U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

12.3 - 12.4 RADIATION PROTECTION DESIGN FEATURES

REVIEW RESPONSIBILITIES

Primary - ~~Radiological Assessment Branch (RAB)~~Emergency Preparedness and Radiation Protection Branch (PERB)[1]

Secondary - None

I. AREAS OF REVIEW

The following areas of the applicant's safety analysis report (SAR) are reviewed, as they relate to radiation protection design features, taking into account design dose rates, anticipated operational occurrences, and accident conditions:

1. FACILITY DESIGN FEATURES

   a. In the preliminary safety analysis report (PSAR), the design certification application, or the combined license (COL) application,[2] the description of equipment and facility design features used for assuring that occupational radiation exposures (ORE) will be as low as is reasonably achievable (ALARA).

   b. The radiation zone designations, including zone boundaries for normal operational, refueling, and accident conditions (based on Regulatory Guides 1.3, 1.4, and 1.7) (PSAR and update in the final safety analysis report, (FSAR), the design certification application, or the COL application).[3]

   c. The illustrative examples of facility design features of the equipment, components, and systems listed in Sections 12.1.3 and 12.3.1 of ~~Standard Format~~

~~and Content..." (Ref. 7)~~Regulatory Guide 1.70[4] including clearly readable scaled layout and arrangement drawings of the facility showing all source locations and the other design details requested in Section 12.3.1 of ~~the "Standard Format..."~~Regulatory Guide 1.70[5] (PSAR and update in FSAR, design certification application, or COL application).[6] Shield wall thicknesses for all shielded spaces should be specified on the drawings or provided in separate tables.

d. Information describing implementation of Regulatory Guide 8.8 guidelines on facility and equipment design and layout. Information describing any proposed alternatives (PSAR and update in FSAR, design certification application, or COL application).[7]

2. SHIELDING

a. The shielding to be provided for each of the radiation sources identified in SAR Chapter 11 and Section 12.2, including the design criteria and the shield material to be used for penetrations and for attenuation of neutrons streaming from the annulus between the RPV and biological shield (PSAR and update in FSAR, design certification application, or COL application).[8] (Note item I.1.c above)

b. The description of the methods by which the shield parameters were determined, including pertinent codes, assumptions, and techniques used or to be used in the calculations (PSAR and update in FSAR, design certification application, or COL application).[9]

c. The description of any special protective features that use shielding, geometric arrangement, or remote handling to assure that ORE will be ALARA (PSAR and update in FSAR, design certification application, or COL application).[10]

d. Information describing implementation of Regulatory Guides 1.69 and 8.8 (regarding special protective features). Information describing any proposed alternatives (PSAR and update in FSAR, design certification application, or COL application).[11]

e. Descriptions of the results of radiation and shielding design reviews, identifying the location of vital areas, in which personnel occupancy may be unduly limited during operations following an accident, and of corrective actions needed, for example, installation of portable shielding, to assure adequate access to vital areas and protection of safety equipment ~~(NUREG-0737, Item II.B.2)~~(10 CFR Part 50, §50.34(f)(2)(vii))[12] (FSAR, design certification application, or COL application).[13]

~~f. Verification that a shielding design review will be performed in accordance with Item II.B.2 of NUREG-0718 and modifications will be made as necessary, based on this review (PSAR).~~[14]

3. VENTILATION

a. The description of the personnel protection features incorporated in the ventilation system designs called for in Section 12.3.3 of ~~Reference 7~~Regulatory Guide 1.70[15] (PSAR and update in FSAR, design certification application, or COL application).[16]

b. Illustrative examples of personnel radiation protection features of the air cleaning system design (PSAR and update in FSAR, design certification application, or COL application).[17]

c. Information describing application of Regulatory Guide 1.52 (particularly Section C.4 & 5) and Regulatory Guide 8.8. Information describing any proposed alternatives, (PSAR and update-in FSAR, design certification application, or COL application).[18]

4. AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

a. The description of the fixed area radiation and continuous airborne radioactivity monitoring instrumentation, including in the PSAR the criteria for placement, and in the FSAR, design certification application, or COL application[19] additional details as called for in Section 12.3.4 of ~~Reference 7~~Regulatory Guide 1.70[20] for normal operation, anticipated operational occurrences, and accident conditions.

b. The criteria and method for obtaining representative in-plant airborne radioactivity concentrations in work areas (PSAR and update in FSAR, design certification application, or COL application).[21]

c. Description of procedures for locating suspected high activity areas.

d. Information describing the implementation of radiation monitoring equipment criteria listed in Regulatory Guides 8.2, 8.8, 1.97 and ANSI N13.1-~~1969~~1993.[22] Information describing any proposed alternatives (PSAR and update in FSAR, design certification application, or COL application).[23]

e. Description of the in-containment high-range radiation monitoring capability after an accident, in accordance with ~~Item II.F.1.3 of NUREG-0737~~10 CFR Part 50, §50.34(f)(2)(xvii)[24] and Regulatory Guide 1.97.

f. Description of locations for fixed radiation monitors in accordance with ANSI/ANS-HPSSC-6.8.1.

5. DOSE ASSESSMENT

a. The description of the basis for the dose assessment process, providing detailed information as to expected occupancy of plant radiation areas for each radiation zone, and the estimated annual person-Sievert (person-rem)[25] doses associated with major functions, such as operation, radwaste handling, normal maintenance, special maintenance (e.g., steam generator tube plugging), refueling, and inservice inspection, in accordance with the provisions of Regulatory Guide 8.19 (PSAR and updated in FSAR, design certification application, or COL application).[26]

b. The description of any additional dose-reducing measures taken as a result of the dose assessment process for specific functions or activities. (PSAR and update in FSAR, design certification application, or COL application).[27]

For those areas of review identified as part of the primary responsibility of other branches, the acceptance criteria and methods of application are contained in the referenced SRP section.[28]

II. ACCEPTANCE CRITERIA

The information provided in the SAR is acceptable if it meets the requirements of 10 CFR Part 50, Section 50.34, and if it contains sufficient information identified in Sections 12.3 and 12.4 of Regulatory Guide 1.70 so that the relevant requirements of the following regulations are met:

1. 10 CFR Part 20, Section ~~20.1(c), "Purpose,"~~20.1101(b), "Radiation Protection Programs" and the definition of ALARA in 20.1003,[29] as it relates to persons involve in licensed activities making every reasonable effort to maintain radiation exposures as low as is reasonably achievable (ALARA).

2. 10 CFR Part 20, Section ~~20.101, "Exposure of individuals to radiation in restricted areas,"~~20.1201, "Occupational dose limits for adults,"[30] as it relates to design features, shielding, ventilation, monitoring, and dose assessment, for the purpose of controlling occupational radiation exposures to individuals in restricted areas.

