9.0 RADIATION SAFETY
9.2 RADIATION PROTECTION PROGRAM

9.2.1 PURPOSE OF REVIEW

The purpose of this review is to determine whether the applicant's radiation protection program is adequate to protect the radiological health and safety of the workers and to comply with the regulatory requirements of 10 CFR Parts 19, 20, and 70.

The applicant's program for protection of members of the public and control of effluent releases is not included in this Chapter but is in SRP Chapter 10.0, "Environmental Protection." While this chapter addresses the review of the applicant's radiation protection program, radiation safety design aspects of the facility and the radiation protection aspects of the Integrated Safety Analysis (ISA) Summary are reviewed under SRP Chapter 9.1, "Radiation Safety Design Features."

9.2.2 RESPONSIBILITY FOR REVIEW

Primary: Health Physicist

Secondary: Project Manager, Environmental Reviewer, ISA Reviewer, and Quality Assurance Reviewer

Supporting: Fuel Cycle Facility Inspector

9.2.3 AREAS OF REVIEW

As specified in 10 CFR Part 20, the applicant is subject to very specific requirements for workers' protection against radiation. 10 CFR 20.1101 requires the applicant to develop, document, and implement a radiation protection commensurate with the scope and extent of licensed activities. The requirements for a radiation protection program are specified in 10 CFR 20.1101(a), (b), (c), and (d). The areas of review should include:

A. As Low As Reasonably Achievable (ALARA)

   i. The applicant's management policy and commitments for ALARA;

   ii. ALARA considerations for design (see Section 9.1);

   iii. ALARA considerations for operations, including:

      a. The system for operational ALARA goals, along with their bases, and a qualitative description of how the applicant will achieve the goals (i.e., numerical goals are not expected, but the applicant should commit to achieving ALARA goals and describe a methodology for achieving them); and

b. Trend analysis.

iv. The planned organizational structure and how units of that structure interact to maintain occupational doses ALARA (e.g., the ALARA Committee);

v. The applicable activities and audits carried out by the individuals in management having responsibility for radiation safety and trend analyses.

B. Organizational Relationships and Personnel Qualifications

i. The applicant's organization of the radiological protection program and the organizational relationships between the positions identified as responsible for radiation protection functions and other line managers;

ii. The qualification requirements for the radiological protection personnel; and

iii. The assignment of specific responsibilities and authorities for key functions.

C. Radiation Safety Procedures and Radiation Work Permits (RWPs)

The applicant's commitments regarding the development, control, and use of approved written radiation safety procedures and RWPs for activities related to radiological safety.

D. Training

The applicant's radiological safety training for all personnel who have authorized access to a restricted area, including:

i. Training objectives;
ii. Management oversight;
iii. Methodology of training;
iv. Who receives the training;
v. A description and the frequency of the training and refresher training; and
vi. The effectiveness of the training.

E. Air Sampling

The applicant's radiological air sampling objectives, methods, and criteria in developing sampling procedures, including:

i. The frequency and methods of analysis of airborne concentrations;
ii. Sampling methods and frequency;
iii. Counting techniques;
iv. Lower limits of detection for specific radionuclides;
v. Specific calculations for concentrations;

vi. Establishment of action levels;
vii. Location of continuous air monitors (CAMs), if used; and
viii. Annunciators and alarms associated with CAMs.

F. Contamination Control

The applicant's control of radiological contamination within the facility, including:

i. The types and frequency of surveys;
ii. Administrative contamination threshold levels;
iii. The methods and choice of instruments used in the surveys;
iv. Establishment of action levels; and
v. The design features to control access, including:

a. Technical criteria and levels defining contamination and high contamination areas;
b. The types and availability of contamination monitoring equipment;
c. Specific limits established for personnel decontamination;
d. Minimum provisions for personnel decontamination;
e. The minimum types of clothing needed to enter contaminated areas;
f. The release criteria for contaminated materials; and
g. The frequency of periodic review of all aspects of access control.

G. External Exposure

The applicant's program for monitoring personnel external radiation exposure, including:

i. The means to measure, assess, and record personnel exposure to radiation; and

ii. The method and criteria to select the type, range, sensitivity, and frequency for analyzing personnel dosimeters and the action levels.

H. Internal Exposure

The applicant's method and criteria to develop a program for monitoring personnel internal radiation exposure, including:

i. Criteria for determining when it is necessary to monitor an individual's internal exposure;
ii. Methods for determining the worker intake;
iii. Frequency of analysis;
iv. Minimum detection levels; and
v. Setting action levels.

I. Summing Internal and External Exposure

The applicant's program for summing internal and external exposure to demonstrate compliance with the dose limits, including the method used to develop procedures for assessing worker's exposures in accordance with NRC regulatory requirements.

J. Respiratory Protection

The applicant's respiratory protection program, including:

i. The equipment to be used;

ii. The conditions under which respiratory protection will be required for routine and nonroutine operations;

iii. The protection factors that will be applied when respirators are being used; and

iv. The criteria for locating the respiratory equipment within the plant.

K. Instrumentation

The applicant's methods for selection of radiological measurement instrumentation, including:

i. The policy for the maintenance and use of operating instrumentation; and
ii. The types of instruments that are available, including their:

a. Ranges;
b. Counting mode;
c. Sensitivity;
d. Alarm setpoints;
e. Planned use; and
f. Frequency of calibration.

9.2.4 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 SRP is not necessarily an endorsement of a particular standard by NRC. Therefore, their use is encouraged, but the applicant may propose alternative, equivalent methods with adequate justification.

9.2.4.1 ALARA (As Low As Is Reasonably Achievable)

9.2.4.1.1 Regulatory Requirements

10 CFR 19.12	Instruction to Workers
10 CFR 20.1101(b)	Radiation Protection Program
10 CFR 20.2102	Records of Radiation Protection Programs
10 CFR 20.2110	Forms of Records

9.2.4.1.2 Regulatory Guidance

RG 8.10, Rev.1-R, May 1977	Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable

9.2.4.1.3 Regulatory Acceptance Criteria

The requirements related to ALARA in the applicant's radiation protection program are specified in Section 9.2.4.1.1. The applicant's program should meet the regulatory requirements if the following acceptance criteria are met:

A. Management's ALARA Policies and Commitments

The applicant provides a clear management commitment to policies and provisions for maintaining individual and collective doses at levels that are ALARA. The applicant's approach addresses the regulatory guidance of RG 8.10, and ensures:

i. That the management commitment will be communicated to all plant personnel through policy statements, instructions to personnel, and similar documents, as well as direct communication, training, and inspection of the workplace.

ii. That the management clearly defined the responsibilities of individuals to implement the ALARA policy.

iii. That the radiation safety manager will have the appropriate authority and independence to prevent unsafe practices.

iv. The qualification and appropriate staffing of the radiation safety organization, commensurate with size and complexity of the radiation protection program.

v. That workers and management will be held accountable for their radiological work performance through a review process or other similar method.

vi. That procedures and engineering controls will include formal plans and measures for applying the ALARA process to occupational exposures.

vii. That modifications to procedures, facilities, and equipment will be justified with respect to optimization of ALARA.

viii. That actions taken to maintain occupational exposures ALARA are documented as part of the radiation protection program.

ix. That performance reviews of ALARA actions are included as part of the radiation protection program review.

x. That individuals likely to receive an occupational dose in excess of 100 mrem (1 mSv) in a year (per 10 CFR 19.12) are instructed on procedures and equipment used to maintain doses ALARA.

B. Design Considerations

Facility and construction design aspects related to ALARA should be reviewed using SRP Section 9.1.

C. Operational Considerations:

The applicant's operational considerations for ALARA are consistent with RG 8.10, particularly as it relates to the performance of the radiation safety officer (RSO) and radiation protection staff.

i. The applicant establishes a system of operational radiological performance goals (also called ALARA goals). The applicant's bases for goals could be collective dose, contamination events, intakes of radioactive material, contamination areas, radioactive waste generation, and liquid and gaseous releases. The applicant's:

a. Goals are measurable, realistic, auditable, and challenging;

b. Senior management periodically reviews the goals and progress towards meeting them; and

c. Goals are evaluated and adjusted accordingly on at least an annual basis.

ii. RSO and radiation protection staff periodically review doses associated with procedures, RWPs, and ALARA goals to identify trends (with special audits for unusual exposures). The applicant commits to perform trending analyses of key performance indicators during facility operation. Examples of key performance indicators are:

a. Radiation exposures of plant workers through bioassay results, contamination surveys, and direct measurements;

b. Concentrations of airborne radioactivity in plant areas;

c. Radioactive contamination in plant areas and on equipment;

d. Operation/malfunctions of radiation measurement instrumentation and respiratory protection equipment;

e. Concentrations of radioactive material in gaseous and liquid effluents (see SRP Chapter 10.0); and

f. Operation of effluent treatment systems (see SRP Chapter 10.0).

iii. Adequate equipment and supplies are available to the radiation protection staff to perform all personnel dosimetry, environmental monitoring, and bioassay functions.

iv. The applicant establishes a system for receiving and reviewing radiation protection related suggestions from employees, and workers are made knowledgeable of the process [RG 8.10 C.2(b)1].

v. A system of pre-planning work exists such that progressively higher levels of approval are required for higher-dose activities.

D. ALARA Committee

The applicant commits to an ALARA Committee that is based on the designation and assigned responsibility and authority for implementing the applicant's ALARA policy and commitments, including the following elements:

i. The ALARA committee is shown to be an organizational structure in which radiation protection personnel will interact, in a timely manner, with production personnel to ensure the methods and techniques for reducing occupational dose are incorporated in facility operation.

ii. The ALARA committee membership includes a chairman and management or worker representatives from the radiation protection organization, environmental organization, engineering, safety, maintenance, and production.

iii. The ALARA committee performs or receives the results of audits of the radiation protection program at least annually and reviews the results of the radiation organization's internal audits.

iv. The ALARA committee evaluates all major design activities, experiments, or plant modifications that could effect radiation levels, doses, and radioactivity levels in liquid and gaseous effluents. The ALARA committee considers the results of the ISA in determining whether further reduction in occupational radiation doses are reasonable.

v. The ALARA committee evaluates trend analyses and the adequacy and implementation of radiological performance (ALARA) goals.

vi. The applicant commits to track the reviews and recommendations of the ALARA committee to completion.

9.2.4.2 Organizational Relationships and Personnel Qualifications

9.2.4.2.1 Regulatory Requirements

10 CFR 70.22(a)(6)	Contents of Applications
10 CFR 70.23(a)(2)	Requirements for Approval of Applications

9.2.4.2.2 Regulatory Guidance

RG 8.10, Rev.1-R, May 1977	Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable

9.2.4.2.3 Regulatory Acceptance Criteria

The requirements for organizational relationships and personnel qualifications related to radiation protection are listed in Section 9.2.4.2.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The organizational relationships clearly identify radiation protection functions and responsibilities of the radiation protection staff, and the operations, support, and engineering organizations. Additionally, each position with radiation protection functions that include authorities and responsibilities (such as those identified in RG 8.10, C.1(c)) is defined and identified. Radiation protection functions include those of the RSO, radiation staff (specialists and technicians), radiation protection engineering, the radiation training, radiation monitoring and surveillance, dosimetry and counting services, and radiation protection auditing.

   i. The RSO (or equivalent) has direct responsibility for establishing and implementing the radiation protection program, has input to facility design and operational planning, has assigned organizational emergency duties through the site emergency plan, has stop-work authority, will be independent of operations, and has direct access to the plant manager [see RG 8.10, C.1(e)].

   ii. The functional organization of the radiation protection staff shows that radiation protection specialists have responsibility for specific activities assigned to the radiation protection program (e.g., dosimetry, surveys, audits, bioassay, and calibration) with radiation protection technicians implementing these functions.

B. The plant manager, or equivalent, has overall responsibility and authority for safety.

C. The minimum staffing of the radiation protection organization ensures that, by shift, all routine radiation functions can be performed in a timely manner and that all radiation requirements can be met during routine operations, non-routine operations such as anticipated events, and accidents. For periods of extended absence of the RSO (because of vacations, illness, etc.), a substitute with equivalent qualifications (see Item E) and training (e.g., emergency management duties) is available to act on his or her behalf.

D. If radiation technical support or audit activities (e.g., instrument calibration and dosimetry) are contracted to qualified off-site corporate or consultant organizations, the contractors are subject to the applicant's quality assurance (QA) program and QA controls.

E. The radiation protection personnel qualifications are based on the following education and experience criteria:

   i. The RSO has a bachelor's degree in science or engineering and at least 5 years experience in health physics with at least one year at a uranium or plutonium processing facility.

   ii. Radiation protection specialists have a bachelor's degree in science and engineering and at least 1 year of experience in applied radiological controls at an operating nuclear facility.

   iii. Radiation protection technicians have a high school diploma or equivalent, technical training commensurate with their assigned duties (e.g., dosimetry, bioassay, etc.), and certification in a technician trainee program.

   An additional five years of experience may be substituted in lieu of a bachelor's degree.

9.2.4.3 Radiation Protection Procedures and Radiation Work Permits (RWPs)

9.2.4.3.1 Regulatory Requirements

10 CFR 20.1101	Radiation Protection Program
10 CFR 70.22	Contents of Applications
10 CFR 70.23	Requirements for Approval of Applications

9.2.4.3.2 Regulatory Guidance

RG 8.10, Rev.1-R, May 1977	Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable

9.2.4.3.3 Regulatory Acceptance Criteria

The requirements for radiation protection procedures and engineering controls, such as RWPs, are listed in Section 9.2.4.3.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant commits to perform activities involving exposure to licensed material in accordance with written, approved radiation protection procedures and/or RWPs.

B. In support of the applicant's commitment in Item A, the applicant's system for implementing RWPs specifies:

   i. How a determination is made to use an RWP;

   ii. The approval levels and organizational positions authorized to approve and issue RWPs (see Item D);

   iii. The types of information included on an RWP (see Item C);

   iv. Provisions for updating/terminating RWPs, including a system to update RWPs when tasks or environmental changes affect worker safety (see Item F);

   v. A method for ensuring workers are aware of the requirements, controls, restrictions, and limits in an RWP;

   vi. Records to be kept for RWPs and retention times; and

   vii. Final disposition of RWPs.

C. The applicant commits to using RWPs for specific purposes only, and RWPs are reissued when the applicant makes significant changes in the task or changes that affect the safety of workers. The application states that the RWP will include a list of the safety requirements for work conducted under the authorization and include at least the following, as applicable:

   i. The number and identification of personnel working on the task;

   ii. Expected radiological conditions (radiation, contamination, and airborne levels);

   iii. Type and frequency of monitoring and dosimetry (e.g., continuous air monitor [CAM], self-alarming dosimetry);

   iv. Estimated exposure times and doses for the authorization;

   v. Limiting exposure times and doses for the authorization;

vi. Special instructions or equipment (e.g., mock-up required, special shielding required);

vii. Hold points or monitoring points, if applicable;

viii. Personnel protective equipment (PPE) requirements;

ix. Authorization signature and date;

x. Actual doses, time, or other information resulting from the completed work authorization are recorded on the RWP [RG 8.10 C.2(a)];

xi. Expiration/termination date of the RWP; and

xii. The information on RWPs is sufficient to allow independent inspection and reconstruction of the circumstances necessitating the RWP, the factors included, and the results.

D. The RSO (or an individual who has the qualifications of the RSO) reviews and approves radiation protection procedures and RWPs [RG 8.10, C.2(b)]. The applicant requires approval from other organizational groups in the preparation and approval of RWPs to ensure that provisions of the RWP address all potential hazards (not just radiological hazards) and that operations comply with all applicable regulations.

E. The applicant commits to a system that ensures that RWPs are not used past their termination dates. The system includes what types of records are to be kept, the retention times for these records, and the final disposition of the RWP. The record system allows independent auditors to reconstruct the circumstances necessitating the RWP, the factors included, and results.

F. The applicant periodically reviews, revises, and updates radiation protection procedures and/or RWPs to identify situations for reducing doses. The reviews occur at intervals not to exceed 2 years.

G. The applicant provides a mechanism to provide current copies of radiation protection procedures and RWPs to personnel and establishes a system for ensuring that RWPs are not used past their expiration date.

H. The applicant develops, maintains, and uses radiation protection procedures and RWPs under the appropriate QA program requirements in accordance with the applicant's graded QA program (SRP Section 15.1).

I. The applicant commits to the use of special reviews and approvals before conducting an activity involving licensed materials with an RWP that is not covered by a written radiation safety procedure.

9.2.4.4 Radiation Training

9.2.4.4.1 Regulatory Requirements

10 CFR 19.12	Instruction to Workers
10 CFR 70.22(a)(6)	Contents of Applications
10 CFR 70.23(a)(2)	Requirements for the Approval of Applications

9.2.4.4.2 Regulatory Guidance

RG 8.10, Rev.1-R, May 1977	Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable
RG 8.29, Rev.1, Feb. 1996	Instructions Concerning the Risks from Occupational Radiation Exposure
NUREG-0041, Oct. 1976	Manual of Respiratory Protection Against Airborne Radioactive Materials
ASTM C986-1989 r.1995	Developing Training Programs for the Nuclear Fuel Cycle
ASTM E1168-1995	Standard Guide for Radiological Protection Training for Nuclear Facility Workers

9.2.4.4.3 Regulatory Acceptance Criteria

The requirements for radiation training are listed in Section 9.2.4.4.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. All personnel and visitors entering restricted areas either receive radiation protection training or are provided a general indoctrination in site-specific safe practices and escorted by an individual who has received radiation training; or

B. Radiation protection training is given prior to occupational exposure and periodically thereafter (RG 8.29); refresher radiation protection training is completed not later than 2 years following the most recent radiation protection training. However, employees authorized to perform "higher-risk" work should be requalified annually (ASTM E1168-1995).

C. The applicant's process for developing a radiation protection training program follows the process outlined in ASTM C986-89 (reapproved 1995). The radiation protection training program objectives, content, testing, requalifications, recordkeeping, and audits are

consistent with the ASTM E1168-1995 standard and Appendix A of RG 8.29. The applicant demonstrates equivalence if it elects not to use these standards.

D. The technical content and extent of radiation protection training is commensurate with the radiological risk present in the workplace (RG 8.29 and ASTM C986-1995) and is accomplished by grading the training requirements for general employees, radiation workers, radiation technicians, and supervisors. In addition, training for all groups, except general employees, includes practical demonstrations, by trainees, of proper equipment use, dosimetry use, PPE use, and incident (e.g., spill) response.

E. To verify the radiation protection training received, the applicant commits to have each trainee acknowledge in writing that the training was received and understood (RG 8.29). The applicant maintains the records of most recent training and testing as specified in ASTM E1168-1995.

9.2.4.5 Air Sampling

9.2.4.5.1 Regulatory Requirements

10 CFR 20.1204	Determination of Internal Exposure
10 CFR 20.1703	Use of Individual Respiratory Protection Equipment
10 CFR 20.1902	Posting Requirements
10 CFR 20.2103	Records of Surveys
10 CFR 20.2110	Forms of Records
10 CFR 20.2203(a)(3)(i)-(ii)	Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Materials Exceeding the Limits
10 CFR 70.22(a)(7)	Contents of Applications

9.2.4.5.2 Regulatory Guidance

RG 8.25, Rev. 1, June 1992	Air Sampling in the Workplace
RG 8.36, July 1992	Radiation Doses to the Embryo/Fetus
NUREG-0041, Oct. 1976	Manual of Respiratory Protection Against Airborne Radioactive Materials
NUREG-1400, Sept. 1993	Air Sampling in the Workplace

ANSI N42.17B-1989	Performance Specifications for Health Physics Instrumentation--Occupational Airborne Radioactivity Monitoring Instrumentation

9.2.4.5.2 Regulatory Acceptance Criteria

The requirements for air sampling are listed in Section 9.2.4.5.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant commits an air sampling program that is consistent with the positions in RG 8.25, including evaluating the need for air sampling, locating samplers, sample representativeness, conditions for adjusting derived air concentrations (DACs), measuring sampled air volume, and evaluating results. NUREG-1400 complements RG 8.25 and presents examples, methods, and techniques for implementing the recommendations of RG 8.25.

B. The applicant's basis for the air sampling program includes:

   i. For each work area, a determination that the frequency for analyzing airborne levels of radioactivity, counting techniques, action levels and actions to be taken when action levels are exceeded, and alarm set points are adequate to meet Part 20; and

   ii. Calculations and verification of airborne concentrations in various areas are controlled under the applicant's QA program (SRP Section 15.1).

C. The applicant's use of and specifications for air sampling instrumentation are consistent with RG 8.25 and ANSI N42.17B-1989. Calibration methods and frequencies for air sampling instruments ensure proper operation of the instrumentation, including the operation of flow rate meters. The applicant specifies the locations of detectors, readouts, annunciators, and alarms. (The applicant may provide this information in support of SRP Section 9.1.4.2; however, the applicant should provide a cross-reference to this material.)

D. The applicant demonstrates that its action levels for airborne activity use appropriate technical criteria to determine the necessary controls, where the demonstration includes the minimum detectable concentrations (MDCs) for the radionuclides of interest.

