

9. ENVIRONMENTAL PROTECTION

9.1 Purpose of Review

The purpose of this review is to determine whether the applicant's proposed environmental protection measures are adequate to protect the environment and public health and safety and to comply with the regulatory requirements imposed by the U.S. Nuclear Regulatory Commission (NRC) in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection against Radiation" and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

This chapter does not address the specific requirements of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," issued August 2003, provides general procedures for the environmental review of licensing actions regulated by the Office of Nuclear Material Safety and Safeguards (NMSS). The staff of the Division of Fuel Cycle Safety and Safeguards (FCSS) should coordinate the preparation of an environmental assessment (EA) and finding of no significant impact (FONSI) or an environmental impact statement (EIS) with the Office of Federal and State Materials and Environmental Management Programs. If the licensee proposes that a requested action is a categorical exclusion under the provisions of 10 CFR 51.22, "Criterion for Categorical Exclusion; Identification of Licensing and Regulatory Actions Eligible for Categorical Exclusion or Otherwise Not Requiring Environmental Review," the FCSS staff should confirm that the action meets the applicable criteria in 10 CFR 51.22(c).

9.2 Responsibility for Review

Primary: Environmental Engineer/Scientist

Secondary: Licensing Project Manager

Supporting: Fuel Cycle Facility Inspector
Radiation Safety Reviewer
Integrated Safety Analysis (ISA) Primary Reviewer

9.3 Areas of Review

The environmental safety program should address the environmental protection measures, including the control and monitoring of gaseous and liquid effluents and the management of solid waste. The environmental program should also provide for the monitoring of the facility environment, including ambient air, surface water, ground water, soils, and vegetation that can be affected by facility effluents. This chapter addresses the areas of review for environmental protection measures, and for environmental monitoring measures.

If the application includes an ISA Summary as required by Subpart H, "Additional Requirements for Certain Licensees Authorized To Possess a Critical Mass of Special Nuclear Material," of 10 CFR Part 70, the environmental reviewer will review the ISA Summary accident sequences that could result in high or intermediate consequences to an individual located outside the controlled area or that could result in a 24-hour averaged release of radioactive material outside the restricted area in concentrations exceeding 5,000 times the values in Table 2 of Appendix B,

“Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage,” to 10 CFR Part 20. Section 9.3.2.3 below addresses areas of review for the ISA Summary specific to environmental protection.

The regulatory requirements for environmental protection appear in 10 CFR Part 20, 10 CFR Part 51, and 10 CFR Part 70. The NRC staff focuses its environmental review on that part of the plant wide safety program that the applicant establishes to control and assess the level of radioactive and nonradioactive releases (gaseous, liquid, and solid) to the environment. Therefore, the staff reviews the effluent control portion of the applicant’s radiation protection program and the applicant’s effluent and environmental monitoring practices.

To receive authorization to possess a critical mass quantity of special nuclear material (SNM), an applicant must also perform an ISA and prepare an ISA Summary in accordance with Subpart H of 10 CFR Part 70. SRP Chapter 3 presents guidance on the ISA. The environmental safety review of the ISA Summary will examine the identified potential accident sequences that result in radiological and non-radiological releases to the environment, the items relied for safety (IROFS) that the applicant specifies to reduce the risk of those accidents, and the associated management measures that provide reasonable assurance that the IROFS will perform their designated safety functions.

Thus, environmental protection encompasses three main components, as necessary: (1) effluent and environmental controls and monitoring, (2) the ISA Summary and other ISA documentation as described in Sections 9.3.1 through 9.3.2 below, and (3) management measures in the license application.

9.3.1 Effluent and Environmental Controls and Monitoring

The staff’s review of the environmental radiation protection program described in the application encompasses the following areas:

- as low as reasonably achievable (ALARA) goals for effluent control
- effluent controls to maintain public doses ALARA
- ALARA reviews and reports to management
- waste minimization practices and, for new operations, design plans for waste minimization

The staff’s review of the applicant’s effluent and environmental monitoring practices described in the application encompasses the following areas:

- in-place filter-testing procedures for air-cleaning systems
- known or expected concentrations of radionuclides in effluents
- physical and chemical characteristics of radionuclides in discharges
- discharge locations

- environmental media to be monitored and the sample locations
- sampling collection and analysis procedures, including the minimum detectable concentrations of radionuclides
- action levels and actions to be taken when the levels are exceeded
- permits, including air discharge and National Pollutant Discharge Elimination System permits
- leak detection systems for ponds, lagoons, and tanks
- pathways analysis methods to estimate public doses
- recording and reporting procedures
- solid waste handling and disposal programs

9.3.2 *Integrated Safety Analysis Summary*

The staff's review of the applicant's ISA Summary related to environmental protection includes the following areas:

