



**DANU-ISG-2022-05**

**Advanced Reactor Content of Application Project**

**Chapter 11, “Organization and  
Human-System Considerations”**

**Interim Staff Guidance**

**March 2024**

**DANU-ISG-2022-05**  
**Advanced Reactor Content of Application Project**  
**Chapter 11, “Organization and Human-System**  
**Interface Considerations”**  
**Interim Staff Guidance**

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## INTERIM STAFF GUIDANCE

### ADVANCED REACTOR CONTENT OF APPLICATION PROJECT

#### CHAPTER 11, “ORGANIZATION AND HUMAN-SYSTEM INTERFACE CONSIDERATIONS”

##### DANU-ISG-2022-05

### 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 organization and human system interface considerations.<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 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 organization and human system interface considerations and the NRC staff review of that portion of the application.

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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.

## **RATIONALE**

The current application guidance related to organization and human system interface considerations 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 reactor application guidance for organization and human system interface considerations. This ISG provides both applicant content of application and NRC staff review guidance.

## **APPLICABILITY**

This ISG is applicable to applicants for non-LWRs<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.

## **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**

### **11.1 Guidance for Applicants and NRC Staff Reviewers**

#### **11.1.1 Organization (Design, Construction, and Operating) and Operating Plans**

##### *Application Guidance*

An application should describe the organizational structure and key management positions in the design, construction, and operating organizations that are responsible for facility design, design review, design approval, construction management, testing, and plant operation. The acceptance criteria are based on the relevant requirements of the following Commission regulations:

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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.

- 10 CFR Part 50, Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion (GDC) 19, “Control Room” (for LWRs), or an equivalent principal design criterion (PDC) for non-LWRs (required by 10 CFR 50.34(a)(3))
- 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants”
- 10 CFR 50.34(a)(6), (9), and (11)
- 10 CFR 50.34(b)(6)(i), (ii), (iv) and (vii)
- 10 CFR 50.34(f)(2)(ii), (f)(2)(iii), (f)(2)(iv), (f)(2)(v), (f)(2)(xi), (f)(2)(xvii), (f)(2)(xviii), (f)(2)(xix), (f)(2)(xxvi), (f)(2)(xxvii), (f)(3)(i), and (f)(3)(vii),<sup>3</sup> as applicable to the specific design
- 10 CFR 50.40(b)
- 10 CFR 50.48(a)(1)(ii)
- 10 CFR 50.71, “Maintenance of records, making of reports”
- 10 CFR 52.47(a)(7) and (8)
- 10 CFR 52.79(a)(17), (26), (27), and (31)
- 10 CFR 52.137(a)(3)(i), (a)(7), and (a)(8)
- 10 CFR 52.157(a), (f)(12), (f)(16)

An application for a CP/OL or COL should include the following information:

- organizational charts of the applicant’s corporate-level management, technical support, and operations organizations, including the organizational and management structure responsible for direction and support of design and construction of the proposed plant
- a general staffing plan for construction, preoperational testing, fuel load, startup testing, and power ascension testing
- a detailed description of the relationship between the applicant’s internal design and construction organizations and how they will interact, and a detailed description of how the applicant will ensure close coordination between the architect-engineer and the nuclear reactor vendor
- plans (preliminary for a CP applicant) for the applicant’s operations organization, including a general staffing plan for operations (OL and COL)

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<sup>3</sup> The requirements here do not apply to 10 CFR Part 50 applicants not listed in 10 CFR 50.34(f). Rulemaking is underway to align the requirements of 10 CFR Part 50 and 10 CFR Part 52 that may make these requirements applicable to all 10 CFR Part 50 applicants. In the interim, the NRC staff should propose license conditions on 10 CFR Part 50 applications to address these regulations.

- the relationship of the nuclear-oriented part of the organization to the rest of the corporate organization
- the provisions for technical support for operations, including interfaces between corporate, operations, and the technical support center (if applicable) (OL and COL)

A DC, ML, or SDA application should focus on the corporate-level management and technical support organizations of the design organization. For the facility design (DC, SDA, ML, CP/OL, or COL applications), the application should describe key management responsibilities in the following areas:

- principal site-related engineering studies of meteorology, geology, seismology, hydrology, demographics, and environmental effects (DC, SDA, and ML applications will consider postulated site parameters in the design rather than actual site characteristics)
- design of structures, systems, and components (SSCs) that are safety significant (e.g., SSCs classified as safety-related or as non-safety related with special treatment under the Licensing Modernization Project)
- each responsible organization's review and approval of safety-related and safety-significant SSC design features
- development of the probabilistic risk assessment, defense-in-depth analysis, and licensing-basis event analysis
- quality assurance for design

