9.0 RADIATION SAFETY
9.1 RADIATION SAFETY DESIGN FEATURES

9.1.1 PURPOSE OF REVIEW

The purpose of this review is to determine with reasonable assurance that the applicant's design for construction and operation of the facility is adequate to protect the radiological health and safety of 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 section also facilitates the review of the radiation safety aspects of accident sequences described in the Integrated Safety Analysis (ISA) Summary, through an interface with SRP Chapter 5.0.

The protection of members of the public and the control of effluent releases is not included in this section, but is covered in SRP Chapter 10.0, "Environmental Protection." While this chapter addresses the review of the applicant's radiation safety design as applied to construction and operation of the facility, the applicant's radiation protection program and management measures are reviewed under SRP Section 9.2, "Radiation Protection Program."

9.1.2 RESPONSIBILITY FOR REVIEW

Primary: Health Physicist

Secondary: Project Manager, Environmental Reviewer, ISA Reviewer, Fire Protection Engineer, Emergency Protection Specialist, and the Primary Reviewer of SRP Section 9.2 (if different from the primary reviewer for Section 9.1).

Supporting: None

9.1.3 AREAS OF REVIEW

As established in 10 CFR 20.1101, the applicant is required to use, to the extent practical, engineered controls based on sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA; see Items A-E). The applicant is also required to establish controls and management measures to meet the performance requirements established in proposed 10 CFR 70.61 (see Item F). The areas of review include:

A. ALARA Design Considerations

i. Organizational relationships and responsibilities with respect to performing radiological design reviews;

ii. Application of ALARA into design-stage collective dose estimates;

iii. Descriptions and elements of the design review process for radiation protection; and

iv. How the applicant used experience from past designs and from operating plants to develop improved radiation protection design, when ALARA threshold values are exceeded.

B. Facility Design Features

i. Proposed equipment and facility design features and facility layout as they relate to occupational radiation protection and ALARA concepts;

ii. The design features incorporated to minimize contamination and waste production, and facilitate ease of operations, maintenance, replacement, and decommissioning consistent with maintaining doses at levels that are ALARA;

iii. Facility design goals as they relate to radiation safety; and

iv. A self-assessment of the individual and collective doses via 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.

C. Source Identification

i. The sources of radiation and contamination in the facility during routine and non-routine operations (e.g., maintenance) including anticipated events; and

ii. The sources of radiation that are used to evaluate consequences in the ISA Summary.

iii. Source identification describes the pertinent information needed for:

a. Input to shielding codes used in the design process (Item E);
b. Establishing related facility design features (Items A and C);
c. Plans and procedures development; and
d. Assessment of occupational dose (Item C).

iv. The methods for estimating source magnitudes and locations at the design stage and how this information is incorporated into the design.

D. Ventilation Systems and Glovebox Design

i. The design and operation of the ventilation systems and gloveboxes as described in support of Chapter 11.0, "Plant Systems," as related to radiological safety, including the:

a. Proposed design objectives;
b. Design and operation; and
c. Monitoring and alarms.

E. Shielding Evaluations

i. Shielding information for each of the radiation sources identified in Item C;

ii. The criteria for penetrations;

iii. Shielding materials;

iv. The methods (e.g., codes) by which the shield parameters (e.g., attenuation coefficients, buildup factors) were determined; and

v. Special protective features that use shielding, geometric arrangement, or remote handling to ensure that occupational radiation exposures will be ALARA in normally occupied areas.

F. Integrated Safety Analysis (ISA)

i. Postulated accident types of accident sequences in the ISA which have radiation safety consequences for workers, including all high and a sample of lower risk accident sequences that result in radiation doses of concern and accidents that result from operations and natural phenomena;

ii. If the applicant’s proposed controlled area (as identified under Item B) includes individuals who are not workers, as defined in 10 CFR 70.4, the applicant describes the training program and postings for these individuals as required under proposed 10 CFR 70.61(f)(2) (Training and postings may be cross-referenced with Sections 9.2).

iii. The methodology in assessing the accident consequences. In particular, the primary reviewers of this SRP section should focus on the ISA source terms (see Item B), transport, and dosimetry analyses;

iv. The items relied on for safety, and associated management measures, to prevent or mitigate each accident sequence that results in radiological consequences in excess of the performance requirements of proposed 10 CFR 70.61.

9.1.4 ACCEPTANCE CRITERIA

Each subject area lists the applicable regulatory requirements and the NRC Regulatory Guides (RGs), NUREG reports, Branch Technical Positions (BTPs), and industry standards that provide a basis that is generally acceptable to the NRC staff for satisfying the applicable regulatory requirements. However, in some cases the use of industry standards has not been endorsed by NRC through a regulation or RG. Further, inclusion in this section is not necessarily an endorsement of a particular standard by NRC. Therefore, their use is encouraged, but alternative, equivalent methods may be proposed in the application with adequate justification.

9.1.4.1 ALARA Design Considerations

9.1.4.1.1 Regulatory Requirements

10 CFR 20.1101(b)	Radiation Protection Programs
10 CFR 20.1406	Minimization of Contamination
10 CFR 20.1501(a)	Surveys--General
10 CFR 70.22(a)(4) and (7)	Contents of Applications
Proposed 10 CFR 70.64	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.1.2 Regulatory Guidance

RG 8.10, Rev. 1-R Sept 1975	Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable

9.1.4.1.3 Regulatory Acceptance Criteria

The requirements related to ALARA design considerations are specified in Section 9.1.4.1.1. The applicant's ALARA design considerations should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives, are met:

A. The applicant defines organizational functions that have the responsibility for performing radiological design and design reviews.

B. The applicant's design and design activities, with respect to radiation protection, incorporate provisions to ensure:

   i. Measures for reducing the need for time spent in radiation areas;

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

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

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

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

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

vii. A commitment to, and description of, continuing radiation safety (ALARA) design reviews for facility or process modifications made during construction and operations.

C. The radiation protection (ALARA) design review process includes:

i. Design reviews and dose assessments performed by competent personnel including (or with the concurrence of) radiation safety staff and radiation safety management;

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

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

iv. Design reviews that are graded based on the hazard (e.g., are compared to defined ALARA trigger levels).

D. The applicant's process for seeking radiation protection related design improvements includes a description of how radiation protection related design improvements are sought, considered, and incorporated where practicable (RG 8.10, C.1(f)).

9.1.4.2 Facility Design Features

9.1.4.2.1 Regulatory Requirements

10 CFR 20.1101(b)	Radiation Protection Programs
10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1406	Minimization of Contamination

10 CFR Part 20 Subpart H	Control of Exposure from External Sources in Restricted Areas
10 CFR 20.1701	Use of Process or Other Engineering Controls
10 CFR 70.22(a)(4) and (7)	Contents of Applications
10 CFR 70.23(a)(3)	Requirements for Approval of Applications
Proposed 10 CFR 70.61(f)	Performance Requirements for New Facilities
Proposed 10 CFR 70.64(b)	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.2.2 Regulatory Guidance

RG 3.29, May, 1975	Preheat and Interpass Temperature Control for the Welding of Low-Alloy Steel for Use in Fuel Reprocessing Plants and in Plutonium Processing and Fuel Fabrication Plants

9.1.4.2.3 Regulatory Acceptance Criteria

The requirements related to facility design features are specified in Section 9.1.4.2.1. The applicant's facility design features should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives, are met:

A. The facility and process drawings and descriptions identify clearly-readable and scaled radiation safety design features that are:

   i. Relied on to reduce doses to meet 10 CFR Part 20 during routine and non-routine operations (including anticipated events); and

   ii. Items relied on for safety to reduce accident doses.