3. 10 CFR Part 20, Section ~~20.103, "Exposure of individuals to concentrations of radioactive materials in restricted areas,"~~20.1201, "Occupational dose limits for adults," 20.1202, "Compliance with requirements for summation of external and internal doses," 20.1203, "Determination of external dose from airborne radioactive material," and 20.1204, "Determination of internal exposure,"[31] as they relate to design features, ventilation, monitoring, and dose assessment, for controlling intake of radioactive materials in restricted areas.

4. 10 CFR Part 20, Section ~~20.104, "Exposure of minors,"~~20.1207, "Occupational dose limits for minors,"[32] as it relates to control of exposure by minors to radioactive materials in restricted areas.

5. 10 CFR Part 20, Section ~~20.203, "Cautions, signs, labels, signals, and controls,"~~20.1601, "Control of access to high radiation areas," 20.1602, "Control of access to very high radiation areas," 20.1901, "Caution signs," 20.1902, "Posting requirements," 20.1903, "Exceptions to posting requirements," 20.1904, "Labeling containers," and 20.1905,

"Exemptions to labeling requirements,"[33] as they relate to posting of radiation areas, high radiation areas, airborne radioactivity areas, and further indications necessary to identify and quantify the presence of radioactive materials in an area.

6. 10 CFR Part 20, Section ~~20.207, "Storage of licensed materials"~~20.1801, "Security of stored material,"[34] as it relates to securing licensed materials against unauthorized removal from the place of storage.

7. 10 CFR Part 50, Appendix A:

    a. General Design Criterion 19 - Control Room as it relates to adequate radiation protection to be provided to permit access to areas necessary for occupancy after an accident, without personnel receiving radiation exposures in excess of 50 mSv (5 rems)[35] to the whole body or the equivalent to any part of the whole body for the duration of the accident.

    b. General Design Criterion 61 - Fuel Storage and Handling and Radioactivity Control as it relates to occupational radiation protection aspects of fuel storage, handling, radioactive waste, and other systems designed to assure adequate safety during normal and postulated accident conditions, with suitable shielding and appropriate containment and filtering systems.

8. 10 CFR Part 70, Section 70.24, "Criticality Accident Requirements" as it relates to procedures and criteria for monitoring for criticality accidents involving special nuclear material.

The following regulatory guides, NUREGs and industry standards provide information, recommendations and guidance and in general describe a basis acceptable to the staff for implementing the requirements of the regulations identified above:

1. Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant accident for Boiling Water Reactors," as it relates to assumptions used in evaluating gaseous concentrations of radionuclides in containment and plant systems, following a loss-of-coolant accident for BWRs.

2. Regulatory Guide 1.4, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Pressurized Water Reactors," as it relates to assumptions used in evaluating gaseous concentrations of radionuclides in containment and plant systems, following a loss-of-coolant accident for PWRs.

3. Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident," as it relates to methods for determining gaseous radionuclides in containment following an accident.

4. Regulatory Guide 1.52, Design, Testing, and Maintenance Criteria for Post-Accident Engineered-Safety-Feature Atmospheric cleanup System Air Filtration and Absorption Units of Light-Water Cooled Nuclear Power Plants," as it relates to radiation protection

considerations for ESF atmosphere cleanup systems operable under postulated DBA conditions, to be designated as "primary systems."

5. Regulatory Guide 1.69, "Concrete Radiation Shields for Nuclear Power Plants," as it relates to the requirements and recommended practices contained in ANSI N101.6 - 1972,[36] "Concrete Radiation Shields" as acceptable for construction of facilities, applicable to occupational radiation protection shielding structures for nuclear power plants.

6. Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," as it relates to a method acceptable to the staff for complying with the Commission's regulations to provide instrumentation for radiation monitoring following an accident in a light-water-cooled nuclear power plant.

7. Regulatory Guide 8.2, "Guide for Administrative Practices in Radiation Monitoring," as it relates to general information on radiation monitoring programs for administrative personnel.

8. Regulatory Guide 8.8, "Information Relevant to Insuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable," as it relates to a basis acceptable to the staff for complying with the Commission's regulations with regard to 10 CFR Part ~~20.1(c)~~20.1101(b) and the definition of ALARA in 20.1003,[37] concerning the radiation protection information to be supplied in Section 12 of Safety Analysis Reports about actions taken during design, construction, operation, and decommissioning to maintain occupational radiation exposures as low as is reasonably achievable.

9. Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable," as it relates to a basis acceptable to the staff for complying with the Commission's regulations with regard to 10 CFR Part ~~20.1(c)~~20.1101(b) and the definition of ALARA in 20.1003,[38] concerning the commitment by management and vigilance by the Radiation Protection Manager and the radiation protection staff to maintain occupational radiation exposures as low as is reasonably achievable.

10. Regulatory Guide 8.12, "Criticality Accident Alarm Systems," as it relates to a system acceptable to the staff for meeting the Commission's requirements for a criticality accident alarm system.

11. Regulatory Guide 8.19, "Occupational Dose Assessment in Light-Water- Reactor Power Plants Design Stage Man-Rem Estimates," as it relates to a method acceptable to the staff for performing an assessment of collective occupational radiation dose as part of the ongoing design review process so that such exposures will be ALARA.

12. NUREG-~~0103~~1430, "Standard Technical Specifications for Babcock and Wilcox ~~Pressurized Water Reactors~~Plants[39]," as it relates to radiation protection considerations in

the applicability, format, and implementation of the Babcock and Wilcox Technical Specification package.

13. NUREG-~~0123~~1433, "Standard Technical Specifications for General Electric ~~Boiling Water Reactors (BWR's)~~Plants, BWR/4[40]," as it relates to radiation protection considerations in the applicability, format, and implementation of the General Electric Technical Specification package.

14. NUREG-1434, "Standard Technical Specifications for General Electric Plants, BWR/6," as it relates to radiation protection considerations in the applicability, format, and implementation of the General Electric Technical Specification package.[41]

15. NUREG-~~0212~~1432, "Standard Technical Specifications for Combustion Engineering ~~Pressurized Water Reactors~~Plants,"[42] as it relates to radiation protection considerations in the applicability, format, and implementation of the Combustion Engineering Technical Specification package.

16. NUREG-~~0452~~1431, "Standard Technical Specifications for Westinghouse ~~Pressurized Water Reactors~~Plants,"[43] as it relates to radiation protection considerations in the applicability, format, and implementation of the Westinghouse Technical Specification package.

17. ~~NUREG-0718 and NUREG-0737 as they relate to implementing task Action Plan Items II.B.2 and II.F.1(3)~~10 CFR Part 50, §50.34(f)(2)(vii) and §50.34(f)(2)(xvii)[44] for construction permit, and operating license, design certification, or COL applications.[45]

18. ANSI/ANS-HPSSC-6.8.1-1981, "Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Reactors," as it relates to criteria for establishment of locations for fixed continuous area gamma radiation monitors, and for design features and ranges of measurement.

19. ANSI N13.1-~~1969~~1993[46] "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities," as it relates to the principles which apply in obtaining valid samples of airborne radioactive materials, and acceptable methods and materials for gas and particle sampling.

20. ANSI N16.2-1969,[47] "Criticality Accident Alarm Systems," as it relates to guidance for the prevention of criticality accidents in the handling, storing, processing, and transporting of fissionable materials.

21. ANSI N101.6-1972,[48] "Concrete Radiation Shields," as it relates to requirements and recommended practices for construction of concrete radiation shielding structures.

22. "Reactor Shielding for Nuclear Engineers," N. M. Schaeffer, Editor- Published by USAEC-OIS, 1973," as it relates to the shield designing process including physics, radiation transport, shielding calculations, special problems, and materials.

23. "Radiation Shielding Design and Analysis Approach for Light Water Reactor Power Plants," Stone and Webster Topical Report, RP-8, 1974," as it relates to the approach and objectives of the shield design and the methods of analysis employed in determining specific shielding requirements.

1. FACILITY DESIGN FEATURES

Acceptability of the facility design features will be based or evidence that the applicant has fulfilled the dose limiting requirements of 10 CFR Part ~~20.101, 20.103, and 20.104~~20.1201, 20.1202, 20.1203, 20.1204, and 20.1207[49] as well as the radiation protection aspects of General Design Criteria 19 and 61, and 10 CFR 50.34. This includes evidence that major exposure accumulating functions (maintenance, refueling, radioactive material handling, processing, etc., in-service inspection, calibration, decommissioning, and recovery from accidents) have been considered in plant design and that potential radiation exposure from these activities will be kept ALARA in accordance with 10 CFR Part ~~20.1(c)~~20.1101(b) and the definition of ALARA in 20.1003[50] and Regulatory Guides 8.8 and 8.10 by radiation protection features incorporated in the design. Such features may include (1) ease of accessibility to work and inspection and sampling areas, (2) the ability to reduce source intensity, (3) design measures to reduce the production, distribution, and retention of activated corrosion products, (4) the ability to reduce time required in radiation fields, and (5) provision for portable shielding and remote handling tools. Access control will be judged for acceptability in accordance with the requirements of 10 CFR ~~20.203~~20.1601, 20.1602, 20.1901, 20.1902, and 20.1903[51] or access control alternatives in Standard Technical Specifications (NUREGs-~~0103, 0123, 0212, and 0452~~1430, 1431, 1432, 1433, and 1434).[52]

Access controls to the spent fuel transfer tube or canal should be more stringent than 10 CFR ~~20.203~~20.1601, 20.1602, 20.1901, 20.1902, and 20.1903.[53] All accessible portions of the spent fuel transfer tube or canal which are capable of having radiation levels greater than 1 Gy per hour (100 rads per hour)[54] shall be shielded during fuel transfer. Use of removable shielding for this purpose is acceptable. This shielding shall be such that the resultant contact radiation levels shall be no greater than 1 Gy per hour (100 rads per hour).[55] All accessible portions of the spent fuel transfer tube shall be clearly marked with a sign stating that potentially lethal radiation fields are possible during fuel transfer. If removable shielding is used for the fuel transfer tubes, it must also be explicitly marked as above. If other than permanent shielding is used, local audible and visible alarming radiation monitors must be installed to alert personnel if temporary fuel transfer tube shielding is removed during fuel transfer operations. Similar precautions shall also apply to any other plant radiation source having radiation levels greater than 1 Gy per hour (100 rads per hour).[56]

The areas inside the plant structures, as well as in the general plant yard, should be subdivided into radiation zones, with identified maximum design dose rate zones and the criteria used in selecting maximum dose rates. Maximum zone dose rate should be defined for each zone, depending on anticipated occupancy and access control. Acceptance criteria are as follows: The areas that have to be occupied on a predictable basis (based on the number of people and stay or transit times) during normal operations and anticipated operational occurrences (including refueling; purging; fuel handling and storage; radioactive material handling; processing, use, storage and disposal; normal maintenance; routine operational surveillance; inservice inspection;

and calibration) should be zoned such that this occupancy results in an annual dose to each of the involved individuals that is as far below the limits of 10 CFR Part 20 as is reasonably achievable, and a total person-Sievert (person-rem)[57] dose that is as low as is reasonably achievable. Based on current operating experience and on predictions being made for new plant designs, it is expected that the plant shielding can be designed, the plant can be zoned, and sufficient radiation protection design features can be incorporated, such that individuals in shielded areas would receive a small fraction of the 10 CFR Part 20 limit.

Using the methods listed in ~~Section II.B.2 of NUREG-0718~~10 CFR Part 50, §50.34(f)(2)(vii),[58] applicants for CPs shall: (1) perform radiation and shielding design reviews of spaces around systems that may contain highly radioactive fluids and (2) implement plant designs or design modifications necessary to permit adequate access to vital areas. Applicants shall, to the extent possible, provide preliminary design information at a level consistent with that normally required at the construction permit stage of review.

Using the methods listed in ~~Section II.B.2 of NUREG-0737~~10 CFR Part 50, §50.34(f)(2)(vii),[59] applicants for standard design certifications, COL, or[60] OLs shall: (1) perform a radiation and shielding design review that identifies the location of vital areas in which personnel occupancy may be unduly limited by radiation during operations following an accident resulting in a degraded core, and (2) provide a description of the types of corrective actions needed to assure adequate access to vital areas.

2. SHIELDING

The shielding design is evaluated as to the assumptions used to calculate shield thickness, the calculational methods used, and the parameters chosen. There are a number of acceptable shielding calculational codes available for use that are effective for determining the necessary shield thickness for gamma ray sources and for combination neutron-gamma sources. Most of the codes used by shield designers have been entered into the code description file of the Radiation Shielding Information Center at Oak Ridge National Laboratory, which means that they have been tested and authenticated for operation but not for reliability and accuracy. ~~RAB~~PERB[61] has a few codes in-house for use in shielding calculations. These are SDC, a kernel integration shield design code; G^3, a general purpose gamma ray scattering program; various versions of QAD and MORSE, a general purpose Monte Carlo multigroup neutron and gamma ray transport code, etc. SDC can calculate gamma ray shielding requirements, handling 12 source geometries (including point, line, disk, plane, slab, and sphere) and with cross sections and material compositions for 17 materials. As many as 12 gamma energy groups, covering the range from 0.1 to 10 MeV, may be used to describe the gamma spectrum. The staff may use these codes, as necessary, to calculate dose rates for given shield designs and source strengths, as a confirmation of the applicant's method.

The applicant's shielding design is acceptable if the methods are comparable to commonly acceptable shielding calculations and if assumptions regarding source terms, cross sections, shield and source geometries, and transport methods are realistic. Acceptable shielding codes include but are not limited to ANISN, QAD, DOT, MORSE, SAM-CE, 05R, 06R, G^3, SDC, and many others. This listing does not imply that all these codes are equivalent, since some are much more sophisticated than others. The staff believes it is advantageous to use a good calculational procedure, since an effective shield design is essential to meeting the criteria that occupational radiation exposures will be as low as is reasonably achievable.

Two documents provide additional guidance for acceptability of the shielding design. One is "Reactor Shielding for Nuclear Engineers," edited by N. M. Schaeffer, published by AEC-OIS, 1973." The second is the Stone & Webster Engineering Corporation topical report RP-8 entitled "Radiation Shielding Design and Analysis Approach for Light Water Reactor Power Plants." These documents provide useful guidance regarding radiation shielding design. Some limitations are noted for RP-8, in that the labyrinth entrance ways may not provide dose rates at the outside entrance consistent with area radiation zoning.

In addition, Regulatory Guide 1.69 and ANSI Standard N101.6[62] provide guidance on the fabrication and installation of concrete shields for occupational radiation protection at nuclear power plants. Acceptability of the shield construction will be based on an indication that the guidance of this document has been implemented in the facility construction, or that acceptable alternatives have been proposed. Regulatory Guide 8.8 provides additional acceptance criteria regarding shielding and isolation in radiation protection design.

3. VENTILATION

The ventilation system will be acceptable for radiation protection purposes if the criteria and bases for ventilation rates within the areas covered in SAR Section 12.2.2 will assure that air will flow from areas of low potential airborne radioactivity to areas of higher airborne radioactivity and then to filters or vents, and that the concentrations of radioactive material in areas normally occupied can be maintained in accordance with the requirements of 10 CFR Part ~~20.103~~20.1201, 20.1202, 20.1203, and 20.1204.[63] The system shall have adequate capability to reduce concentrations of airborne radioactivity in areas not normally occupied where maintenance or in-service inspection has to be performed, to levels in accordance with the requirements of 10 CFR ~~20.103~~20.1201, 20.1202, 20.1203, and 20.1204.[64] The system shall be designed so that filters containing radioactivity can be easily maintained and will not create an additional radiation hazard to personnel maintaining them, or those in adjacent occupied areas. Acceptability of the ventilation system, relative to radioactive gases and particulates will also be based on evidence that the applicant has applied the guidance of Regulatory Guide 8.8 or that acceptable alternatives have been proposed.

Regulatory Guide 1.52, particularly Sections C.4 and 5, provides guidance that can be used in this review, although the guide is written with regard to mitigating accidents involving airborne radioactivity. Good practice in that regard is applicable to normal operation as well, since release of radioactivity in normal operational occurrences is usually different only in quantity from some of the accident cases.

4. AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING SYSTEMS

a. The area radiation monitoring systems will be acceptable if they meet the provisions of 10 CFR Part ~~20.103~~20.1201, 20.1202, 20.1203, and 20.1204,[65] Regulatory Guide 8.15, Regulatory Guide 1.97 and ~~NUREG-0737, Task Action Plan Item II.F.1~~10 CFR Part 50, §50.34(f)(2)(xvii),[66] and the following criteria:

1. Principal protection against intake of radioactive materials is provided by engineering controls.

2. The detectors are located in areas which may be normally occupied without restricted access and which may have a potential for radiation fields in excess of the radiation zone designations discussed in ~~Section 12.3.II.1 of Reference 7~~the third paragraph under Item 1, above, FACILITY DESIGN FEATURES,[67] in accordance with ANSI/ANS-HPSSC-6.8.1.

3. The detectors provide on-scale readings of dose rate that include the design maximum dose rate of the radiation zone in which they are located as well as the maximum dose rate for anticipated operational occurrences and accidents.

4. The detectors are calibrated during fuel outages, and after any maintenance work is performed on the detector.

5. Each monitor has a local audible alarm and variable alarm set points. Monitors located in high noise areas should also have visual alarms.

6. Readout and annunciation are provided in the control room.

7. The in-containment high-range radiation monitors meet the criteria of ~~Section II.F.1 of NUREG-0118 and 0737~~10 CFR Part 50, 50.34(f)(2)(xvii).[68]

8. Emergency power is initiated after loss of offsite power.

b. The airborne radioactivity monitoring system will be acceptable if it meets the following criteria:

   1. Air should be sampled at normally occupied locations where airborne radioactivity may exist, such as solid waste handling areas, spent fuel pools, reactor operating floors, and BWR turbine buildings. The monitoring system should be capable of detecting ten MPC-hours of particulate and iodine radioactivity from any compartment which has a possibility of containing airborne radioactivity and which normally may be occupied by personnel, taking into account dilution in the ventilation system. Continuous monitoring of air being exhausted from locations within the facility during normal operation is an acceptable method. Noble gas monitors should be calibrated such that, when monitoring for ^{133}Xe, the instrument response will determine concentrations accurately.

   2. Representative air concentrations are measured at the detectors, which are located as close to the sampler intakes as possible.

3. Ventilation monitors are upstream of HEPA filters.

4. The detectors are calibrated routinely and after any maintenance work is performed on the detector.

5. Each location has a local audible alarm and variable alarm set points. Monitors located in high noise areas should also have visual alarms.

6. Readout and annunciation are provided in the control room.

7. Emergency power is initiated after loss of offsite power.

c. The in-plant accident radiation monitoring systems will be acceptable if they meet the following criteria:

1. Personnel have the capability to assess the radiation hazard in areas which may be accessed during the course of an accident, in accordance with the criteria of ~~Item II.F.1 of NUREG-0718 and 0737,~~10 CFR Part 50, §50.34(f)(2)(xvii)[69] and Regulatory Guide 1.97.

2. Portable instruments to be used in the event of an accident should be placed so as to be readily available to personnel responding to an emergency.

3. Emergency power should be provided for installed accident monitoring systems.

4. The accident monitoring systems should have usable ranges which include the maximum calculated accident levels; and should be designed to operate properly in the environment caused by the accident.

5. Applicants for CPs, standard design certifications, COL,[70] and OLs should provide two high-range radiation monitor systems in containment which are documented to meet the requirements of ~~Table II.F.1 of NUREG-0718 and 0737~~10 CFR Part 50, §50.34(f)(2)(xvii).[71]

d. Regulatory Guide 1.21, Appendix A, provides useful, guidance about effluent monitoring, that is applicable to the acceptability of airborne radioactivity monitoring in-plant. Regulatory Guide 8.2 includes guidance on surveys to evaluate radiation hazards. American National Standard ANSI N13.1-~~1969~~1993[72] provides detailed guidance on sampling airborne radioactive materials in nuclear facilities and may be used for acceptance criteria on the actual sampling process and certain techniques involved. Regulatory Guide 8.8 provides further guidance on monitoring systems.

e. Instrumentation to monitor for accidental criticality will be acceptable if it meets the criteria of 10 CFR Part 70.24 (a)(1), Regulatory Guide 8.12, and ANSI Standard N16.2.[73]

5. DOSE ASSESSMENT

The dose assessment will be acceptable if it documents in appropriate detail the assumptions made, calculations used, the results for each radiation zone, including numbers and types of workers involved in each, expected and design dose rates, and projected person-Sievert (person-Sievert)[74] doses, in accordance with Regulatory Criteria 8.19.