For facility construction (CP/OL or COL applications), and manufacturing (ML applications), the application should describe key management responsibilities in the following areas:

- material and component specification review and approval
- procurement of materials and equipment

In addition to considering the following two bullets for construction and manufacturing, the following two bullets should be considered for preoperational activities (CP/OL, ML, or COL applications). Specifically, the application should describe key management responsibilities in the following areas:<sup>4</sup>

- management of construction activities (for MLs, management of manufacturing activities)
- quality assurance activities for construction (for MLs, quality assurance activities for manufacturing)

In addition, an ML application should describe key management responsibilities for shipping a manufactured reactor (preparation for shipping, conduct of shipping, and verification of the condition of the reactor upon receipt at the deployment site).

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<sup>4</sup> Additional guidance in this area can be found in DANU-ISG-2022-06, "Chapter 12 'Post-manufacturing and construction Inspection, Testing, and Analysis Program,'" (Ref. 4).

For the operational period (OL or COL), the application should describe key management responsibilities in the following areas:

- nuclear, probabilistic risk assessment, mechanical, structural, electrical, thermal-hydraulic, metallurgy and materials, and instrumentation and controls engineering (design and technical support)
- plant chemistry
- health physics
- fueling and refueling operations support
- maintenance support
- operations support
- fire protection
- quality assurance
- training
- safety review
- startup testing
- emergency planning
- security

A single application could potentially include more than one unit or module, describe the operating configurations of the units or modules and the common structures, systems, and components and possible interaction between the units or modules, and the sequencing of unit or module construction and operation. If the application is for more than one module or unit, the applicant should address staffing plans that account for any staggered timelines under which additional modules/units would come online with respect to construction, preoperational testing, fuel load, startup, and power ascension testing of each new module/unit. The applicant should also describe the organizational arrangement and functions to meet the needs of the multiple modules/units. This description should include the extent to which the organizational arrangement and functions are shared among the modules/units addressed in the application, as well as the organizational arrangement and functional divisions or controls established to preserve the integrity of individual modules/units or programs.

For plant sites with existing operating nuclear modules/units, the application should discuss the extent to which the organizational arrangement and functions are shared between the new and existing modules/units. It should also discuss the organizational arrangement and functional divisions or controls established to preserve the integrity of the new and existing modules/units or programs. NRC guidance on the operating organization appears in Regulatory Guide

(RG) 1.33, "Quality Assurance Program Requirements (Operation)," (Ref. 5) which endorses American National Standards Institute (ANSI)/American Nuclear Society (ANS)-3.2-2012, "Managerial, Administrative, and Quality Assurance Controls for the Operational Phase of Nuclear Power Plants" (Ref. 6).

### *Staff Review Guidance*

NUREG-0800 sections 13.1.1, "Management and Technical Support Organization" (Ref. 7) and 13.1.2 - 13.1.3, "Operating Organization," (Ref. 8) provide further guidance to the staff on the review of the construction, testing, and operating organizations. Additionally, NUREG-0800 sections 13.5.1.1, "Administrative Procedures – General," (Ref. 9) and 13.5.2.1, "Emergency and Operating Procedures," (Ref. 10) provide further guidance to the staff on the review of operating plans. The staff should consider whether portions of these guidance documents are relevant within the context of a given application and apply the applicable guidance in conjunction with this ISG. Relevant guidance should be applied to the extent reasonable for a given application type during the review of CP, ML, DC, SDA, OL, and COL applications (e.g., a CP application may not contain the fully developed information in certain areas that an OL application would include).

#### 11.1.1.1 Education and Experience of Key Management Personnel

The application should describe the education and experience necessary for each key management position given above. A CP or COL application should describe the applicant's past experience in the design and construction of nuclear power plants or of non-power reactors similar to the proposed facility. It should also describe experience in other activities of similar scope and complexity.

A CP or COL application should also describe the ability of the applicant's technical staff to support or perform the safety-related activities specified in the application. It should describe the level of risk analysis experience available for performing necessary probabilistic risk assessments or other risk-informed evaluations.

The application should describe the education and experience necessary for key personnel. In doing so, the application should follow the guidance endorsed by RG 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," (Ref. 11) (e.g., relevant experience could include work performed in a nuclear-fueled electric power production plant (commercial or military) during preoperational, startup testing, or operational activities). Individual experience that may not be entirely applicable should be compared to the responsibilities of the position.

