



**DANU-ISG-2022-04**

**Advanced Reactor Content of Application Project**

**Chapter 10, “Control of Occupational Dose”**

**Draft Interim Staff Guidance**

**May 2023**

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|---------------|-----------------|---------------------|---------------------|------------------|
| <b>OFFICE</b> | QTE             | NRR/DANU/UTB1/BC    | NRR/DANU/UTB2/BC(A) | NRR/DANU/UARL/PM |
| <b>NAME</b>   | KAzariah-Kribbs | MHayes              | SPhillpot           | MOrenak          |
| <b>DATE</b>   | 3/10/22         | 5/3/22              | 4/22/22             | 2/14/23          |
| <b>OFFICE</b> | OGC (NLO)       | NRR/DANU/UARP/BC(A) | NRR/DANU/D          |                  |
| <b>NAME</b>   | MCarpentier     | SLynch              | MShams              |                  |
| <b>DATE</b>   | 5/4/23          | 3/15/23             | 5/4/23              |                  |

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**DRAFT INTERIM STAFF GUIDANCE**  
**ADVANCED REACTOR CONTENT OF APPLICATION PROJECT**  
**CHAPTER 10, “CONTROL OF OCCUPATIONAL DOSE”**  
**DANU-ISG-2022-04**

**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 reactor application associated with an applicant’s control of occupational dose.<sup>1</sup> 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-AI66). 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 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 May 2023 (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

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<sup>1</sup> 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.

non-LWR application associated with the control of occupational dose and the NRC staff review of that portion of the application.

Following approval of the 10 CFR Part 53 final rule, this ISG guidance will be supplemented, as necessary, to provide guidance for developing controls for occupational dose to reflect any differences between current requirements in 10 CFR Parts 50 and 52 and new requirements in 10 CFR Part 53. The 10 CFR Part 53 rulemaking would revise the NRC's regulations by adding a risk-informed, technology-inclusive regulatory framework for commercial nuclear reactors, in response to the related requirements of the Nuclear Energy Innovation and Modernization Act (NEIMA; Public Law 115-439), as amended by the Energy Act of 2020. Key documents related to the 10 CFR Part 53 rulemaking, including preliminary and draft proposed rule language and stakeholder comments, can be found at Regulations.gov under Docket ID NRC-2019-0062.

## **RATIONALE**

The current application guidance related to control of occupational dose 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 controlling occupational dose. This ISG provides both applicant content of application and NRC staff review guidance.

## **APPLICABILITY**

This ISG is applicable to applicants for non-LWR<sup>2</sup> 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](mailto: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; e-mail: [oir\\_submission@omb.eop.gov](mailto:oir_submission@omb.eop.gov).

## **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.

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<sup>2</sup> 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.

## GUIDANCE

Requirements described in 10 CFR 50.34, “Contents of application; technical information”; 10 CFR 52.47, “Contents of applications; technical information”; 10 CFR 52.79, “Contents of application; technical information in final safety analysis report”; 10 CFR 52.137, “Contents of application; technical information”; and 10 CFR 52.157, “Contents of application; technical information in the final safety analysis report,” specify that an application for a OL, DC, COL, SDA, or ML needs to describe, among other things, the kinds and quantities of radioactive materials expected to be produced in the operation of the facility. In 10 CFR 20.1101, “Radiation protection programs,” the NRC requires the control of occupational radiation exposures within the limits set forth in 10 CFR Part 20, including assuring that occupational radiation exposure will be ALARA for OLs and COLs. In 10 CFR 19.12, “Instruction to workers,” the NRC requires keeping workers who may receive an occupational radiation exposure of over 100 millirem informed regarding radiation protection at the worksite. The applicant and the NRC staff should also refer to the “Radiation Protection Program,” portion of DANU-ISG-2022-01 for related guidance on this topic.

### *Application Guidance*

Chapter 10 of an application for an OL, COL, DC, or ML should provide information on facility and equipment design and radiation sources that are necessary to ensure that the occupational radiation protection standards set forth in 10 CFR Part 20, “Standards for the Protection against Radiation” (Ref. 4), are met. For an OL and COL, the application should also include operational programs necessary to ensure that the occupational radiation protection standards in 10 CFR Part 20 are met. The applicant may describe information needed for this final safety analysis report (FSAR) chapter in a separate radiation protection program (RPP) description document, which may be part of a separate submittal and incorporated by reference. For an OL or COL, the applicant should provide a description of the management policy and organizational structure necessary to ensure occupational radiation exposures are as low as is reasonably achievable (ALARA).