<u>Technical Rationale</u>[75]

The technical rationale for application of the above acceptance criteria is discussed in the following paragraphs.[76]

1. The referenced sections of 10 CFR Part 20 specify that the licensee shall use sound radiation protection principles to control occupational doses from radioactivity that may be received from both internal and external sources, and maintain security of licensed radioactive materials that are stored in controlled or unrestricted areas.

   The referenced sections of 10 CFR Part 20 apply to this Standard Review Plan (SRP) because they establish limits on radioactive doses that may be received by individuals in restricted areas, provide guidance on external and internal exposure and combinations of the two, specify requirements that must be included in a licensee's operational radiation protection program to ensure that occupational exposures are ALARA, and provide requirements for storage security of licensed radioactive materials.

   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 will not receive radiation doses exceeding the limits specified in 10 CFR Part 20.[77]

2. Compliance with GDC 19 with regard to personnel radiation exposures inside the control room during design basis accident conditions requires a control room that will provide for access and occupancy under accident conditions while limiting radiation exposures to 50 mSv (5 Rem) or less for the whole body, or its equivalent to any part of the body, for the duration of the accident.

   A radiation dose associated with access and occupancy of the power reactor control room under accident conditions is specified so that personnel who are required to monitor and control the course of the accident will be able to perform these functions without concern for their personal health and safety. The limits on radiation dose is maintained by design of control room and associated support equipment. Guidance on evaluation of control room habitability during accidents is provided in Regulatory Guide 1.78, Regulatory Position C.6, and in SRP Section 6.4, Control Room Habitability System.

Meeting this criterion provides assurance that those personnel needed to monitor and control an accident will be able to perform those functions effectively, without exceeding established radiation dose limits.[78]

3. Compliance with GDC 61 requires that systems which may contain radioactivity be designed to assure adequate safety under normal and postulated accident conditions. This criterion specifies that such facilities shall be designed with appropriate containment, confinement, and filtering systems.

The requirements of this GDC apply to SRP Section 12.3-4 because systems and components that contain radioactive material are a potential sources of radiation exposure to individual workers in the event of leakage of the systems or components, during normal operation, anticipated operational occurrences, or in the event of an accident.

Meeting the requirement of GDC 61 provides a level of assurance that releases of radioactive materials during normal operation and during anticipated operational occurrences will not result in radiation doses that exceed the limits specified in 10 CFR Part 20. In addition, meeting the requirement will help assure that systems continue to perform safety functions under postulated accident conditions.[79]

4. Compliance with the requirements of 10 CFR Part 70 §70.24 requires installation of a system that will energize clearly audible alarm signals if an accidental criticality occurs. In addition, emergency procedures are required for each area in which special nuclear material is handled, used, or stored.

Accidental criticality is a possibility wherever special nuclear material is handled, used, or stored. Operating procedures relative to maintaining subcritical geometries of special nuclear materials, training of personnel in the handling of the materials, the equipment and facilities used to manipulate the materials, and fundamental controls for accounting for the special nuclear material are all required. These requirements, collectively, provide assurance that an unanticipated nuclear criticality accident will not occur.

Meeting these requirements provides assurance that personnel who work in the vicinity of special nuclear material will not be subject to excessive radiation exposure should an accidental criticality occur.[80]

III. REVIEW PROCEDURES

The information on radiation protection design features furnished in the SAR, including referenced parts of Chapters 9 and 11, is reviewed for completeness in accordance with Regulatory Guide 1.70. The reviewer evaluates the SAR text and the scaled layout drawings of the facility, concentrating on the sources, shielding, and layouts for the auxiliary building, including the radwaste systems, decontamination facilities, office and access control areas, laundry, lockers and shower rooms including personnel decontamination area, and laboratory facilities; the fuel handling facilities, including the spent fuel pool fuel transfer, and related equipment; and the BWR turbine building, including location of steam lines, reheaters, and moisture separators. For the PSAR, this review is particularly concerned with preliminary design features which may not appear to be consistent with assuring that ORE will be ALARA. In this review, radiation protection design features are evaluated using the guidelines of Regulatory Guide 8.8. The access control plans are reviewed both to determine conformance with 10 CFR Part ~~20.203~~20.1601, 20.1602, 20.1901, 20.1902, 20.1903, 20.1904, 20.1905[81] or Standard Technical Specifications, and to determine whether they will control access properly in limited access areas and in restricted access areas (high radiation areas). SAR Chapters 9 and 11 are reviewed as necessary to evaluate dose rates in the spent fuel pool areas, location of airborne radioactivity monitoring instruments within ventilation systems, and radwaste systems as they relate to radiation protection design. The reviewer evaluates all relevant aspects of the initial design plans, particularly to identify new arrangements, improved designs, unusual shield thicknesses, a new or modified shield thickness calculational procedure, unusual assumptions in the calculation, and placement of radiation monitors.

~~RAB~~PERB[82] evaluates the adequacy of the applicant's shielding design on the basis of acceptable radiation shielding codes. ~~RAB~~PERB[83] may make verifying check calculations with SDC, G^3, QAD, or MORSE, whichever is specifically applicable to the situation.

For the FSAR the reviewer considers any changes in the design that might necessitate changes in operating procedures to accommodate a changed radiation zone or a different location of equipment.

The reviewer determines whether the applicant has followed the guidance of the referenced regulatory guides and industry standards, both by comparison of the applicant's methods with the information in the guides and by the applicant's reference to any such guides or to proposed alternatives. The reviewer evaluates whether the alternatives are equivalent to, or improvements on, the methods cited in the referenced regulatory guides. Otherwise, alternatives are likely to be disapproved.

Based on the review, ~~RAB~~PERB[84] may request additional information or request the applicant to reevaluate the radiation protection design features to meet the acceptance criteria of subsection II of this SRP.

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[85]

IV. EVALUATION FINDINGS

The staff's review should verify that adequate and sufficient information, in accordance with the provisions of Section 12.1 of Regulatory Guide 1.70 and the radiation protection aspects of 10 CFR Part 50, Section 50.34, as well as General radiation protection aspects of Design Criteria 19 and 61, is contained in the SAR and amendments as a basis for conclusions of the following type, which are to be included in the staff's Safety Evaluation Report (SER). The report will include a summary of the applicant's coverage, the staff's basis for review and acceptance criteria, and the findings of the review. The following is a brief representation of typical evaluation findings.

The staff concludes that the radiation protection design features are acceptable and meets the relevant requirements of 10 CFR Part 20, 10 CFR Part 50, General Design Criteria 19 and 61, and 10 CFR Part 70. This conclusion is based on the following:

> The radiation protection design features at (plant name) are intended to help maintain occupational radiation exposures within regulatory limits and as low as is reasonably achievable, consistent with 10 CFR Part ~~20.1(c)~~20.1101(b) and the definition of ALARA in 20.1003[86] and the dose-limiting provisions of ~~20.101, 20.103, 20.203, and 20.207~~20.1201, 20.1202, 20.1203, 20.1204, 20.1601, 20.1602, 20.1801, 20.1901, 20.1902, 20.1903, 20.1904, and 20.1905[87], as well as Regulatory Guides 8.8, and 8.10. Many of these design features have been incorporated as a result of the applicant's radiation protection design review and from radiation exposure experience gained during the operation of other nuclear power plants. (Include examples of design features incorporated to reduce radiation to workers during maintenance operations, reduce radiation sources where operations must be performed, allow quick entry and easy access, provide remote operation capability or reduce the time required for work in radiation fields, and examples of other features that reduce radiation exposure of personnel.) These design features are consistent with those contained in Regulatory Guide 8.8 and are acceptable.
>
> Access control is in accordance with the requirements of 10 CFR ~~20.203~~20.1601, 20.1602, 20.1901, 20.1902, and 20.1903[88] and access control alternatives in Standard Technical Specification (NUREGs-~~0103, 0123, 0212, and 0452~~1430, 1431, 1432, 1433, and 1434)[89] and is acceptable.
>
> Areas within the restricted area will be divided into (number of zones) radiation zones. The dose rate criterion for each of these zones is derived from expected occupancy and access restrictions. These criteria are then used as the basis for the radiation shielding design. This allows for arrangements of radioactive equipment that are in accordance with the requirements of 10 CFR Part 20, and the guidelines of Regulatory Guide 8.8. During plant operation and refueling conditions, the Health physics staff will evaluate area access classifications, and monitor entry into areas to update posting and entry requirements in accordance with 10 CFR Part ~~20.203~~20.1601, 20.1602, 20.1901, 20.1902, and 20.1903[90] (and Standard Technical Specifications).
>
> All plant radiation sources capable of producing radiation levels in excess of 1 Gy per hour (100 rads per hour)[91] will be shielded and clearly marked, indicating that potentially lethal radiation fields are possible. If other than permanent shielding is used, administrative controls will be initiated and local audible and visible alarming monitors must be installed to alert personnel if temporary shielding is removed.
>
> The radiation shielding will be designed to provide protection against radiation for operating personnel, both inside and outside the plant, and for the general public. The

following are several of the shielding design features incorporated into (plant name). (List several examples of shielding design features used at plant.) Some of the criteria used by (utility) in locating penetrations in shield walls at (plant name) are: (list several shield penetration location criteria used.) These shielding techniques are designed to maintain personnel radiation exposures as low as is reasonably achievable, in accordance with the ALARA provisions of Regulatory Guides 8.8 and 8.10, and are acceptable.

The general shield design methodology and source term inventories used for (plant name) are similar to those from operating reactors. The basic radiation transport analysis used for the applicants' shield design is based on (list appropriate shielding computer codes used). The applicant also used shielding information from operating nuclear plants as input data for the shield design calculations. All concrete shielding in the plant will be constructed in general compliance with Regulatory Guide 1.69. We find the shielding design and methodology presented in the (Preliminary or Final) SAR, design certification application, or COL application[92] acceptable based on the criteria of the SRP.

The ventilation system at (plant name) will be designed to ensure that plant personnel are not inadvertently exposed to airborne contaminants exceeding those given in 10 CFR Part 20. The applicant intends to maintain personnel exposures as low as is reasonably achievable by: (1) maintaining air flow from areas of potentially low airborne contamination to areas of higher potential concentrations; (2) ensuring negative or positive pressures to prevent exfiltration or infiltration of potential contaminants; and (3) locating ventilation system intakes so that intake of potentially contaminated air from other building exhaust points is minimized. These design criteria are in accordance with the guidelines of Regulatory Guides 1.52 and 8.8. (List examples of exposure reduction features in the ventilation system.)

The applicant's area radiation monitoring system is designed to: (1) monitor the radiation levels in areas where radiation levels could become significant, and where personnel may be present; (2) alarm when the radiation levels exceed preset levels to warn of increased radiation levels; and (3) provide a continuous record of radiation levels at key locations throughout the plant. In order to meet these objectives, the applicant plans to use (number) area monitors located in areas where personnel may be present, and where radiation levels could become significant. The area radiation monitoring system meets the criteria of ~~Section II.F.1(3) of NUREG-0737~~10 CFR Part 50, §50.34(f)(2)(xvii)[93] and Regulatory Guide 1.97 and is equipped with local and remote audio and visual alarms and a facility for central recording. (List examples of other area monitoring system features.) The design objectives of the applicants' airborne radioactivity monitoring system are: (1) to assist in maintaining occupational exposure to airborne contaminants as low as is reasonably achievable; (2) to check on the integrity of systems containing radioactivity; and (3) to warn of unexpected release of airborne radioactivity to prevent inadvertent overexposure of personnel. The applicant will install airborne radioactivity monitors in work areas where there is a potential for airborne radioactivity. These airborne radioactivity monitors have the capability to detect maximum permissible concentrations(s) in air (MPC) of the most restrictive particulate and iodine radionuclides in the area or cubicle of lowest ventilation flow rate within (10) hours(s) (usually denoted as 10 MPC-hrs). The applicant will provide portable continuous air monitors when needed to monitor air in areas not provided with fixed airborne radioactivity monitors. All airborne and area radioactivity monitors will be calibrated periodically. (List examples of other airborne radioactivity monitoring features.) The objectives and location criteria of (plant name) area and airborne radiation monitoring systems are in conformance with those portions of 10 CFR Parts ~~20.201~~20.1501,[94] 50.34, and 70.24, as well as Regulatory Guides 1.97, 8.2, and 8.8, and ANSI Standard 13.1 1993,[95] related to airborne radioactivity monitoring.

The objective of the applicant's accident radiation monitoring system is to provide the capability to assess the radiation hazard in areas which may be occupied during the course of an accident. The installed instruments have emergency power supplies; and the portable instruments are placed to be readily accessible to personnel responding to an emergency. The systems are designed for use in the event of an accident in terms of (1) usable instrument range, and (2) the environment the instrument can withstand, and meeting the provisions of ~~Section II.F.1(3) of NUREG-0737~~10 CFR Part 50, §50.34(f)(2)(xvii)[96] and Regulatory Guide 1.97.

