



DANU-ISG-2022-03

Advanced Reactor Content of Application Project

**Chapter 9, “Control of Routine Plant Radioactive Effluents,
Plant Contamination and Solid Waste”**

Interim Staff Guidance

March 2024

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DRAFT INTERIM STAFF GUIDANCE
ADVANCED REACTOR CONTENT OF APPLICATION PROJECT
**CHAPTER 9, “CONTROL OF ROUTINE PLANT RADIOACTIVE EFFLUENTS,
PLANT CONTAMINATION, AND SOLID WASTE”**
DANU-ISG-2022-03

PURPOSE

The U.S. Nuclear Regulatory Commission (NRC or Commission) staff is providing this interim staff guidance (ISG) for two reasons. First, this ISG provides guidance on the contents of applications to an applicant submitting a risk-informed, performance-based application for a construction permit (CP) or operating license (OL) under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, “Domestic Licensing of Production and Utilization Facilities” (Ref. 1), or for a combined license (COL), a manufacturing license (ML), a standard design approval (SDA), or a design certification (DC) under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants” (Ref. 2), for a non-light water reactor (non-LWR). The application guidance found in this ISG supports the development of the portion of a non-LWR application associated with an applicant’s control of routine plant radioactive effluents, plant contamination, and solid waste.¹ Second, this ISG provides guidance to NRC staff on how to review such an application.

As of the date of this ISG, the NRC is developing a rule to amend 10 CFR Parts 50 and 52 (RIN 3150-A166). The NRC staff notes this guidance may need to be updated to conform to changes to 10 CFR Parts 50 and 52, if any, adopted through that rulemaking. Further, as of the date of this ISG, the NRC is developing an optional performance-based, technology-inclusive regulatory framework for licensing nuclear power plants designated as 10 CFR Part 53, “Licensing and Regulation of Advanced Nuclear Reactors,” (RIN 3150-AK31). After promulgation of those regulations, the NRC staff anticipates that this guidance will be updated and incorporated into the NRC’s Regulatory Guide (RG) series or a NUREG series document to address content of application considerations specific to the licensing processes in this document.

BACKGROUND

This ISG is based on the advanced reactor content of application project (ARCAP), whose purpose is to develop technology-inclusive, risk-informed, and performance-based application guidance. The ARCAP is broader than, and encompasses, the industry-led technology-inclusive content of application project (TICAP). The guidance in this ISG supplements the guidance

¹ The NRC is issuing this ISG to describe methods that are acceptable to the NRC staff for implementing specific parts of the agency’s regulations, to explain techniques that the NRC staff uses in evaluating specific issues or postulated events, and to describe information that the NRC staff needs in its review of applications for permits and licenses. The guidance in this ISG that pertains to applicants is not NRC regulations and compliance with it is not required. Methods and solutions that differ from those set forth in this ISG are acceptable if supported by a basis for the issuance or continuance of a permit or license by the Commission.

found in Division of Advanced Reactors and Non-power Production and Utilization Facilities (DANU)-ISG-2022-01, “Review of Risk-Informed, Technology-Inclusive Advanced Reactor Applications – Roadmap,” issued in March 2024 (Ref. 3), which provides a roadmap for developing all portions of an application. The guidance in this ISG is limited to the portion of a non-LWR application associated with the control of routine plant radioactive effluents, plant contamination, and solid waste and the NRC staff review of that portion of the application.

RATIONALE

The current application guidance related to the control of routine plant radioactive effluents, plant contamination, and solid waste is directly applicable only to light water reactors (LWRs) and may not fully identify the information to be included in a non-LWR application or efficiently provide a technology-inclusive, risk-informed, and performance-based review approach for non-LWR technologies. This ISG serves as the non-LWR application guidance for control of routine plant radioactive effluents, plant contamination, and solid waste. This ISG provides both applicant content of application and NRC staff review guidance.

APPLICABILITY

This ISG is applicable to applicants for non-LWR² permits and licenses that submit risk-informed, performance-based applications for CPs or OLs under 10 CFR Part 50 or for COLs, SDAs, DCs, or MLs under 10 CFR Part 52. This ISG is also applicable to the NRC staff reviewers of these applications.

PAPERWORK REDUCTION ACT

This ISG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 50 and 52 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0011 and 3150-0151. Send comments regarding this information collection to the FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555 0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the OMB reviewer at: OMB Office of Information and Regulatory Affairs (3150-0011 and 3150-0151), Attn: Desk Officer for the Nuclear Regulatory Commission, 725 17th Street, NW Washington, DC 20503.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

GUIDANCE

Nuclear power plants that generate liquid, gaseous, and solid waste during normal operations must have processes to contain, store, and release these wastes in accordance with NRC regulations. In 10 CFR Part 20, “Standards for protection against radiation,” (Ref. 4), the NRC

² Applicants desiring to use this ISG for a light water reactor application should contact the NRC staff to hold pre-application discussions on their proposed approach.

sets limits on the activity of liquid and gaseous waste which can be released into the environment as well as establishing requirements for contamination control. In addition, 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste" (Ref. 5), describes the classes of low-level waste and acceptable packaging for its disposal, as a function of its composition and activity level. Each reactor design that generates radioactive wastes must have radioactive waste management systems that ensure these requirements are met.

10 CFR Part 50, Appendix A, "General Design Criteria for Nuclear Power Plants," contains the General Design Criteria (GDCs) that establish the minimum requirements for the principal design criteria for water-cooled nuclear power plants. Appendix A also indicates that the GDCs are generally applicable to other types of nuclear power units and are intended to provide guidance in determining the principal design criteria (PDC) for such other units. As such, GDC 60, "Control of releases of radioactive materials to the environment"; GDC 61, "Fuel storage and handling and radioactivity control"; and GDC 64, "Monitoring radioactivity releases," establish design criteria for controlling and monitoring releases of radioactive materials to the environment for LWRs. GDC 63, "Monitoring fuel and waste storage," establishes design criteria for detecting conditions that may result in the loss of heat removal and excessive radiation levels in radioactive waste systems. Further guidance can be found in Regulatory Guide (RG) 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors" (Ref. 6), and the advanced reactor design criteria (ARDC) 60, 61, 63, and 64 contained therein.

Requirements described in 10 CFR 50.34, "Contents of applications; technical information," 10 CFR 50.34a, "Design objectives for equipment to control releases of radioactive material in effluents – nuclear power reactors," 10 CFR 52.47, "Contents of applications; technical information," 10 CFR 52.79, "Contents of applications; technical information in final safety analysis report," 10 CFR 52.137, "Contents of applications; technical information," and 10 CFR 52.157, "Contents of applications; technical information in final safety analysis report," specify that an application for a CP, OL, DC, COL, SDA, or ML describe the radioactive materials expected to be produced in the operation, an estimate of the radionuclides expected to be released annually to unrestricted areas, and the means for controlling and limiting radioactive effluents and radiation exposures to within the limits set forth in the regulations. However, as discussed below, an alternative approach to demonstrating compliance with these requirements is for an application to provide a summary of the design features and describe a performance monitoring program for effluent releases in lieu of providing detailed system descriptions and analysis of estimated effluent releases. This alternative would require an exemption to some of the listed regulations.

This guidance for Chapter 9 applies to a non-LWR application for a 10 CFR Part 50 CP and OL or a 10 CFR Part 52 COL, SDA, ML or DC. For a DC, however, conceptual design information is permitted for those portions of a design for which an application does not seek certification (refer to RG 1.206, "Applications for Nuclear Power Plants" (Ref. 7)), and for a ML, SDA, or DC, the programmatic information may be deferred to the COL stage using COL action items.

Application Guidance

An applicant for a CP shall include the PDC within the preliminary safety analysis report (PSAR) in accordance with 10 CFR 50.34. An applicant for a CP should consider design and programmatic elements that are required as part of an OL application that may benefit from early assessment and description in the PSAR, especially as they may impact final facility design elements that could be difficult to change during construction (e.g., facility layout, shielding). Examples of this type of information include (1) a radioactive effluents monitoring

program to verify compliance with 10 CFR Part 20 and 10 CFR 50.34a requirements, (2) design provisions that will meet 10 CFR 20.1406 to minimize contamination and control and collect any spillage, and (3) a process control program (PCP) for solid waste that meets 10 CFR Part 61. An application for a COL should also include information to satisfy these requirements in accordance with 10 CFR 52.79(a)(3), (16), and (45).