B. The identification of the features in Item A include:

   i. Locations of detectors and alarm systems;

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

   iii. Provisions for installation/removal of temporary shielding;

   iv. Locations and access control points for restricted areas;

v. The controlled area, including the applicant's means to limit access to the controlled area for any reason;

vi. The restricted area;

vii. Change rooms, showers, and locker rooms; and

viii. The contamination control, decommissioning facilitation, and waste minimization design features required by 10 CFR 20.1406. (The reviewer should also refer to SRP Chapter 10.0.)

C. The applicant's self-assessment of the submitted facility design, shielding, layout, traffic patterns, expected maintenance, and sources shows that both collective and individual doses from significant activities are within the limits of 10 CFR Part 20, ALARA, and meet facility design goals 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.

D. Worker access controls for high and very high radiation areas 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 are adjacent to shower and decontamination facilities and are provided with ventilation systems that filter dispersible radionuclides. Administrative (i.e., programmatic) aspects of access control and storage are reviewed under SRP Section 9.2.5.8, "Contamination Control."

9.1.4.3 Source Identification

9.1.4.3.1 Regulatory Requirements

10 CFR 70.22(a)(4) and (7)	Contents of Applications
Proposed 10 CFR 70.64	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.3.2 Regulatory Guidance

RG 8.10, Rev. 1-R Sept 1975	Operating Philosophy for Maintaining Occupational Radiation Exposures as Low as is Reasonably Achievable

9.1.4.3.3 Regulatory Acceptance Criteria

The requirements related to source identification are specified in Section 9.1.4.3.1. The applicant's source identification should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives, are met:

A. Internal and External Dose Considerations

The applicant provides quantitative descriptions and estimates of contained sources (RG 8.10, C.2(a)) and uses the quantitative descriptions as the basis for the radiation protection program, the internal radiation protection program, the ventilation system design, and the shield design calculations with consideration of routine and non-routine operations, including anticipated events and accident conditions. The quantitative descriptions include:

i. Tabulations of the calculated concentrations of radioactive material, by isotopic composition, expected during routine and non-routine operations including anticipated events, and accident conditions, for equipment cubicles, corridors, and operating areas normally occupied by operating personnel; and

ii. The models and parameters (e.g., source strength or geometry) for the calculations and the basis for the values used.

B. The contained and airborne radioactivity sources estimated at the design stage are based on an assumption of several years of facility operation. The applicant identifies specific assumptions, discusses uncertainties, and justifies the conservatism of each assumption.

9.1.3.4 Ventilation Systems and Glovebox Design

9.1.4.9.1 Regulatory Requirements

10 CFR 20.1101(b)	Radiation Protection Programs
10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1501(a)	Surveys--General
10 CFR 20.1701	Use of Process or Other Engineering Controls
10 CFR 70.22(a)(4) and (7)	Contents of Applications
Proposed 10 CFR 70.64	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.4.2 Regulatory Guidance

ANSI/ASME N510-1980 (1989)	Testing of Nuclear Air Cleaning Systems
ERDA 76-21	Nuclear Air Cleaning Handbook, C. A. Burchsted, A. B. Fuller, J. E. Kahn

9.1.4.4.3 Regulatory Acceptance Criteria

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 radiation protection (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, heating and air conditioning, accident functions, controlling chemical exposures, reducing effluent releases, etc.). Explicit acceptance criteria related to the ventilation design, testing, redundancy, capacity and capability, monitoring, environmental qualifications, natural phenomena, fire protection, air supply, removal and replacement of filters, and gloveboxes can be found in Section 11.4.5.

The requirements related to radiation safety for ventilation and glovebox design are specified in Section 9.1.4.4.1. The applicant's ventilation and glovebox design, as related to radiation safety, should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives are met:

A. The applicant demonstrates that the design and operation of the ventilation system and/or gloveboxes 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 Energy Research and Development Administration (ERDA) 76-21 (see also Section 11.4.5).

B. The applicant commits to design objectives for ventilation systems and gloveboxes that ensure that:

    i. 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; and

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

C. Air monitoring and warning systems associated with the ventilation system and gloveboxes, that are required to function during a loss of power (in addition to performing their specified functions) 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. In addition to local alarms, the applicant provides readouts for air monitoring and alarm systems that are accessible during accidents. Certain programmatic aspects of air monitoring and warning systems are reviewed under SRP Section 9.2, "Radiation Protection Program."

9.1.4.5 Shielding

9.1.4.5.1 Regulatory Requirements

10 CFR 20.110(b)	Radiation Protection Programs
10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1501(a)	Surveys--General
10 CFR 20.1701	Use of Process or Other Engineering Controls
10 CFR 70.22(a)(4) and (7)	Contents of Applications
Proposed 10 CFR 70.64	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.5.2 Regulatory Guidance

ANSI/ANS 6.4.2-1985	Specification of Radiation Shielding Materials

9.1.4.5.3 Regulatory Acceptance Criteria

The requirements related to shielding are specified in Section 9.1.4.5.1. The applicant's shielding design should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives, are met:

A. The applicant's facility descriptions (e.g., facility layout diagrams submitted for SRP Section 1.1 or Chapter 5.0) detail the use of and locations where the applicant included permanent shielding into the design to lower dose rates to comply with 10 CFR Part 20 during routine and non-routine operations and anticipated events. The applicant identifies and describes any areas that facilitate installation and removal of temporary shields for non-routine operations. (Where the applicant identifies the use of temporary shielding, local audible and visible alarming radiation monitors are installed to alert personnel if shielding is not present, consistent with the external radiation hazard). The use of permanent shielding is consistent with the external sources identified under Section 9.1.4.2.3(A).

B. Shielding design to minimize external and internal doses meets design goals and is described in sufficient detail to verify results.

C. The applicant derives permanent or temporary shielding requirements and specifications based on identified design objectives. The applicant's specified dose or dose-rate design objectives are based on fractions of 10 CFR 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 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, management measures 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.

D. For each instance the applicant provides 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. The applicant demonstrates adequate attenuation through:

   i. Analyses (calculations); or

   ii. Reference to similar configurations that were previously analyzed or experimentally verified.

E. The applicant commits to and describes 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 10 CFR Part 20. The applicant's objective for this commitment is to verify that the applicant provided sufficient shielding (particularly with regard to penetrations, labyrinths, shield doors, etc.) for the life of the facility, prior to initiation of operations; and to verify that design models and calculations are representative of actual operating conditions with respect to occupational radiation protection.

F. Shielding and features such as penetrations provided and/or installed to minimize non-penetrating external radiation doses, including that to the skin, extremities, and lens of the eye, meet design goals and are described in sufficient detail to verify results.

G. Where used, the applicant's analyses for calculating shielding requirements are comparable to commonly acceptable shielding calculations and use realistic assumptions regarding source terms, cross sections, shield and source geometries, and transport methods. The applicant uses codes that 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 calculation methods would be acceptable to NRC staff for analyses of complex geometries (e.g., shield penetrations). The applicant's analyses descriptions are acceptable if provided in sufficient detail to allow independent confirmatory calculations.

H. The applicant considers facilitating waste minimization in accordance with §20.1406 in its selection of shielding materials and the decision between permanent or temporary shielding,

as one design consideration. The applicant's descriptions of the physical and nuclear properties of shielding materials used for various functions in the facility are consistent with ANSI/ANS-6.4.2.

I. 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.

9.1.4.6 Integrated Safety Analyses (ISA) Summary

9.1.4.6.1 Regulatory Requirements

Proposed 10 CFR 70.61	Performance Requirements
Proposed 10 CFR 70.62	Safety Program and Integrated Safety Analysis
Proposed 10 CFR 70.64	Requirements for New Facilities or New Process at Existing Facilities

9.1.4.6.2 Regulatory Guidance

NUREG-1513 (DRAFT 1998) *Integrated Safety Analysis Guidance Document*

9.1.4.6.3 Regulatory Acceptance Criteria

The requirements related to the ISA Summary are specified in Section 9.1.4.6.1. The applicant's ISA Summary as it applies to design for radiation protection should meet the regulatory requirements if the following regulatory acceptance criteria, or information describing acceptable alternatives, are met:

A. The applicant uses appropriate and verified assessment methods, computer codes, and literature values.

B. The applicant considers a complete range of credible accident sequences that could adversely affect radiation protection and cause the consequences of concern described in proposed 10 CFR 70.61.

C. The applicant makes reasonable estimates of the radiological consequences to workers (considering source term, transport, and dosimetry) of accident sequences. (Note that radiological consequences to the public and chemical consequences resulting from licensed material or hazardous chemicals resulting from licensed material to the workers and public are evaluated in Chapters 10.0 and 8.0, respectively.)

D. The applicant identifies effective controls and management measures to prevent and mitigate accident sequences and radiological consequences of concern for workers.

E. If the applicant's controlled area could be occupied by individuals who are not workers, as defined in 10 CFR 70.4, the applicant provides training and postings in accordance with 10 CFR 19.12(a)(1)-(5) and 10 CFR 19.11(a), respectively.

F. The applicant describes and commits to appropriate management measures to ensure the continued availability and reliability of safety controls to prevent and mitigate radiological consequences of concern for workers.

9.1.5 REVIEW PROCEDURES

9.1.5.1 Acceptance Review

The primary reviewer should perform an acceptance review to determine if the application for construction approval or the license application adequately addresses the items in Section 9.1.3, "Areas of Review."

Guidance specific to the application for construction approval and the license application is provided below.

A. Application for Construction Approval

   Specifically, the safety assessment of the design basis should address Section 9.1.3(A)-(E) consistent with the level of design. Where information is under development or not yet available, the applicant may use a commitment to provide the material with the license application in lieu of the actual material.

B. License Application

   Specifically, the safety assessment of the license application should update the material provided in the application for construction approval and address Section 9.1.3(A)-(F) in full.

If the primary reviewer verifies that radiation safety design features are adequately addressed in the application for construction approval or the license application, the primary reviewer should accept the application for the safety evaluation in Section 9.1.5.2. If the primary reviewer identifies significant deficiencies in the material provided, the primary reviewer should request that the applicant submit additional information prior to the start of the safety evaluation.

9.1.5.2 Safety Evaluation

After determining that the application is acceptable for review in accordance with either Section 9.1.5.1(A) (application for construction approval) or 9.1.5.1(B) (license application), the primary reviewer should perform a safety evaluation against the acceptance criteria described in

Section 9.4. On the basis of its review, the staff may request that the applicant provide additional information or modify the application to meet the acceptance criteria in SRP Section 9.4.

Guidance specific to the application for construction approval and the license application is provided below.

A. Application for Construction Approval

The primary reviewer should establish that the applicant's facility design as described in the safety assessment of the design basis and other commitments, as they relate to radiation safety, meet or exceed the regulatory acceptance criteria in Section 9.1.4.

The primary reviewer should coordinate the radiation safety design aspects of the ventilation, gloveboxes, and air cleaning systems of this SRP section, with the primary reviewer of SRP Chapter 7.0, "Fire Protection," and the primary reviewer of SRP Chapter 11.0, "Plant Systems," to ensure that the application for construction approval contains adequate and consistent information and that conflicts do not exist between the various technical areas.

B. License Application

While this section addresses the applicant's radiation safety *design*, the applicant's radiation protection *program* and management measures are reviewed under SRP Chapter 9.2, "Radiation Protection Program," with the license application. Certain aspects of radiation safety, such as facility access controls, zoning, and security of stored material, can not be cleanly categorized into either "design" or the "radiation protection program." Review of these areas should be coordinated with the reviewer of SRP Section 9.2, "Radiation Protection Program." The review should confirm that appropriate aspects of the radiation design, updated from the construction approval stage, are fed appropriately into the radiation protection program. Other considerations include:

i. The information in Section 9.1.4.2, regarding the facility and process design drawings and descriptions, could be included by a reference to SRP Chapter 1.1, "Facilities and Process Overview," or SRP Chapter 5.0, "Integrated Safety Analyses," (which requires additional process description information through proposed 10 CFR Part 70 Subpart H). The primary reviewer should perform the safety evaluation of this information as it pertains to radiation protection design, regardless of where it appears in the application. Particularly, the primary reviewer should confirm with the emergency protection specialist and the physical protection specialist that the applicant is able to limit access to the controlled area.

ii. The primary reviewer should coordinate the updated radiation safety design aspects of the ventilation, gloveboxes, and air cleaning systems of this SRP section, with the primary reviewer of SRP Chapter 7.0, "Fire Protection," to ensure that the fire protection related aspects of the ventilation, gloveboxes, and air cleaning systems are not in

conflict with radiation protection and with the primary reviewer of SRP Chapter 11.0, "Plant Systems," for the non-radiation protection related aspects of the ventilation and air cleaning systems, to verify that the license application contains adequate and consistent information.

When the safety evaluation is complete, the primary reviewer, with assistance from the other reviewers, should prepare the radiation safety design input for the Safety Evaluation Report (SER), as described in Section 9.1.6 using the acceptance criteria from Section 9.1.4. The secondary reviewer should coordinate the radiation safety design input with the balance of the reviews and the SER.

9.1.6 EVALUATION FINDINGS

The primary reviewer should document the safety evaluation by preparing material suitable for inclusion in the SER. The primary reviewer should describe the review, explain the basis for the findings, and state the conclusions.

The staff could document the safety evaluation for the application for construction approval as follows:

The staff reviewed the application for construction approval for [insert facility name] to according to Section 9.1 of NUREG-1718. The staff evaluated [insert a summary statement of what was evaluated] and found [insert a summary statement of the findings]. The applicant estimated the 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 for the current level of design and are acceptable.

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

The general shielding design and analysis methodology used by the applicant is acceptable. The applicant 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 applicant's shield design is based on [list appropriate shielding computer codes used].

The ventilation system at [facility name] should ensure that worker exposures do not exceed the performance requirements of 10 CFR Part 70 under accident conditions.

The NRC staff concludes that there is reasonable assurance that the applicant's radiation safety design process and design features meet the requirements of 10 CFR Part 70.

The staff could document the safety evaluation for the license application as follows:

The staff reviewed the license application for [insert facility name] to possess and use SNM according to Section 9.1 of NUREG-1718. The staff evaluated [insert a summary statement of what was evaluated] and found [insert a summary statement of the findings]. The applicant supplied information on the radiation safety design features and design process 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). The applicant considered contamination control, decommissioning facilitation, and waste minimization in developing the design features of the facility, as required by 10 CFR 20.1406. The applicant also incorporated radiation safety design features as a result of the applicant's radiation safety design review and from radiation dose experience gained during the operation of other facilities.

The applicant 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 described organizational relationships and responsibilities with respect to performing radiological design reviews, which ensure the adequate application of ALARA in design stage activities, including future facility modifications.

The general shielding design and analysis methodology used by the applicant 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 [facility name] is designed to ensure that facility personnel are not inadvertently exposed to airborne contaminants exceeding those given in 10 CFR Part 20.

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 9.1, satisfy the requirements of 10 CFR Parts 20 and 70.

9.1.7 REFERENCES

All documents referenced in the acceptance criteria for this review area have been listed in Sections 9.1.4.1-9.1.4.6 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 either the application for construction approval or the license application, with adequate justification.

A. Regulatory Guide 1.33, Rev. 2, *Quality Assurance Program Requirements (Operational)*, U.S. Nuclear Regulatory Commission, February 1978.

B. 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*, U.S. Nuclear Regulatory Commission, June 1978.