- accident sequences (and associated facility processes) that, if unmitigated, would result in releases to the environment
- likelihood and environmental consequences of these accident sequences
- controls relied on to reduce the unmitigated risk from high or intermediate risk to an acceptable level
- availability and reliability of controls

9.3.3 *Environmental Protection Management Measures*

The staff's review of the applicant's management measures related to environmental protection includes the following areas:

- a method for grading management measures commensurate with the reduction in risk attributable to each control or control system
- a commitment to design, implement, and maintain the controls and control systems to ensure that they are available and reliable to perform their functions when needed

Review Interfaces

In addition to Chapter 9 of the application, the environmental reviewer should examine information in the following other areas to ensure that it is consistent with the information in Chapter 9:

- facility and process descriptions applied to environmental protection as described in SRP Chapter 1
- the safety program, ISA commitments, and ISA documentation applied to environmental protection as described in SRP Chapter 3
- the radiation safety program as described in SRP Chapter 4
- chemical processes applied to environmental protection as described in SRP Chapter 6
- fire-initiated accident sequences that have the potential to result in high or intermediate consequences as described in SRP Chapter 7
- configuration management, maintenance, training and qualifications, procedures, audits and assessments, incident investigations, record management, and other quality assurance elements as described in SRP Chapter 11¹

9.4 Acceptance Criteria

Sections 9.4.3.1 through 9.4.3.3 describe acceptance criteria for the effluent and environmental controls and monitoring, the ISA Summary, and management measures.

9.4.1 Regulatory Requirements

To be considered acceptable, the application must satisfy the following regulatory requirements for environmental protection:

- Subpart B, "Radiation Protection Programs"; Subpart D, "Radiation Dose Limits for Individual Members of the Public"; and Subpart F, "Surveys and Monitoring," of 10 CFR Part 20 specify the effluent control and treatment measures necessary to meet the dose limits and dose constraints for members of the public. Subpart F also states the survey requirements. Subpart K, "Waste Disposal," specifies the waste disposal requirements; Subpart L, "Records," specifies the records requirements; and Subpart M, "Reports," specifies the reporting requirements.
- 10 CFR Part 51 provides that the applicant must establish effluent and environmental monitoring systems to provide the information required by 10 CFR 51.60(a).
- 10 CFR Part 70 requires the applicant to demonstrate that proposed facilities and equipment, including measuring and monitoring instruments and devices for the disposal of radioactive effluents and wastes, are adequate to protect the environment and public health and safety, as specified in 10 CFR 70.22(a)(7).

¹ Section 9.3.3 addresses areas of review for management measures applied to environmental protection.

- 10 CFR Part 70 also provides that the applicant for a facility (as described in 10 CFR 70.4, “Definitions”) must submit a safety assessment of the design basis of the principal structures, systems, and components of the plant, including provisions for protection against natural phenomena, as specified in 10 CFR 70.22(f).
- 10 CFR Part 70 also provides that an applicant for a facility must provide an ISA Summary that includes a list of the IROFS established by the applicant and other elements, as described in 10 CFR 70.65(b).
- 10 CFR 70.59, “Effluent Monitoring Reporting Requirements,” outlines the reporting requirements for radiological effluent monitoring for a 10 CFR Part 70 licensee.

9.4.2 Regulatory Guidance

The regulatory guidance for environmental protection appears in the following NRC and industry documents:

- NRC Regulatory Guide 4.15, “Quality Assurance for Radionuclide Monitoring Programs (Inception through Normal Operations to License Termination)—Effluent Streams and the Environment,” Revision 2, July 2007
- NRC Regulatory Guide 4.16, “Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants,” December 1985
- NRC Regulatory Guide 4.20, “Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors,” December 1996
- NRC Regulatory Guide 8.37, “ALARA Levels for Effluents from Materials Facilities,” July 1993
- NRC Information Notice 94-07, “Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR Part 20,” January 28, 1994
- NRC Information Notice 94-23, “Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program,” March 25, 1994
- American National Standards Institute (ANSI) N13.1-1982, “Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities”
- ANSI N42.18-1980, “Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactive Effluents”
- National Council on Radiation Protection and Measurements (NCRP) Report No. 123, “Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground,” Volumes I and II, January 1996
- NUREG/CR-6410, “Nuclear Fuel Cycle Accident Analysis Handbook,” March 1998

- NUREG-1513, “Integrated Safety Analysis Guidance Document,” May 2001
- NUREG-1748, “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs,” August 2003

9.4.3 Regulatory Acceptance Criteria

9.4.3.1 Environmental Report or Categorical Exclusion

An environmental report is required for actions listed in 10 CFR 51.60(b). NUREG-1748 discusses the acceptance criteria for the environmental report.

