bioassay. The facility for dosimetry processing is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) for dosimetry processing in accordance with 10 CFR 20.1501(c). The facility for in-vivo bioassay, e.g., whole body counting, is designed and configured to allow for low background counting sufficient to meet range and sensitivity criteria consistent with the guidance in Regulatory Guides 8.9 and 8.26. The facility for in-vivo bioassay allows for the collection, processing, storage and shipment of samples for analysis.

Laundry Facility

A facility is provided for the receipt, storage, cleaning, laundering, and monitoring of contaminated personnel protective clothing and equipment. Gaseous and liquid effluents resulting from the laundering process are directed through release points that are processed, monitored, and controlled to assure that resulting radiation doses are less than the applicable limits in 10 CFR Parts 20 and 50 and as low as is reasonably achievable (ALARA). Radioactive wastes resulting from the laundering and cleaning processes are collected and properly disposed of in accordance with the requirements in 10 CFR Part 20, Subpart K.

12.5.3.2 Monitoring Instrumentation and Equipment

Radiation monitoring instrumentation and equipment are selected, maintained and used to provide the appropriate detection capabilities, ranges, sensitivities and accuracies required for the types and levels of radiation anticipated at the plant and in the environs during routine operations, major outages, abnormal occurrences, and postulated accident conditions. The quantities of instrumentation and equipment are sufficient to meet the anticipated needs of the plant during all anticipated conditions –taking into account the amount of instrumentation and equipment that may be unavailable at any one time due to periodic testing and calibration, maintenance, and repair.

The types and nominal characteristics of the instrumentation are as follows:

Laboratory and Fixed Instrumentation

- Multi-channel gamma analysis system to identify and measure gamma emitting radionuclides in solid, liquid and gaseous samples. Some of the sample types analyzed include primary reactor coolant, liquid and gaseous waste and airborne contaminants.
- Counters to measure gross beta and gamma activity.
- A low background counter to detect and measure gross alpha activity.
- A liquid scintillation counter to measure tritium in liquid and gaseous samples.
- A whole-body counter to detect and quantify personnel intakes of radioactivity.
- Fixed instrumentation, such as small article monitors, hand and foot monitors, and portal monitors, to monitor for contamination on personnel, materials, and equipment.

Portable Monitoring Instrumentation and Equipment (nominal ranges are given in parentheses for illustrative purposes only)

- Beta-gamma count rate survey meters (0-50,000cpm) to detect radioactive contamination on surfaces and for low level exposure rate measurements.
- Low-range (0-50 mR/hr) and high range (0-1,000 R/hr) beta-gamma survey meters and ion chamber survey meters (0-50 R/hr) are used to measure the full range of dose rates necessary for radiation protection purposes during routine operations, abnormal occurrences and accidents.
- Beta-gamma survey meters (0-10,000 R/hr) to monitor the plant and environs during and following an accident.
- Count rate meters (0-500,000 cpm) to monitor directly for alpha activity.
- Neutron survey instruments (0-5 rem/hr) to measure neutron dose rates for radiation protection purposes.
- High and low volume air samplers equipped with appropriate filter media are used to take grab samples that are analyzed to assess airborne radioactivity concentrations, estimate actual or potential exposure, and to determine respiratory protection measures.
- Continuous air monitors (CAMs) provide a means to observe trends in airborne radioactivity concentrations. CAMs equipped with local alarm capability are used in

occupied areas where needed to alert personnel to sudden changes in airborne radioactivity concentrations.
- Hand-held friskers to detect radioactive contamination.
- Portable air sampling and analysis system to determine airborne radioiodine concentrations during and following an accident consistent with the criteria in NUREG-0737, Item III.D.3.3.

Personnel Monitoring Instrumentation and Equipment

- Individual personnel dosimeters to measure gamma, beta and neutron radiation dose with sensitivities and ranges appropriate to measure the expected levels and types of radiation.
- Direct-reading dosimeters to provide real-time gamma dose information with sensitivities and ranges appropriate to measure the expected levels and types of radiation.
- Special dosimeters to monitor extremity dose with sensitivities and ranges appropriate to measure the expected levels and types of radiation.
- Personnel air samplers to monitor individual exposure to airborne radioactivity.
- Remote and local reading alarm dosimeters (which may be coupled with direct or electronic surveillance equipment, as necessary).