For Chapter 9 content, DC, SDA, and ML applications need only include (i) information to identify the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive effluents and radiation exposures within the limits set forth in Part 20 (per 10 CFR 52.47(a)(5), 52.137(a)(5) and 52.157(e), respectively); (ii) information required by 10 CFR 20.1406 (per 10 CFR 52.47(a)(6), 52.137(a)(6), and 52.157(f)(9), respectively); and (iii) information with respect to the design of equipment to maintain control over radioactive material in gaseous and liquid effluents produced during normal reactor operations as described in 10 CFR 50.34a(e) (per 10 CFR 52.47(a)(10), 52.137(a)(10), and 52.157(f)(11), respectively). Programmatic information identified below related to Chapter 9 (e.g., radiation protection program description) that is not included in an application for a DC, SDA, or ML should be addressed in the subsequent COL applications.

The applicant should provide the additional information described below as part of its OL application. The applicant may request final approval for a particular design element or program described below in the CP application if the information provided in the PSAR is complete and equivalent to that provided in an OL application, in accordance with 10 CFR 50.35, "Issuance of Construction Permits."

The guidance in Sections 9.1 through 9.3 below summarizes the information that should be included in an application regarding control and management of liquid and gaseous effluents, contamination, and solid waste. The guidance also summarizes the information that should be included in a risk-informed approach to demonstrate compliance with the applicable regulations.

The applicant may describe the needed information for final safety analysis report (FSAR) Chapter 9 within the radiation protection program or the PCP document, which may be part of a separate application document. Because the NRC staff will rely on information in the radiation protection program, the PCP document and the FSAR to make its safety finding, such information does not need to be repeated in the FSAR. However, the FSAR should incorporate this information by reference to ensure that future changes are properly evaluated through the FSAR change process to determine the need for prior NRC approval.

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

- 10 CFR Part 20
- the scope of the topics described in GDC 60, 61, 63, and 64 (or applicable RG 1.232 ARDC or proposed design-specific PDC)
- 10 CFR 50.34
- 10 CFR 50.34a
- 10 CFR 52.47
- 10 CFR 52.79
- 10 CFR 52.137

- 10 CFR 52.157
- 10 CFR Part 61
- 10 CFR Part 71

9.1 Liquid and Gaseous Effluents

The application must provide assurance that the limits on the release of radioactive liquid and gaseous effluents and direct radiation, as appropriate, during normal operation (including anticipated operational occurrences (AOOs)) will meet the relevant requirements in 10 CFR Part 20 and 10 CFR Parts 50 and 52. Specifically, the applicant must address the following:

- 10 CFR 20.1101(b) requires the licensee to use, to the extent practical, engineering controls and procedures to achieve doses to members of the public that are as low as reasonably achievable (ALARA).
- 10 CFR 20.1301(a) specifies the allowable annual dose and allowable hourly dose to members of the public from routine operation.
- 10 CFR 20.1301(e) specifies that a licensee subject to the provisions of Environmental Protection Agency's generally applicable environmental radiation standards in 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Reactors," (Ref. 8) shall comply with those standards.
- 10 CFR 20.1302(b) provides two options to demonstrate compliance with 10 CFR 20.1301, "Dose limits for individual members of the public," by allowing the designer to show that 1) the total effective dose equivalent to the individual likely to receive the highest dose from licensed operation does not exceed the annual dose limit; or 2) the concentrations of radionuclides in liquid and gaseous effluents (contained in 10 CFR Part 20, Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure Effluent Concentrations; Concentrations for Release to Sewerage," Table 2, "Effluent Concentrations") are not exceeded and specified annual and hourly doses to an individual in an unrestricted area are not exceeded.
- 10 CFR 20.1302(c) contains a provision allowing for adjustment, upon Commission approval, of the concentrations contained in 10 CFR Part 20, Appendix B, Table 2, to take into account the actual physical and chemical characteristics of the effluent.
- 10 CFR 50.34 specifies the contents of applications for CPs and OLs.
- 10 CFR 50.34a specifies design objectives for the release of radioactive material in effluents.
- GDC 60 (or RG 1.232, ARDC 60, or proposed design-specific PDC, as applicable) specifies that the waste systems have sufficient holdup capacity for retention of gaseous and liquid effluents containing radioactive materials.