The application should include proposed principal design criteria (PDC) that address the design, fabrication, construction, testing, and quality of the structures, systems, and components necessary to control occupational exposure to within regulatory limits. For LWRs, 10 CFR Part 50, Appendix A, General Design Criteria for Nuclear Power Plants,” General Design Criterion (GDC) 19, “Control room,” requires the provision of conditions that allow for safe operation under normal conditions. Additionally, GDC 61, 63, and 64, and 10 CFR 50.34(f)(2) items (viii), (xxvi), (xxvii), and (xxviii) provide criteria regarding protecting workers from occupational exposure. For non-LWRs, the application should describe design-specific PDC, including those necessary for the control of occupational exposure that allow the safe operation of the plant under normal and accident operations. The design-specific PDC should include those necessary to control occupational exposure, including ensuring occupational radiation exposures are ALARA, such as shielding, ventilation, area radiation and airborne radioactivity monitoring instrumentation, and dose assessment for expected occupancy. Further guidance on the development of PDC for non-LWRs appears in Regulatory Guide (RG) 1.232, “Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors,” (Ref. 5).

For a DC and ML, certain parts of the design information may be conceptual (refer to RG 1.206, “Applications for Nuclear Power Plants,” (Ref. 6) for DCs and 10 CFR 52.157(f)(22) for MLs), and the programmatic information may be deferred according to regulation to the COL stage

using COL action items.

For an SDA, the application should describe the means for controlling and limiting radiation exposures within the limits set forth in Part 20 for those areas addressed by the SDA scope. The programmatic information may be deferred according to regulation to the COL stage.

In accordance with 10 CFR 50.34(a)(6), the preliminary safety analysis report in the application for a CP need only provide the following information related to the control of occupational dose: a preliminary plan for the applicant's organization, training of personnel, and conduct of operations. The means for controlling and limiting radioactive effluents and radiation exposures within the limits set forth in Part 20 is only required at the FSAR stage pursuant to 10 CFR 50.34(b)(3). Consistent with these requirements, CP application should include (1) a description of its plans to develop, at the OL or stage, comprehensive worker protection programs, organizational structure, training, and monitoring to ensure the requirements are met in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations" (Ref. 7); and 10 CFR Part 20; and (2) a description of the design-specific PDC necessary to control occupational exposures, and (3) a preliminary description of design provisions necessary to control occupational exposure, including ensuring that occupational doses are ALARA, such as shielding, ventilation, area radiation and airborne radioactivity monitoring instrumentation, and dose assessment for expected occupancy. The applicant can provide the additional information requested below during the OL application review.

The NRC staff reviewers will rely on information in both the RPP description document and the FSAR to make its safety finding, and information from an RPP description does not need to be repeated in the FSAR. However, the FSAR should incorporate the RPP description document by reference to ensure that future changes to it are properly evaluated through the FSAR change process to determine the need for prior NRC approval.

#### *Staff Review Guidance*

The NRC staff reviewers must determine whether the application provides assurance that occupational doses will be controlled and meet the requirements in 10 CFR Part 19 and 10 CFR Part 20. Specifically, the NRC staff must ensure that the applicant has addressed the following:

- a. 10 CFR 19.12, "Instruction to workers," as it relates to keeping workers who receive occupational radiation exposure informed regarding radiation protection at the worksite
- b. 10 CFR 20, Subpart C, "Occupational Dose Limits" (10 CFR 20.1201–20.1208)
- c. 10 CFR 20, Subpart G, "Control of Exposure From External Sources in Restricted Areas" (20.1601 – 20.1602)
- d. 10 CFR 20.1101 and the definition of ALARA in 10 CFR 20.1003, "Definitions," as they relate to those measures that ensure that radiation exposures resulting from licensed activities are below specified limits and ALARA

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

- 10 CFR 50.34
- design-specific PDC for non-LWRs equivalent to GDCs 19, 61, 63, and 64, as applicable
- 10 CFR 52.47
- 10 CFR 52.79
- 10 CFR 52.137
- 10 CFR 52.157
- 10 CFR 19.12
- 10 CFR Part 20, Subparts C (10 CFR 20.1201–20.1208) and G (20.1601 – 20.1602)
- 10 CFR 20.1101
- 10 CFR 20.1003
- 29 CFR 1910.134 “Occupational Safety and Health Standards - Respiratory Protection” (Ref. 8)

### Acceptance Criteria

The NRC staff reviewer should ensure that the application includes sufficient information to understand the general design and operational controls that will be used to control occupational doses. The reviewer should be able to reach and document the applicable safety findings for this topic in the NRC staff’s safety evaluation report if the application includes the following information:

- a. Describe important equipment and facility design features that satisfy the design-specific PDC necessary to control occupational exposure, including ensuring occupational radiation exposures are ALARA, such as shielding, ventilation, area radiation and airborne radioactivity monitoring instrumentation, and dose assessment for expected occupancy.
- b. Describe major radiation sources, including sources that require (1) shielding, (2) special ventilation systems, (3) special storage locations and conditions, (4) traffic or access control, (5) special plans or procedures, and (6) monitoring equipment. This chapter need not include information on source terms used in licensing-basis event analysis, as this information should be provided elsewhere in the application.
- c. Describe the design features provided to control access to radiologically restricted areas (including potentially very high radiation areas), describe each very high radiation area, and indicate physical access controls and radiation monitor locations for each of these areas.
- d. Describe those features that reduce the need for maintenance and other operations in radiation fields, reduce radiation sources in areas where operations may be performed, allow quick entry and easy access, provide remote operation capability, or reduce the time spent working in radiation fields, as well as any other features that reduce radiation exposure of personnel.
- e. Describe methods for reducing the production, distribution, and retention of activation products through design, material selection, water chemistry, decontamination procedures, and so forth.

- f. DCs, MLs, and SDAs may use COL action items to defer certain technical information to a COL application that references the DC/ML/SDA, such as: (1) complete design information for the remainder of a proposed facility, (2) verification of site parameters, (3) completion of analyses and design reports for as-built plant systems, and (4) development and implementation of operational programs. A COL application that references a DC/ML/SDA should describe how the applicant proposes to resolve each COL action item.
- g. For OL and COL applications, provide a description of the comprehensive worker protection programs, organizational structure, training, and monitoring to ensure the 10 CFR Part 19 and 10 CFR Part 20 requirements are met. Describe the important elements of these programs. Include a discussion of any relevant RGs, Nuclear Energy Institute (NEI) templates, or standards.
  - i. As an option to ensure the 10 CFR Part 19 and 10 CFR Part 20 requirements are met, an applicant may refer to NEI 07-08A, "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA) (Ref. 9), which provides a complete generic ALARA program description for use in developing COL applications. While the NRC staff has not endorsed NEI 07-08A in an NRC RG, it has approved the NEI 07-08A generic program description template via safety evaluation and NEI 07-08A is similar to an approved topical report. Accordingly, an applicant who wishes to adopt the NEI 07-08A program description template to ensure occupational radiation exposures are ALARA 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 description identifies as an applicant's responsibility. If an applicant chooses to reference this template to address the above acceptance criteria, there is no need to replicate text in the FSAR. An applicant may need to update or revise the template to reflect operation of the specific non-LWR and/or if they are submitting an OL application.
  - ii. These criteria for operational controls could also be addressed in the RPP description document provided the RPP document is incorporated by reference into the FSAR.

## **IMPLEMENTATION**

The NRC staff will use the information discussed in this ISG to review non-LWR applications for CPs, OLs, COLs, SDAs, DCs, 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-2022-04 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. 10), 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 NRC 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 an applicant or 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

Discussion to be provided in the final ISG.

## 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 is reasonably achievable                                                |
| ARCAP | advanced reactor content of application project                                   |
| 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 |
| DC    | design certification                                                              |
| FSAR  | final safety analysis report                                                      |
| GDC   | general design criterion/a                                                        |
| ISG   | interim staff guidance                                                            |
| LWR   | light-water reactor                                                               |
| ML    | manufacturing license                                                             |
| NEI   | Nuclear Energy Institute                                                          |
| NRC   | U.S. Nuclear Regulatory Commission                                                |
| OL    | operating license                                                                 |
| PDC   | principal design criterion/a                                                      |
| RG    | regulatory guide                                                                  |
| RPP   | radiation protection program                                                      |
| SDA   | standard design approval                                                          |
| 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," May 2023 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22048B546).
4. 10 CFR Part 20, "Standards for Protection against Radiation."
5. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.232, "Guidance for Developing Principal Design Criteria for Non-Light Water Reactors," Washington, DC
6. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.206, "Applications for Nuclear Power Plants," Washington, DC
7. 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations."
8. Title 29 of the *Code of Federal Regulations*, Part 1910, "Personal Protective Equipment," Chapter 134, "Occupational Safety and Health Standards."
9. Nuclear Energy Institute, NEI 07-08A, "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)."
10. U.S. Nuclear Regulatory Commission, Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests."