U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD FOR mPOWER^{TM} iPWR DESIGN

12.5 OPERATIONAL RADIATION PROTECTION PROGRAM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of health physics.

Secondary - None

I. AREAS OF REVIEW

The review includes the following areas of the applicant's final safety analysis report (FSAR) for a design certification (DC) or combined license (COL), as they relate to the operational aspects of the radiation protection program.

To achieve the goal of maintaining occupational and public doses both below regulatory limits and as low as is reasonably achievable (ALARA), the operational radiation protection program and its implementation milestones are reviewed to ensure that the program is fully described and references any applicable standards. Fully described means that the program is clearly and sufficiently described in terms of the scope and level of detail such that the description would allow for a reasonable assurance finding of acceptability.

The specific areas of review are as follows:

1. Organization

   A. The administrative organization of the radiation protection program, including the authority and responsibility of each position identified (COL FSAR).

   B. The experience and qualifications of the personnel responsible for conducting various aspects of the radiation protection program and for handling and monitoring radioactive material. Reference may be made to FSAR Chapter 13 as appropriate (COL FSAR).

   C. Information describing the implementation of Regulatory Guides (RGs) 1.8, 8.2, 8.8, and 8.10. Information describing any proposed alternatives (COL FSAR).

   D. Review of qualifications, experience, and organization related to the operational radiation protection program. This review is coordinated with the general review of staffing and qualifications in Standard Review Plan (SRP) Chapter 13.

   E. The authority and responsibility of the management and staff for implementation and documentation of radiation program reviews required by Title 10 of the *Code of Federal Regulations* (CFR), Section 20.1101 and 10 CFR 20.2102 (COL

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FSAR).

2. Equipment, Instrumentation, and Facilities

A. The criteria for selecting portable and laboratory technical equipment and instrumentation for (1) performing radiation and contamination surveys, (2) in-plant airborne radioactivity monitoring and sampling, (3) area radiation monitoring, and (4) personnel monitoring (including audible alarming, electronic dosimeters) for normal operation, anticipated operational occurrences (AOOs), and accident conditions (DC FSAR or the COL FSAR). The review includes the quantity of each type of instrument, taking into consideration that some instruments will be unavailable during calibration, maintenance, and repair.

B. The description of instrument storage, calibration, and maintenance facilities (DC FSAR or the COL FSAR).

C. The description and location of the radiation protection facilities (including locker and shower rooms, personnel decontamination area, respiratory protective equipment, “hot” machine shop and repair facilities, use of close-capture filtration devices, and other contamination control equipment and areas) and information describing how such facilities and services will allow male and female workers to receive the necessary protection against radioactive contamination (DC FSAR or the COL FSAR).

D. The location of items in A(1), A(2), A(3), and A(4) above and the description of types of detectors and monitors, sensitivity, range, frequency, alarms, and recordkeeping as well as methods of calibration (DC FSAR or COL FSAR).

E. Information describing the implementation of the equipment and facilities included in RGs 1.97, 8.4, 8.8, 8.9, 8.15, and 8.28, as well as information describing any proposed alternatives (DC FSAR or COL FSAR).

3. Procedures

A. The description of physical and administrative measures for controlling access to, and work within, radiation areas, high-radiation areas, and very-high-radiation areas (COL FSAR).

B. The description of procedures governing the accountability and storage of radioactive sources not fixed to, or installed in, plant systems (COL FSAR).

C. The description of procedures and methods of operation for ensuring that occupational radiation exposure (ORE) will be ALARA, especially procedures used in refueling, inservice inspections, radwaste handling, spent fuel handling, loading and shipping, normal operation, routine maintenance, and sampling and calibration that are specifically related to radiation safety (COL FSAR).

D. The description of methods, frequencies, and procedures for conducting radiation surveys (COL FSAR).

E. The description of the bases and methods for monitoring and control of surface

contamination (including loose discrete radioactive particles) for personnel and equipment, including the surveillance program to ensure that licensed materials will not be inadvertently released from the controlled area (COL FSAR).

F. The description of engineering controls for limiting airborne radioactivity, as well as methods and procedures for evaluating and controlling potential airborne radioactivity concentrations, special air sampling, and issuance and use of respiratory equipment (COL FSAR).

G. The description of radiation protection training and retraining programs (COL FSAR).

H. Information describing the implementation of RGs 1.8, 8.2, 8.7, 8.8, 8.9, 8.10, 8.13, 8.15, 8.27, 8.29, 8.34, 8.35, 8.36, and 8.38, including information describing any proposed alternatives (COL FSAR).

I. The description of radiation protection procedures, consistent with the guidance in RG 1.33, Appendix A, to implement the applicable requirements in 10 CFR 20.1101, Appendix B to 10 CFR Part 50, and Subpart H of 10 CFR Part 71 (COL FSAR). This review is coordinated with the overall review of the quality assurance program in SRP Chapter 17.

J. The description of procedures covering (1) the packaging and transportation of licensed radioactive materials pursuant to the requirements of 10 CFR 71.5 and Subpart G of 10 CFR Part 71 and (2) the transfer of low-level radioactive waste pursuant to the requirements of Subpart K of 10 CFR Part 20 (COL FSAR).

4. Operational Program Description and Implementation. For a COL application, the U.S. Nuclear Regulatory Commission (NRC) staff reviews the descriptions of the radiation protection program, the ALARA program, the Ground Water Protection program, and the program for controlling highly radioactive leakage and the associated proposed implementation milestones. The staff also reviews FSAR Table 13.4 “Operational Program Description and Implementation,” to ensure that the radiation protection program and associated milestones are included.

Review Interfaces

Systems described in the FSAR may differ from those outlined in the DSRS. The staff should use the following recommended section interfaces as the basis for reviewing other supplemental or complementary information provided in the FSAR for a specific plant design:

1. For COL reviews of operational programs, the review of the applicant’s implementation plan is performed under SRP Section 13.4, “Operational Programs.”

2. The review of the applicant's technical specifications reporting requirements for occupational exposures under DC FSAR or the COL FSAR Section 16.0, "Technical Specifications," and Technical Specification 5.6.1, "Occupational Radiation Exposure Report."

3. Technical Specifications Section 5.3.1, as it relates to staff qualification.

4. Technical Specifications Section 5.5.2, Primary Coolant sources outside of the containment.

5. Technical Specifications Section 5.7, as it relates to access controls to High Radiation Areas with dose rates not exceeding 1.0 rem/hour and High Radiation Areas with dose rates greater 1.0 rem/hour.

6. FSAR Chapter 7 Appendix B INSTRUMENTATION AND CONTROLS SYSTEM ARCHITECTURE – as it relates to the design features of safety related equipment that provided for radiological protection of plant workers, reducing ORE associated with servicing and maintaining of plant instrumentation and to minimize contamination of the facility and the environment.

7. FSAR 7.1 FUNDAMENTAL DESIGN PRINCIPLES – as it relates to the design features of safety related equipment that provided for radiological protection of plant workers, reducing ORE associated with servicing and maintaining of equipment.

8. FSAR 7.2 SYSTEM CHARACTERISTICS – as it relates to the safety related instrumentation provided for monitoring radiological conditions during an accident.

9. Design-Specific Review Standard (DSRS) Section 11.6, "Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring", as it relates to compliance with the Commission's regulations to provide instrumentation to monitor important to safety plant variables and systems during and following an accident, including the types, ranges and qualification of radiation monitoring equipment required for accident monitoring, and design features provided for radiological protection of plant workers, reducing ORE associated with servicing and maintaining of plant instrumentation and to minimize contamination of the facility and the environment.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. 10 CFR 19.12, as it relates to keeping workers informed about the storage, transfer, or use of radioactive materials or radiation and instructing them about the risk associated with ORE, necessary precautions, procedures to reduce exposures, and the purpose and function of the protective devices employed.