- GDC 64 (or RG 1.232, ARDC 64, or proposed design-specific PDC, as applicable) specifies monitoring requirements for, in part, effluent discharge paths for radioactivity that may be released from normal operations.
- 10 CFR 52.47 specifies the required contents of applications for DCs.
- 10 CFR 52.79 specifies the required contents of applications for COLs.
- 10 CFR 52.137 specifies the required contents of applications for SDAs.
- 10 CFR 52.157 specifies the required contents of applications for MLs.

The regulations in 10 CFR 50.34, 50.34a, 10 CFR 52.47, 10 CFR 52.79, 10 CFR 52.137, and 10 CFR 52.157 require system descriptions and analysis of estimated effluent releases. If a particular reactor design can be shown to not generate any normal radioactive effluent releases throughout its life cycle, then the application can meet these regulations by describing (1) sufficient information to substantiate this design attribute, (2) controls to ensure the design will maintain this characteristic throughout the life of the plant, and (3) how the applicant will detect an unexpected radioactive effluent release.

As an alternative to providing detailed system descriptions and analysis of estimated effluent releases, an applicant may submit a request for an exemption to these requirements if it can demonstrate compliance with 10 CFR Part 20 by establishing a performance monitoring program to confirm design features and programmatic controls effectively limit the release of radioactive effluents. This request for exemption should describe a performance monitoring program for effluent releases that will ensure that effluent release limits will be met during normal operations for the life of the plant, and this program description may be in Chapter 9 of the FSAR or the radiation protection program document. Information related to plant systems can be limited to general descriptions of layout and technologies used to limit the release of the various inventories of radioactive materials within the plant and how operating experience or other information provides confidence in the expected system performance. While the application does not have to include the specific analysis of effluent releases, an applicant should provide a summary of estimated doses to a member of the public from any such releases and develop such a specific analysis for its internal engineering documents. These specific analyses along with additional details of the design features and associated programmatic controls could be the subject of an audit by NRC staff reviewers at the time of application review or subsequently as part of inspections during plant construction or operation.

The description of the monitoring program should address monitoring the performance of the design features that control the liquid and gaseous effluents (e.g., release pathways, instrument coverage, instrument accuracy and equipment reliability) and by monitoring the releases themselves, including frequency and methods.

The applicant must also ensure that all other exemption requirements are met and discussed in the request, pursuant to 10 CFR 50.12 or 10 CFR 52.7.

When an applicant elects to pursue an exemption to the content of application requirements referenced above by use of a performance monitoring program in lieu of providing complete system descriptions and supporting analyses, significant portions of the system design information that has historically been provided in FSARs may not be required to be included in

Chapter 9 of the application's FSAR, such as the following:

- detailed quality assurance (QA) provisions for radioactive waste management structures, systems, and components (SSCs) as described in RG 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants" (Ref. 9)
- types and characteristics of filtration, ion-exchange resins, and adsorbent media to treat liquid process and effluent streams, including expected removal efficiencies, decontamination factors, holdup or decay times, and the applications of these characteristics in estimating releases by specific waste streams and treatment methods
- information describing the types of proposed filtration and adsorption media, including details from the applicant or suppliers, as generic or plant-specific information, in characterizing removal efficiencies, decontamination factors, and holdup or decay times
- availability of standby equipment, alternate processing routes, and interconnections between permanently installed subsystems and skid-mounted processing equipment

9.1.1 Staff Review Guidance - Acceptance Criteria

For applications that pursue an exemption and propose a performance monitoring program, the NRC staff reviewer should ensure that the application includes sufficient information to understand the general layout and technologies used for radioactive waste system design, the radioactive sources, the monitoring instrumentation to be used, and the applicable programmatic requirements for controlling effluent releases. The reviewer should be able to reach a safety finding and address the topics in the NRC's safety evaluation report if the application includes the following information:

- a. Describes the sources of normal radioactive liquid and gaseous waste, including the general quantities and composition of liquid and gaseous radioactive waste estimated to be contained in the systems. Includes a high-level description of any mathematical models and parameters used for developing the source terms. In addition, provides a summary of the estimated doses to a member of the public from normal radioactive liquid and gaseous waste releases. This information will assist the staff in drawing independent conclusions as to the feasibility of the reactor design meeting effluent release requirements.
- b. Refers to the radiation protection program, which describes organizations, procedures, and other means to limit the release of radionuclides from or within the plant.
- c. Includes the instrumentation to be used to monitor normal and potential liquid and gaseous effluent pathways including types, release points, approximate instrument locations, instrument alarm and/or trip setpoints, automatic control features, and provisions for calibration. The NRC staff needs this information to determine that all liquid and effluent release paths are properly monitored.
- d. Describes any equipment performance requirements or quality standards that are considered necessary to ensure instrument accuracy and equipment reliability. The degree of instrument accuracy and equipment reliability need only be commensurate

with the degree to which the equipment is being relied upon to meet 10 CFR Part 20 and 10 CFR 50.34a requirements. The NRC staff needs this information to evaluate the quality of the instruments monitoring effluent releases to ensure that release requirements will be met.

- e. Describes a summary of the design features and how the performance monitoring program will ensure that releases of radioactive liquid and gaseous effluents comply with the requirements in 10 CFR 20.1101, "Radiation protection programs," 10 CFR 20.1301, 10 CFR 20.1302, "Compliance with dose limits for individual members of the public," and 10 CFR 50.34a (including GDC 64 or ARDC 64, or proposed design-specific PDC, if applicable). This description should include how effluent concentration limits have been established, what monitoring is to be done and how often (e.g., sampling frequencies), and the process for reviewing the results and determining compliance with the applicable requirements. The performance monitoring should be consistent with the guidance contained in NUREG/BR-0303, "Guidance for Performance-Based Regulation," issued December 2002 (Ref. 10).

Since the NRC staff is relying on the performance monitoring program to make its safety decision, it is important that sufficient descriptive information on the program attributes be included to provide confidence that deviations from expected effluent release quantities are detected in sufficient time to ensure that release limits in 10 CFR Part 20 and ALARA design objectives specified in 10 CFR 50.34a will not be exceeded.

- f. Includes proposed PDCs that address design, fabrication, construction, testing, quality, and performance requirements necessary to provide reasonable assurance that the facility can be operated without undue risk to public health and safety.

For applications not pursuing an exemption, the reviewer should be able to reach a safety finding and address the topics in the NRC's safety evaluation report if the application includes the information in acceptance criteria 9.1.1.a through 9.1.1.d and 9.1.1.f as detailed above and the following information:

- g. Includes system descriptions, analysis of estimated effluent releases, and descriptions of surveys and monitoring to meet the requirements in 10 CFR 20.1101, 10 CFR 20.1301, 10 CFR 20.1302, and 10 CFR 50.34a (including GDC 64 or ARDC 64, or proposed design-specific PDC, if applicable).

The level of detail in the application should be sufficient for the NRC staff to conclude that the design includes the equipment and programmatic controls capable of controlling releases of radioactive materials in liquid and gaseous effluents in accordance with the requirements specified above. Information contained in the radiation protection program may be incorporated by reference into the FSAR in lieu of repeating the information in this chapter. The staff may also rely on audits of the applicant's internal effluent release analysis to provide further confidence that effluent release limits can be met during plant operation.

For applications utilizing the guidance in Nuclear Energy Institute (NEI) 18-04, Revision 1, “Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Licensing Basis Development” (Ref. 11), the NRC expects that the applicant will analyze abnormal events involving the radioactive liquid and gaseous effluents and waste systems as part of licensing basis event (LBE) analysis to determine their risk significance and contribution to LBE identification. Specifically, as stated in NEI 18-04, Revision 1, Section 3.2.1:

The LBEs identified in the PRA [probabilistic risk assessment] can identify important events that have the potential to release radioactivity to the public. Thus, LBEs can inform the determination of the limiting source terms and potential releases to be considered for operational protection in normal operations as well as AOOs and DBEs [design basis events] that can then be used to identify design-specific shielding, filtering capability of the heating, ventilation, and air conditioning system, monitoring, and other requirements for different types of non-LWRs.

As part of the LBE analysis (in Chapter 3 of the safety analysis report for applications using NEI 18-04, Revision 1), applicants should show that AOOs are unlikely to result in a plant exceeding the dose limits defined in 10 CFR 20.1301(a)(1). Therefore, this chapter of the application does not need to repeat evaluations addressing this dose requirement or analysis of risk significance of the radioactive waste systems performed as part of the LBE analysis.

9.2 Contamination Control

Application Guidance

The application should describe sufficient design and programmatic information to address 10 CFR 20.1406, “Minimization of contamination,” which requires that the design and operation minimize contamination of the facility and the environment.