An environmental report is not required for licensing actions that meet the requirements for a categorical exclusion, as defined in 10 CFR 51.22(c). However, if, under 10 CFR 51.23(c)(11), the action involves an amendment to licenses for fuel cycle plants, radioactive waste disposal sites, and other materials licenses identified in 10 CFR 51.60(b)(1) for changes in process operations or equipment, the applicant must demonstrate that the action will not result in significant effects on the environment. NUREG-1748 gives the acceptance criteria for this categorical exclusion.

If a license application indicates a significant increase in the potential for, or consequences of, radiological accidents, then the licensing action is NOT categorically excluded from review under the National Environmental Policy Act. The application must include an environmental report, and the staff must prepare an EA.

9.4.3.2 Effluent and Environmental Controls and Monitoring

An applicant’s proposed environmental protection measures are acceptable if they provide for qualified and trained staff, effluent control, and effluent and environmental monitoring in accordance with the NRC’s requirements. Using the acceptance criteria defined in SRP Chapter 11, the NRC staff will review qualifications and training that the applicant has established for plant personnel who are associated with environmental protection. This review will include the qualification and training of managers, supervisors, technical staff, operators, technicians, and maintenance personnel whose levels of knowledge are important to the environment and protect public health and safety. The NRC will expect managers and staff to have levels of education and experience commensurate with the responsibilities of their positions.

9.4.3.2.1 Effluent Controls and Waste Minimization

In accordance with 10 CFR 20.1101, “Radiation Protection Programs,” each licensee must implement a radiation protection program, which is discussed in detail in SRP Chapter 4. The environmental review of the radiation protection program focuses on the applicant’s methods to maintain *public* doses ALARA in accordance with 10 CFR 20.1101. NRC guidance on compliance with these regulations appears in Regulatory Guide 8.37.

Specifically, 10 CFR 20.1101(d) requires the applicant to establish constraints on airborne emissions of radioactive material to the environment, excluding radon-222 and its decay products. Such constraints must ensure that the individual member of the public who is likely to receive the highest dose will not be expected to receive a total effective dose equivalent (TEDE) in excess of 0.1 millisievert (10 millirem) per year from these emissions. To meet the reporting

requirements of 10 CFR 20.2203, "Reports of Exposures, Radiation Levels, and Concentrations of Radioactive Material Exceeding the Constraints or Limits," the applicant must have (and describe) procedures for reporting to the NRC when these dose constraints are exceeded and must take prompt appropriate corrective action to prevent recurrence. NRC guidance on compliance with this regulation can be found in Regulatory Guide 4.20.

The environmental review of the radiation protection program also focuses on the applicant's waste minimization practices. Applicants for new licenses are required to comply with 10 CFR 20.1406, "Minimization of Contamination," which states that the applicant must describe how facility design procedures for operation will, to the extent practicable, minimize contamination of the facility and the environment, facilitate eventual decommissioning, and minimize the generation of radioactive waste. Applicants requesting amendment or renewal of existing licenses must minimize and control waste generation during operations as part of the radiation protection program, in accordance with 10 CFR 20.1101 (Volume 62 of the *Federal Register*, page 39,082 (62 FR 39082); July 21, 1997).

NRC Information Notice 94-23 offers guidance for waste minimization programs. SRP Chapter 10 offers more information on compliance with the decommissioning aspects of the waste minimization regulations.

The proposed radiation protection program is acceptable if it satisfies the following criteria:

- Radiological (ALARA) Goals for Effluent Control

ALARA goals are set at a modest fraction (10 to 20 percent) of the values in Table 2, Columns 1 and 2, and Table 3 of Appendix B to 10 CFR Part 20 and the external exposure limit in 10 CFR 20.1302(b)(2)(ii), or the dose limit for members of the public, if the applicant proposes to demonstrate compliance with 10 CFR 20.1301, "Dose Limits for Individual Members of the Public," through a calculation of the TEDE to the individual likely to receive the highest dose.

An applicant's constraint approach is acceptable if it is consistent with guidance found in Regulatory Guide 4.20 and if the applicant's description of the constraint approach provides sufficient detail to demonstrate specific application of the guidance to proposed routine and nonroutine operations, including anticipated events.

- Effluent Controls To Maintain Public Doses ALARA

The applicant describes and commits to the use of effluent controls (e.g., procedures, engineering controls, and process controls) to maintain public doses ALARA. Common control practices include filtration, encapsulation, adsorption, containment, recycling, leakage reduction, and storage of materials for radioactive decay. Practices for large, diffuse sources (such as contaminated soils or surfaces) include covers, wetting during operations, and the application of stabilizers. The applicant must demonstrate a commitment to reduce unnecessary exposure to members of the public and releases to the environment.