2. 10 CFR 20.1101, as it relates to (1) development, documentation, and implementation of a radiation protection program, (2) the use of procedures and controls to achieve doses to workers and the public that are ALARA, as defined in 10 CFR 20.1003, and (3) the review and audit of the radiation protection program content and implementation.

3. 10 CFR 20.1201, as it relates to occupational dose limits for adults.

4. 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, and 10 CFR 20.1204, as they relate to demonstrating compliance with internal and external dose limits.

5. 10 CFR 20.1206 and 10 CFR 20.2105, as they relate to the authorization, control, and documentation of planned special exposures to adult workers.

6. 10 CFR 20.1207, as it relates to control of occupational radiation doses received by minors.

7. 10 CFR 20.1208, as it relates to control of radiation doses received by the embryo/fetus of a declared pregnant worker.

8. 10 CFR 20.1301 and 10 CFR 20.1302, as they relate to controlling radiation doses to individual members of the public and the maximum dose rate in unrestricted areas.

9. 10 CFR 20.1406, as it relates to the facility design and procedures for operation of the plant for minimizing contamination of the facility site.

10. 10 CFR 20.1501, as it relates to performance of surveys to comply with the regulations in 10 CFR Part 20.

11. 10 CFR 20.1501(c) and 10 CFR 20.1502, as they relate to requirements for providing appropriate personnel monitoring equipment to individuals who are occupationally exposed.

12. 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.1901, 10 CFR 20.1902, 10 CFR 20.1903, 10 CFR 20.1904, and 10 CFR 20.1905, as they relate to posting of, and control of access to, radiation areas, high-radiation areas, very-high-radiation areas, airborne radioactivity areas, and other indicators necessary to identify and quantify the presence of radioactive materials in an area.

13. 10 CFR 20.1701 and 10 CFR 20.1702, as they relate to controlling the concentrations and limiting the intake of radioactive materials in the air.

14. 10 CFR 20.1703, as it relates to the use of respiratory protective equipment to limit the intake of radioactive material.

15. 10 CFR 20.1906, as it relates to appropriate handling of packages containing certain quantities of radioactive materials.

16. 10 CFR 20.1801, as it relates to securing licensed materials against unauthorized removal from the place of storage.

17. 10 CFR 20.1802, as it relates to controlling licensed material that is not in storage.

18. 10 CFR 20.2001 and 10 CFR 20.2006, as they relate to the transfer of radioactive materials and the disposal of low-level radioactive waste.

19. 10 CFR 20.2101, 10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2104, 10 CFR 20.2105, 10 CFR 20.2106, 10 CFR 20.2107, and 10 CFR 20.2110, as they relate to maintaining records of individuals who are provided with personnel monitoring equipment and who are exposed to radiation, and records of the radiation protection program, including surveys.

20. 10 CFR 20.2201, as it relates to reports to the NRC required from licensees immediately after they become aware of any loss or theft of certain quantities of licensed material.

21. 10 CFR 20.2202, 10 CFR 20.2203, 10 CFR 20.2204, and 10 CFR 20.2205, as they relate to requirements for reports to the NRC concerning individual exposures that exceed regulatory limits, incidents requiring notification, levels of radiation or concentrations of radioactive materials in excess of certain values, and planned special exposures.

22. 10 CFR 20.2206 and 10 CFR 19.13, as they relate to requirements for informing workers of the results of their individual monitoring.

23. Utilizing the mPower™-specific source term values, the requirements of 10 CFR 50.34(f)(2)(viii) and 10 CFR 50.34(f)(2)(xxvii), as they relate to monitoring of in-plant radiation and airborne radioactivity for routine and accident conditions as discussed in the guidance of items II.B.3 and III.D.3.3 of NUREG-0737.

24. 10 CFR 50.120, as it relates to the provisions and requirements for training radiation protection technicians.

25. General Design Criterion (GDC) 64 found in Appendix A to 10 CFR Part 50, as it relates to the provision of appropriate monitoring for the reactor containment atmosphere and spaces containing components for the recirculation of loss-of-coolant-accident fluids.

26. Appendix B to 10 CFR Part 50 and Subpart H of 10 CFR Part 71, as they relate to quality assurance programs.

27. 10 CFR 71.5 and Subpart G of 10 CFR Part 71, as they relate to the control of licensed radioactive material during packaging and transportation, as well as Subpart K of 10 CFR Part 20, as it relates to the transfer of low-level radioactive materials and waste.

28. NUREG-xxxx, “Standard Technical Specifications for mPower™ Plants,” as it relates to the reporting requirements for radiation exposures in the format and implementation of the mPower™ Technical Specification package.

29. 29 CFR 1910.134, “Respiratory Protection” and RG 8.15, as they relate to the program for the use of mixed hazard respiratory protection in the radiologically controlled areas (RCAs) of the plant.

30. 10 CFR 50.34(f)(2)(xxvi), as it relates to the leakage control program for systems outside containment that contain (or might contain) accident source term concentration of radioactive materials following an accident.

31. 10 CFR 20.1501(b), as it relates to the calibration of radiation protection instruments used for quantitative radiation measurements.

32. 10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material,” 10 CFR Part 40, “Domestic Licensing of Source Material,” and 10 CFR Part 70, “Domestic Licensing of Special Nuclear Material,” as they relate to the requirements for the receipt, storage and use of byproduct, source, and special nuclear material.

33. 10 CFR 50.65(a), as it relates to providing reasonable assurance that systems, structures and components (SSCs) important to safety, including those that are relied upon to mitigate accidents or transients or are used in plant emergency operating procedures (EOPs) (i.e., radiation monitors or radiation protection features described in DSRS Section 12.3), are capable of fulfilling their intended functions.

DSRS Acceptance Criteria

Specific DSRS acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are set forth below. The DSRS is not a substitute for the NRC's regulations, and compliance with it is not required. Identifying the differences between this DSRS section and the design features, analytical techniques, and procedural measures proposed for the facility, and discussing how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria, is sufficient to meet the intent of 10 CFR 52.47(a)(9), "Contents of applications; technical information." The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41) for COL applications.

The following RGs, NUREGs, and industry standards provide information, recommendations, and guidance and in general describe a basis acceptable to the staff to implement the requirements of 10 CFR Part 19, 10 CFR Part 20, and 10 CFR Part 50:

1. RG 1.8, as it relates to compliance with the Commission's regulations regarding qualification of nuclear power plant personnel.

2. RG 1.33, as it relates to compliance with the Commission's quality assurance regulatory requirements during nuclear power plant operations.

3. RG 1.97 and DSRS Section 7.2 (for safety-related equipment), as they relate to compliance with the Commission's regulations to provide instrumentation to monitor plant variables and systems during and following an accident.

4. RG 8.2, as it relates to general information on radiation monitoring programs for administrative practices.

5. RG 8.4, as it relates to standards for direct-reading and indirect-reading pocket dosimeters used for personnel dose or dose rate measurements.

6. RG 8.7, as it relates to the specification of records necessary to describe the ORE of individuals and to the conditions under which the exposure may occur.

7. RG 8.8, as it relates to meeting the requirements of 10 CFR 20.1101(b) and the definition of ALARA in 10 CFR 20.1003 by providing radiation protection information pertaining to actions taken during the design, construction, operation, and decommissioning to ensure that ORE remains ALARA.

8. RG 8.9, as it relates to appropriate concepts, models, equations, and assumptions to be used in determining the extent of an individual's intake of radioactive materials and resulting committed internal dose.

9. RG 8.10, as it relates to meeting the requirements of 10 CFR 20.1101(b) and the definition of ALARA in 10 CFR 20.1003 concerning commitment by the applicant's management and vigilance by the radiation protection manager and the radiation protection staff to maintain ORE ALARA.

10. RG 8.13, as it relates to the description of the instruction to be provided concerning biological risks to embryos or fetuses resulting from prenatal ORE.

11. RG 8.15, as it relates to elements of acceptable respiratory protection programs.

12. RG 8.27, as it relates to a radiation protection training and retraining program consistent with the ALARA objective and acceptable to the NRC staff for meeting the training requirement of 10 CFR Part 19.

13. RG 8.28, as it relates to the appropriate use of audible alarm dosimeters and the conditions under which they should not be relied on to perform their intended function.

14. RG 8.29, as it relates to providing appropriate instruction to workers, consistent with the requirements of 10 CFR 19.12, on the risks to individuals who might be exposed to ORE.

15. NUREG-0938, as it relates to monitoring individuals for exposure to tritium.

16. RG 8.34, as it relates to criteria acceptable to the NRC staff that licensees may use to determine when monitoring is required, as well as methods acceptable to the NRC staff for calculating occupational doses when intake is known.

17. RG 8.35, as it relates to guidance on the conditions and prerequisites for permitting planned special exposures, as allowed by 10 CFR Part 20, and the associated specific monitoring and reporting requirements.

18. RG 8.36, as it relates to determination of the total radiation dose to the embryo/fetus as the sum of the deep-dose equivalent to, and dose to the embryo/fetus from, intakes of the declared pregnant worker.

19. RG 8.38, as it relates to guidance on acceptable methods to control access to high- and very-high-radiation areas in nuclear power plants that follows the requirements specified in 10 CFR Part 20.

20. NUREG/CR-0041, as it relates to the provision of technical information to licensees on the appropriate application of respiratory protective devices for protection against airborne radioactive materials, including selection and maintenance of equipment and personnel training.

21. NUREG-0731, as it relates to appropriate staffing levels and technical expertise considered essential within a utility to support nuclear power plant operation properly.

22. NUREG-1736, as it relates to the requirements for a radiation protection program (including program review and audit) and compliance with 10 CFR Part 20.

23. American National Standards Institute (ANSI)/American Nuclear Society (ANS)

3.1-1993, reaffirmed 1999, as it relates to criteria for selection, qualifications, responsibilities, and training of personnel in operating and support organizations, as appropriate for the safe and efficient operation of nuclear power plants.

24. ANSI/Health Physics Society (HPS) N13.6-1999, as it relates to guidance to the employer for the systematic generation and retention of records relating to ORE.

25. ANSI/HPS N13.11-1999, as it relates to the performance criteria for personal radiation dosimeters that require processing.

26. ANSI/HPS N13.14-1994, as it relates to personnel monitoring.

27. ANSI/HPS N13.30-1996, as it relates to detection and dosimetry of internally deposited radionuclides.

28. ANSI/HPS N13.42-1997, as it relates to monitoring radiation dose from internally deposited radionuclides.

29. ANSI Institute for Electrical and Electronics Engineers (IEEE) 309-1999 (R2006), as it relates to guidance on specification of test conditions - such as associated electronic circuitry, environment, and counting rate - to ensure that operating characteristics can be appropriately evaluated.

30. ANSI N42.20-2003, as it relates to the accuracy and overall performance of personnel radiation monitors.

31. ANSI N42.17A, ANSI N42.17B, ANSI N42.17C, and IEEE N42.30, as they relate to the accuracy and overall performance of portable survey instruments.

32. ANSI N323A, ANSI N323B, ANSI N323C, and ANSI N323D, as they relate to the calibration and maintenance of portable radiation survey instruments.

33. Memorandum from Larry W. Camper to David B. Matthews and Elmo E. Collins, dated October 10, 2006, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML103420044), and NUREG/CR-3587 (ADAMS Accession No. ML081360413), as they relate to operating programs that facilitate decommissioning.

34. IEEE-N42.12, IEEE-N42.14 and IEEE-N42.25, as they relate to the calibration and maintenance of radiation protection laboratory instruments.

35. RG 1.160, as it relates to providing reasonable assurance that safety-related SSCs and other than safety-related SSCs that are relied upon to mitigate accidents or transients or are used in plant EOPs, are capable of performing their intended function.

36. RG 1.97 and NUREG-0800, SRP Section 11.6, “Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring,” as they relate to compliance with the Commission’s regulations that require the licensee to provide instrumentation for monitoring important to safety plant variables and systems during and following an accident.

The specific acceptance criteria are described below.

1. Organization

   Acceptance will be based on a determination that the organization described, and the duties, qualifications, and training of the individuals responsible for ensuring that ORE will be ALARA; (1) are in accordance with 10 CFR 20.1101(b) and the definition of ALARA in 10 CFR 20.1003; RGs 1.8, 8.2, 8.8, and 8.10; and 10 CFR 19.12; and (2) are such that doses resulting from licensed activities fall within the limits of 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1204, 10 CFR 20.1301, 10 CFR 20.1302, 10 CFR 50.120, NUREG-0731, and NUREG-1736. Alternatives will be evaluated on the basis of a comparison with the referenced RGs.

2. Equipment, Instrumentation, and Facilities

   Acceptance will be based on a determination of the following:

   A. Sufficient sampling and analysis capabilities for reactor coolant and containment samples are available during normal and accident conditions, consistent with 10 CFR 50.34(f)(2)(viii).

   B. The radiochemistry laboratory is equipped to perform the routine analyses required for personnel protection, surveys, and related radiation protection functions, in accordance with 10 CFR 20.1501.

   C. The counting room (low background) has the necessary instrumentation to perform routine counting on all plant radioactivity samples (e.g., water, air, swipes) in conformance with 10 CFR 20.1501 and with GDC 64 in Appendix A to 10 CFR Part 50. Counting room equipment normally includes the following:

      i. Radionuclide spectrometry equipment (such as a multichannel gamma pulse height analyzer).

      ii. Low-background alpha-beta proportional counter and gamma and alpha-beta scintillation counters.

      iii. End-window Geiger-Mueller type counter.

   D. The applicant's program describes the criteria for selecting instruments for measuring radiation or radioactivity in accordance with 10 CFR 20.1501. The program includes a description of the following types of instrument functions and where appropriate, the related performance criteria:

      i. Portable low- and high-range ion chamber rate meters, capable of measuring, with appropriate margins, the mPower^{TM}-specific accident source term.

      ii. Portable beta gamma counters.

      iii. Portable alpha scintillation or proportional counter rate meters.

iv. Portable neutron dose equivalent rate meters.

v. Fixed and portable air samplers for use with particulate filters and iodine collection devices (such as charcoal cartridges or equivalent filters) and airborne radioactivity monitors.

vi. High-range instruments, including beta, photon and airborne activity, capable of measuring, with appropriate margins, the mPower™-specific accident source term.

vii. Fixed area monitors with local and remote readouts and alarm functions.

viii. Instruments for releasing material from the RCA, such as small item contamination (i.e., box) counters.

E. The applicant's program describes the criteria for selecting the types and quantities of personnel monitoring equipment for use in measuring radiation or radioactivity, in accordance with 10 CFR 20.1501 and 20.1502. The program includes a description of the following types of instrument functions and where appropriate, the related performance criteria:

i. Personnel contamination monitors (e.g., friskers, hand-and-foot monitors, standup portal monitors).

ii. Self-reading low and intermediate pocket dosimeters, including audible alarm dosimeters (for early evaluation of individual doses). Performance and other characteristics for the selection criteria for dosimeters are consistent with the guidance contained in RGs 8.4 and 8.28 or to appropriate proposed alternatives.

iii. Remote and local reading alarm dosimeters (coupled with direct or electronic surveillance equipment) for monitoring workers in high-dose/high-dose-rate environments.

iv. Personal dosimeters (e.g., film badges, thermoluminescent dosimeters (TLD), optically stimulated dosimeters) of sufficient range and sensitivity that are processed and evaluated by a processor accredited by the National Voluntary Laboratory Accreditation Program (NVLAP), as appropriate, in conformance with 10 CFR 20.1501(c).

v. Provisions for bioassays (in vivo and in vitro as appropriate) and facilities capable of detecting intakes of expected radionuclides (e.g., mixed fission and activation products, tritium, and alpha-emitting nuclides) to meet the requirements of 10 CFR 20.1204 and RG 8.9, and NUREG-0938 or to satisfy appropriate proposed alternatives.

F. The applicant's program describes the methods that will be used to specify utility-issued personnel protection equipment to be provided to minimize personnel contamination and minimize internal exposure in accordance with 10 CFR Part 20, Subpart H and the guidance contained in RG 8.15 and RG 8.8, including the following:

i. Anticontamination clothing.

ii. Plastic suits for contamination control in wet work environments.

iii. Head covers, shoe covers, gloves, face shields, and safety-related items (including provisions for personnel cooling in high-temperature work environments).

iv. Pressure demand (e.g., full-facepiece) air line respirators.

v. Pressure demand self-contained breathing apparatus.

vi. Air purifying respirators (e.g., full-face negative pressure, powered air purifying).

vii. Respiratory protection equipment and facilities that meet the requirements of 10 CFR 20.1703.

viii. Work efficiency equipment (e.g., ice vests, air-supplied suits, or other heat stress coping equipment).

G. At a minimum, the following radiation protection support facilities or areas will be provided:

i. Portable instrument calibration and storage area. The latter should be easily accessible.

ii. Personnel decontamination area with necessary monitoring equipment. This facility should be located and designed to expedite rapid cleanup of male and female personnel and should not be used as a multiple-purpose area.

iii. Facility and equipment to clean, sanitize, repair, and decontaminate personnel protective equipment, monitoring instruments, respirators, and associated equipment.

iv. A change room for donning protective clothing (i.e., anticontamination suits) and storage of personal items.

v. Control points for entrance into, or exit from, controlled access areas of the plant, condition signs, labels, and signals, in accordance with 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.1901, 10 CFR 20.1902, 10 CFR 20.1903, 10 CFR 20.1904, and 10 CFR 20.1905.

vi. Storage and control capability for licensed materials in unrestricted areas, in accordance with 10 CFR 20.1801 and 10 CFR 20.1906.

vii. One or more radiation protection stations, which may be used as locations for storage and issuance of portable radiation survey equipment, respiratory protective equipment, personnel monitoring

equipment, and contamination control supplies. The equipment should be readily accessible, and the stations should be equipped to facilitate communication throughout the plant.

viii. Training facilities for conducting general employee training, health physics technician hands-on practical factors exercises, and prework ALARA mockup training.

ix. Radiation work control stations (and/or remote surveillance facilities) for overseeing work in high-radiation and very-high-radiation areas.

H. Special shields and equipment include the following:

i. Lead blankets
ii. Remote tools and handling equipment
iii. Portable ventilation equipment

Acceptance will also be based on implementation of the guidance of RG 8.8 or the provision of acceptable alternatives.

3. Procedures

Plans and procedures will be acceptable if they meet the criteria in 10 CFR 20.1101, 10 CFR 20.1601, and 10 CFR 20.1602 or the mPower™ Technical Specification for access control; RGs 1.33, 1.8, 8.8, 8.10, 8.15, and 8.38; or proposed appropriate alternatives. There should be provision for a special control procedure to ensure that measures are implemented such that personnel cannot gain unauthorized or inadvertent access to a very-high-radiation area. The radiation work permit program should include data on radiation levels in the area, allowable working time, protective clothing and respiratory protective equipment, special tools, portable shielding, and special personnel monitoring devices. The description of operation, maintenance, repair, surveillance, and refueling procedures and methods used by the applicant should be reviewed to ensure that ORE will be ALARA and in accordance with RG 8.8.

For major dose accumulating functions, a post operation review should evaluate the effectiveness of the work permit program in ensuring that ORE will be ALARA in future similar activities. Quality assurance criteria and inspections should be provided for the radiation procedures identified in RG 1.33, in accordance with Appendix B to 10 CFR Part 50. Quality assurance of procedures applicable to packaging and transportation of radioactive materials are in accordance with Subpart H of 10 CFR Part 71. There should be (1) provisions for supervision and control of the handling or movement of material within and from radiation or controlled access areas and (2) procedures for controlling the speed of radioactive materials.

There should also be provisions for personnel monitoring procedures, bioassays, and keeping records of and reporting personnel doses. In addition, 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 20.2101, 10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2104, 10 CFR 20.2105, 10 CFR 20.2106, 10 CFR 20.2107, 10 CFR 20.2110, 10 CFR 20.2201, 10 CFR 20.2203, 10 CFR 20.2204, 10 CFR 20.2205, and 10 CFR 20.2206, provide the criteria for radiation surveys, calibration of instruments and equipment used for quantitative radiation measurements, personnel monitoring, bioassays, recordkeeping,

and reporting. Guidance regarding these areas appears in RG 8.2 (surveys and personnel monitoring); RG 8.9, (bioassays); RGs 8.2 and 8.7 (recordkeeping and reporting); RG 8.8 (decontamination, inspection, radiation protection program, and operations); RG 8.13 (training on radiation risks to fetuses); RG 8.27 (radiation protection training); RG 8.29 (training on radiation risks); RG 8.34 (monitoring criteria and calculation of occupational doses); RG 8.35 (planned special exposures); RG 8.36 (doses to the embryo/fetus); and NUREG-0737 using the mPower™-specific source term.

10 CFR 20.1501(b) requires that the instruments and equipment used for quantitative radiation measurements be periodically calibrated. The guidance contained in NUREG-1736 and Information Notice 93-30 notes that the licensee must demonstrate that the instrument is; calibrated to make measurements; is sufficiently sensitive to meet the applicable regulatory requirements in 10 CFR Parts 20; and that the development of the calibration intervals considers factors, including, but not limited to, the stability of the instrument output over time and the environment in which the instrument will be used. The guidance notes that calibration information can be found in the instrument manufacturer's guidance; however, the licensee, not the instrument manufacturer, is responsible for demonstrating that the instrument and calibration methods used are sensitive enough to meet NRC regulatory requirements. Industry standards such as ANSI N42.17A, ANSI N42.17B, ANSI N42.17C, IEEE N42.30, ANSI N323A, ANSI N323B, ANSI N323C, ANSI N323D, IEEE-N42.12, IEEE-N42.14, and IEEE-N42.25, provide information regarding the current industry practices for specifying and calibrating radiation protection instruments and equipment.

The acceptability of the radiation protection program will also be based on provisions for indoctrination and personnel training and retraining programs. Guidance appears in RGs 1.8, 8.8, 8.10, 8.15, and 8.27. In addition, 10 CFR 19.12 requires instruction of personnel on radiation protection. An annual review of the radiation protection program should include updating procedures, equipment, and facilities where improvements are warranted. Different parts of the radiation protection program can be reviewed each year, on a rotating basis, such that the entire program is reviewed at least once every 3 years. The program should include regular audits to determine where ORE is occurring and to review methods for reducing these exposures.

For any portion of the post-accident subsystems that supports safety-related functions, as identified by the applicant, the review of these design features is performed under DSRS Chapter 7 and SRP Section 13.3. In this context, the review, using RG 1.97, addresses the performance, design, qualification, display, quality assurance, and selection of monitoring variables of radiation monitoring equipment required for accident monitoring and sampling.

The review of radiation monitoring instrumentation and controls used for occupational radiation protection or minimization of contamination, including provisions for automatic control features and interdependence with sensing elements other than radioactivity (e.g., fluid level, valve position, and system pressure, flow rate, and temperature), is performed using the guidance presented in DSRS Section 12.3-12.4, the related DSRS sections and DSRS Section 11.6, “Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring.“ The review addresses the types and placement of such sensors in plant subsystems, operational ranges and qualification of sensing

elements supporting the functions of radiation monitoring subsystems, the functional interdependence and the logic for alarming and controlling processes, used for maintaining ORE ALARA and minimizing facility and environmental contamination as required by 10 CFR Part 20.

Using the requirements listed in 10 CFR 50.34(f)(2)(xxvii) and the additional guidance from RG 1.97, DSRS Section 7.2 (safety-related equipment only) and NUREG-0800, DSRS Section 11.6, "Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring," (for equipment important to safety), and Section III.D.3.3 of NUREG-0737 using the mPower™-specific source term, applicants for construction permits should provide preliminary design information concerning monitoring in-plant radiation dose rates and airborne radioactivity for a broad range of routine and emergency conditions. The monitors should meet the criteria of RG1.97 and DSRS Section 7.2, using the mPower™-specific source term.

Using the methods listed in 10 CFR 50.34(f)(2)(xxvii) and additional guidance from RG 1.97 and Section III.D.3.3 of NUREG-0737 using the mPower™-specific source term, applicants for operating licenses (OLs) and COLs should describe the equipment, training, and procedures to measure accurately the radioiodine concentration and external radiation dose rate levels in areas within the plant where plant personnel may be present during an accident.

Using the methods listed in 10 CFR 50.34(f)(2)(viii) and additional guidance from RG 1.97 and Section II.B.3 of NUREG-0737 using the mPower™-specific source term, applicants for OLs and COLs should describe the equipment, training, and procedures to obtain and analyze samples of reactor coolant and containment during an accident without resulting in excessive radiation doses to plant personnel.

Utility management structure and technical lessons will be acceptable if they meet the criteria in RG 8.8 and NUREG-0737.

Compliance with 10 CFR Part 20 alone may not provide sufficient protection of workers in situations involving mixed hazards (i.e., toxic gas protection of required plant operators or smoke protection of fire brigade personnel in the RCA) while in the RCAs of the plant. Therefore, COL applicants should specify the regulatory basis for ensuring protection of workers utilizing respiratory protection equipment for protection against mixed hazards in the RCAs of the plant consistent with the guidance contained in RG 8.15.

In 10 CFR 50.65(a)(1), the NRC requires that power reactor licensees monitor the performance or condition of SSCs against licensee-established goals in a manner sufficient to provide reasonable assurance that such SSCs are capable of fulfilling their intended functions. In addition, good maintenance is also important in ensuring that failure of other than safety-related SSCs that could initiate or adversely affect a transient or accident is minimized, including those that are relied upon to mitigate accidents or transients or are used in plant EOPs (i.e., radiation monitors or radiation protection features described in Section 12.3).

4. Operational Programs. For COL reviews, the description of the operational program and proposed implementation milestone for the Radiation protection programs are reviewed

in accordance with 10 CFR 20.1101 and 10 CFR 20.1406 and to the extent that it is not described in other sections the leakage control program required by 10 CFR 50.34(f)(2)(xxvi). Implementation is required by license conditions.

Acceptance will be based on a determination that the 10 CFR Part 52 COL applicant has described the intended implementation of the radiation protection program, ALARA program and Ground Water Protection program. A phased-in implementation should include appropriate milestones in the construction of the facility. Staffing levels, equipment, facilities, and procedures necessary to ensure radiation safety of the workers and public, and minimization of contamination for each phase of implementation should be identified. At a minimum, the program implementation at the following milestones must be addressed:

A. Before receipt of licensed radioactive sources

B. Before receipt of special nuclear material (i.e., reactor fuel) subject to the monitoring requirements of 10 CFR 70.24

C. Before loading fuel in the reactor vessel

D. Before the first shipment of radioactive material from the facility site

The NRC staff's safety evaluation reports (SERs) associated with Nuclear Energy Institute (NEI) technical reports NEI 07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description" (ADAMS Accession No. ML091490684), NEI 07-08A, "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)" (ADAMS Accession No. ML093220178), and NEI 08-08A, "Generic FSAR Template Guidance for Life Cycle Minimization of Contamination" (ADAMS Accession No. ML093220530), provide the bases for the use of the referenced templates to describe acceptable operational ALARA, Radiation Protection and Ground Water Protection programs which conform to the guidance of the stated Regulatory Guidance documents. For those licensees that elect to demonstrate compliance with the programmatic requirements of 10 CFR 20.1101 and 20.1406 via alternate methods, SECY-04-0032, "Programmatic Information Needed for Approval of a Combined License Without Inspections, Tests, Analyses, and Acceptance Criteria" notes that in the absence of ITAAC, "fully described" should be understood to mean that the program is clearly and sufficiently described in terms of the scope and level of detail to allow a reasonable assurance finding of acceptability at the COL stage.

Technical Rationale

The technical rationale for application of these acceptance criteria to the areas of review addressed by this DSRS section is discussed in the following paragraphs:

1. Compliance with 10 CFR 19.12 requires keeping workers informed about radiation levels, instructing them about health problems associated with exposure to radiation, teaching them precautions to minimize exposure to radiation, instructing them to report violations of Commission regulations, and instructing them in the appropriate response to warnings of an unusual occurrence.

   This DSRS section relates to review and approval of the radiation protection program that must be implemented at all nuclear power plants. It covers administration of the

program, problem identification and resolution, qualifications of radiation protection personnel, equipment and facilities that support the radiation protection program, and operating and administrative procedures that must be in place. The requirements imposed by 10 CFR 19.12 for instructions provided to individuals who receive occupational exposures are one aspect of the overall radiation protection program at a nuclear plant site.

Meeting the requirements of 10 CFR 19.12 offers a level of assurance that radiation doses to individuals who work in restricted areas will be limited to the lowest practicable levels because 10 CFR 19.12 requires that the workers themselves be stakeholders in maintaining low levels of radiation doses.

2. The referenced sections of 10 CFR Part 20 relate to the administration of the radiation protection program, including maintaining ORE ALARA, to be used in the operation of a nuclear power plant.

   The referenced sections of 10 CFR Part 20 specify in detail the administrative procedures to which this DSRS applies, including problem identification and resolution; maintenance of radiation doses ALARA; use of engineering controls and monitoring to control radiation exposures; doses in unrestricted areas; performance of surveys; posting of radiation areas; receipt, control, storage, transfer, and disposal of radioactive material; and maintaining records of and reporting radiation exposures.

   Meeting the requirements of the referenced sections of 10 CFR Part 20 will provide a level of assurance that exposure to radioactivity will be controlled such that individual workers and members of the public will only receive radiation doses that fall within the limits specified in 10 CFR Part 20 and are ALARA.

3. The NRC regulations 10 CFR 50.34(f)(2)(viii) and 10 CFR 50.34(f)(2)(xxvii) relate to the capability to promptly obtain and analyze reactor coolant and containment atmospheres during accident conditions (without resulting in excessive radiation doses to individuals) and to monitor in-plant radiation and airborne radioactivity for routine and accident conditions.

   This DSRS section relates to review and approval of the radiation protection program that must be implemented at all nuclear power plants. It covers administration of the program, qualifications of radiation protection personnel, equipment and facilities that support the radiation protection program and operating and administrative procedures that must be in place. The requirements imposed by 10 CFR 50.34(f)(2)(viii) and 10 CFR 50.34(f)(2)(xxvii) are an integral part of the areas covered by this DSRS section.

   Meeting the requirements of 10 CFR 50.34(f)(2)(viii) and 10 CFR 50.34(f)(2)(xxvii) will provide a level of assurance that actions needed to monitor conditions in the plant during a postulated accident can be performed such that individual workers will not receive radiation doses that exceed the limits specified in 10 CFR Part 20.

4. Compliance with GDC 64 in Appendix A to 10 CFR Part 50 requires that means be provided to monitor the atmosphere in areas in which components are located that potentially contain radioactive fluids and gases that may be released during normal operation, AOOs, and form postulated accidents.

DSRS Section 12.5 covers the administrative controls that encompass the radiation protection program. GDC 64 applies to DSRS Section 12.5 because one part of the program is monitoring and surveillance of radiation areas during normal operation, during AOOs, and following accidental releases of radioactive materials.

Meeting the requirements of GDC 64 will provide a level of assurance that releases of radioactive materials to the environment will be detected and that resultant exposures will be ALARA and will not exceed the limits specified in 10 CFR Part 20.

5. 10 CFR Part 71 contains requirements for packaging and transporting licensed radioactive materials. These requirements apply to the transportation of radioactive wastes as well as the transportation of activated or contaminated, components or equipment transferred during the operation and maintenance of the plant. Additional requirements in Appendix G to 10 CFR Part 20 apply to the transfer of radioactive wastes for land disposal.

   The scope of 10 CFR Part 20 and DSRS Section 12.5 includes the transfer of radioactive materials. Although the programmatic requirements in 10 CFR Part 71 extend beyond monitoring and radiation surveys, they are provided to ensure that the transportation of licensed radioactive materials offsite does not result in unnecessary or inadvertent exposures to members of the public and that an uncontrolled release of such material does not occur.

   Meeting the requirements of 10 CFR 71.5, in addition to the requirements in Appendix G to 10 CFR Part 20, will provide a level of assurance that releases of radioactive materials to the environment will not result from transportation or waste disposal activities and that doses to members of the public will not exceed the limits specified in 10 CFR Part 20.

6. Appendix B to 10 CFR Part 50 establishes quality assurance requirements for the operation of a nuclear power plant. Guidance is provided by RG 1.33.

   The procedures implemented to ensure the quality of the radiation protection program safety-related activities identified in RG 1.33, as well as the required periodic review of the content and implementation of the radiation protection program required by 10 CFR 20.1101(c), 10 CFR 20 Subpart G and 10 CFR 20 Subpart H, a, are integral to DSRS Section 12.5.

   A quality assurance program satisfies the quality assurance requirements in 10 CFR 71.101 if it meets the requirements of Appendix B to 10 CFR Part 50 and is established, maintained, and executed to address the transportation of radioactive materials.

7. Meeting the requirements of 10 CFR Part 20.1406, by utilizing the guidance contained in RG 4.21, which specifies the administrative procedures to which this DSRS applies, including problem identification and resolution; maintenance of design features provided to minimize contamination; use of engineering controls and monitoring to minimize contamination; and maintaining records to facilitate decommissioning, will provide a level of assurance that operations will minimize, to the extent practicable,

8. Establishing a leakage control program for systems outside of containment that contain

(or might contain) accident source term concentration of radioactive materials following an accident that satisfies the requirement of 10 CFR 50.34(f)(2)(xxvi) and provides a level of assurance that the health and safety of the plant workers and the public will be adequately protected.

9. The elements of the radiation protection program provided to address the regulations of 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," 10 CFR Part 40, "Domestic Licensing of Source Material," and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," pertaining to the receipt, storage and use of byproduct, source, and special nuclear material such as reactor fuel, sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors, ensure that adequate protection from exposure to radiation from these source will be provided for workers and members of the public.

III. REVIEW PROCEDURES

The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

These review procedures are based on the identified DSRS acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. In accordance with 10 CFR 52.47(a)(8),(21), and (22), for new reactor license applications submitted under Part 52, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues and medium- and high-priority generic safety issues that are identified in the version of NUREG-0933 current on the date 6 months before application and that are technically relevant to the design; (2) demonstrate how the operating experience insights have been incorporated into the plant design; and, (3) provide information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v). These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding SER section.

2. Using the guidance contained in RGs 1.8 and 8.8, the staff reviews the applicant's description of the organizational position, functional responsibilities, experience, and qualifications of personnel responsible for the radiation protection program. The plant organization, functional responsibilities, and qualifications of personnel are the primary responsibility of the quality and maintenance section and the operator licensing and human performance section, and they are reviewed under DSRS Chapter 13. The reviewer evaluates the radiation protection organization, function, and personnel qualifications in accordance with RGs 1.8 and 8.8.

3. The staff reviews the applicant's description of equipment necessary to measure radioactivity as well as radiation fields and exposures—including the number, type, range, sensitivity, calibration method and frequency, availability, and planned used of portable, fixed, laboratory, and personnel monitoring instrumentation—for all units on the site.

4. The staff reviews the applicant's description of the health physics facilities and associated protective equipment for controlling ORE and contamination.

5. The staff reviews the applicant's description of the methods for ensuring development of the training, retraining, and indoctrination program and the radiation protection instruction manuals.

6. The staff reviews the applicant's description of the procedures to receive, store, transfer, and dispose of radioactive material; to control exposures; to control and minimize contamination; to facilitate decommissioning; to provide adequate radiation monitoring; and to conduct program reviews and quality assurance. The review of the quality assurance program is the primary responsibility of the quality and maintenance section and the operator licensing and human performance section, and they are reviewed under SRP Chapter 17.

7. Operational Programs. The reviewer verifies that the radiation protection program, the ALARA program, Ground Water Protection program, and the leakage reduction program are fully described in accordance with 10 CFR 20.1101, 10 CFR 20.1406 and 10 CFR 50.34(f)(2)(xxvi). The reviewer verifies that the methods for performing instrument calibrations and establishing calibration frequencies, in accordance with 10 CFR 1501(b), are described. The reviewer verifies that the program and implementation milestones are included in FSAR Table 13.4. The implementation milestones are identified in the DSRS acceptance criteria, above. The reviewer ensures the program and associated implementation milestones are included within the license condition on operational programs and implementation.

   Implementation of this program will be inspected in accordance with NRC Inspection Manual Chapter (IMC)-2504, "Construction Inspection Program - Non-ITAAC Inspections."

On the basis of the review, the reviewer may request additional information or ask the applicant to modify the submittal to meet the acceptance criteria described in Subsection II.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the staff's technical review and analysis support conclusions of the following type to be included in the staff's SER. The reviewer also states the bases for those conclusions.

In accordance with the provisions of Section C.I.12.5 of RG 1.206 for a COL FSAR under 10 CFR Part 52 and the radiation protection aspects of 10 CFR 52.79, the staff's review should verify that the FSAR and amendments include sufficient information to arrive at conclusions of the following type, which must be included in the staff's SER. The report will include a summary of the applicant's submittal, the staff's basis for review and acceptance criteria, and the findings of the review:

> The staff concludes that the operational radiation protection program and ALARA program are acceptable and meet the requirements of 10 CFR 19.12 and 10 CFR 19.13; 10 CFR Part 20; and GDC 64 in Appendix A to 10 CFR Part 50. This conclusion is based on the following findings.

The Radiation protection program objectives are to provide reasonable assurance that the limits of 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1204, 10 CFR 20.1207, and 10 CFR 20.1208 will not be exceeded; to reduce unavoidable exposures further; and to ensure that individual occupational radiation exposures are maintained as far below regulatory limits as is reasonably achievable and that total person-rem doses are ALARA, in accordance with 10 CFR 20.1101(b) and the definition of ALARA in 10 CFR 20.1003 and RGs 8.8 and 8.10.

The duties of the plant [radiation protection manager] include [list duties]. The radiation protection organizations, qualifications, personnel training, program objectives, and implementation methods are in accordance with the guidelines in RGs 1.8, 8.2, 8.8, 8.10, and 8.13 and with 10 CFR 19.12 and NUREG-0731, and therefore, are acceptable.

The radiation protection features at [plant name] include a [radiochemistry laboratory, personnel decontamination and emergency treatment areas, an access control point, counting room, calibration room, respirator testing facility, office, laundry, and other relevant features]. These facilities are sufficient to maintain occupational radiation exposures ALARA and are consistent with the requirement in 10 CFR 50.34(f)(2)(xxvii) and the guidance in Section III.D.3.3 of NUREG-0737 and RG 1.97 using the mPower™-specific source term, which provides additional detail and clarification of requirements and with the provisions of RG 8.8.

Equipment to be used for radiation protection purposes includes portable radiation survey instruments, personnel monitoring equipment, fixed and portable area and airborne radioactivity monitors, laboratory equipment, air samplers, respiratory protective equipment, and protective clothing. The applicant has described a respiratory protection program that meets the requirements of 10 CFR Part 20, Subpart H for radiological airborne contaminants and "Labor" 29 CFR 1910.134, "Occupational Safety and Health Standards – Respiratory Protection," consistent with the guidance contained in RG 8.15, as they relate to the program for the use of respiratory protection for mixed hazards in the RCAs of the plant. The applicant has describes the number and types of equipment to be used are adequate, meet the criteria of RG 1.97 using the mPower™-specific source term. The instruments and equipment used for quantitative measurements are calibrated and provide reasonable assurance that the applicant will be able to maintain occupational exposures ALARA. The applicant has described the process to be used to ensure that instruments and calibration methods used comply with 10 CFR 20.1501(b), consistent with the guidance contained in NUREG-1736.

All permanent and temporary plant personnel will be assigned [beta-gamma thermoluminescent dosimeter badges or film badges to be worn in restricted areas at all times.] A processor accredited under NVLAP will process these badges as appropriate. All personnel assigned [dosimeter or film badges] also must wear [direct or indirect] reading dosimeters when entering RCAs. The readings from these dosimeters will be used to keep a running total of an individual's dose before TLD or film badge processing. Plant visitors wear self-reading dosimeters or are escorted by an individual wearing such personnel dosimetry devices. Appropriate caution signs, labels, and signals will be provided in accordance with 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.1901, 10 CFR 20.1902, 10 CFR 20.1903, 10 CFR 20.1904, and 10 CFR 20.1905. Neutron film badges, neutron dosimeters, and alarm dosimeters will also be provided for personnel when necessary. Whole body counts of all plant personnel will be conducted on a

scheduled basis, and other bioassays will be provided when deemed necessary by the [radiation protection manager], in accordance with 10 CFR 20.1201, 10 CFR 20.1202, 10 CFR 20.1203, 10 CFR 20.1204, 10 CFR 20.1207, and 10 CFR 20.1208. Records of surveys, personnel monitoring, and bioassays will be maintained in accordance with 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.2101, 10 CFR 20.2102, 10 CFR 20.2103, 10 CFR 20.2104, 10 CFR 20.1205, 10 CFR 20.2106, 10 CFR 20.2107, 10 CFR 20.2201, 10 CFR 20.2203, and 10 CFR 20.2206, as well as RG 8.7. All radiation exposure information will be processed and recorded in accordance with 10 CFR Part 20.

The staff reviewed the description of maintenance, repair, surveillance, and refueling procedures and methods used by the applicant to ensure that all plant radiation protection procedures, practices, and criteria have been considered and that occupational radiation exposures will be ALARA and in accordance with RG 8.8. Procedures will also be developed to ensure that plant or visitor personnel to the site do not exceed exposure limits, to administer and control conditions of radiation work permits, to post radiation areas, to establish radiation access control zones, to control all radioactive material entering or leaving the plant site, and to train plant and visitor personnel in radiation protection policies and procedures and meet the quality assurance guidance of RG 1.33 with respect to the requirements of 10 CFR 20.1101, Appendix B to 10 CFR Part 50, and 10 CFR 71.101.

Storage and control of licensed materials in unrestricted areas will be maintained in accordance with 10 CFR 20.1601, 10 CFR 20.1602, 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 20.1901, and 10 CFR 20.1902. The applicant's program complies with 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," 10 CFR Part 40, "Domestic Licensing of Source Material," and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," as they relate to the requirements for the receipt, storage and use of byproduct, source, and special nuclear material.

Facilities and procedures are adequate to provide reasonable assurance that the plant will be operated in a manner that will minimize, to the extent practicable, contamination of the facility and the environment, in accordance with 10 CFR 20.1406.

In accordance with the requirements of 10 CFR 50.65(a), consistent with the guidance provided in RG 1.160, procedures are provided to monitor the performance or condition of SSCs, including those that are relied upon to mitigate accidents or transients or are used in plant EOPs, against licensee-established goals in a manner sufficient to provide reasonable assurance that SSCs important to safety, including those that are relied upon to mitigate accidents or transients or are used in plant EOPs (i.e., radiation monitors or radiation protection features described in Section 12.3), are capable of fulfilling their intended functions.

A leakage control program for systems outside of containment that contain (or might contain) accident source term concentration of radioactive materials following an accident, that satisfies the requirement of 10 CFR 50.34(f)(2)(xxvi), has been described by the applicant.

The utility management structure and technical resources meet the criteria in NUREG-0731 and are acceptable.

On the basis of the information presented in the [DC FSAR or COL FSAR] by the applicant, the staff concludes that the applicant intends to implement a radiation protection program that will maintain in-plant radiation exposures as far below the applicable limits of 10 CFR Part 20 as is reasonably achievable and will maintain radiation exposures ALARA.

The applicant described the radiation protection program in conformance with 10 CFR 20.1101. The program and its implementation milestones are included within the license condition on operational program implementation.

V. IMPLEMENTATION

The staff will use this DSRS section in performing safety evaluations of mPower™-specific DC, or COL, applications submitted by applicants pursuant to 10 CFR Part 52. The staff will use the method described herein to evaluate conformance with Commission regulations.

Because of the numerous design differences between the mPower™ and large light-water nuclear reactor power plants, and in accordance with the direction given by the Commission in SRM- COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010 (ADAMS Accession No. ML102510405), to develop risk-informed licensing review plans for each of the small modular reactor (SMR) reviews including the associated pre-application activities, the staff has developed the content of this DSRS section as an alternative method for mPower™-specific DC, or COL submitted pursuant to 10 CFR Part 52 to comply with 10 CFR 52.47(a)(9), "Contents of applications; technical information."

This regulation states, in part, that the application must contain "an evaluation of the standard plant design against the SRP revision in effect 6 months before the docket date of the application." The content of this DSRS section has been accepted as an alternative method for complying with 10 CFR 52.47(a)(9) as long as the mPower™ DCD FSAR does not deviate significantly from the design assumptions made by the NRC staff while preparing this DSRS section. The application must identify and describe all differences between the standard plant design and this DSRS section, and discuss how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria. If the design assumptions in the DC application deviate significantly from the DSRS, the staff will use the SRP as specified in 10 CFR 52.47(a)(9). Alternatively, the staff may supplement the DSRS section by adding appropriate criteria in order to address new design assumptions. The same approach may be used to meet the requirements of 10 CFR 52.79(a)(41) for COL applications.

VI. 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 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

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

6. RG 1.8, “Qualification and Training of Personnel for Nuclear Power Plants.”

7. RG 1.33, “Quality Assurance Program Requirements (Operations).”

8. RG 1.97, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants.”

9. RG 8.2, “Guide for Administrative Practices in Radiation Monitoring.”

10. RG 8.4, “Personnel Monitoring Device-Direct-Reading and Indirect-Reading Pocket Dosimeters.”

11. RG 8.7, “Instructions for Recording and Reporting Occupational Radiation Exposure Data.”

12. RG 8.8, “Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable.”

13. RG 8.9, “Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program.”

14. RG 8.10, “Operational Philosophy for Maintaining Occupational Radiation Exposures as Low as Is Reasonably Achievable.”

15. RG 8.13, “Instruction Concerning Prenatal Radiation Exposure.”

16. RG 8.15, “Acceptable Programs for Respiratory Protection.”

17. RG 8.27, “Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants.”

18. RG 8.28, “Audible-Alarm Dosimeters.”

19. RG 8.29, “Instruction Concerning Risks from Occupational Radiation Exposure.”

20. RG 8.34, “Monitoring Criteria and Methods To Calculate Occupational Radiation Doses.”

21. RG 8.35, “Planned Special Exposures.”

22. RG 8.36, “Radiation Doses to the Embryo/Fetus.”

23. RG 8.38, “Control of Access to High and Very High Radiation Areas of Nuclear Power Plants.”

24. NUREG/CR-0041, “Manual of Respiratory Protection Against Airborne Radioactive Materials.”

25. NUREG-0731, “Guidelines for Utility Management and Technical Resources.”

26. NUREG-0737, “Clarification of TMI Action Plan Requirements.”

27. NUREG-1736, “Consolidated Guidance: 10 CFR Part 20 - Standards For Protection Against Radiation.”

28. NUREG/CR-3587, “Identification of Evaluation of Facilitation Techniques for Decommissioning Light Water Power Reactors.”

29. ANSI/ANS 3.1-1993 (R1999), “Selection, Qualification, and Training of Personnel for Nuclear Power Plants.”

30. ANSI/HPS N13.6-1999, “Practice for Occupational Radiation Exposure Records Systems.”

31. ANSI/HPS N13.11-1999, “Personnel Dosimetry Performance—Criteria for Testing.”

32. ANSI/HPS N13.14-1994, “Internal Dosimetry Programs for Tritium Exposure—Minimum Requirements.”

33. ANSI/HPS N13.30-1996, “Performance Criteria for Radiobioassay.”

34. ANSI/HPS N13.42-1997, “Internal Dosimetry for Mixed Fission Activation Products.”

35. ANSI IEEE 309-1999 (R2006), “Test Procedure for Geiger-Mueller Counters.”

36. ANSI N42.20-2003, “Performance Criteria for Active Personnel Radiation Monitors.”

37. IEEE-N42.14-1999, “Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emission Rates of Radionuclides”

38. ANSI N42.17A-2003, “Performance Specifications for Health Physics Instrumentation—Portable Instrumentation for Use in Normal Environmental Conditions.”

39. ANSI N323A-1997, “American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments.”

40. Memorandum from Larry W. Camper to David B. Matthews and Elmo E. Collins, “List of Decommissioning Lessons Learned in Support of the Development of a Standard Review Plan for New Reactor Licensing,” October 10, 2006 (ADAMS Accession No. ML062620355).

41. NRC IMC-2504, “Construction Inspection Program - Non-ITAAC Inspections,” issued October 15, 2009.

42. NUREG-0938, “Information for Establishing Bioassay Measurements and Evaluation of Tritium Exposure”

43. RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning” (ADAMS Accession No. ML080500187).

44. Electric Power Research Institute Technical Report 1016099, “Groundwater Protection Guidelines for Nuclear Power Plants” 2008.

45. NEI 07-03A [Revision 0], “Generic FSAR Template Guidance for Radiation Protection Program Description” and the associated NRC SER (ADAMS Accession No. ML091490684).

46. NEI 07-08A [Revision 0], “Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)” and the associated NRC SER (ADAMS Accession No. ML093220178).

47. NEI-08-08A [Revision 0], “Generic FSAR Template Guidance for Life Cycle Minimization of Contamination,” October 2009 (ADAMS Accession Nos. ML0934805320 and ML093220530 (Public Version)).

48. 10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material.”

49. 10 CFR Part 40, “Domestic Licensing of Source Material.”

50. 10 CFR Part 70, “Domestic Licensing of Special Nuclear Material.”

51. 29 CFR 1910.134, “Occupational Safety and Health Standards – Respiratory Protection.”

52. SECY-04-0032, “Programmatic Information Needed for Approval of a Combined License without Inspections, Tests, Analyses, and Acceptance Criteria.” (ADAMS Accession No. ML071640462)

53. ANSI/IEEE N323B-2003, “Radiation Protection Instrumentation Test and Calibration, Portable Survey Instrumentation for Near Background Operation.”

54. ANSI/IEEE N323C-2009, “Radiation Protection Instrumentation Test and Calibration— Air Monitoring Instruments.”

55. ANSI/IEEE N323D-2002, “Installed Radiation Protection Instrumentation.”

56. IEEE-N42.12-1994, “American National Standard Calibration and Usage of Thallium Activated Sodium Iodide Detector Systems for Assay of Radionuclides.”

57. ANSI N42.17B-R2005, “Performance Specifications for Health Physics Instrumentation-Occupational Airborne Radioactivity Monitoring Instrumentation.”

58. ANSI N42.17C-R2005, “Performance Specifications for Health Physics Instrumentation - Portable Instrumentation for Use in Extreme Environmental Conditions.”

59. IEEE-N42.25-1997, “American National Standard Calibration and Usage of Alpha-Beta Proportional Counters.”

60. IEEE-N42.30-2002, “American National Standard for Performance Specification for Tritium Monitors.”

61. Information Notice No. 93-30, "NRC Requirements for Evaluation of Wipe Test Results;

Calibration of Count Rate Survey Instruments."

62 DSRS Section 11.6, “Guidance on Instrumentation and Control Design Features for Process and Effluent Radiological Monitoring, and Area Radiation and Airborne Radioactivity Monitoring.”

62. 10 CFR 50, Appendix A, GDC 64, “Monitoring Radioactivity Releases.”

63. NUREG-xxxx, “Standard Technical Specifications for mPower™ Plants.”

64. RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants.”