12.5.3.3 Personnel Protective Clothing and Equipment

A sufficient inventory of serviceable personnel protective clothing and equipment is maintained for use during plant operations, refueling and other outages, abnormal conditions, and accidents. Only respirators that are tested and certified by the National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA), or otherwise approved by the NRC, are used. [Note: The applicant may wish to include sufficient information with the application to allow the NRC to consider approval of special use respirator filters (e.g., iodine canisters) and disposable supplied-air suits in accordance with the requirements in 10 CFR Parts 20.1703(b) and 20.1705.]

Personnel protective clothing and equipment includes the following:

- Anti-contamination clothing for both dry and wet work conditions, including heat stress reduction accessories
- Head covers, shoe covers, gloves, and safety-related items
- Full facemask respirators with high-efficiency particulate and charcoal filters
- Pressure demand full facemask air line respirators
- Pressure demand full facemask self-contained breathing apparatus

12.5.3.4 Other Protective Equipment

- Portable ventilation systems with HEPA filters
- Temporary containments, tents, and enclosures
- Heat-stress reduction equipment
- Vacuums with HEPA filters

- Portable liquid filtration equipment
- Temporary shielding

12.5.4 PROCEDURES

Radiation protection procedures are established, implemented and maintained sufficient to provide adequate control over the receipt, possession, use, transfer, and disposal of byproduct, source, and special nuclear material and assure compliance with applicable requirements in 10 CFR Parts 19, 20, 50, 70, and 71. Procedures for radiation protection are prepared consistent with the guidance in Regulatory Guides 1.8, 8.2, 8.7, 8.8 and 8.10 the guidance referenced in NUREG-1736 that is applicable to power reactors, and NEI 06-14 (QAPD). The procedures are implemented by Radiation Protection staff trained and qualified in accordance with the requirements in 10 CFR 50.120 and consistent with the guidance in Regulatory Guide 1.8. Additionally, some procedures are implemented by plant staff trained in accordance with the requirements of 10 CFR 19.12 and consistent with the guidance in Regulatory Guides 8.13, 8.27, and 8.29.

12.5.4.1 Radiological Surveillance

Radiological surveillance procedures comply with 10 CFR 20.1501 and are consistent with the guidance in Regulatory Guides 8.2, 8.8, and 8.10.

Trained and qualified radiation protection staff will routinely survey accessible areas in the plant and environs to assess the presence and levels of radiation, radioactive contamination, and airborne radioactivity. The instrumentation and techniques used for these surveys are selected based upon the purpose of the survey and the anticipated types and levels of radiation and radioactivity involved. Surveys are performed using effective practices to minimize personnel exposure and avoid the spread of contamination.

The frequency and extent of the surveys will depend upon several factors, such as location, actual or potential radiation levels, plant operational status and work in progress, and accessibility/occupancy. The frequency of surveys may be weekly, monthly, quarterly, semiannually, annually, or as directed by the Radiation Protection Manager. Surveys are performed more frequently in accessible areas subject to changes in radiological conditions.

Survey results are recorded and maintained in accordance with the requirements in 10 CFR Part 20. Survey results for accessible areas are posted or otherwise made available to provide adequate notice to workers of radiological conditions.

Radiation surveys are routinely performed for detection of beta and gamma radiation. Surveys for neutron radiation are performed in accessible areas where such radiation may be present.

Area contamination surveys are routinely performed for the detection of removable and fixed beta-gamma contamination. Surveys for alpha contamination are performed where alpha contamination is anticipated. Alpha contamination surveys will also be performed periodically as a check to verify that alpha contamination is not present.

Personnel will monitor themselves for contamination after exiting from contaminated areas and at exit points from the RCA or other Restricted Areas with a potential for contamination. Materials and equipment are monitored for contamination after removal from contaminated areas and prior to being released from the RCA or other Restricted Areas with a potential for contamination.

Surveys to assess airborne radioactivity levels are performed with continuous air monitors (CAMs) and by taking grab samples (using portable low or high volume air samplers) with appropriate media for collecting particulate, iodine, gas, or tritium samples. In order to warn personnel of changing airborne conditions, CAM alarm set points are set at a fraction of the concentration values given in 10 CFR Part 20, Appendix B, Table 1, Column 3, for radionuclides expected to be encountered. Air monitoring and sampling are sufficient to identify the potential hazard(s), determine the need for and verify the effectiveness of process and engineering controls, permit proper selection of respiratory protection equipment, and estimate doses from intakes.

Emergency operating procedures include provisions for use of a portable monitoring system, consistent with the criteria in NUREG-0737, Item III.D.3.3, to sample and analyze for radioiodine in areas of the plant during and following an accident. Procedures include methods for taking and analyzing samples in the field, as well as for analyzing samples in the count room facility, accounting for techniques to reduce counting system saturation from a high-activity sample.

Instrumentation and equipment used to perform surveys are calibrated prior to initial use, after performance of maintenance or repairs that might affect the calibration, and at least annually. Operational checks to test function or response are made daily for continuously operating instrumentation and equipment (e.g., friskers, portal monitors, and continuous air monitors) and prior to use or daily, whichever is less frequent, for other instrumentation and equipment. Operational checks are performed for emergency and special use instrumentation and equipment on a regular schedule as specified in written procedures.

Survey records and records of calibration and maintenance of instrumentation and equipment used for surveys are documented and maintained in accordance with applicable requirements in 10 CFR 20.2101-20.2110.

12.5.4.2 Methods to Maintain Exposures ALARA

Methods to maintain exposures ALARA in accordance with Regulatory Guides 8.8 and 8.10 are included in radiation protection procedures, as well as applicable operating and maintenance procedures. Some examples of the types of methods that will be used to maintain exposures ALARA are discussed below for the following operational categories.

Refueling

[Note: For boiling water reactor applications only - After the reactor coolant system is depressurized, it is degassed and sampled to verify that the gaseous activity is low, prior to removing the reactor head. After flooding the refueling pool above the reactor, purification of the refueling pool water continues in order to maintain exposures from activity in the water ALARA. Movement of irradiated fuel assemblies will be accomplished with the assembly maintained underwater. By following these procedures, the normal radiation level on the refueling bridge during these operations is expected to be less than 5 mrem/h. The Radiation Work Permit (RWP) system is used to maintain positive radiological control over work in progress.]

Inservice Inspection

Prior to entry into radiation areas to perform inspections, personnel should study, as appropriate: blueprints, drawings, photographs, videotapes, previous inspection reports, previous radiation and contamination surveys, and/or previous RWPs appropriate to the particular job to be performed. This will acquaint personnel with the job location, the work to be done, and radiation and contamination levels previously experienced at the job location. Surveys are performed to the extent required to determine current contamination and/or radiation levels. From this data, previous data, and past work experience of personnel for similar jobs, an RWP (paragraph 12.5.4.5) is issued. Equipment is checked and/or calibrated to verify it is operating properly prior to entry into the radiation area. Temporary shielding will be used, where practicable, to reduce radiation exposures.

Radwaste Handling

The handling of radwaste by station personnel has been minimized by plant design. The radwaste system is shielded and incorporates remotely operated liquid radwaste systems. The systems are designed to minimize operator exposure in all waste processing and handling operations. The radwaste system is described in FSAR Chapter 11.

Spent Fuel Handling

Spent fuel handling and loading of shipping casks is performed underwater, using fuel handling cranes and/or manual extension tools. This operation normally requires a small crew working in the fuel handling area and usually involves little exposure to radiation. The RWP system will be used to maintain positive radiological control over this task.

Some of the methods used to maintain exposure ALARA during spent fuel handling are:

Maintain at least 8 feet of water above the fuel assembly to minimize radiation levels, purify fuel pool water to minimize exposure due to water activity, cool the spent fuel pool water to minimize evaporation, provide continuous air sampling while moving fuel to evaluate airborne activity in the area and have emergency procedures immediately available. After the shipping cask is loaded, it is decontaminated using a pressurized water washing device to minimize loose contamination on the cask and thereby minimize the amount of hand cleaning of the cask.

Normal Operation

The plant was designed so that significant radiation sources are minimized, shielded, and/or located in cubicles. Instrument readouts for instrumentation required for normal operation, for the most part, can be read remotely from the control room or from other low radiation areas. Instrumentation that cannot be placed remotely in a low radiation area or that is read infrequently is situated, where possible, so that it can be read from the entrance to the cubicle or from a low radiation area within the cubicle. Operators are instructed to stay outside areas in which radiation levels are high as much as possible, and they are apprised of locations within such areas where the radiation level is usually the lowest. If an operator plans to enter a high radiation area, he notifies radiation protection personnel and specifies the high radiation area(s) to be accessed. Upon exiting the high radiation area(s), he records exposure data and time spent in the area.