Engineering options that do not substantially reduce the collective dose and require unreasonable costs are not required. "Reasonableness" can be founded on qualitative or quantitative cost/benefit analyses. Quantitative analyses may use a value of 2,000 per person-rem (person-centisievert), as discussed in NUREG-1530,

“Reassessment of the NRC’s Dollar per Person-Rem Conversion Factor Policy,” issued December 1995.

- ALARA Reviews and Reports to Management

The applicant commits to an annual review of the content and implementation of the radiation protection program, which includes the ALARA effluent control program. This review includes analysis of trends in release concentrations, environmental monitoring data, and radionuclide usage; determines whether operational changes are needed to achieve the ALARA effluent goals; and evaluates all designs for system installations or modifications. The applicant also commits to reporting the results to senior management, along with recommendations for changes in facilities or procedures that are necessary to achieve ALARA goals.

- Waste Minimization

To comply with 10 CFR 20.1406, applications for new licenses must describe how the facility’s design procedures for operation will minimize, to the extent practicable, the contamination of the facility and the environment and the generation of radioactive waste. Waste minimization programs proposed by applicants for both new and existing licenses are acceptable if the programs include the following:

- top management support
- the methods used to characterize waste generation (including types and amounts) and waste management costs (including costs of regulatory compliance, paperwork, transportation, treatment, storage, and disposal)
- periodic waste minimization assessments to identify waste minimization opportunities and solicit employee or external recommendations
- provisions for technology transfer to seek and exchange technical information on waste minimization
- the methods used to implement and evaluate waste minimization recommendations

9.4.3.2.2 Effluent and Environmental Monitoring

The applicant’s effluent monitoring is considered acceptable if it meets the following criteria:

- The known or expected concentrations of radioactive materials in airborne and liquid effluents are ALARA *and* are below the limits specified in Table 2 of Appendix B to 10 CFR Part 20 or the site-specific limits established in accordance with 10 CFR 20.1302(c).

If, in accordance with 10 CFR 20.1302(c), the applicant proposes to adjust the effluent concentrations in Appendix B to 10 CFR Part 20 to account for the actual physical and chemical characteristics of the effluents, the applicant must provide information on aerosol size distributions, solubility, density, radioactive decay equilibrium, and chemical

form. This information must be complete and accurate to justify the derivation and application of the alternative concentration limits for the radioactive materials.

- If the applicant proposes to demonstrate compliance with 10 CFR 20.1301 using a calculation of the TEDE to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1), it must support the calculation of the TEDE by pathway analyses with appropriate models, codes, and assumptions that accurately represent the facility, site, and the surrounding area. In addition, the assumptions must be reasonable, input data must be accurate, all applicable pathways must be considered, and the results must be interpreted correctly.

NCRP Report No. 123 provides acceptable methods for calculating the dose from radioactive effluents. The use of computer codes is acceptable for pathway analyses if the applicant can demonstrate that any code it has used has undergone validation and verification to demonstrate the validity of estimates developed using the codes for established input sets. Dose conversion factors are acceptable for use in the pathway analyses if they are based on the methodology described in International Commission on Radiological Protection 30, "Limits for Intakes of Radionuclides by Workers," 1982, as reflected in the U.S. Environmental Protection Agency's Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," issued September 1988. Such methods are acceptable for determining the dose to the maximally exposed individual during normal facility operations and anticipated events.

- The applicant identifies and monitors all liquid and airborne effluent discharge locations and identifies monitoring locations. For those effluent discharge points that have input from two or more contributing sources within the facility, sampling each contributing source is considered necessary for effective process and effluent control.
- The applicant continuously samples airborne effluents from all routine and nonroutine operations and from anticipated events associated with the plant, including effluents from areas that are not used for processing SNM, such as laboratories, experimental areas, storage areas, and fuel element assembly areas.

Effluents are sampled unless the applicant has established (by periodic sampling or other means) that radioactivity in the effluent is insignificant and will remain so. In such cases, the effluent is sampled at least quarterly to confirm that its radioactivity is not significant. For the purposes of this SRP, radioactivity in an effluent is significant if the concentration averaged over a calendar quarter is equal to 10 percent or more of the appropriate concentration listed in Table 2 of Appendix B to 10 CFR Part 20.

- The sample collection and analysis methods and frequencies are appropriate for the effluent medium and the radionuclide(s) being sampled. Sampling methods ensure that the applicant obtains representative samples using appropriate sampling equipment and sample collection and storage procedures. For liquid effluents, the applicant collects representative samples at each release point to determine the concentrations and quantities of radionuclides that are released to an unrestricted area, including discharges to sewage systems. For continuous releases, the applicant collects samples continuously at each release point. For batch releases, the applicant collects a representative sample of each batch. If the applicant uses periodic sampling in lieu of

continual sampling, it shows that the samples are representative of actual releases. Monitoring instruments are calibrated at least annually, or more frequently if suggested by the manufacturer.

- The applicant performs radionuclide-specific analyses on selected composite samples unless either of the following criteria exists:
 - The gross alpha and beta activities are so low that individual radionuclides could not be present in concentrations greater than 10 percent of the concentrations specified in Tables 2 or 3 of Appendix B to 10 CFR Part 20.
 - The radionuclide composition of the sample is known through operational data, such as the composition of the feed material.

Monitoring reports in which the quantities of individual radionuclides are estimated on the basis of methods other than direct measurement include an explanation and justification of how the results were obtained.

Operational data may not be adequate for determining radionuclide concentration in certain cases. Such cases include, but are not limited to: (1) plants that process uranium in which extraction, ammonium diuranate precipitation, ion exchange, or other separation process could result in the concentration of thorium isotopes (principally thorium-234), (2) plants that process uranium of varying enrichments, and (3) plants that process plutonium in which significant variation in the plutonium-238/plutonium-239 ratio among batches and the continuous ingrowth of americium-241 would preclude the use of feed material data to determine the radionuclide composition of effluents.

The applicant performs radionuclide analyses more frequently than usual (1) at the beginning of the monitoring program until it establishes a predictable and consistent radionuclide composition in effluents, (2) whenever there is a significant, unexplained increase in gross radioactivity in effluents, and (3) whenever a process change or other circumstance might cause a significant variation in the radionuclide composition.

- The minimum detectable concentration (MDC) for sample analyses is not more than 5 percent of the concentration limits listed in Table 2 of Appendix B to 10 CFR Part 20. If the actual concentrations of radionuclides in samples are known to be higher than 5 percent of the 10 CFR Part 20 limits, the analysis methods need only be adequate to measure the actual concentration. However, in such cases, the MDC must be low enough to accommodate fluctuations in the concentrations of the effluent and the uncertainty of the MDC.
- The laboratory quality control procedures are adequate to validate the analytical results. These procedures include the use of established standards, such as those provided by the National Institute of Standards and Technology, and standard analytical procedures, such as those established by the National Environmental Laboratory Accreditation Conference.

- The proposed action levels and actions to be taken if the action levels are exceeded are appropriate. The action levels are incremental, such that each increasing action level results in a more aggressive action to ensure effluent control. A slightly higher than normal concentration of a radionuclide in an effluent triggers an investigation into the cause of the increase. The specified action level will result in the shutdown of an operation if the specified level is exceeded. These action levels are selected on the basis of the likelihood that a measured increase in concentration could indicate potential violation of the effluent limits.
- The applicant completely and accurately describes all applicable Federal and State standards for discharges and any permits issued by Federal, State, or local governments for gaseous and liquid effluents.
- The systems for detecting leakage from ponds, lagoons, and tanks are adequate to detect and ensure against any unplanned releases to ground water, surface water, or soil.
- The applicant controls and maintains releases to sewer systems to meet the requirements of 10 CFR 20.2003, "Disposal by Release into Sanitary Sewerage," including the following:
 - The material is water soluble.
 - Known or expected discharges meet the effluent limits specified in Table 3 of Appendix B to 10 CFR Part 20.
 - The known or expected total quantity of radioactive material released into the sewer system in a year does not exceed 5 curies (Ci) (185 gigabecquerels (GBq)) of hydrogen-3, 1 Ci (37 GBq) of carbon-14, and 1 Ci (37 GBq) of all other radioactive materials combined.

Solubility is determined in accordance with the procedure described in NRC Information Notice 94-07.

- Reporting procedures comply with the requirements of 10 CFR 70.59 and the guidance in Regulatory Guide 4.16. The applicant provides reports that include the concentrations of principal radionuclides released to unrestricted areas in liquid and gaseous effluents and the MDC for the analysis and the error for each data point.
- The applicant's procedures and facilities for solid and liquid waste handling, storage, and monitoring result in safe storage and timely disposition of the material.

The scope of the applicant's environmental monitoring is acceptable if it is commensurate with the scope of activities at the facility and the expected impacts from operations as identified in the environmental report and if it meets the following criteria:

- Background and baseline concentrations of radionuclides in environmental media have been established through sampling and analysis.

- Monitoring includes sampling and analyses for monitoring air, surface water, ground water, soil, sediments, and vegetation, as appropriate.
- The description of monitoring identifies adequate and appropriate sampling locations and frequencies for each environmental medium, the frequency of sampling, and the analyses to be performed on each medium.
- Monitoring procedures employ acceptable analytical methods and instrumentation. The applicant commits to an instrument maintenance and calibration program that is appropriate to the given instrumentation. If the applicant proposes to use its own analytical laboratory for the analysis of environmental samples, the applicant commits to providing third-party verification of the laboratory's methods (such as that obtained by participation in a round-robin measurement program).
- Appropriate action levels and actions to be taken if the levels are exceeded are specified for each environmental medium and radionuclide.

Action levels are selected on the basis of a pathway analysis that demonstrates that, below those concentrations, doses to the public will be ALARA *and* below the limits specified in Subpart B to 10 CFR Part 20. The action levels specify the concentrations at which an investigation would be performed and levels at which process operations would be shut down.

- MDCs are specified for sample analyses and are at least as low as those selected for effluent monitoring in air and water. MDCs for sediment, soil, and vegetation are selected on the basis of action levels to ensure that sampling and analytical methods are sensitive and reliable enough to support the application of the action levels.
- Data analysis methods and criteria that the applicant will use to evaluate and report the environmental sampling results are appropriate and will indicate when an action level is being approached in time to take corrective actions.
- The description of the status of all licenses, permits, and other approvals of facility operations required by Federal, State, and local authorities is complete and accurate.
- Environmental monitoring is adequate to assess impacts to the environment from potential radioactive and nonradioactive releases, as identified in high- and intermediate-consequence accident sequences in the ISA.

9.4.3.3 *Integrated Safety Analysis Summary*

In accordance with 10 CFR 70.60, "Applicability," applicants requesting a license to possess and process greater than a critical mass of SNM are required to perform an ISA and submit an ISA Summary to the NRC for approval. The applicant's treatment of environmental protection in the ISA is acceptable if it fulfills the following criteria:

- The ISA provides a complete list of accident sequences that result in radiological and nonradiological releases to the environment.

- The ISA uses acceptable methods to estimate environmental effects that may result from accident sequences and to determine whether the effects are high or intermediate consequences as defined in 10 CFR 70.61, "Performance Requirements." NUREG/CR-6410 describes acceptable methods for estimating environmental effects from accident sequences.
- The ISA provides a reasonable estimate of the likelihood and consequences of each accident sequence identified.
- The ISA identifies adequate engineering or administrative controls or both for each accident sequence of environmental significance. These controls will prevent or mitigate high- and intermediate-consequence accident sequences to an acceptable level. (Consequence categories are defined in 10 CFR 70.61 and in SRP Chapter 3.) IROFS provide the indicated level of protection.
- The ISA affords adequate levels of assurance so that IROFS will satisfactorily perform their safety functions. Configuration management, training, and maintenance activities contribute to achieving this assurance.
- For an ISA Summary of a facility that has not yet been constructed, the specifications for IROFS may not be complete at the time the ISA Summary is submitted. The IROFS functions should be described in sufficient detail for the reviewer to determine their adequacy to prevent or mitigate the accident sequence. For example, the description of an in-line gamma monitor used to alert an operator of an off-normal condition should define the range of gamma activity that the monitor needs to detect. A description of a ventilation system that controls the consequences of an enclosure spill should include its air-moving capacity. The description of a stack sampler that detects excessive airborne releases should include the capacities of the sampler.

In addition to participating in the integrated review of the ISA performed in accordance with SRP Chapter 3, the reviewer should also examine, in detail, the fire-initiated release scenarios provided in the ISA Summary to demonstrate compliance with 10 CFR 70.61 because fire-initiated accident scenarios have the potential for environmental consequences. This review should follow the guidance provided in applicable sections of SRP Chapter 3 to give a detailed evaluation of these scenarios, including a review of fire-induced consequences to the environment, the likelihood of such consequences, and IROFS chosen to prevent or mitigate those consequences.

The reviewer should consider the following factors in determining the acceptability of the applicant's descriptions of fire-initiated accident sequences:

- Scenario descriptions are sufficiently detailed to allow an understanding of the fire hazards that permits an evaluation of potential accident sequences.
- The applicant has adequately described the environmental consequences and likelihood of accident sequences identified in the ISA Summary involving fire, including risks from hazardous chemicals produced from licensed material and risks from radioactive materials.

- All controls that are used to mitigate or prevent the scenario are identified as IROFS or as defense-in-depth measures. For those controls that are IROFS, reliability and associated management measures should be indicated.
- Analyses that the applicant has performed as part of the evaluation should be part of the ISA and should be referenced or identified for potential further review by the NRC staff.

9.4.3.4 Environmental Protection Management Measures

The management measures applied to IROFS designated to prevent or mitigate accident sequences in which the IROFS are needed are acceptable if they meet the acceptance criteria in SRP Chapter 11.

9.5 Review Procedures

The staff will review the environmental report, environmental protection measures, ISA Summary, and management measures to verify that they meet the acceptance criteria defined in SRP Section 9.4. If the applicant has not provided sufficient information to make these determinations, the reviewer(s) will request additional information in coordination with the facility project manager. Chapter 4 of the NRC's Fuel Cycle Licensing Branch "Materials Licensing Procedures Manual," Revision 5, issued September 1996, specifies the format for a request for additional information.

9.5.1 Effluent and Environmental Controls and Monitoring

An environmental specialist will review the applicant's environmental protection measures in coordination with the fuel cycle facility inspector responsible for environmental protection. Any comments or concerns that the environmental reviewer or inspector identifies will be addressed and resolved, and the safety evaluation report (SER) (described in Section 9.6) for the licensing action will contain a statement indicating whether the inspection staff has any objections to the approval of the proposed licensing action. In addition, the review will include an evaluation of inspection reports and semiannual effluent reports, submitted in accordance with 10 CFR 70.59, to ensure licensee performance in environmental protection.

9.5.2 Integrated Safety Analysis Summary

As part of the environmental protection review, the environmental specialist will review the ISA Summary, including all identified accident sequences that can have significant environmental consequences, to determine whether the list completely and properly identifies all potential accidents. The environmental specialist will coordinate this review with the ISA reviewer. A detailed review will be conducted of (1) the accident sequences that, when left unmitigated, are rated as "high" consequence to an individual located outside the controlled area, (2) approximately 10 percent of the "intermediate" consequence sequences, and (3) a smaller number of accident sequences in which the consequences are less than intermediate. However, additional intermediate and low consequence sequences may be evaluated on the basis of the results of the initial review.

An evaluation of the ISA Summary requires coordination with other technical reviewers. The environmental review of the IROFS will be coordinated with the reviewers for the specific assurance functions, such as training and maintenance. The review of the ISA Summary may require the examination of the ISA and of detailed supporting ISA documents located at the

facility. On the basis of these reviews, the reviewer should decide what supporting documents need to be reviewed. The reviewer will clearly identify in the SER either the materials examined and the descriptions and commitments considered and relied on or the basis for the staff's safety decision.

9.5.3 Management Measures

The environmental reviewer should review the grades assigned to the IROFS to ensure that the management measures described in SRP Chapter 11 are used to determine whether the licensee has established adequate management measures to apply to all IROFS designated to prevent or mitigate high or intermediate accident consequences to a member of the public or intermediate consequences to the environment in accordance with 10 CFR 70.61(b)(2), 10 CFR 70.61(c)(2), and 10 CFR 70.61(c)(3). The environmental reviewer should review the grades assigned to the IROFS to ensure that the management measures are graded commensurate with the reduction of risk attributable to the IROFS.

During the application and ISA Summary review, the reviewer should identify and communicate to the inspection staff any items or issues that should be inspected during an operational readiness review, if such a review will be performed. These items could include confirming that the engineered controls installed in the process actually meet the capabilities described in the ISA Summary and that administrative controls are implemented through procedures and operator training.

9.6 Evaluation Findings

An SER documents the evaluation findings of the environmental protection review of the application, including the review of the environmental protection program and the ISA Summary.

The staff reviewers will verify that the information submitted by the applicant is in accordance with 10 CFR Part 20, 10 CFR Part 51, and 10 CFR Part 70 and is consistent with the guidance in this SRP as it applies to environmental protection. In the input to the SER, the primary reviewer should document the bases for determining the adequacy of the application with respect to environmental protection and should recommend additional license conditions in areas where the application is not adequate. The primary reviewer also describes the applicant's approach to ensuring the quality and reliability of the IROFS required for environmental protection.

Environmental protection is often reviewed and evaluated in conjunction with the environmental report, and the EA or EIS summarizes the environmental protection function. However, the EA or EIS does not become part of the license. The SER should briefly discuss issues identified during the review, and any recommended license conditions based on the analysis in the EA or EIS should be added to the license.

If an EA or EIS is prepared for the licensing action, the environmental safety section of the SER should report the date the document was issued. If the EA results in a FONSI, the SER should include the publication date of the FONSI in the *Federal Register*. If an EIS is prepared, the SER would include the *Federal Register* publication date for the record of decision. When applicable, the SER will also document the determination that an action meets the requirements for a categorical exclusion.

9.6.1 Safety Evaluation

The following language would be appropriate for a licensing action that requires an environmental review:

The applicant has committed to adequate environmental protection measures, including (1) environmental and effluent monitoring and (2) effluent controls to maintain public doses ALARA as part of the radiation protection program. The NRC staff concludes, with reasonable assurance, that the applicant's conformance to the application and license conditions is adequate to protect the environment and public health and safety and to comply with the regulatory requirements imposed by the Commission in 10 CFR Part 20, 10 CFR Part 51, and 10 CFR Part 70. The bases for these conclusions are as follows:

[State the bases for the conclusion, including any recommended license conditions.]

If the action requires preparation of an EIS, the SER should include the following language:

The NRC staff prepared an environmental impact statement (EIS) [publication date] for this licensing action as required by 10 CFR 51.20. On the basis of the EIS, the NRC stated in its record of decision [publication date in the *Federal Register*] that the preferred option was [state preferred option here].

If the action requires preparation of an EA and results in a FONSI, the SER should include the following language:

The NRC staff prepared an environmental assessment (EA) for this action as required by 10 CFR 51.45 and 10 CFR 51.60. On the basis of the EA, the staff has reached a finding of no significant impact, published in the *Federal Register* on [publication date and FR citation].

If the staff determines that the action was categorically excluded from environmental review under 10 CFR 51.22, the SER should include the following language:

The staff has determined that the amended actions are administrative, organizational, or procedural in nature. Based on this evaluation, there is no significant impact to the environment, and the action of amending the license is eligible for categorical exclusion. Therefore, in accordance with 10 CFR 51.22(c)(11), neither an environmental assessment nor an environmental impact statement is required for this action. The regulation at 10 CFR 51.22(c)(11) allows for a categorical exclusion if the following four requirements have been satisfied:

- (1) There is no significant change in the types or significant increase in the amounts of any effluents that may be released off site.
- (2) There is no significant increase in individual or cumulative occupational radiation exposure.
- (3) There is no significant construction impact.

- (4) There is no significant increase in the potential for, or consequences from, radiological accidents.

The changes made in this licensing action do not pose a significant change or increase in parameters (1) through (4) above. There are no changes in the types or increases in the amounts of effluents. Occupational exposure is expected to remain the same. These changes involve no additional construction activity. The potential for, and consequences from, radiological accidents are expected to be the same.

[State the bases for the conclusion, including any recommended license conditions.]

The NRC staff prepared an environmental impact statement (EIS) [publication date] for this licensing action as required by 10 CFR 51.20. On the basis of the EIS, the NRC stated in its record of decision [publication date in the *Federal Register*] that the preferred option was [state preferred option here].

9.7 References

U.S. Code of Federal Regulations, Chapter I, Title 10, "Energy," Part 20, "Standards for Protection against Radiation."

U.S. Code of Federal Regulations, Chapter I, Title 10, "Energy," Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

U.S. Code of Federal Regulations, Chapter I, Title 10, "Energy," Part 70, "Domestic Licensing of Special Nuclear Material."

American National Standards Institute, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities," ANSI N13.1-1982.

American National Standards Institute, "Specification and Performance of On-Site Instrumentation for Continuously Monitoring Radioactive Effluents," ANSI N42.18-1980.

National Council on Radiation Protection and Measurements, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground," NCRP Report No. 123, Volumes I and II, January 1996.

U.S. Environmental Protection Agency, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," Federal Guidance Report No. 11, September 1988.

U.S. Nuclear Regulatory Commission, "Guidance to Hazardous, Radioactive, and Mixed Waste Generators on the Elements of a Waste Minimization Program," Information Notice No. 94-23, March 25, 1994.

U.S. Nuclear Regulatory Commission, "Solubility Criteria for Liquid Effluent Releases to Sanitary Sewerage under the Revised 10 CFR Part 20," Information Notice 94-07, January 28, 1994.

U.S. Nuclear Regulatory Commission, NMSS/FCSS/Fuel Cycle Licensing Branch, "Materials Licensing Procedures Manual," Revision 5, September 1996.

U.S. Nuclear Regulatory Commission, "Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination)—Effluent Streams and the Environment," Regulatory Guide 4.15, Revision 2, July 2007.

U.S. Nuclear Regulatory Commission, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants," Regulatory Guide 4.16, Revision 1, December 1985.

U.S. Nuclear Regulatory Commission, "Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors," Regulatory Guide 4.20, December 1996.

U.S. Nuclear Regulatory Commission, "ALARA Levels for Effluents from Materials Facilities," Regulatory Guide 8.37, July 1993.

U.S. Nuclear Regulatory Commission, "Nuclear Fuel Cycle Accident Analysis Handbook," NUREG/CR-6410, March 1998.

U.S. Nuclear Regulatory Commission, "Integrated Safety Analysis Guidance Document," NUREG-1513, May 2001.

U.S. Nuclear Regulatory Commission, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," NUREG-1748, August 2003.