The principles of contamination control that should be embodied in the applicant’s design and operating philosophy are threefold: (1) prevention of unintended releases, (2) early detection if there is unintended release of radioactive contamination, and (3) prompt assessment to support a timely and appropriate response. The application content in this area should be developed using a risk-informed approach that considers the magnitude of the hazard involved. Licensee activities do not all reflect the same potential for contamination of a facility and the environment, or for the generation of radioactive waste. Therefore, the applicant should use judgment to determine the extent of the information provided.

Even applications that do not deal with large or significant amounts of radioactive material need to address the minimization and facilitation provisions of the regulations. However, applicants should address those provisions using common sense and good judgment and ensure that all other applicable regulatory limits are met. RG 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning” (Ref. 12), contains further guidance.

For the programmatic elements of 10 CFR 20.1406, NEI 08-08A, “Generic FSAR Template Guidance for Life Cycle Minimization of Contamination,” describes a template for an operational program to minimize contamination throughout the life-cycle of a facility, including provisions for minimizing facility contamination, environmental contamination, waste generation, and facilitating decommissioning. While the NRC staff has not endorsed NEI 08-08A, it has approved the NEI 08-08A minimization of contamination program template via safety evaluation

and NEI 08-08A is similar to an approved topical report. Accordingly, an applicant who wishes to adopt the NEI 08-08A program template to minimize facility contamination should explain why the program template applies to its proposed facility, including how the conditions for use of the template, if any, are satisfied, and add any information the program template identifies as an applicant's responsibility.

9.2.1 Staff Review Guidance – Acceptance Criteria

The NRC staff reviewer should ensure that the application includes sufficient information to understand how contamination in the plant will be minimized. The reviewer should be able to reach a safety finding and address the topics in the NRC's safety evaluation report if the application includes the following information:

- a. Design provisions to minimize contamination and control and collect any spillage. This should include how the facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. The NRC reviewer needs to understand the applicant's design provisions to control contamination to make a finding that the plant meets the requirements in 10 CFR 20.1406.

9.3 Solid Waste

Application Guidance

The application should describe the sources of solid waste and design capacities of the solid waste management system (SWMS). If a vendor-supplied process for solidification or dewatering is used, the applicant should commit to provide the topical report or other certification documenting an appropriate approval of the process and associated containers to be used.

Additionally, the applicant should describe the methods and controls, process parameters, sampling and surveillance requirements that are necessary for the interim storage, solidification or dewatering, packaging, and final disposal of radioactive wastes to meet the following regulations:

- 10 CFR 20.1302 and 10 CFR 20.1301(e), as they relate to radioactive materials released in gaseous and liquid effluents to unrestricted areas. These criteria apply to releases resulting from SWMS operation during normal plant operations and AOOs.
- 10 CFR 20.1406, as it relates to the design and operational procedures for minimizing contamination, facilitating eventual decommissioning, and minimizing the generation of radioactive waste.
- 10 CFR 20.2006, "Transfer for disposal and manifests," and Appendix G to 10 CFR Part 20, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests," as they relate to the requirements for transferring and manifesting radioactive materials shipments to authorized facilities (e.g., disposal sites, waste processors).

- 10 CFR 20.2007, “Compliance with environmental and health protection regulations,” as it relates to compliance with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of radioactive wastes, such as mixed wastes characterized by the presence of hazardous chemicals and radioactive materials, that may be disposed under 10 CFR Part 20.
- 10 CFR 20.2108, “Records of waste disposal,” as it relates to the maintenance of waste disposal records until the NRC terminates the pertinent license requirements.
- 10 CFR 50.34, as it relates to a description of the facilities radioactive waste handling systems.
- 10 CFR 50.34a, as it relates to the provision of sufficient information to demonstrate that design objectives for equipment necessary to control releases of radioactive effluents to the unrestricted areas are kept ALARA.
- GDC 60, or ARDC 60, or a proposed design-specific PDC, as it relates to the design of the SWMS to control the release of radioactive materials in liquid effluents from the SWMS and to handle solid wastes produced during normal plant operation, including AOOs.
- GDC 61, or ARDC 61, or proposed design-specific PDC, as it relates to providing assurance that releases of radioactive materials during normal operation and AOOs, including adverse conditions on system components, will not result in radiation doses that exceed the 10 CFR Part 20.
- GDC 63, or ARDC 63, or proposed design-specific PDC, as it relates to the ability of the SWMS to detect conditions that may result in excessive radiation levels and to initiate appropriate safety actions.
- 10 CFR 61.55, “Waste classification,” and 10 CFR 61.56, “Waste characteristics,” as they relate to classifying, processing, and disposing of dry solid and wet wastes at approved low-level radioactive waste disposal sites.
- 10 CFR Part 71, “Packaging and Transportation of Radioactive Material” (Ref. 13), and 49 CFR Subchapter C, “Hazardous Materials Regulations,” Parts 171–180, as they relate to the use of approved containers and packaging methods for the shipment of radioactive materials.
- 40 CFR Part 190, generally applicable environmental radiation standards, as implemented under 10 CFR 20.1301(e)), as it relates to limits on total annual doses from all sources of radioactivity and radiation from the site (with single or multiple units).
- 49 CFR 173.443, “Contamination control” (Ref. 14), as it relates to methods and procedures used to monitor for the presence of removable contamination on shipping containers, and 49 CFR 173.441, “Radiation level limitations and exclusive use provisions,” as it relates to methods and procedures.