Routine Maintenance

Routine maintenance falls into the categories of preventive maintenance (planned and scheduled maintenance such as lubrication, adjustments, and tests) and corrective maintenance (unscheduled maintenance such as valve packing, pump seal replacement, and stopping leaks). Procedures are usually written for preventive maintenance jobs and for some recurring corrective maintenance jobs. These procedures specify the precautions to be taken to minimize personnel exposure while performing the maintenance. The procedures list the required lubricants, special tools and equipment, and the acceptance standards. This serves to minimize the time spent in the radiation area and thereby minimize personnel dose.

In addition, the preventive maintenance procedure normally states whether an RWP is required. When the RWP is issued, the radiation and/or contamination levels are listed, shielding is specified, if appropriate, and additional specific instructions are given to personnel. For corrective maintenance jobs in radiation areas, a similar approach is used.

Extension tools are used when practical to minimize personnel dose when working on radioactive components/equipment. Detailed surveys are performed and the RWP is issued (if required) with specific instructions. The individuals performing the work may be required to read procedure manuals or may be shown pictures or sketches to aid in understanding what is to be accomplished, how it is to be accomplished as safely and quickly as possible, and what the acceptance criteria are for completing the job. At the discretion of health physics personnel, additional requirements may be imposed to reduce personnel exposures.

After the job is completed, debriefings may be conducted to obtain input from personnel actually performing the work, as well as from supervisory and support personnel. This will assist in revising procedures for ALARA considerations.

Sampling

Most sampling of radioactive systems is performed inside the hoods in the sampling station, which protect personnel from airborne activity. Protective clothing and gloves are required when sampling radioactive systems to prevent contamination of personnel.

A survey instrument may be used to check radiation levels. The liquid sample container is normally washed with clean water and dried before being brought into the radiochemistry laboratory for analysis. The dose received from handling sample bottles is minimized by grasping the bottle at the top, by using tongs, or by using a sample carrier.

Calibration

Calibration of most ranges of the portable gamma detection instruments is performed inside a shielded calibrator, thereby eliminating a large portion of the exposure received from calibration of portable instruments. Portable sources used to calibrate fixed instruments (such as the area radiation monitoring system) are transported in shielded containers to minimize personnel exposure.

Where possible, fixed instruments requiring routine calibration are situated so that the necessary test signals needed for calibration can be inserted from a low radiation area with the instruments in place.

12.5.4.3 Posting and Labeling

Procedures for posting and labeling will assure compliance with 10 CFR 20.1901, 20.1902, 20.1903, 20.1904, and 20.1905.

Based on current survey results, Radiation Areas, High Radiation Areas, Very High Radiation Areas, Airborne Radioactivity Areas, and Radioactive Materials Areas are posted in accordance with the requirements in 10 CFR 20.1901, 20.1902, and 20.1903. Containers of licensed radioactive materials are labeled in accordance with 10 CFR 20.1904 and 20.1905.

Criteria and procedures are established for posting areas and marking items (e.g., tools and equipment) to indicate the presence of fixed or removable surface contamination. Areas posted to indicate the presence of removable contamination, are referred to hereafter as “Contamination Areas.”

“Posted areas”, as used in Section 12.5 of this FSAR, refers to Radiation Areas, High Radiation Areas, Very High Radiation Areas, Airborne Radioactivity Areas, Contaminated Areas, and Radioactive Materials Areas.

12.5.4.4 Access Control

Procedures for access control will assure compliance with 10 CFR 20.1902, 20.1903, 20.1601, and 20.1602 and are consistent with the guidance in Regulatory Guide 8.38.

Access to posted areas is restricted and controlled, at a minimum, through the use of instructions to workers, radiation work permits, caution signs, and barriers. Access to High and Very High Radiation Areas is controlled consistent with the guidance in Regulatory Guide 8.38, including the use alternative methods for access control as described in the regulatory guide and specified in plant technical specifications.

[Note: This section should describe each Very High Radiation Area and refer to its location on plant layout diagrams in Sections 12.3-4. This section should also include a description of the additional administrative controls for restricting access to each Very High Radiation Area as required by 10 CFR 20.1602. Sections 12.3-4 should include detailed drawings showing isometric views of each Very High Radiation Area and indicate physical access controls and radiation monitor locations for each area.]

Unescorted access to Radiation Areas or Radioactive Materials Areas will require, at a minimum, authorization by Radiation Protection, the use of a radiation work permit (RWP), and instruction of individuals gaining unescorted access in accordance with 10 CFR 19.12 and consistent with the guidance in Regulatory Guide 8.13. In addition to the foregoing, unescorted access to Contaminated, High Radiation, Very High Radiation, or Airborne Radioactivity Areas will require, at a minimum, training of individuals gaining unescorted access consistent with Regulatory Guides 8.27 and 8.29.

Posted areas will generally be contained within the plant Security Area, i.e., an area to which access is controlled in accordance with 10 CFR Part 73. Unescorted access to the plant Security Area will require instruction of individuals gaining unescorted access in accordance with 10 CFR 19.12.

Areas where significant doses could be received (e.g., High Radiation, Very High Radiation, and Airborne Radioactivity Areas), are generally contained within the plant building complex. A Radiological Controlled Area (RCA) is established to encompass the plant building complex to enhance control over access to such areas. Access to the RCA is through a primary access control point or alternate access control points as established by Radiation Protection. Unescorted access to the RCA will require authorization by Radiation Protection, the use of a radiation work permit, and instruction and training of individuals gaining unrestricted access in accordance with 10 CFR 19.12 and consistent with the guidance in Regulatory Guides 8.13, 8.27, and 8.29.

Radiation Protection may authorize access to the Security Area, RCA, or a Radiation or Radioactive Materials Area for individuals without instruction or training where such individuals are continuously under the control of a designated escort who is instructed and trained in accordance with 10 CFR 19.12 and consistent with the guidance in Regulatory Guides 8.13, 8.27, and 8.29, and instructed on the duties and responsibilities associated with being an escort.

Access by a worker who is a minor (i.e., under the age of 18 years) or declared pregnant worker to posted areas with a potential for significant exposure, e.g., High Radiation, Very High Radiation, and Airborne Radioactivity Areas is restricted unless otherwise authorized by Radiation Protection.

12.5.4.5 Radiation Work Permits

Procedures covering the use of a radiation work permit (RWP) are consistent with the guidance in Regulatory Guide 8.8.

RWPs are issued by Radiation Protection to help ensure adequate protection of personnel for access to and work within areas with a potential for significant exposure. Access to any posted area will require an RWP. An RWP may control access to multiple areas or to a set of related jobs or tasks.

At a minimum, each RWP will include the following information:

- Description of the area(s) to be accessed and work to be performed;
- Designation of personnel or groups covered by the RWP;
- Radiological conditions existing within the area(s) to be accessed, based on current surveys, and anticipated radiological conditions for the time span over which the work is performed;
- Requirements for use of personnel monitoring devices, protective clothing, and respiratory protection equipment;
- Special instructions and a description of special tools, shielding, other equipment utilized to perform work, and any process and engineering controls being employed to minimize exposures; and
- Extent and type of radiation protection monitoring and surveillance to be provided.

For access to and work within High Radiation and Very High Radiation Areas, the applicable RWP will specify a limitation on stay-time or a means for limiting dose received while in the area (e.g., via an alarm set point for an electronic dosimeter).

12.5.4.6 Personnel Monitoring

Personnel monitoring procedures are sufficient to assure compliance with 10 CFR Parts 19 and 20 and are consistent with the guidance in Regulatory Guides 8.2, 8.7, 8.9, 8.13, 8.20, 8.26, 8.32, 8.34, 8.35, and 8.36.

Each individual accessing the RCA or a posted area on an unescorted basis, or for whom occupational dose monitoring of external dose is required in accordance with 10 CFR 20, is monitored using an individual monitoring device that is appropriate for monitoring the types of external radiation to which the individual is exposed. For individuals who are required to be monitored in accordance with 10 CFR Part 20, if the individual monitoring device does not provide real-time dose information (i.e., the capability for the individual to track his or her own dose as it occurs), then an additional means of monitoring is provided for the individual that fulfills that function.

Individuals accessing the RCA or a posted area on an escorted basis, for whom occupational dose monitoring of external dose is not required in accordance with 10 CFR Part 20, are monitored either with an individual monitoring device worn by the individual or via an individual monitoring device worn by the escort.

Individual monitoring devices that require processing, except for those devices excluded by 10 CFR 20.1501(c), are processed and evaluated by a NVLAP-accredited processor, as appropriate, for the type(s) and ranges of radiation being monitored with the device.

Each individual whose internal dose is required to be monitored in accordance with 10 CFR Part 20, or who wears a respirator for radiation protection purposes, or who accesses an Airborne Radioactivity Area, is monitored by means sufficient to identify and quantify intakes in order to be able to estimate his or her committed effective dose equivalent (CEDE) and, as applicable, his or her committed dose equivalent (CDE).

Situations that may result in a person receiving an abnormal or inadvertent intake are evaluated on a case-by-case basis to determine the need for monitoring by means sufficient to identify and quantify intakes in order to be able to estimate the CEDE or CDE, as applicable.

Individuals suspected of having received an intake are evaluated to quantify the intake, if any, in order to estimate the CEDE or CDE, as applicable.

In demonstrating compliance with regulatory requirements, effective dose equivalent may be used in lieu of deep dose equivalent consistent with the guidance in Regulatory Issue Summary (RIS) 2003-04 and other related guidance.

Individual monitoring results are reported annually to the individual, and at the request of an individual who is terminating employment or who is requesting this information from a previous employer, in accordance with the requirements in 10 CFR 19.13.

Personnel monitoring records, as well as records associated with testing, calibration, processing, and maintaining instrumentation and equipment used for personnel monitoring, are documented and maintained in accordance with applicable requirements in 10 CFR 20-2101-20.2110.

12.5.4.7 Dose Control

Compliance is maintained with the requirements in 10 CFR 20.1201, 20.1202, 20.1203, and 20.1204, as they relate to demonstrating compliance with internal and external occupational dose limits contained in 10 CFR 20, Subpart C. Doses to adult workers are kept below the occupational dose limits in 10 CFR 20.1201. Doses to workers who are minors and declared pregnant workers are kept below the respective occupational dose limits in 10 CFR 20.1207 and 10 CFR 20.1208. Doses to members of the public are kept below public dose limits in 10 CFR 20.1301, which is demonstrated by complying with the requirements of 10 CFR 20. 1302.

To the extent practical, procedures and engineered controls based on sound radiation protection principles are used to keep occupational doses and doses to members of the public as low as is reasonably achievable (ALARA). A description of facility design features and engineered controls intended to maintain occupational exposures ALARA is included in FSAR Sections 12.3-12.4. A description of systems and facility design features intended to maintain public exposures ALARA is included in FSAR Chapter 11.

As described in Sections 12.5.1 and 12.5.2, management policy is established, and organizational responsibilities and authorities are assigned to implement an effective program for maintaining occupational radiation exposures ALARA. Procedures are established and implemented that are in accordance with 10 CFR 20.1101 and consistent with the guidance in Regulatory Guides 8.8 and 8.10. Examples of such procedures include the following:

I. During the construction, pre-operational and operational phases, Radiation Protection will assure that new or modified designs and the selection of equipment are reviewed to assure that measures are considered to minimize occupational and public radiation exposures during operation, refueling, and decommissioning of the plant.

II. Radiation Protection will assure that procedures and methods for operation, maintenance, repair, surveillance, refueling, and other activities that may involve significant exposures are reviewed prior to initial use and periodically thereafter to assure measures are considered to minimize occupational and public radiation exposures. [Note: A definition of "significant exposures" should be included with this paragraph. For example, "significant exposures" may include activities that are estimated to involve greater than 1 person-rem of collective dose.]

III. For activities involving significant exposures, pre-job briefings are conducted for personnel who will receive the exposures. The briefings are intended to assure that personnel understand the radiological conditions expected to be present and the measures being employed to control and minimize dose. Post-job reviews are performed to evaluate the effectiveness of measures employed to control and minimize dose and to identify and implement improvements to minimize occupational and/or public radiation exposures for future similar activities.

Planned special exposures, as described in 10 CFR 20.1206, if used, will be conducted in accordance with the requirements in 10 CFR 20.2104 and consistent with the guidance in Regulatory Guide 8.35.

12.5.4.8 Contamination Control

Contamination control procedures are established to help assure compliance with 10 CFR Parts 20.1406 and 20.1701 and to prevent the unauthorized release of radioactive materials to unrestricted areas.

Areas, items, and personnel are routinely surveyed and monitored for contamination to protect personnel, ensure that contamination control methods are effective and to prevent licensed materials from being released from an RCA or Controlled Area in an unauthorized manner. Areas and items with fixed or removable contamination are posted, labeled, or marked in a conspicuous manner to indicate the presence of contamination.

Personnel accessing Contaminated or Airborne Radioactivity Areas are required to use protective clothing and equipment as appropriate to the circumstances to prevent personal contamination.

Personnel found with external contamination are decontaminated promptly. Contaminated items are decontaminated or disposed of as radioactive waste or are marked and controlled. Areas that become contaminated are decontaminated as soon and as thoroughly as practical, taking into account factors such as the nature of operations in the area and the potential for exposure associated with the decontamination. The number of accessible contaminated areas within the plant are kept to a minimum.

Facility design and operational procedures are reviewed to identify nonradioactive systems that could possibly become radioactive through interfaces with radioactive systems. Routine sampling and monitoring of these systems is described in the plant radiation monitoring program, and overall guidance is consistent with Bulletin 80-10.

Practical measures are implemented to prevent the spread of contamination, including:

- Air pressure gradients and airflows are maintained from areas of low potential contamination to areas of higher potential contamination;
- Leaks and spills are contained promptly and repaired or cleaned up as soon as practical;
- Potentially contaminated systems, equipment, and components are surveyed for the presence of contamination when opened or prior to removal;
- Containments, caches and enclosures are used during maintenance, repairs, and testing, when practical, to contain spills or releases;
- Engineering controls, such as portable ventilation or filtration units to reduce concentrations of radioactivity in air or fluids, are used where practical;
- Criteria for selecting tools, materials, and equipment for use in contaminated areas will include minimizing the use of porous or other materials that are difficult to decontaminate;
- The use of disposable materials that are likely to become contaminated and necessitate disposal as radioactive waste are minimized;

- Areas, surfaces, and tools that are prone to contamination are designed and coated (e.g., using agents to "fix" contamination, such as strippable coatings), as practical to facilitate decontamination;
- Contaminated tools and equipment are segregated from clean tools and equipment.

12.5.4.9 Respiratory Protection

Respiratory protection procedures will assure compliance with 10 CFR Part 20, Subpart H, and are consistent with the guidance in Regulatory Guide 8.15.

A written policy statement issued by the plant management covers the use of process and engineering controls in lieu of respirator use to limit intakes and the routine, non-routine, and emergency use of respirators.

Written procedures are established and implemented that cover the following:

- Monitoring, including air sampling and bioassays;
- Supervision and training of respirator users;
- Fit-testing;
- Respirator selection;
- Breathing air quality;
- Inventory, control, storage, issuance, maintenance, repair, testing, and quality assurance of respiratory protection equipment;
- Recordkeeping; and
- Limitations on periods of use and relief from respirator use.

An assessment is performed to assure that the total effective dose equivalent (TEDE) is maintained ALARA, when respiratory protection equipment is used to limit intakes of radioactive materials.

Airborne radioactivity is minimized by the design and configuration of the plant's heating, ventilation and air conditioning systems (HVAC), the use of enclosures and containments, and good housekeeping practices. Portable air movers and vacuums equipped with HEPA filters to minimize concentrations of radioactivity in air or on surfaces are vented to monitored, filtered discharge pathways.

When it is not practical to apply process and engineering controls to control the concentrations of radioactive materials in the air and maintain the TEDE ALARA, intakes are limited by controlling access to and limiting stay times in Airborne Radioactivity Areas and by using respiratory protection equipment or other controls.

The Radiation Protection Manager will assign to a single individual, knowledgeable in the area of respiratory protection consistent with the guidance in Regulatory Guide 8.15, the overall responsibility to establish and maintain a respiratory protection program and procedures that include:

- air sampling and monitoring sufficient to identify hazards, select proper equipment, and determine doses from intakes;

- conducting surveys and bioassays as necessary to evaluate actual intakes; and
- testing respirators for operability immediately prior to each use.

Only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA) is used, unless otherwise authorized by the NRC.

Prior to being fit-tested for a face sealing respirator, and before the first field use of a non-face sealing respirator, individuals are certified as medically fit by a qualified medical practitioner. Recertification of medical fitness is made every twelve months or at a frequency specified by the medical practitioner.

Each respirator user is advised that he or she may leave the area at any time for relief from any conditions (such as equipment malfunction, physical or psychological distress, or communications failure) that might require such relief.

In selecting and using respiratory protection equipment, provisions are made for vision correction, adequate communications, extreme temperature conditions, and concurrent use of other safety or radiological protection equipment.

For circumstances when respiratory protection equipment is used from which an unaided individual would have difficulty extricating himself or herself, and therefore might be exposed to a potentially life-threatening situation, a standby rescue person is required. The standby rescue person shall be equipped with respiratory protection equipment appropriate for the potential hazards and shall be immediately available to provide assistance.

12.5.4.10 Radioactive Material Control

Procedures are established, implemented and maintained that assure compliance with the requirements of 10 CFR 20.1801, 20.1802, 20.1902, 20.1904, 20.1905, 20.1906, 20.2001, 20.2005, 20.2006, 20.2007, 20.2201, and 10 CFR 71.5 to assure positive control over licensed radioactive material so that unnecessary or inadvertent exposures do not occur and such material is not released into uncontrolled areas in a manner that is not authorized by regulation or the license.

12.5.4.11 Radiation Protection Training

Procedures are developed, implemented, and maintained that assure that selection, qualification, training, and periodic retraining of radiation protection staff and radiation workers are conducted in accordance with the requirements in 10 CFR Parts 19, 20, and 10 CFR 50.120 and consistent with the guidance in Regulatory Guides 1.8, 8.13, 8.15, 8.27, and 8.29.

12.5.4.12 Quality Assurance

Consistent with the requirements of 10 CFR 20.1101, the radiation protection program and procedures are established, implemented, maintained and reviewed under the quality assurance program described NEI 06-14 (QAPD).

Consistent with the requirements in 10 CFR 71.101(f), the quality assurance program described in NEI 06-14 (QAPD) will apply to the program, procedures and activities involving the transportation of radioactive material.

I. REFERENCES

1. 10 CFR Part 19, "Notices Instructions, and Reports to Workers: Inspections and Investigations."

2. 10 CFR Part 20, "Standards for Protection Against Radiation."

3. 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

4. 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

5. 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

6. 10 CFR Part 73, "Physical Protection of Plants and Materials"

7. Regulatory Guide 1.8, Revision 3, "Qualification and Training of Personnel for Nuclear Power Plants."

8. Regulatory Guide 1.97, Revision 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident."

9. Regulatory Guide 8.2, "Guide for Administrative Practices in Radiation Monitoring."

10. Regulatory Guide 8.4, "Direct-Reading and Indirect-Reading Pocket Dosimeters."

11. Regulatory Guide 8.6, "Standard Test Procedures for G-M Counters."

12. Regulatory Guide 8.7, Revision 2, "Instructions for Recording and Reporting Occupational Radiation Exposure Data."

13. Regulatory Guide 8.8, Revision 3, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable."

14. Regulatory Guide 8.9, Revision 1, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program."

15. Regulatory Guide 8.10, Revision 1R, "Operational Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable."

16. Regulatory Guide 8.13, Revision 3, "Instruction Concerning Prenatal Radiation Exposure."

17. Regulatory Guide 8.15, Revision 1, "Acceptable Programs for Respiratory Protection."

18. Regulatory Guide 8.20, Revision 1, "Applications of Bioassay for I-125 and I-131."

19. Regulatory Guide 8.26, "Applications of Bioassay for Fission and Activation Products."

20. Regulatory Guide 8.27, "Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants."

21. Regulatory Guide 8.28, "Audible Alarm Dosimeters."

22. Regulatory Guide 8.29, Revision 1, "Instruction Concerning Risks from Occupational Radiation Exposure."

23. Regulatory Guide 8.32, "Criteria for Establishing a Tritium Bioassay Program."

24. Regulatory Guide 8.34, "Monitoring Criteria and Methods To Calculate Occupational Radiation Doses."

25. Regulatory Guide 8.35, "Planned Special Exposures."

26. Regulatory Guide 8.36, "Radiation Doses to Embryo/Fetus."

27. Regulatory Guide 8.38, Revision 1, "Control of Access to High and Very High Radiation Areas of Nuclear Power Plants."

28. NUREG-0737, "Clarification of TMI Action Plan Requirements."

29. NUREG-1736, "Consolidated Guidance: 10 CFR Part 20—Standards For Protection Against Radiation."

30. Regulatory Issue Summary 2003-04, "Use of the Effective Dose Equivalent In Place of the Deep Dose Equivalent in Dose Assessments"

31. NEI 06-14, Quality Assurance Program Description, Revision 4