Instrumentation to monitor for accidental criticality meets the criteria of 10 CFR Part ~~20~~70.24(a)(1),[97] Regulatory Guide 8.12, and ANSI Standard N16.2,[98] and is acceptable.

The applicant provided a dose assessment, as described in Regulatory Guide 8.19, including a completed summary table of occupational radiation exposure estimates, sufficient detail to explain how the assessment process was performed, a systematic process for considering and evaluating dose-reducing changes in design and operations as part of the comprehensive ongoing design reviews and a record of the review procedures, documentation requirements, and identification of principle ALARA-related changes resulting from the dose assessment, which is acceptable.

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff’s evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[99]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[100] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[101]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulatory guides and NUREGs.

VI. REFERENCES

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

2. 10 CfR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A.

3. 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

4. Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss-of-Coolant Accident for Boiling Water Reactors."

5. Regulatory Guide 1.4, "Assumptions Used for Evaluation of the Potential Radiological Consequences of a Loss-of-Coolant Accident for Pressurized Water Reactors."

6. Regulatory Guide 1.7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of Coolant Accident."

7. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Post Accident Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Absorption Units of Light-Water-Cooled Nuclear Power Plants."

8. Regulatory Guide 1.69, "Concrete Radiation Shields for Nuclear Power Plants."

9. Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."

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

11. Regulatory Guide 8.2, "Administrative Practices in Radiation Monitoring."

12. Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable."

13. Regulatory Guide 8.10," Operational Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable."

14. Regulatory Guide 8.12, "Criticality Accident Alarm Systems."

15. Regulatory Guide 8.19, "Occupational Dose Assessment in Light-Water Reactor Power Plants Design Stage Man-Rem Estimates."

~~16. NUREG-0103, "Standard Technical Specifications for Babcock and Wilcox Pressurized Water Reactors."~~

~~17. NUREG-0123, "Standard Technical Specifications for General Electric Boiling Water Reactors (BWR/5)."~~

~~18. NUREG-0212, "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors."~~

~~19. NUREG-0452, "Standard Technical Specifications for Westinghouse Pressurized Water Reactors."~~

16. NUREG-1430, "Standard Technical Specifications for Babcock and Wilcox Plants."

17. NUREG-1433, "Standard Technical Specifications for General Electric Plants, BWR/4."

18. NUREG-1434, "Standard Technical Specifications for General Electric Plants, BWR/6."

19. NUREG-1432, "Standard Technical Specifications for Combustion Engineering Plants."

20. NUREG-1431, "Standard Technical Specifications for Westinghouse Plants."[102]

~~21. NUREG-0737, "Clarification of TMI Action Plan Requirements."~~[103]

21. ANSI/ANS-HPSSC-6.8.1-1981, "Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Reactors."

22. ANSI N13.1 - ~~1969~~1993[104], "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities."

23. "Reactor Shielding for Nuclear Engineers," N. M. Schaeffer, Editor; published by USAEC-OIS, 1973.

24. "Radiation Shielding Design and Analysis Approach for Light-Water Reactor Power Plants," Stone and Webster Topical Report, RP-8, 1974.

SRP Draft Section 12.3
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	Current PRB name and abbreviation	Editorial change made to reflect current PRB name, Emergency Preparedness and Radiation Protection Branch, and abbreviation, PERB.
2.	SRP-UDP update item	Added reference to design certification application and combined license application.
3.	SRP-UDP update item	Added reference to design certification application and combined license application.
4.	SRP-UDP format item	Provided proper reference to Regulatory Guide 1.70.
5.	SRP-UDP format item	Provided proper reference to Regulatory Guide 1.70.
6.	SRP-UDP update item	Added reference to design certification application and combined license application.
7.	SRP-UDP update item	Added reference to design certification application and combined license application.
8.	SRP-UDP update item	Added reference to design certification application and combined license application.
9.	SRP-UDP update item	Added reference to design certification application and combined license application.
10.	SRP-UDP update item	Added reference to design certification application and combined license application.
11.	SRP-UDP update item	Added reference to design certification application and combined license application.

Item	Source	Description
12.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(vii).
13.	SRP-UDP update item	Added reference to design certification application and combined license application.
14.	Editorial	Deleted Paragraph f. because it relates to post-TMI actions and also is redundant with Paragraph e.
15.	SRP-UDP update item	Provided proper reference to Regulatory Guide 1.70.
16.	SRP-UDP update item	Added reference to design certification application and combined license application.
17.	SRP-UDP update item	Added reference to design certification application and combined license application.
18.	SRP-UDP update item	Added reference to design certification application and combined license application.
19.	SRP-UDP update item	Added reference to design certification application and combined license application.
20.	SRP-UDP update item	Provided proper reference to Regulatory Guide 1.70.
21.	SRP-UDP update item	Added reference to design certification application and combined license application.
22.	Integrated Impact No. 676	Changed reference to reflect that ANSI N13.1 1969 was reaffirmed in 1993.
23.	SRP-UDP update item	Added reference to design certification application and combined license application.

Item	Source	Description
24.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).
25.	SRP-UDP format item	Changed "person-rem" to SI units, "person-Sievert."
26.	SRP-UDP update item	Added reference to design certification application and combined license application.
27.	SRP-UDP update item	Added reference to design certification application and combined license application.
28.	Editorial	Added standard paragraph noting the location of acceptance criteria and description of methods of application for those areas of review identified as the primary responsibility of other branches.
29.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.1(c) with 10 CFR Part 20 §20.1101(b) and the definition of ALARA in §20.1003.
30.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.101 with 10 CFR Part 20 §20.1201.
31.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.103 with 10 CFR Part 20 §20.1201, §20.1202, §20.1203, and §20.1204.
32.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.104 with 10 CFR Part 20 §20.1207.
33.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, and §20.1903.
34.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.207 with 10 CFR Part 20 §20.1801.
35.	SRP-UDP format item	Added SI units for rems.

Item	Source	Description
36.	Integrated Impact No. 614	The reference to ANSI N101.6 - 1972 needs to be updated to ANS 6.4 - 1985, provided that comparison of the two versions supports the update of the citation.
37.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.1(c) with 10 CFR Part 20 §20.1101(b) and the definition of ALARA in §20.1003.
38.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.1(c) with 10 CFR Part 20 §20.1101(b) and the definition of ALARA in §20.1003.
39.	Integrated Impact No. 615	Provided updated reference for Standard Technical Specifications for Babcock and Wilcox plants.
40.	Integrated Impact No. 615	Provided updated reference for Standard Technical Specifications for General Electric plants, BWR/4.
41.	Integrated Impact No. 615	Provided reference for Standard Technical Specifications for General Electric plants, BWR/6.
42.	Integrated Impact No. 615	Provided updated reference for Standard Technical Specifications for Combustion Engineering plants.
43.	Integrated Impact No. 615	Provided updated reference for Standard Technical Specifications for Westinghouse plants.
44.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(vii), and §50.34(f)(2)(xvii).
45.	SRP-UDP update item	Added reference to design certification application and combined license application.

Item	Source	Description
46.	Integrated Impact No. 676	Changed reference to reflect that ANSI N13.1 1969 was reaffirmed in 1993.
47.	Integrated Impact No. 614	The reference to ANSI N16.2 - 1969 needs to be updated to ANS 8.3 - 1986, provided that comparison of the two versions supports the update of the citation.
48.	Integrated Impact No. 614	The reference to ANSI N101.6 - 1972 needs to be updated to ANS 6.4 - 1985, provided that comparison of the two versions supports the update of the citation.
49.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.101, §10.103, and §20.104 with 10 CFR Part 20 §20.1201, §20.1202, §20.1203, §20.1204, and §20.1207.
50.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.1(c) with 10 CFR Part 20 §20.1101(b) and the definition of ALARA in §20.1003.
51.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, and §20.1903.
52.	Integrated Impact No. 615	Revised references for Standard Technical Specifications.
53.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, and §20.1903.
54.	SRP-UDP format item	Added SI units for rads per hour.
55.	SRP-UDP format item	Added SI units for rads per hour.
56.	SRP-UDP format item	Added SI units for rads per hour.

Item	Source	Description
57.	SRP-UDP format item	Changed "person-rem" to SI units, "person-Sievert."
58.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(vii).
59.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(vii).
60.	SRP-UDP format item	Identified different types of licensing actions.
61.	Current PRB abbreviation	Editorial change made to reflect current PRB abbreviation, PERB.
62.	Integrated Impact No. 614	The reference to ANSI N101.6 - 1972 needs to be updated to ANS 6.4 - 1985, provided that comparison of the two versions supports the update of the citation.
63.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.103 with 10 CFR Part 20 §20.1201, §20.1202, §20.1203, and §20.1204.
64.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.103 with 10 CFR Part 20 §20.1201, §20.1202, §20.1203, and §20.1204.
65.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.103 with 10 CFR Part 20 §20.1201, §20.1202, §20.1203, and §20.1204.
66.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).
67.	SRP-UDP format item	Provided proper reference to the Subsection in SRP 12.3-4 on radiation zones.
68.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).
69.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).

Item	Source	Description
70.	SRP-UDP update item	Identified different types of licensing actions.
71.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).
72.	Integrated Impact No. 676	Changed reference to reflect that ANSI N13.1 1969 was reaffirmed in 1993.
73.	Integrated Impact No. 614	The reference to ANSI N16.2 - 1969 needs to be updated to ANS 8.3 - 1986, provided that comparison of the two versions supports the update of the citation.
74.	SRP-UDP format item	Changed "person-rem" to SI units, "person-Sievert."
75.	SRP-UDP format item	"Technical Rationale" added to "ACCEPTANCE CRITERIA" subsection to describe the bases for referencing 10 CFR Part 20, GDC 19, GDC 61, and 10 CFR Part 70 §70.24.
76.	SRP-UDP format item	Added lead-in sentence for "Technical Rationale."
77.	SRP-UDP format item	Added Technical Rationale for 10 CFR Part 20.
78.	SRP-UDP format item	Added Technical Rationale for GDC 19.
79.	SRP-UDP format item	Added Technical Rationale for GDC 61.
80.	SRP-UDP format item	Added Technical Rationale for 10 CFR Part 70 §70.24.
81.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, §20.1903, §20.1904, and §20.1905.
82.	Current PRB abbreviation	Editorial change made to reflect current PRB abbreviation, PERB.

Item	Source	Description
83.	Current PRB abbreviation	Editorial change made to reflect current PRB abbreviation, PERB.
84.	Current PRB abbreviation	Editorial change made to reflect current PRB abbreviation, PERB.
85.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
86.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.1(c) with 10 CFR Part 20 §20.1101(b) and the definition of ALARA in §20.1003.
87.	Integrated Impact No. 613	Replaced references to sections of 10 CFR Part 20 with revised references.
88.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, and §20.1903.
89.	Integrated Impact No. 615	Revised references for Standard Technical Specifications.
90.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.203 with 10 CFR Part 20 §20.1601, §20.1602, §20.1603, §20.1901, §20.1902, and §20.1903.
91.	SRP-UDP format item	Added SI units for rads per hour.
92.	SRP-UDP update item	Added reference to design certification application and combined license application.
93.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(xvii).
94.	Integrated Impact No. 613	Replaced reference to 10 CFR Part 20 §20.201 with 10 CFR Part 20 §20.1501.
95.	Integrated Impact No. 676	Changed reference to reflect that ANSI N13.1 1969 was reaffirmed in 1993.

Item	Source	Description
96.	SRP-UDP update item	Updated reference to 10 CFR Part 50, §50.34(f)(2)(vii).
97.	Editorial	Corrected reference to 10 CFR Part 70 §70.24(a)(1) from 10 CR Part 20 §20.24(a)(1).
98.	Integrated Impact No. 614	The reference to ANSI N16.2 - 1969 needs to be updated to ANS 8.3 - 1986, provided that comparison of the two versions supports the update of the citation.
99.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items.
100.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
101.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
102.	Integrated Impact No. 615	Revised references for Standard Technical Specifications.
103.	SRP-UDP update item	Deleted reference to NUREG-0737.
104.	Integrated Impact No. 676	Changed reference to reflect that ANSI N13.1 1969 was reaffirmed in 1993.

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Integrated Impact No.	Issue	SRP Subsections Affected
613	Revise SRP Subsections to replace citations of superseded sections of 10 CFR Part 20.	Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 1 Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 2 Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 3 Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 4 Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 5 Subsection II, ACCEPTANCE CRITERIA, first paragraph, subitem 6 Subsection II, ACCEPTANCE CRITERIA, second paragraph, subitem 8 Subsection II, ACCEPTANCE CRITERIA, second paragraph, subitem 9 Subsection II, ACCEPTANCE CRITERIA, Facility Design Features, first paragraph Subsection II, ACCEPTANCE CRITERIA, Facility Design Features, first paragraph Subsection II, ACCEPTANCE CRITERIA, Facility Design Features, first paragraph Subsection II, ACCEPTANCE CRITERIA, Facility Design Features, second paragraph Subsection II, ACCEPTANCE CRITERIA, Ventilation, first paragraph Subsection II, ACCEPTANCE CRITERIA, Ventilation, first paragraph Subsection II, ACCEPTANCE CRITERIA, Area Radiation and Airborne Radioactivity Monitoring Systems, paragraph a Subsection III, REVIEW PROCEDURES, first paragraph