9.2.4.6 Contamination Control

9.2.4.6.1 Regulatory Requirements

10 CFR 20.1406	Minimization of Contamination
10 CFR 20.1501	Surveys and Monitoring--General
10 CFR 20.1601	Control of Access to High Radiation Areas

10 CFR 20.1602	Control of Access to Very High Radiation Areas
10 CFR 20.1703	Use of Individual Respiratory Protection Equipment
10 CFR 20.1901	Caution Signs
10 CFR 20.1902	Posting Requirements
10 CFR 20.1904	Labeling Containers
10 CFR 20.1906	Procedures for Receiving and Opening Packages
10 CFR 20.2103	Records of Surveys
10 CFR 20.2110	Forms of Records
10 CFR 20.2203	Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Materials Exceeding the Limits

9.2.4.6.2 Regulatory Guidance

RG 8.24, Rev.1, Oct. 1979	Health Physics Surveys During Enriched Uranium 235 Processing and Fuel Fabrication
BTP, April 1993	License Condition for Leak Testing Sealed Byproduct Material Sources
BTP, April 1993	License Condition for Leak Testing Sealed Plutonium Sources
BTP, April 1993	License Condition for Plutonium Alpha Sources
BTP, April 1993	License Condition for Leak Testing a Sealed Source which Contains AIpha and/or Beta-Gamma Emitters
BTP, April 1993	License Condition for Leak Testing Sealed Uranium Sources
April 1993	Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, or Special Nuclear Material
ANSI N323-1978 r.1983	Radiation Protection Instrumentation Tests and Calibrations
ANSI N542-1977	Sealed Radioactive Sources Classification

9.2.4.6.3 Regulatory Acceptance Criteria

The requirements for contamination control are listed in Section 9.2.4.6.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant's policy for controlling contamination is clearly stated. The policy mandates the use of personnel monitoring equipment, and that personnel perform a whole body survey each time they leave a known contamination area, or a minimum hand and shoe survey each time they leave a potentially contaminated restricted area.

B. Features of the facility that help control contamination are consistent with RG 8.24 and included in the facility descriptions (e.g., fume hoods, step-off pads, personnel monitoring equipment at egress points).

C. The applicant's facility operating procedures include procedures that minimize, to the extent practicable, contamination in the facility pursuant to 10 CFR 20.1406 and a commitment to a contamination survey program.

D. The contamination survey program is based on the information provided in RG 8.24 on contamination level limits and types, methods, instruments, and frequencies of surveys. For each area, the applicant specifies the types of radiation, the criteria for contamination action levels (for both removable and fixed contamination), action levels, and actions to be taken if exceeded. Contamination surveys are conducted routinely for the accessible areas of the plant site where contamination is likely. The types of instruments and methods used in the surveys are adequate to allow assessment of working conditions. The instruments are sufficiently sensitive to measure contamination at or below the assigned action levels and tested and calibrated in accordance with ANSI N323 (or equivalent).

E. The applicant documents contamination surveys, investigations, corrective actions, and reviews, along with deficiencies. The RSO reviews this documentation for possible trends and needed corrective actions. The applicant tracks contamination levels and contaminated areas as part of the ALARA goals (see Section 9.2.4.1.3(C)).

F. The applicant's maximum personnel contamination levels for skin and clothing are established and specified consistent with RG 8.24. The applicant uses means to detect contamination in excess of these levels. If the applicant detects contamination in excess of these levels, the applicant then decontaminates; investigates; corrects; and documents the source, probable cause, and other pertinent information. The applicant states the minimum detectable levels.

G. The applicant's access control and security of stored radioactive material is in accordance with 10 CFR Part 20, and the applicant performs periodic reviews to verify:

    i. Proper posting, labeling, and operability of access controls;

ii. Proper identification of restricted areas to prevent the spread of contamination; and

iii. Sufficient numbers and appropriate locations of step-off pads, change facilities, PPE facilities, and personnel monitoring equipment.

H. The applicant establishes a system that ensures that equipment and materials removed from contaminated areas are not contaminated above specific release levels. The contamination levels of items (tools, equipment, etc.) given release clearance are in accordance with NRC's BTP, "Guidelines for Contamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material."

I. The applicant performs sealed source leak testing in accordance with written procedures and in accordance with the 5 NRC BTPs listed in Section 9.2.4.6.2. The procedures include acceptable contamination levels, test frequencies, and actions if action limits are exceeded.

9.2.4.7 External Exposure

9.2.4.7.1 Regulatory Requirements

10 CFR 19.13	Notifications and Reports to Individuals
10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1203	Determination of External Doses from Airborne Radioactive Material
10 CFR 20.1206	Planned Special Exposures
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1302	Compliance with Dose Limits for Individual Members of the Public
10 CFR 20.1501	Surveys and Monitoring--General
10 CFR 20.1502	Conditions Requiring Individual Monitoring of External and Internal Occupational Doses
10 CFR 20.1601	Control of Access to High Radiation Areas
10 CFR 20.1602	Control of Access to Very High Radiation Areas
10 CFR 20.1901	Caution Signs

10 CFR 20.1902	Posting Requirements
10 CFR 20.1906	Procedures for Receiving and Opening Packages
10 CFR 20.2101	Records--General Provisions
10 CFR 20.2103	Records of Surveys
10 CFR 2105	Records of Planned Special Exposures
10 CFR 20.2106	Records of Individual Monitoring Results
10 CFR 20.2110	Forms of Records
10 CFR 20.2202	Notification of Incidents
10 CFR 20.2203	Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Materials Exceeding the Limits
10 CFR 20.2206	Reports of Individual Monitoring

9.2.4.7.2 Regulatory Guidance

RG 8.4, Feb. 1973	Direct and Indirect-Reading Pocket Dosimeters
RG 8.7, Rev. 1, June 1992	Instructions for Recording and Reporting Occupational Radiation Exposure Data
RG 8.28, Aug. 1981	Audible Alarm Dosimeters
RG 8.34, July 1992	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses
RG 8.35, June 1992	Planned Special Exposures
ANSI N13.11-1983	Personnel Dosimetry Performance, Criteria for Testing
ANSI N13.15-1985	Dosimetry Systems, Performance of Personnel Thermoluminescence
ANSI N13.27-1981 r. 1992	Dosimeters and Alarm Ratemeters, Performance Requirements for Pocket-Sized Alarm
ANSI N322-1977	Inspection and Test Specifications for Direct and Indirect Reading Quartz Fiber Pocket Dosimeters

ANSI N323-1978 r.1983 Radiation Protection Instrumentation Tests and Calibrations

9.2.4.7.3 Regulatory Acceptance Criteria

The requirements for external exposure are listed in Section 9.2.4.7.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant determines who are and are not occupationally exposed individuals and who is to be monitored for exposure in accordance with RG 8.34. For non-occupationally exposed workers, the limits for members of the public apply, and acceptability is based on compliance with the surveys required by 10 CFR 20.1302.

B. The applicant's type, range, sensitivity, accuracy, frequency for personnel dosimetry and area dosimetry, and methods for recording measured dose are justified for the types, energy, and amount of radiation and are consistent with ANSI N13.11-1983, ANSI N13.15-1985, ANSI N13.27-1981, ANSI N322-1977, and ANSI N323-1978 r. 1983.

C. The applicant may use administrative dose levels, below 10 CFR Part 20 limits, to demonstrate that doses are maintained ALARA. The applicant specifies administrative dose limits that are a fraction (e.g., 20 percent) of the 10 CFR Part 20 limits, and the applicant identifies the actions and approvals necessary to exceed the administrative dose limits.

D. A dosimetry processor, holding accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP), processes and evaluates personnel dosimetry (except those specified in 10 CFR 20.1501(c)).

E. The applicant's source identification and control program:

   i. Identifies sources of external exposure throughout the facility along with controls and responsibilities for restricted, controlled, and unrestricted areas;

   ii. Identifies methods for materials inventory, movement, and storage to prevent releases and limit external exposures; and

   iii. Complies with 10 CFR 20.1906, 10 CFR Part 71, and U.S. Department of Transportation requirements (49 CFR 171-178) for the receipt and off-site transfer of radioactive materials.

9.2.4.8 Internal Exposure

9.2.4.8.1 Regulatory Requirements

10 CFR 19.13 Notifications and Reports to Individuals

10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1204	Determination of Internal Exposure
10 CFR 20.1206	Planned Special Exposures
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1302	Compliance with Dose Limits for Individual Members of the Public
10 CFR 20.1502	Conditions Requiring Individual Monitoring of External and Internal Occupational Doses
10 CFR 20.1703	Use of Individual Respiratory Protection Equipment
10 CFR 20.1901	Caution Signs
10 CFR 20.1902	Posting Requirements
10 CFR 20.2101	Records--General Provisions
10 CFR 20.2103	Records of Surveys
10 CFR 20.2105	Records of Planned Special Exposures
10 CFR 20.2106	Records of Individual Monitoring Results
10 CFR 20.2110	Forms of Records
10 CFR 20.2202	Notification of Incidents
10 CFR 20.2203	Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Materials Exceeding the Limits
10 CFR 20.2206	Reports of Individual Monitoring

9.2.4.8.2 Regulatory Guidance

RG 8.7, Rev. 1, June 1992	Instructions for Recording and Reporting Occupational Radiation Exposure Data
RG 8.9, Rev. 1, July 1993	Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program

RG 8.13	Instructions Concerning Prenatal Radiation Exposures (Draft DG-8014, Proposed Rev. 3, Oct. 1994)
RG 8.25, Rev. 1, June 1992	Air Sampling in the Workplace
RG 8.34, July 1992	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses
RG 8.35, June 1992	Planned Special Exposures
ANSI N13.22, 1995	Bioassay Program for Uranium
ANSI N13.30, 1996	Performance Criteria for Radiobioassay
ANSI N42.17B-1989	Performance Specifications for Health Physics Instrumentation--Occupational Airborne Radioactivity Monitoring Instrumentation

9.2.4.8.3 Regulatory Acceptance Criteria

The requirements for internal exposure are listed in Section 9.2.4.8.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant establishes and implements a program to monitor internal doses in accordance with the information, recommendations, and guidance in RG 8.9, RG 8.25, RG 8.34, and ANSI/HPS N13.22-1995.

B. The applicant's internal dose monitoring program specifies:

   i. Criteria for participation;

   ii. Frequencies of routine measurements;

   iii. Use of confirmatory measurements;

   iv. Methods to be used;

   v. MDCs;

   vi. Action levels and actions to be taken when exceeded; and

   vii. Methods for determining worker doses from quantities of radionuclides in the body, in the work area air, and/or combinations of these.

C. When the applicant uses air sampling to determine worker intake, the applicant specifies the frequency of sampling and data analyses, the MDC, the action levels, and the actions taken when the levels are exceeded. The applicant uses bioassays to evaluate the effectiveness of using air sampling to determine worker intake.

D. When the applicant uses bioassay to determine worker intake, the applicant specifies the types of bioassay used, the frequency of data collection for each type, the MDCs, the action levels, and the actions taken when the levels are exceeded. The applicant commits to a continuing QA program on all phases of the bioassay program, including sample collection, qualifications of laboratory personnel, laboratory intercomparisons, computational checks, and use of appropriate blanks and standards.

E. The applicant commits to use engineering controls to limit the intake of radioactive material, including auxiliary ventilation systems (e.g., portable filtration systems) used to control airborne contaminants (e.g., when servicing primary ventilation or machining contaminated surfaces) and containment structures used to protect personnel working in adjacent areas, when feasible.

9.2.4.9 Summing Internal and External Exposure

9.2.4.9.1 Regulatory Requirements

10 CFR 20.1201	Occupational Dose Limits For Adults
10 CFR 20.1202	Compliance with Requirements for Summation of External and Internal Doses
10 CFR 20.1206	Planned Special Exposures
10 CFR 20.1207	Occupational Dose Limits for Minors
10 CFR 20.1208	Dose to Embryo/Fetus
10 CFR 20.1301	Dose Limits for Individual Members of the Public
10 CFR 20.1302	Compliance with Dose Limits for Individual Members of the Public
10 CFR 20.2101	Records--General Provisions
10 CFR 20.2103	Records of Surveys
10 CFR 20.2104	Determination of Prior Occupational Dose
10 CFR 20.2105	Records of Planned Special Exposures

10 CFR 20.2106	Records of Individual Monitoring Results
10 CFR 20.2110	Forms of Records
10 CFR 20.2202	Notification of Incidents
10 CFR 20.2203	Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Materials Exceeding the Limits
10 CFR 20.2206	Reports of Individual Monitoring

9.2.4.9.2 Regulatory Guidance

RG 8.7, Rev. 1, June 1992	Instructions for Recording and Reporting Occupational Radiation Exposure Data
RG 8.34, July 1992	Monitoring Criteria and Methods to Calculate Occupational Radiation Doses
RG 8.35, June 1992	Planned Special Exposures
ANSI N13.6-1966 r.1989	Practice for Occupational Radiation Exposure Records Systems

9.2.4.9.3 Regulatory Acceptance Criteria

The requirements for summing internal and external exposure are listed in Section 9.2.4.9.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the applicant commits to sum internal and external dose in accordance with RGs 8.7, 8.34, and 8.36.

9.2.4.10 Respiratory Protection

9.2.4.10.1 Regulatory Requirements

10 CFR 20.1701	Use of Process or Other Engineering Controls
10 CFR 20.1702	Use of Other Controls
10 CFR 20.1703	Use of Individual Respiratory Protection Equipment
10 CFR 20.2110	Forms of Records

9.2.4.10.2 Regulatory Guidance

RG 8.15, Oct. 1976	Acceptable Programs for Respiratory Protection

NUREG-0041, Oct. 1976	Manual of Respiratory Protection Against Airborne Radioactive Materials
ANSI Z88.2-1992	Practices for Respiratory Protection
ANSI Z88.6-1984	Physical Qualifications for Respirator Use

9.2.4.10.3 Regulatory Acceptance Criteria

The requirements for respiratory protection are listed in Section 9.2.4.10.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant's respiratory protection program meets ANSI Z88.2, with defined responsibilities and requirements in the areas of training, control and use of respiratory protection equipment, mask-fit testing, and breathing air purity. (ANSI Z88.6 provides additional guidance on medical qualifications and examinations for respiratory protection.)

B. The applicant maintains adequate numbers and locations of respiratory protection equipment and current training as needed to satisfy emergency response functions.

C. The applicant specifies methods to determine internal dose when respiratory protection equipment is used or when engineering and administrative controls for respiratory protection are used. The applicant's methods show a preference for engineered controls over respiratory protection equipment and the factors in the dose calculations include the time of exposure to airborne radioactive materials, the measurement and variability of airborne concentrations of radioactive material during the exposure, and for respirators, the respirator's protection factor and proper fitting.

9.2.4.11 Instrumentation

9.2.4.11.1 Regulatory Requirements

10 CFR 20.1501	Surveys and Monitoring--General
10 CFR 20.2103	Records of Surveys

9.2.4.11.2 Regulatory Guidance

RG 8.28, Aug. 1981	Audible Alarm Dosimeters
ANSI N13.4, 1971	Specification for Portable X- or Gamma-Radiation Survey Instruments
ANSI N42.12-1980	Calibration and Usage of Sodium Iodide Detector Systems

ANSI N42.15-1980	Performance Verification of Liquid Scintillation Counting Systems
ANSI N42.17A-1989	Performance Specifications for Health Physics Instrumentation--Portable Instrumentation for Use in Normal Environmental Conditions
ANSI N42.17B-1989	Performance Specifications for Health Physics Instrumentation--Occupational Airborne Radioactivity Monitoring Instrumentation

9.2.4.11.3 Regulatory Acceptance Criteria

The requirements for instrumentation are listed in Section 9.2.4.11.1. The reviewer should find reasonable assurance that the applicant meets the regulatory requirements if the following acceptance criteria are met:

A. The applicant's policy for the maintenance and use of operating radiation instrumentation commits to continuing availability of sufficient numbers and types of instruments for all routine (Part 20) and emergency operations. The number and types of instruments available is consistent with the information on radiation measuring instruments and instrument calibration in ANSI N42.17A, ANSI N42.17B, and ANSI N323.

B. The applicant's criteria for selecting radiation measuring instruments and equipment facilitates:

   i. Performing radiation and contamination surveys;

   ii. Sampling airborne radioactivity;

   iii. Monitoring area radiation;

   iv. Monitoring personnel;

   v. Performing radioactive analyses; and

   vi. Using high-range, portable instrumentation, with justified ranges, as necessary to monitor conditions during and after accidents.

C. The applicant commits to calibrate all instruments at least semi-annually and to recalibrate if conditions occur that could otherwise affect the calibration, e.g., maintenance.

D. The applicant's radiation protection procedures (with respect to radiation protection instrument checks) establish daily operational checks of continuously operating radiation protection instruments.

E. The applicant identifies the locations of and describes the facilities related to radiation protection instrumentation, including:

   i. A radiochemistry laboratory equipped to perform the analyses required by 10 CFR 20.1501;

   ii. A low-background counting room equipped to perform routine counting of all plant samples (water, swipes, air); and

   iii. Instrument storage, calibration, decontamination, and maintenance facilities.

9.2.5 REVIEW PROCEDURES

9.2.5.1 Acceptance Review

The primary reviewer should perform an acceptance review to determine if the application (construction or license) adequately addresses the items in Section 9.2.3, "Areas of Review."

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

A. Application for Construction Approval

   The applicant is not expected to address the radiation protection program in detail with the application for construction approval. However, the primary reviewer should evaluate the safety assessment of the design basis to ensure that the commitments and program goals, as related to the areas of review described in Section 9.2.3, are appropriate for radiation protection at the design stage.

B. License Application

   Specifically, the license application should address Section 9.2.3 in full.

If the primary reviewer verifies that the radiation protection program is adequately addressed (construction or license), the primary reviewer should accept the application for the safety evaluation in Section 9.2.2. 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.

9.2.5.2 Safety Evaluation

After determining that the application is acceptable for review in accordance with either Section 9.2.5.1(A) (construction) or 9.2.5.1(B) (license), the primary reviewer should perform a safety evaluation against the acceptance criteria described in Section 9.2.4. 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 9.2.4.

The review performed in this section pertains to programmatic aspects of occupational doses during routine operations and anticipated events. The safety assessment of the design basis and doses from accidents are reviewed under the SRP chapter dealing with the ISA and ISA Summary (SRP Chapter 5.0) and the Radiation Safety Design Features Section (SRP Section 9.1). Doses to the public and the environment, including ALARA, are the subject of SRP Chapter 10.0, “Environmental Protection.”

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 design basis for radiation protection and related commitments will lead to a radiation protection program that will meet or exceed the regulatory acceptance criteria in Section 9.2.4.

B. License Application

The following items should be noted regarding the relationships between the primary reviewer and the secondary reviewers for this SRP section in performing the safety evaluation for the license application:

i. The plant organization, functional responsibilities, and qualifications of personnel are also reviewed as part of the SRP chapters on Organization and Administration (SRP Chapter 2.0) and Training and Qualifications (SRP Section 15.4). Applicants may choose to provide the information in this section explicitly or by providing a reference to those chapters. The primary reviewer of this section coordinates with the primary reviewers of the other chapters to verify the completeness and consistency of the information and that the acceptance criteria are satisfied.

ii. The radiation protection training program and the respiratory protection training program could be described by the applicant in the SRP Section on Training and Qualifications (SRP Section 15.4). Applicants may choose to provide the information in this section explicitly or by providing a reference to that section. The primary reviewer of this section uses the acceptance criteria in this section to evaluate these commitments, regardless of where they appear in the application.

When the safety evaluation is complete, the primary reviewer, with assistance from the other reviewers, should prepare the radiation protection program input for the Safety Evaluation Report (SER), as described in Section 9.2.6 using the acceptance criteria from Section 9.2.4.

9.2.6 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 name of facility] according to Section 9.2 of NUREG-1718. The staff evaluated [Insert a summary statement of what was evaluated] and found that [summarize the findings].*
>
> *The staff concluded that the applicant provided adequate commitments and goals for the design basis as it applies to radiation protection and that these commitments and goals should result in a protection program that will meet or exceed the requirements and guidance outlined in NUREG-1718. As a result, in concert with the evaluation conducted under Section 9.1 of NUREG-1718, the applicant meets the requirements in the area of radiation protection to approve construction of the facility under proposed 10 CFR Part 70.*

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

> *The staff reviewed the application for the license for [insert name of facility] to possess and use SNM according to Section 9.2 of NUREG-1718. The staff evaluated [Insert a summary statement of what was evaluated] and found that [summarize the findings].*
>
> *The applicant's radiation protection program includes: (1) an effective documented program to ensure that occupational radiological exposures are ALARA; (2) an organization with adequate qualification requirements for the radiation safety personnel; (3) approved written radiation protection procedures or RWPs for radiation protection activities; (4) radiation safety training for all personnel who have access to restricted areas; (5) requirements for an air sampling program; (6) control of radiological contamination within the facility; (7) a respiratory protection program; (8) requirements for radiological measurement instrumentation; and (9) a program for monitoring personnel external and internal radiation exposure. Conformance to this program should ensure safe operation and provide early detection of unfavorable trends to allow prompt corrective action.*
>
> *The NRC staff concludes, with reasonable assurance, that the applicant's radiation protection program is adequate and that the applicant has the necessary technical staff to administer an effective radiation safety program that meets the requirements of 10 CFR Parts 19, 20, and 70 for a license to possess and use SNM.*

9.2.7 REFERENCES

All referenced documents in the acceptance criteria for this review area have been listed in Sections 9.2.4.1-9.2.4.12 and are not repeated here. However, in addition to those documents, the following documents contain information that is specific to nuclear reactors, but which is also relevant to this review area. Applicants may choose to reference portions of these documents in the 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.

C. RG 1.97, Rev. 3, May 1983, *Instrumentation for Light-Water-Cooled Nuclear Power Plants To Assess Plant and Environs Conditions During and Following an Accident* , U.S. Nuclear Regulatory Commission, May 1983.