The application should also identify any waste streams that could contain hazardous chemicals and radioactive materials, or mixed waste, that will need to be processed and disposed of in accordance with applicable Federal, State, and local regulations.

NEI 07-10A, Revision 0, "Generic FSAR Template Guidance for Process Control Program (PCP)" (Ref. 15), is one element of the Process and Effluent Monitoring and Sampling Program. The PCP identifies administrative and operational controls for waste processing, process parameters, and surveillance requirements to assure that final waste products of nuclear power reactors meet the requirements for waste forms for burial at a low-level waste disposal site licensed under 10 CFR Part 61. The generic PCP presents methods by which liquid and wet waste may be processed and disposed of in accordance with Part 61 and packaged and transported in accordance with 10 CFR Parts 20 and 71 and 49 CFR Parts 171-180. While the NRC staff has not endorsed NEI 07-10A, it has approved the PCP template via safety evaluation and NEI 07-10A is similar to an approved topical report. Accordingly, an applicant who wishes to employ the NEI 07-10A PCP template for the portion of the Chapter 9 application content it covers should explain why the template applies to its proposed facility, including how the conditions for use of the template, if any, are satisfied, and add any information the template notes as an applicant's responsibility.

9.3.1 Staff Review Guidance - Acceptance Criteria

The NRC staff reviewer should ensure that the application includes sufficient information to understand the design of the SWMS (either as a permanently installed system or in combination with mobile systems), which includes the equipment necessary to process liquid, wet, and dry solid wastes and the control releases of radioactive materials associated with the operation of the SWMS. The reviewer should be able to reach a safety finding and address the topics in the NRC's safety evaluation report if the application includes the following information:

- a. Provides a high-level description of the SWMS that includes the following:
 - i. expected sources of waste (e.g., resins, sludge, filters, charcoal), waste composition (e.g., mixed waste), chemical makeup, dry or wet and other important factors
 - ii. the equipment design capacities for expected waste volumes and radioactivity inventories of Class A, B, and C waste associated with normal operation and AOOs
- b. Describes design provisions to control and collect any solid waste spillage from equipment malfunction or puncture of waste containers.
- c. Proposes PDC that address design, fabrication, construction, testing, quality, and performance requirements necessary to provide reasonable assurance that the facility can be operated without undue risk to public health and safety.
- d. Provides a description of operational controls for waste processing and surveillance requirements which assure that:
 - i. Allowable doses to members of the public will remain within required levels.

- ii. The final waste product meets the requirements of applicable Federal, State, and disposal site waste form requirements for burial at a 10 CFR Part 61 licensed low-level waste disposal site.
- iii. As an option to address this criterion, the applicant may refer to NEI 07-10A. If the applicant chooses to reference this template, the FSAR does not need to replicate the text. Note: NEI developed this template for LWRs and may need to update it to reflect the specific technology. For example, Section 3.5 of the template describes a set of “waste types” typically generated at LWRs. Depending on the specific technology, non-LWRs may need to address other “waste types” not typically generated at a LWR.

IMPLEMENTATION

The NRC staff will use the information discussed in this ISG to review non-LWR applications for CPs, OLs, DCs, COLs, SDAs, and MLs under 10 CFR Part 50 and 10 CFR Part 52. The NRC staff intends to incorporate this guidance in updated form in the RG or NUREG series, as appropriate.

BACKFITTING AND ISSUE FINALITY DISCUSSION

The NRC staff may use DANU-ISG-2022-03 as a reference in its regulatory processes, such as licensing, inspection, or enforcement. However, the NRC staff does not intend to use the guidance in this ISG to support NRC staff actions in a manner that would constitute backfitting as that term is defined in 10 CFR 50.109, “Backfitting,” and as described in NRC Management Directive 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests” (Ref. 16), nor does the NRC staff intend to use the guidance to affect the issue finality of an approval under 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.” The staff also does not intend to use the guidance to support NRC staff actions in a manner that constitutes forward fitting as that term is defined and described in Management Directive 8.4. If a licensee believes that the NRC is using this ISG in a manner inconsistent with the discussion in this paragraph, then the licensee may file a backfitting or forward fitting appeal with the NRC in accordance with the process in Management Directive 8.4.

CONGRESSIONAL REVIEW ACT

DANU-ISG-2022-03, Chapter 9, “Control of Routine Plant Radioactive Effluents, Plant Contamination and Solid Waste,” is a rule as defined in the Congressional Review Act (5 U.S.C. 801-808). However, the Office of Management and Budget has not found it to be a major rule as defined in the Congressional Review Act.

FINAL RESOLUTION

The NRC staff will transition the information and guidance in this ISG into the RG or NUREG series, as appropriate. Following the transition of all pertinent information and guidance in this document into the RG or NUREG series, or other appropriate guidance, this ISG will be closed.

ACRONYMS

ALARA as low as reasonably achievable

AOO	anticipated operational occurrence
ARCAP	advanced reactor content of application project
ARDC	advanced reactor design criterion
CFR	<i>Code of Federal Regulations</i>
COL	combined license
CP	construction permit
DANU	Division of Advanced Reactors and Non-power Production and Utilization Facilities
DBE	design basis event
DC	design certification
FSAR	final safety analysis report
GDC	general design criterion/a
ISG	interim staff guidance
LBE	licensing basis event
LWR	light-water reactor
ML	manufacturing license
NEI	Nuclear Energy Institute
NRC	U.S. Nuclear Regulatory Commission
OL	operating license
PCP	process control program
PDC	principal design criterion
PRA	probabilistic risk assessment
QA	quality assurance
RG	regulatory guide
SDA	standard design approval
SSC	structure, system, and component
SWMS	solid waste management system
TICAP	technology-inclusive content of application project

REFERENCES

1. Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, “Domestic Licensing of Production and Utilization Facilities.”
2. 10 CFR Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”
3. U.S. Nuclear Regulatory Commission, DANU-ISG-2022-01, “Review of Risk-Informed, Technology-Inclusive Advanced Reactor Applications – Roadmap,” March 2024 (ADAMS Accession No. ML23277A139).
4. 10 CFR Part 20, “Standards for Protection against Radiation.”
5. 10 CFR Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste.”
6. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.232, “Guidance for Developing Principal Design Criteria for Non-Light Water Reactors,” Washington, DC
7. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.206, “Applications for Nuclear Power Plants,” Washington, DC
8. Title 40 of the *Code of Federal Regulations*, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Reactors.”
9. U.S. Nuclear Regulatory Commission, Regulatory Guide, 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Washington, DC
10. U.S. Nuclear Regulatory Commission, NUREG/BR-0303, “Guidance for Performance-Based Regulation,” December 2002 (Available at: <https://www.nrc.gov/reading-rm/doc-collections/nureqs/brochures/br0303/br0303.pdf>).
11. Nuclear Energy Institute, NEI 18-04, “Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light Water Reactor Licensing Basis Development,” Revision 1, August 2019 (ADAMS Package Accession No. ML19241A336)
12. U.S. Nuclear Regulatory Commission, Regulatory Guide 4.21, “Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning,” Washington, DC
13. 10 CFR Part 71, “Packaging and Transportation of Radioactive Material.”
14. Title 49 of the *Code of Federal Regulations*, Part 173, “Shippers – General Requirements for Shipments and Packagings.”
15. Nuclear Energy Institute, NEI 07-10A, “Generic FSAR Template Guidance for Process Control Program (PCP),” Revision 0 (ADAMS Accession No. ML091460627)
16. U.S. Nuclear Regulatory Commission, Management Directive 8.4, “Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests”