RADIATION SAFETY
4.2 RADIATION SAFETY DESIGN FEATURES

4.2.1 PURPOSE OF REVIEW

The purpose of this review is to determine with reasonable assurance that the applicant's design is adequate to protect the radiological health and safety of the workers and to comply with the regulatory requirements of 10 CFR Parts 20 and 70, during routine and non-routine operations including anticipated events. This chapter also facilitates the review of the radiation safety aspects of accidents that are analyzed in the integrated safety analysis (ISA), through an interface with SRP Chapter 3.0.

The protection of members of the public and control of effluent releases is not included in this chapter but is in SRP Chapter 9.0, "Environmental Protection." While this chapter reviews the applicant's radiation safety (RS) *design*, the applicant's RS *program* and administrative controls are reviewed under SRP Chapter 4.1, "Radiation Safety Program."

4.2.2 RESPONSIBILITY FOR REVIEW

Primary: Health Physicist

Secondary: None

Supporting: Licensing Project Manager
Lead reviewer of SRP Chapter 4.1 if different then primary reviewer
Fire Protection Engineer (primary reviewer of SRP Chapter 7.0)
Primary reviewers of Chapter 12

4.2.3 AREAS OF REVIEW

Engineered controls that provide for radiological safety are required to be established and implemented by 10 CFR 20.1101. (As used in this SRP the terms *Radiation Safety* and *Radiation Protection* are synonymous). Six elements of the applicant's proposed RS design features are reviewed by the staff, as identified in the following list.

1. Facility Design Features

   Areas to be reviewed should include the applicant's proposed equipment and facility design features and plant layout as they relate to occupational RS and ALARA concepts. Consistent with maintaining doses at levels that are ALARA, the incorporation of features to minimize contamination and waste production, and facilitate ease of operations, maintenance, replacement, and decommissioning, are also reviewed.

2. Source Identification

Areas to be reviewed should include the applicant's description of the sources of radiation and contamination in the plant during routine and non-routine operations (e.g., maintenance) including anticipated events. The applicant's description of the sources of radiation and contamination that are used in accident analyses in Chapter 3.0, "ISA," should also be reviewed. Areas to be reviewed should include the pertinent information needed for:

a. Input to shielding codes used in the design process;
b. Establishing related facility design features;
c. Plans and procedures development; and
d. Assessment of occupational dose.

The methodology for estimating source magnitudes and locations, at the design stage, after several years of plant operation, and incorporating this information into the design should also be reviewed.

3. ALARA Design Considerations

Areas to be reviewed should include the applicant's organizational relationships and responsibilities with respect to performing radiological design reviews; the application of ALARA into design-stage man-rem estimates, the descriptions and elements of the design review process for RS, and how experience from past designs and from operating plants has been used to develop improved RS design, when ALARA threshold values are exceeded.

4. Ventilation Systems

Areas to be reviewed should include the design and operation of the ventilation systems, as related to radiological safety, including the proposed design objectives, minimum flow velocity at hood openings, the types of filters and the maximum differential pressure across filters, and the frequency and types of tests required to ensure ventilation system performance.

5. Shielding Evaluations

Areas to be reviewed should include the applicant's proposed uses of permanent and temporary radiation shielding as part of the RS program. The information on the shielding design objectives, the types of shielding materials to be used, special analyses of features such as cell penetrations, the determination of requirements in work areas, and the methods (e.g., codes) by which those requirements are satisfied should also be reviewed.

6. Integrated Safety Analysis (ISA)

Areas to be reviewed should include the postulated accidents in the ISA which have RS consequences for the workers, environment, and public. Areas reviewed for the ISA results include all high and a sample of lower risk accident sequences that result in radiation doses of concern. The methodology in assessing the accident consequences, the likelihood, and the risk index associated with each of these accident sequences are also reviewed. In particular, the primary reviewer of this SRP chapter should focus on the ISA source term, transport, and dosimetry analyses. Controls established by the applicant to prevent or mitigate each accident sequence, and the levels of assurance applied to the controls should be reviewed in the context of radiological safety.

4.2.4 ACCEPTANCE CRITERIA

4.2.4.1 Regulatory Requirements

Regulations applicable to this SRP chapter are listed below [followed in brackets by the applicable acceptance criteria sections]:

Code of Federal Regulations, *Title 10*, *Energy*, Part 20, "Standards for Protection Against Radiation."

§ 20.1101 *Radiation Protection Programs* **[Sections 4.2.4.3.1, 4.2.4.3.3, 4.2.4.3.4, 4.2.4.3.5]**

§ 20.1201 Occupational Dose Limits For Adults **[Sections 4.2.4.3.1, 4.2.4.3.4, 4.2.4.3.5]**

§ 20.1301 *Dose Limits for Individual Members of the Public* **[Sections 4.2.4.3.1, 4.2.4.3.4, 4.2.4.3.5]**

§ 20.1406 *Minimization of Contamination* **[Sections 4.2.4.3.1, 4.2.4.3.3]**

§ 20.1501 *Surveys - General*, Subsection (a) **[Sections 4.2.4.3.3, 4.2.4.3.4, 4.2.4.3.5]**

§ 20.1601 *Control of Access to High Radiation Areas* **[Sections 4.2.4.3.1]**

§ 20.1602 *Control of Access to Very High Radiation Areas* **[Sections 4.2.4.3.1]**

§ 20.1701 *Use of Process or Other Engineering Controls* **[Section 4.2.4.3.4]**

Code of Federal Regulations, *Title 10, Energy,* Part 70, "Domestic Licensing of Special Nuclear Material."

§ 70.22 *Contents of Applications*, Subsections (a)(4) and (a)(7) **[Sections 4.2.4.3.1, 4.2.4.3.2, 4.2.4.3.3, 4.2.4.3.4, 4.2.4.3.5]**

Radiation Safety

§ 70.23 *Requirements for Approval of Applications*, Subsection (a)(3) **[Section 4.2.4.3.1]**

Nuclear Regulatory Commission (U.S.), Washington, D.C. "Domestic Licensing of Special Nuclear Material (10 CFR Part 70)." *Federal Register* : Vol. 64, No. 146. pp. 41338–41357. July 30, 1999.

§ 70.61 *Performance Requirements* **[Section 4.2.4.3.6]**

§ 70.62 *Safety Program and Integrated Safety Analysis* **[Section 4.2.4.3.6]**

§ 70.65 *Additional Content of Applications* **[Section 4.2.4.3.6]**

4.2.4.2 Regulatory Guidance

NRC Regulatory Guides (RGs), NUREG reports, and industry standards that provide a generally acceptable basis to the NRC staff for satisfying the regulatory requirements listed in Section 4.2.4.1 are listed below [followed in brackets by the applicable acceptance criteria sections].

1. NRC Regulatory Guides (RGs)

   RG 8.10, Rev. 1-R Sept 1975 — *Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable* **[Sections 4.2.4.3.2 and 4.2.4.3.3]**

   RG 8.19, Rev. 1 June 1979 — *Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants - Design Stage Man-Rem Estimates* **[Sections 4.2.4.3.2 and 4.2.4.3.3]**

2. NRC NUREG Reports

   NUREG-1513 (DRAFT 1998) — *Integrated Safety Analysis Guidance Document* **[Section 4.2.4.3.6]**

3. Industry Standards: (Although these industry standards represent acceptable practices of the nuclear industry, and have been successfully utilized in past licensing actions, their use has not been endorsed by NRC through a regulation or RG. Further, inclusion in this SRP is not necessarily an endorsement of a particular standard by NRC. Therefore, alternative but equivalent methods may be proposed in the application with adequate justification.)

   ANSI/ANS-6.1.1-1991 — *Neutron and Gamma-Ray Fluence-to-Dose Factors* **[Sections 4.2.4.3.3. and 4.2.4.3.5]**

   ANSI/ANS-6.1.2-1991 — *Neutron and Gamma-Ray Cross Sections for Nuclear Radiation Protection Calculations for Nuclear Power Plants* **[Section 4.2.4.3.5]**

ANSI/ANS-6.4-1985 *Guidelines on the Nuclear Analyses and Design of Concrete Radiation Shielding for Nuclear Power Plants* **[Section 4.2.4.3.5]**

ANSI/ANS-6.4.2-1985 *Specification of Radiation Shielding Materials* **[Section 4.2.4.3.5]**

ANSI/ASME N510-1980 *Testing of Nuclear Air Cleaning Systems* **[Section 4.2.4.3.4]**

ERDA 76-21 Nuclear Air Cleaning Handbook, C. A. Burchsted, A. B. Fuller, J. E. Kahn **[Section 4.2.4.3.4]**

4.2.4.3 Regulatory Acceptance Criteria

4.2.4.3.1 Facility Design Features

Acceptability of the radiation safety design should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 20.1101(b), 20.1201, 20.1301, 20.1406, 20.1601, 20.1602, and 10 CFR 70.22(a)(7) and 70.23(a)(3) related to facility design features for RS, and the following Acceptance Criteria, or information describing acceptable alternatives:

1. The plant and process drawings and descriptions should be acceptable if they identify clearly-readable and scaled RS design features that are:

   a. Relied on to reduce doses to meet Part 20 during routine and non-routine operations (including anticipated events); and/or

   b. Identified by the ISA as items relied on for safety to reduce accident doses.

   The identification of these features should be acceptable if they include:

   a. Locations of detectors and alarm systems;

   b. Locations of permanent shielding (including penetrations, labyrinths, shield doors, etc.);

   c. Provisions for installation/removal of temporary shielding;

   d. Locations and access control points for restricted areas, high radiation, and very high radiation areas;

   e. Change rooms, showers, and locker rooms;

   f. The contamination control, decommissioning facilitation, and waste minimization design features required by 10 CFR 20.1406. Shield wall thicknesses for all shielded spaces should be specified on the drawings or provided in separate tables. (Note that

this information can be included here or through a reference to information provided for the acceptance criteria in SRP Chapter 3.0.)

2. The predicted radiation doses from licensed activities should be acceptable if they are within the limits of Part 20, including ALARA as required by 10 CFR 20.1101(b), as evidenced in the application by a summary figure or table of predicted annual occupational doses for the types of work functions (e.g., operations, routine maintenance, special maintenance, in-service testing and surveillance, and waste management) provided at the facility.

3. Access controls for high and very high radiations areas should be acceptable if they meet 10 CFR 20.1601 and 20.1602, respectively. For general radiation areas, change rooms are provided for changing into personnel protective equipment (PPE). Change rooms should be adjacent to shower and decontamination facilities and be provided with ventilation systems that filter dispersable radionuclides. Administrative (i.e., programmatic) aspects of access control and storage are reviewed under SRP Section 4.1.5.8, "Contamination Control."

4.2.4.3.2 Source Identification

Acceptability of the application should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 70.22(a)(4) and (a)(7), related to specifying the types, form, and amount of licensed material to be used at the facility; and the following Acceptance Criteria, or information describing acceptable alternatives:

1. External Dose Considerations: Acceptability of contained radiation sources descriptions should be based on quantitative descriptions and estimates of contained sources being provided (RG 8.10, Position C.2(a)) and used as the basis for the RS program and for shield design calculations, with consideration of routine and nonroutine operations, including anticipated events and accident conditions. The descriptions are acceptable if they include isotopic composition, locations in the plant, source strength and source geometry, and the basis for the values used in the application.

2. Internal Dose Considerations: Acceptability of contained radiation sources descriptions should be based on quantitative descriptions and estimates of contained sources being provided (RG 8.10, Position C.2(a)) and used as the basis for the internal RS program and for design of the ventilation systems, with consideration of routine and nonroutine operations and accident conditions. The descriptions should be acceptable if they include:
   a. Tabulations of the calculated concentrations of radioactive material, by nuclide, expected during routine and non-routine operations including anticipated events, and accident conditions identified in the ISA, for equipment cubicles, corridors, and operating areas normally occupied by operating personnel;

   b. The models and parameters for the calculations.

3. The contained and airborne radioactivity sources estimated at the design stage should be based on an assumption of several years of facility operation, to account for the buildup of

radioactivity and contamination in the plant. These source estimates should also account for the variability of the radioactive properties of the Hanford tank wastes. The application should be acceptable if the specific assumptions, a discussion of uncertainties, and a justification of each assumptions' conservatism are provided.

4.2.4.3.3 ALARA Design Considerations

Acceptability of the application should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 20.1101(b), 20.1406, 20.1501, and 10 CFR 70.22(a)(7) related to ALARA design considerations, and the following Acceptance Criteria, or information describing acceptable alternatives:

1. The applicant's design and design activities, with respect to RS, should be acceptable if they are described in the application and are evidenced by provisions to ensure:

    a. The incorporation of measures for reducing the need for time spent in radiation areas;

    b. Measures to improve the accessibility to components requiring periodic maintenance or inservice inspection;

    c. Measures to reduce the distribution and retention of radioactive materials throughout plant systems;

    d. Measures to control (reduce) contamination, facilitate decommissioning, and minimize secondary radioactive waste production in accordance with 10 CFR 20.1406;

    e. Measures instructing designers and engineers in ALARA design objectives;

    f. Measures incorporating experience from operating plants and past designs; and

    g. Commitment to, and description of, continuing RS (ALARA) design reviews for facility or process modifications made during construction and operations.

2. The RS (ALARA) design review process should be acceptable if:

    a. The organizational responsibilities and relationships associated with these reviews and related dose assessments are described;

    b. Design reviews and dose assessments are performed by competent personnel including (or with concurrence of) RS staff and RS management;

    c. Design reviews include review of previous jobs, designs, operating experience and processes for applicability and improvements;

    d. Design reviews include documentation (e.g., ALARA Design Review Checklists) and tracking of recommendations to completion; and

e. Design reviews and approvals required are graded based on the hazard (e.g., are compared to defined ALARA trigger levels). Note that some of this information can be included under SRP Section 4.1.4.3.1.

3. A self-assessment of the submitted plant design, shielding, layout, traffic patterns, expected maintenance, and sources, should be performed and described in the application, and is acceptable if the assessment supports that both collective and individual doses from significant activities will be ALARA for routine and non-routine operations including anticipated events. For purposes of design stage estimates, significant activities could be defined as dose-causing activities conservatively estimated to result in greater than 0.01 person-sievert (1.0 person-rem) per year.

4. The process for seeking RS related design improvements should be acceptable if the application includes a description of how RS related design improvements are sought, considered, and incorporated where practicable (RG 8.10, Position C.1(f)). Acceptability at the design stage should be based on the description of the methods for design stage person-rem estimates and dose assessments; the methods and tables in RG 8.19 are generally acceptable.

4.2.4.3.4 Ventilation

A ventilation system is necessary to provide confinement integrity and to process off-gas before being exhausted to the environment. The review performed in this SRP section concerns those functions of the ventilation and air cleaning system that pertain to occupational RS (specifically, controlling internal dose through limiting airborne radioactivity). Ventilation systems will have many other functions than controlling internal radiation exposure to workers through containment (e.g., off-gas management, prevention of hydrogen gas buildup, heating and air conditioning, accident functions, controlling chemical exposures, reducing effluent releases, etc.). Applicable acceptance criteria for functions other than RS of ventilation and air treatment systems, and construction and performance specifications of ducts, blowers, and filters; are provided in the SRP Chapter 12.0, “Plant Systems.”

Acceptability of the application should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 20.1101(b), 20.1201, 20.1301, 20.1501, 20.1701; and 10 CFR 70.22(a)(7), related to designing and operating ventilation systems to control internal radiation doses, and the following Acceptance Criteria, or information describing acceptable alternatives:

1. Acceptability should be based on a demonstration that the design and operation of the ventilation system protects workers and public from airborne radioactive material such that limits of 10 CFR Part 20 will not be exceeded during routine and non-routine operations and anticipated events. Recommendations for the design, construction, and testing of nuclear air cleaning systems (e.g., zoning, moisture separation, HEPA filtration, operational/maintenance considerations, etc.) that are generally acceptable to NRC staff are provided in ERDA 76-21.

2. Design objectives for ventilation systems should be acceptable if they are stated and ensure that:

    a. During routine and non-routine operations and anticipated occurrences, airborne concentrations in occupied operating areas are well below the limits of 10 CFR Part 20 Appendix B;

    b. The use of engineering (i.e., design) controls shall be preferred over the use of respirators (10 CFR 20.1701);

    c. Airflow patterns are from areas of lesser contamination potential to areas of greater contamination potential, with periodic checks that ensure that design pressure differentials are maintained; and

    d. Items relied on for safety allow for routine in-place testing of HEPA filtration systems as outlined in ASME N510.

3. The specifications for ventilation system performance should be acceptable with respect to RS, if they include minimum flow velocity at openings of hoods, maximum differential pressure across filters for operability, types of filters to be used, the frequency and types of tests required to measure ventilation system performance, the acceptance criteria, and the actions to be taken if the acceptance criteria are not satisfied.

4. Air monitoring and warning systems associated with the ventilation system, that are required to function during a loss of power, are acceptable if (in addition to performing their specified functions) they are provided with an uninterruptable power supply, unless they can tolerate a temporary loss of function without loss of data, and are provided with a stand-by power supply. Readouts for air monitoring and alarm systems should be acceptable if, in addition to local alarms, central readout and alarm is provided that is accessible during accidents. Certain programmatic aspects of air monitoring and warning systems are reviewed under SRP Section 4.1, “Radiation Safety Program.”

4.2.4.3.5 Shielding

The review criteria below for shielding apply only to TWRS unless otherwise noted upon further understanding of the AVLIS design.

Acceptability of the application should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 20.11o1(b), 20.1201, 20.1301, 20.1501(a), and 10 CFR 70.22(a)(7) related to designing and providing shielding from external radiation sources, and the following Review Criteria, or information describing acceptable alternatives:

1. Facility descriptions (e.g., facility layout diagrams submitted for SRP Section 1.1 or Chapter 3.0) should be acceptable if they describe, in detail, use of and locations where permanent shielding has been included into design to lower dose rates to comply with 10 CFR Part 20 during routine and non-routine operations and anticipated events. Acceptability should also be based on the description of areas that have been provided by design to facilitate

installation and removal of temporary shields for non-routine operations. (Where temporary shielding is to be used, local audible and visible alarming radiation monitors should be installed to alert personnel if shielding is not present, consistent with the external radiation hazard).

2. Shielding provided and/or installed to minimize nonpenetrating external radiation doses, including that to the skin, extremities, and lens of the eye (e.g., for glove box operations with significant dose contributions from Sr-90/Y-90 or bremsstrahlung radiation) should be acceptable if the shielding and features such as penetrations meet design goals and are described in sufficient detail to verify results.

3. The derivation of permanent or temporary shielding requirements and specifications should be acceptable if based on design objectives that are identified in the application. Dose or dose-rate design objectives should be acceptable if specified and based on fractions of Part 20 limits and personnel occupancy predictions, for both continually and intermittently occupied areas of the facility. Occupancy accounts for duration and frequency of exposures, and also accounts for the fact that doses in particular areas may either be occupational (radiation worker) or non-occupational (general employee). An objective, for design purposes, of 20 percent of the applicable annual limits in 10 CFR Part 20 (e.g., 1.0 rem/yr for restricted areas), accounting for occupancy estimates, is acceptable to the staff. For continuously occupied areas, this translates to an average dose rate of 0.5 mrem/hr (20 percent of the occupational dose limit of 5 rem in a 2000 hour work-year). (These objectives are comparable to the design limits of 10 CFR 835.1002.) Notwithstanding this design objective, administrative controls would need to supplement the design objective to further reduce doses consistent with ALARA. Another acceptable design objective is that the use of straight-line penetrations of shield walls should be minimized.

4. Adequacy of provided shielding should be acceptable if, for each instance of shielding associated with reducing doses from high or very high radiation areas, the shielding used and features such as penetrations, shield doors, and labyrinths meet design goals and are described in sufficient detail to verify results. Adequate attenuation can be demonstrated by: (a) analyses (calculations), or (b) reference to similar configurations that were previously analyzed or experimentally verified provided that this reference is clear and specific.

5. Where used, analyses for calculating shielding requirements should be acceptable if described and comparable to commonly acceptable shielding calculations, and if realistic assumptions are used regarding source terms, cross sections, shield and source geometries, and transport methods. Codes used should rely on the use of flux-to-dose conversion factors of ANSI/ANS 6.1.1 and cross sections of ANSI/ANS-6.1.2. (recommends ENDF/B library). Generally, only Monte-Carlo calculational methods would be acceptable to NRC staff for analyses of complex geometries (e.g., shield penetrations). Analyses descriptions are acceptable if provided in sufficient detail to allow independent confirmatory calculations.

6. Selection of shielding materials and decisions between permanent or temporary shielding should be acceptable if they consider facilitation of decommissioning and waste

minimization, in accordance with §20.1406, as one design consideration. Descriptions of the physical and nuclear properties of shielding materials used for various functions in the plant should be acceptable if consistent with ANSI/ANS-6.4.2.

7. In cases where the confinement barrier or process equipment provides the primary shielding and is relied on for safety as determined by the ISA, the quality assurance program is applied to all aspects of the shielding design, procurement, installation, maintenance, etc. For shielding that is relied on for safety, the design and analyses approaches used by the applicant should be described; for concrete, the methods in ANSI/ANS-6.4-1985 should be acceptable.

8. The applicant should commit to and describe a radiation shielding test program that will verify the efficacy of installed shielding materials in meeting the radiation shielding design goals and the regulatory external dose requirements of Part 20. The objective of this effort should be to verify that sufficient shielding has been provided (particularly with regard to penetrations, labyrinths, shield doors, etc.) for the life of the plant, prior to initiation of operations; and to verify that design models and calculations are representative of actual operating conditions with respect to occupational RS.

4.2.4.3.6 Integrated Safety Analyses (ISA)

Acceptability of the application should be based on a finding of reasonable assurance that the applicant would meet those requirements of 10 CFR 70.61, 70.62 and 70.65; the guidance in NUREG-1513 (DRAFT), and the following Acceptance Criteria, or information describing acceptable alternatives. RS assessments that support the ISA should be acceptable if they:

1. Use appropriate and verified assessment methods, computer codes, and literature values.

2. Consider a complete range of credible accident sequences that could adversely affect radiological exposures and cause the consequences of concern.

3. Reasonably estimate radiological consequences (considering source term, transport, and dosimetry) of accident sequences.

4. Identify effective controls to prevent and mitigate accident sequences and radiological consequences of concern.

5. Describe and commit to appropriate management control systems to ensure the continued availability and reliability of safety controls to prevent and mitigate radiological consequences of concern.

4.2.5 REVIEW PROCEDURES

4.2.5.1 Acceptance Review

The primary reviewer should evaluate the application to determine whether it addresses the "Areas of Review" discussed in Section 4.2.3, above. If significant deficiencies are identified, the applicant should be requested to submit additional material before the start of the safety evaluation.

4.2.5.2 Safety Evaluation

After determining that the application is acceptable for review in accordance with Section 4.2.1, above, the primary reviewer should perform a safety evaluation against the acceptance criteria described in Section 4.2.4. The primary reviewer of this SRP chapter coordinates the efforts of the secondary reviewers identified in Section 4.2.2. If necessary, a request for additional information to the applicant should be coordinated with the licensing project manager. The final step should be the preparation of the safety evaluation report (SER) input by the primary reviewer, for the licensing project manager, in accordance with Section 4.2.6, "Evaluation Findings."

The following items should be noted regarding the relationships between the primary reviewer and the secondary reviewers for this SRP chapter in performing the safety review:

1. While this chapter addresses the applicant's RS *design*, the applicant's RS *program* and administrative controls are reviewed under SRP Chapter 4.1, "Radiation Safety Program." However, certain aspects of the program, such as facility access controls, zoning, and security of stored material, can not be cleanly categorized into either "design" or "program." Review of these areas should be coordinated with the reviewer of SRP Section 4.1, "Radiation Safety Program," since they are partially included in SRP Section 4.2.4.3.1, and in SRP Section 4.1.4.3.6 as part of the review of contamination controls.

2. The information in Section 4.2.4.3.1, regarding the facility and process design drawings and descriptions, could be included by a reference to SRP Chapter 1.1, "Facilities and Process Description," or SRP Chapter 3.0, "Integrated Safety Analyses," (which requires additional process description information through 10 CFR Part 70, as revised). The primary reviewer of this SRP chapter should perform the safety evaluation of this information as it pertains to RS, regardless of where it appears in the license application.

3. The RS aspects of the ventilation and air cleaning systems that are reviewed by the primary reviewer of this SRP chapter, should be coordinated with the primary reviewer of SRP Chapter 12.0, "Plant Systems," for the non-RS related aspects of the ventilation and air cleaning systems, to verify that adequate and consistent information was provided.

4.2.6 EVALUATION FINDINGS

The staff's evaluation should verify that the license application provides sufficient information to satisfy the regulatory requirements of Section 4.2.4.1 and that the regulatory acceptance criteria in Section 4.2.4.3 have been appropriately considered in satisfying the requirements. On the basis of this information, the staff should conclude that this evaluation is complete. The reviewers should write material suitable for inclusion in the SER prepared for the entire

application. The SER should include a summary statement of what was evaluated and the basis for the reviewers' conclusions.

The staff can document the evaluation as follows:

The applicant has supplied information on the radiation safety design features and design process for the [insert facility], that demonstrate, with reasonable assurance, that radiation doses will be within the limits of 10 CFR Part 20 and will be as low as is reasonably achievable (ALARA). [Insert a summary statement of what was evaluated and why the reviewer finds the submittal acceptable.] *The applicant has considered contamination control, decommissioning facilitation, and waste minimization, in developing the design features of the facility, as required by 10 CFR 20.1406. Many of the radiation safety design features have been incorporated as a result of the applicant's radiation safety design review and from radiation dose experience gained during the operation of other facilities. [Include examples of design features incorporated to reduce contamination and radiation dose 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.]*

The applicant has made estimates of facility radiation sources capable of producing significant radiation levels, and significant airborne radioactivity, based on (include the applicant's basis for radiation and airborne source terms). These estimates demonstrate a conservative approach and are acceptable.

The applicant has described organizational relationships and responsibilities with respect to performing radiological design reviews, that ensure the adequate application of ALARA in design stage activities, and to plant modifications made during construction and operations.

The general shielding design and analysis methodology used by the applicant is consistent with industry practice and is acceptable. The applicant has provided an adequate treatment of features requiring special analyses, such as cell penetrations, and has shown by calculation that doses in work areas meet requirements. The basic radiation transport analysis used for the applicants' shield design is based on (list appropriate shielding computer codes used).

The ventilation system at (plant name) is 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.

The NRC staff concludes that there is reasonable assurance that the applicant's radiation safety design process and design features are adequate and, in concert with an effective

radiation safety program of SRP Section 4.1, satisfy the requirements of 10 CFR Parts 20 and 70.

4.2.7 REFERENCES

All referenced documents in the Acceptance Criteria for this review area have been listed in Section 4.2.4.2, and are not repeated here. However, in addition to those documents, the following references contain information that is specific to nuclear reactors (or other nuclear facilities), but which is also relevant to this review area. Applicants may choose to reference portions of these documents in the SAR, with adequate justification, and provide that these references are clear and specific.

1. Nuclear Regulatory Commission (U.S.) (NRC). Regulatory Guide 1.33, Rev. 2, "Quality Assurance Program Requirements (Operational)." NRC: Washington, D.C. February 1978.

2. Nuclear Regulatory Commission (U.S.) (NRC). Regulatory Guide 8.8, Rev. 3, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be as Low as is Reasonably Achievable." NRC: Washington, D.C. June 1978.

3. International Committee on Radiological Protection (ICRP) Publication 55, "Optimization and Decision Making in Radiological Protection." ICRP: Oxford. 1989.

4. American National Standards Institute/American Society of Mechanical Engineers, ANSI/ASME N509-1989, "Nuclear Power Plant Air Cleaning Units and Components." ANS: LaGrange Park, Illinois.

5. Nuclear Regulatory Commission (U.S.) (NRC). Regulatory Guide 1.97, Rev. 3, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident." NRC: Washington, D.C. May 1983.

6. American National Standards Institute/American Nuclear Society, ANSI/ANS 6.3.1-1987, "Program for Testing Radiation Shields in Light Water Reactors (LWR)." ANS: LaGrange Park, Illinois.