#### 11.1.2 Basis/number of Operating Shift Crews, their Staffing, and Responsibilities

### *Application Guidance*

The requirements in 10 CFR 50.54(k) and 10 CFR 50.54(m) identify the minimum number of licensed operators who must be on site, in the control room, and at the controls. These requirements are conditions in every nuclear power reactor OL issued under 10 CFR Part 50. They are also conditions in every COL issued under 10 CFR Part 52; however, they are applicable only after the Commission makes the finding under 10 CFR 52.103(g) that the acceptance criteria in the COL are met.



The application should describe the functions, responsibilities, and authorities of the following plant positions (OL or COL):

- operations supervisors
- operating crew shift supervisors/managers
- shift technical advisors
- reactor operators and senior operators
- non-licensed operators

For each position listed above, the application should describe the interfaces with offsite personnel or key management positions. Such interfaces include defined lines of reporting responsibilities (e.g., from the plant manager to the immediate superior), lines of authority, communication channels, and roles in risk-informed evaluations and decision-making. The application should also describe the authority that may be granted to operations supervisors; to operating crew shift supervisors/managers, including the authority to issue standing or special orders; and to reactor operators and senior operators.

The application should describe the shift position titles, applicable operator licensing requirements for each person holding such a position, and the minimum numbers of personnel planned for each shift for all combinations of modules/units proposed to be at the station in either operating or safe shutdown mode. The application should also describe shift crew staffing plans unique to refueling operations. In addition, it should describe the proposed means of assigning shift responsibility for implementing the radiation protection and fire protection programs on a round-the-clock basis, where appropriate.

If the station contains, or there are plans for it to contain, power-generating facilities other than those specified in the application (e.g., fossil-fueled units), the applicant should describe interfaces with the organizations operating the other facilities. The description should include any proposed sharing of personnel between the units, the duties of the shared personnel, and the proportion of the time they will be assigned to the non-nuclear units.

The staffing requirements in 10 CFR 50.54(k) and (m) do not apply to applicants for a CP, DC, or SDA. However, an applicant for a CP, DC, or SDA should consider the minimum licensed operator staffing necessary for a facility of the type described in the application because staffing is a necessary, practical consideration when designing and constructing a facility. Therefore, a CP, DC, or SDA application may be uniquely well-suited to address licensed operator staffing in the context of a specific design approach and applicants should consider doing so for the sake of regulatory certainty.

If a DC applicant proposes a design for which it believes the licensed operator staffing required by 10 CFR 50.54(k) and (m) is not necessary and seeks NRC approval of alternative staffing plans as part of the DC, the NRC can include design-specific operating requirements in the DC rule.<sup>5</sup> For example, in certifying the NuScale standard design in 10 CFR Part 52, Appendix G

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<sup>5</sup> CP applicants that would like to propose a licensed operator staffing plan that does not meet the requirements in 10 CFR 50.54(k) and (m) but seek NRC approval of the plan as part of the permit are encouraged to discuss this approach with the staff during preapplication interactions.

For example, it might be possible for a CP applicant to describe control room design features in the application and,

(88 FR 3287, January 19, 2023; corrected 88 FR 7355, February 3, 2023), the Commission imposed alternative control room staffing requirements in lieu of the requirements of 10 CFR 50.54(m) on any COL applicant referencing the Part 52, Appendix G. Thus, other DC applicants may wish to propose alternative control room staffing requirements.

An applicant for a DC may consider the NuScale approach or a similar one. To do so, an applicant can provide the technical basis for any proposed design-specific requirements that would address control room staffing in conjunction with control room configuration as part of the application. An applicant for a COL whose application references a rule certifying a design must follow any certified design-specific staffing requirements that apply in lieu of 10 CFR 50.54(m). Specifically, a rule in the Part 52 appendix certifying the standard design could include (in paragraph IV, "Additional Requirements and Restrictions") an alternative staffing regulation, including the requirement provisions, staffing table, and appropriate table notes. If a DC applicant chooses this approach, then it should include the proposed design-specific requirements, including a staffing table and table notes, with the DC application (e.g., in Section 7 of the DC application).

For applicants considering remote or autonomous operations, early and extensive preapplication activities are critical to ensure a thorough understanding of the design and potential Commission policy decisions associated with the proposed approach.

#### *Staff Review Guidance*

NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)," (Ref.12) provides guidance for the NRC staff to systematically review and assess requests by licensees of nuclear power plants for exemption from the licensed operator staffing requirements 10 CFR 50.54(m). The NRC staff should perform a single review of an application that describes and analyzes more than one module/unit and issue a single safety evaluation report (SER) on such an application, where possible.

#### 11.1.3 Human Factors Engineering

##### *Application Guidance*

An application for a CP/OL, DC, SDA, ML, or COL should include relevant human factors engineering (HFE) information commensurate with the applicant's design and safety analysis. The applicant should clearly describe the most important HFE issues for its proposed facility and should demonstrate that its HFE program incorporates practices and guidelines that satisfy the current requirements.<sup>6</sup> The HFE program description should cover the HFE design process,

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under 10 CFR 50.35(b), request the NRC to incorporate approval of such features in any CP issued. An OL will include the conditions in 10 CFR 50.54(m) and 10 CFR 50.54(k) unless the OL application requests and justifies an exemption from those regulations and the NRC grants the request.

<sup>6</sup> The requirements here do not apply to 10 CFR Part 50 applicants not listed in 10 CFR 50.34(f). Rulemaking is underway to align the requirements of 10 CFR Part 50 and 10 CFR Part 52 that may make these requirements applicable to all 10 CFR Part 50 applicants. In the interim, the staff expects all 10 CFR Part 50 applicants to address 10 CFR 50.34(f)(2)(iii).

the HFE final design, its implementation, and ongoing performance monitoring, to the extent relevant to the application.

The application should include proposed PDC for the design, fabrication, construction, testing, and quality of those SSCs whose satisfactory performance depends on HFE. The application should describe how the design satisfies its design-specific PDC for HFE. For guidance on developing PDC, the applicant can refer to RG 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," (Ref. 13). Additionally, applications should describe how the design will satisfy any requirements of 10 CFR 50.34(f) that are relevant to the technology, including the following sections:

- 50.34(f)(2)(ii)
- 50.34(f)(2)(iii)
- 50.34(f)(2)(iv)
- 50.34(f)(2)(v)
- 50.34(f)(2)(xi)
- 50.34(f)(2)(xvii)
- 50.34(f)(2)(xviii)
- 50.34(f)(2)(xix)
- 50.34(f)(2)(xxvi)
- 50.34(f)(2)(xxvii)
- 50.34(f)(3)(i)

The application should describe any flexibilities incorporated and any deviations in the HFE analysis from the existing HFE guidance (for instance by relying on a supporting safety analysis). The application should demonstrate that these deviations do not compromise the safe operation of the proposed facility.<sup>7</sup>

Applicants are encouraged to engage in preapplication activities that can support reviewer understanding of the proposed HFE approach and analysis.

### *Staff Review Guidance*

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<sup>7</sup> Certain standards that contain HFE requirements may also apply to a given application. For example, 10 CFR 50.55a(h)(3) states the following:

Applications filed on or after May 13, 1999, for construction permits and operating licenses under this part, and for design approvals, design certifications, and combined licenses under part 52 of this chapter, must meet the requirements for safety systems in IEEE Std. 603–1991 and the correction sheet dated January 30, 1995.

Section 5.14, "Human Factors Considerations," of IEEE Std. 603–1991 (Ref. 14) states the following:

Human factors shall be considered at the initial stages and throughout the design process to assure that the functions allocated in whole or in part to the human operator(s) and maintainer(s) can be successfully accomplished to meet the safety system design goals, in accordance with IEEE Std 1023-1988.

The following guidance documents are for use by the NRC staff to review human factors engineering information within an application:

- NUREG-0711, “Human Factors Engineering Program Review Model,” (Ref. 15)
- NUREG-1791
- NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” Chapter 18, “Human Factors Engineering,” (Ref.16) provides guidance for the review of LWRs and may be useful in the review of non-LWRs. Further, the NRC staff may use flexibilities in the HFE process that are currently described in NUREG-0800 during the review of a specific design (see NUREG-0800, Chapter 18, Part IV’s discussion on the grading of reviews and the Chapter 1, “Introduction and Interfaces,” for further guidance regarding these flexibilities (Ref. 17)).

#### 11.1.3.1 Training for Plant Staff

##### *Application Guidance*

The NRC regulations listed below address the training of nuclear power plant personnel. An OL/COL applicant should describe the training programs that it will develop to meet these regulations. In demonstrating compliance with these regulations, the applicant may include documents that are reflected in or incorporated by reference into the FSAR (e.g., topical reports) or are part of the FSAR (e.g., emergency plans in accordance with 10 CFR 50.34(b)(6)(v)).

- 10 CFR 19.12, “Instruction to workers”
- 10 CFR 26.29, “Training”
- 10 CFR 50.34(a)(6)
- 10 CFR 50.34(b)(6)(i) and(ii)
- 10 CFR 50.34(f)(2)(i)
- 10 CFR 50.48(a)(2)(i)
- 10 CFR 50.54(i-1)
- 10 CFR 50.120, “Training and qualification of nuclear power plant personnel”
- 10 CFR Part 50, Appendix B, Criterion II
- 10 CFR Part 50, Appendix E, “Emergency Planning and Preparedness for Production and Utilization Facilities”
- 10 CFR 52.79(a), paragraphs (14), (33), (34), and (36)(ii)

NRC guidance on nuclear plant worker training includes RG 1.8, which endorses

ANSI/ANS-3.1-2014, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants" (Ref. 18). The applicant should indicate the extent to which it uses the applicable portions of this guidance and should justify any exceptions. The training programs should focus on tasks that are important to plant operations in achieving nuclear safety and defense in depth, or that are risk-significant. They should use a systems (or systematic) approach to training (SAT), as defined in 10 CFR 55.4, "Definitions." The program description addressing the applicable sections of 10 CFR Part 26, "Fitness for Duty Programs" (Ref. 19), should be provided in a CP/OL/COL application document separate from the safety analysis report.

### 11.1.3.2 Licensed Operator Initial and Continuing (Requalification) Training

#### 11.1.3.2.1 Considerations for Administering the First Operator Licensing Examinations Before Fuel Load<sup>8</sup>

#### *Application Guidance*

An OL or COL applicant should describe its process and timeline for establishing the testable content for initial operator licensing examinations. In particular, the applicant should describe how it will identify the items to be tested on initial licensing examinations and how it will determine the importance and basis for each item; this may be through development of a knowledge and abilities catalog or a similar mechanism. The applicant should use subject-matter experts, including those with prior work experience at an operating nuclear reactor, to determine the scope of systems, procedures, and evolutions to be included and to evaluate the importance of topical items and statements with respect to safe facility operation. The scoping criteria should include all systems, procedures, and evolutions important to overall safe plant operation, not just those related to protecting the reactor core and containment. To establish the regulatory basis for examination content validity, the applicant should link statements to the applicable sections of 10 CFR 55.41, "Written examination: operators"; 10 CFR 55.43, "Written examination: senior operators"; or 10 CFR 55.45, "Operating tests." The applicant must develop this testable content before administering initial operator licensing examinations.

OL and COL applicants should inform the NRC staff if they are requesting an exemption to use an alternative to the criteria in NUREG-1021, "Operator Licensing Examination Standards for Power Reactors" (Ref. 20), as required by 10 CFR 55.40(a). If so, the applicant should describe the examination methods (e.g., multiple-choice written questions, job performance measures, or scenarios), the structure (e.g., the number of written questions), and the proposed passing score for applicable sections. The applicant should explain how the chosen methods, structure, and passing scores support examination validity, reliability, and fairness. The requirements in 10 CFR 55.41, 10 CFR 55.43, and 10 CFR 55.45 apply unless an exemption from these requirements is also requested and granted.

OL and COL applicants should describe how they use the SAT process to determine the job tasks supporting the development of the testable content and the examination methods. They should also describe how they will meet examination security requirements in accordance with 10 CFR 55.49, "Integrity of examinations and tests."

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<sup>8</sup> OL and COL applications are not required to include the information detailed in this section. This ISG discusses this information to help identify specific information that the applicant will need to develop and make available before administering the first operator licensing examinations.

OL and COL applicants should describe how they will designate procedures that may still be considered draft but are approved for use to support examinations. Procedures supporting examination materials should undergo two forms of review: (1) an administrative review to verify that they meet all requirements of the facility licensee's writer's guide (or equivalent), technical specifications, and final safety analysis report and (2) a technical review to verify that they are correct for proper operations of plant systems and equipment. The applicant should ensure that its management will approve the procedures provided to the NRC for each initial operator licensing examination, in accordance with the facility's administrative procedures.

OL and COL applicants should describe the simulation facility to be used to administer initial operator licensing examinations. The simulation facility must meet the requirements of 10 CFR 55.46(c) or be approved by the Commission under 10 CFR 55.46(b) before the applicant administers any operator licensing examinations.

OL and COL applicants should provide a timeline for initial operator licensing examinations before fuel load, as well as the anticipated number of individual license operator applicants. This information will help the NRC determine the staff resources needed and ensure that these will be available.

Preapplication interactions to discuss any planned exemption from 10 CFR 55.40, "Implementation," as well as the timeline for administration of the first operator licensing examinations prior to fuel load, would assist in ensuring appropriate resources are available.

#### 11.1.3.2.2 Implementation of Training Programs

##### *Application Guidance*

An OL or COL applicant should describe its process and schedule for establishing the initial training programs for reactor operators and senior reactor operators to meet the requirements in 10 CFR Part 55, "Operators' Licenses" (Ref. 21), with milestones for implementation during construction. In particular, it should describe how it will meet the requirements for SAT-based training programs. It should detail the qualifications needed for individuals to enter the program, the courses of instruction that the facility will administer, the nature of training to be provided, and the startup and shutdown experience provided. Alternatively, instead of giving these details, the application may state that the applicant will seek accreditation from the National Academy of Nuclear Training. Under the "Memorandum of Agreement Between the Institute of Nuclear Power Operations and the U.S. Nuclear Regulatory Commission" (Ref. 22), the NRC has recognized that such training program accreditation constitutes a means of meeting the training-related requirements of 10 CFR 50.120 and of Part 55. However, accreditation does not imply the removal of regulatory oversight; the NRC still performs many activities to ensure that appropriate training is provided, such as administering all initial operator licensing exams, inspection of requalification exams, observation of accreditation boards, inspections of any aspect of the training program when deemed necessary, etc. If the applicant selects accreditation from the National Academy of Nuclear Training but does not achieve accreditation before the administration of the first operator licensing examinations, then the NRC staff will need to inspect the applicant's training program before the first examination.

Nuclear Energy Institute (NEI) 06-13A, "Template for an Industry Training Program Description," (Ref. 23), provides a complete generic training program description for use with combined license (COL) applications. Appendix A to NEI 06-13A describes a "Cold License Training Plan," which is the portion of the licensed operator training program that applies before completion of

the first refueling outage. “Cold” licensing of operators provides the method for operations personnel to acquire the knowledge and experience required for licensed operator duties during the unique conditions of new plant construction and initial operation. While the NRC staff has not endorsed NEI 06-13A, it has approved the generic training program description in it via safety evaluation and NEI 06-13A is similar to an approved topical report. Accordingly, an applicant who wishes to employ the NEI 06-13A training program description template for the portion of the Chapter 11 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.

An OL or COL applicant should also describe the licensed operator requalification program as required in 10 CFR 50.54(i-1) and 10 CFR 55.59, “Requalification,” including the first anticipated requalification period set in 10 CFR 55.59(a)(1). Additionally, if there is a significant time lag between the initial operator licensing examination and license issuance (e.g., because the applicant needs to complete cold licensing experience requirements, such as preoperational testing), the applicant should consider how operator license applicants will maintain their knowledge, skills, and abilities after passing the initial examination.

Interactions between applicants and staff to discuss whether the applicant will request Commission approval of the training program will help align sufficient resources for a timely review.

#### *Staff Review Guidance*

Applicants may also propose alternative methods for the cold licensing of operators. If the applicant references NEI 06-13A in its application, the reviewer should confirm that 06-13A is followed and all site-specific information is included.

#### 11.1.3.2.3 Use of Simulation Facilities for Operator Training, Experience, and Examinations during Construction

#### *Application Guidance*

The applicant’s description of the licensed operator training program should address the use of a simulator. RG 1.149, “Nuclear Power Plant Simulation Facilities for Use in Operator Training, License Examinations, and Applicant Experience Requirements,” (Ref. 24), provides an acceptable approach for using simulation facilities. The application should state whether the applicant will use a plant-referenced simulator or a Commission-approved simulator for operator licensing examinations. If the applicant will use a plant-referenced simulator, the applicant should commit to informing the NRC when it determines that the simulation facility meets the requirements to be a plant-referenced simulator. This notification should occur well in advance of the first scheduled operator licensing examination.

For Commission-approved simulators, the application should describe the items listed in 10 CFR 55.46(b), including the components of the simulation facility intended for use, the performance tests for the simulation facility and the results of these tests, and the procedures for maintaining examination and test integrity in accordance with 10 CFR 55.49. The application should also explain how the simulator allows for the performance of actions necessary to accomplish a representative sample of the 13 items listed in 10 CFR 55.45(a), and it should confirm the following:

- The simulator response will model that of the reference plant during operating tests.
- The simulator can perform a sufficient number of operating tests so that the examination is not predictable.

Because the detailed control room design may not be completed upon the submission of a COL application, the simulator to train operators would likewise not be fully designed at that time. In this case, the COL will include design acceptance criteria as part of the inspections, tests, analyses, and acceptance criteria to govern the control room design. Upon completion of the control room design, a simulator incorporating that design can be built, which will be necessary to allow for a subsequent declaration of a Plant Referenced Simulator. Alternatively, the applicant may instead elect to develop and seek approval of a Commission Approved Simulator. In addition, for such a case the application should include a proposed timeline for when the simulator will be available to train the operators; a license condition governing operational program implementation, as described in SECY 05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," would also govern that timeline. A Commission-approved simulator may require significant review resources; therefore, a presubmittal meeting will help the NRC ensure that sufficient resources are available to support review and approval in advance of any operator licensing examinations. The simulation facility must meet the requirements of 10 CFR 55.46(c) or be approved by the Commission under 10 CFR 55.46(b) before the applicant administers any operator licensing examinations.

#### 11.1.3.3 Issuance of Licenses Prior to Fuel Load

##### *Application Guidance*

An OL or COL applicant should describe its process for ensuring that operator licenses will be maintained active, in accordance with 10 CFR 55.53(e), prior to initial fuel load. This may include having operators on shift performing the functions of reactor operators or senior reactor operators who have meaningful duties analogous to those of the minimum licensed positions under the technical specifications. For example, these personnel may operate controls and apparatus during preoperational testing that will directly affect reactivity or power level upon fuel load and plant startup.

Prior to fuel load, an OL or COL holder may submit a request for exemption from 10 CFR 55.31(a)(5), which requires an applicant for an operator's license to perform reactivity manipulations either on the actual plant, or on a plant-referenced simulator that meets the requirements of 10 CFR 55.46(c) (including the requirement that the simulator model the most recent core load of the reference plant). For plants under construction, the licensing of operators will be necessary prior to fuel load on account of the time needed to fully train the operators. However, fuel cannot be loaded into the reactor unless the Commission issues the OL (Part 50) or finds under 10 CFR 52.103(g) that the acceptance criteria in the ITAAC have been met (Part 52); therefore, an applicant for an operator's license must manipulate the controls of a plant-referenced simulator as required by 10 CFR 55.31(a)(5) or justify an exemption from that regulation under 10 CFR 55.11.

OL and COL applicants for a multiunit facility should consider the guidance in NUREG-1021 for licensing operators at multiple units. If the licensing will occur simultaneously, the application should describe how those requirements are met. If an individual is expected to be licensed first for one unit and then later for others, the applicant may request an exemption from the



requirement to administer another examination for the subsequent units. Preapplication interactions to discuss what exemptions will be requested for licensing operators prior to fuel load will help the NRC align sufficient resources for a timely review.

#### 11.1.3.4 Non-licensed Personnel Training

##### *Application Guidance*

An OL or COL applicant should describe the training program for non-licensed nuclear plant personnel to meet the requirements of 10 CFR 50.120(b)(2) and (3). The applicant should describe how the training program is derived from the SAT process, as defined in 10 CFR Part 55. In addition to the technical training required for each non-licensed plant staff position, the program should include training in physical security, radiological emergency preparedness and response, administrative procedures, radiation protection, fire protection, quality assurance, and fitness for duty (fitness for duty should be addressed in a separate application document).

The applicant should describe a program for periodic evaluation of the non-licensed plant staff training program by individuals not directly responsible for the training. This evaluation should include an assessment of the training program's effectiveness in developing trainees' ability to meet job performance requirements. The training program should periodically be revised and updated to reflect evaluation results, industry experience, and changes to the facility, procedures, regulations, and quality measures.

The training program descriptions should include the initial training, periodic retraining, and qualifications required for non-licensed plant staff. These programs are to be established, implemented, and maintained for 18 months before the scheduled date for initial fuel load. As an option for addressing the non-licensed plant staff training criterion, the applicant may use the training program template in NEI 06-13A.

#### 11.2 Staff Review Guidance – Acceptance Criteria

The NRC reviewer should ensure that the application includes sufficient information to understand organization and human-system interface considerations. The reviewer should be able to reach a safety finding and conclude that the requirements<sup>9</sup> governing the applicant's organization and human-system interfaces are met if the application includes the following information:

- a. The applicant has described the assignment of plant operating responsibilities, the reporting chain up through the chief executive officer of the applicant, the proposed size of the regular plant staff, the functions and responsibilities of each major plant staff group, the proposed shift crew complement for single-module/-unit or multiple-module/-unit operation, and the qualification requirements for key members of the plant staff.

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<sup>9</sup> It should be noted that while certain Part 50 requirements are specifically cited within the acceptance criteria for the purposes of providing clarification, the acceptance criteria themselves are broadly applicable to the review of CP, ML, DC, SDA, OL, and COL applications. However, it may be necessary for the reviewer to adjust the review depth associated with individual criteria in light of the specific type of application under consideration (e.g., the information in a CP may be less detailed than that of an OL).

- b. The applicant is technically qualified, as specified in 10 CFR 50.34, "Contents of applications; technical information"; 10 CFR 50.40, "Common standards"; 10 CFR 50.48; and 10 CFR Part 50 or 10 CFR Part 52 (as applicable). The application describes how the HFE and planned human-system interactions satisfy the design-specific PDC related to HFE and human-system interactions.
- c. To address 10 CFR 50.34(b)(6)(i), (ii), (iv), and (v), the key positions for ensuring the safe operation of the plant are in the operating organization, consistent with the quality assurance program and ANS 3.2. On-shift personnel are able to provide initial facility response in the event of an emergency.
- d. To address 10 CFR 50.34(b)(6)(iii), the applicant has adequately described the groups and key positions responsible for implementing the initial test program, consistent with the quality assurance program and ANS 3.2, and providing technical support for the operation of the facility.
- e. Plans for the construction, testing, and operating organizations are consistent with the relevant portions of NUREG-0800 sections 13.1.1, "Management and Technical Support Organization" and 13.1.2 - 13.1.3, "Operating Organization."
- f. Plans for conduct of operations are consistent with the relevant portions of NUREG-0800 sections 13.5.1.1, "Administrative Procedures - General" and 13.5.2.1, "Emergency and Operating Procedures."
- g. The applicant has proposed education and experience requirements for key personnel that conform to the qualifications and experience guidance endorsed by RG 1.8 (i.e., work performed in a nuclear fueled electric power production plant (commercial or military) during preoperational, startup testing, or operational activities), including provisions for individual experience which may not be entirely applicable to be weighed against the requirements of the position. Any alternatives to, or exceptions from, this guidance have been adequately justified.
- h. The applicant's proposed organization conforms to the guidance of RG 1.33, or the applicant has provided justification for an alternative.
- i. An adequate number of licensed operators will be available at all required times to satisfy the minimum staffing requirements of 10 CFR 50.54(m), or the applicant has provided justification for an exemption. (10 CFR 50.54(i)–(m) requires the applicant to demonstrate that the operating organization satisfies minimum requirements for operator supervision and the availability of licensed senior operators and licensed operators during specific reactor conditions and modes of operation. Any requests for exemptions from the licensed operator staffing requirements in 10 CFR 50.54(m) should be justified using the guidance in NUREG-1791.)
- j. Engineering expertise on shift<sup>10</sup> should be consistent with the Commission's Policy Statement on Engineering Expertise on Shift (Volume 50 of the *Federal Register*, page 43621; October 28, 1985) (Ref. 25) and within the guidelines of Three Mile Island Action Plan Item I.A.1.1, "Shift Technical Advisor," of NUREG-0737, "Clarification of TMI

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<sup>10</sup> 10 CFR 50.120 requires that the applicant provide a training program derived from a systems approach to training as defined in 10 CFR 55.4 and must provide for the training and qualification of the shift technical advisor.

Action Plan Requirements,” issued November 1980 (Ref. 26). Otherwise, the applicant should provide justification for an alternative.

- k. To address 10 CFR 50.34(f)(3)(vii), the applicant has described the role and function of the architect-engineer and the nuclear steam supply system vendors during design and construction in a manner consistent with NUREG-0800, Section 13.1.1, as well as the organizational controls over the project-related activities of the architect-engineer and nuclear reactor vendors, including preservation of documentation.
- l. The applicant has identified and described the reporting responsibilities and authorities in the functional areas of radiation protection/health physics, quality assurance, and training. The reporting responsibilities and authorities ensure independence from normal operating pressures.
- m. The applicant has defined the responsibilities of the operating organization related to activities important to the safe operation and maintenance of the facility. Functional areas (e.g., maintenance, operations, training) are separately supervised and managed.
- n. To address 10 CFR 50.34(b)(6)(v), sufficient managerial depth is available to provide qualified backup, consistent with the quality assurance program and ANS 3.2, for overall station operation in the event of temporary unexpected contingencies.
- o. To address 10 CFR 26.205(c), the numbers of licensed and non-licensed personnel subject to 10 CFR 26.205 are sufficient to allow shift schedules that prevent personnel impairment from fatigue due to the duration, frequency, or sequencing of successive shifts.
- p. The training program for licensed operators meets the requirements of 10 CFR Part 55.
- q. The training program for non-licensed nuclear plant personnel meets the requirements of 10 CFR 50.120(b)(2) and (3).

## **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-2022-05 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. 27), 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-2022-05, “Chapter 11, ‘Organization and Human-System Considerations,’” 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

ANS	American Nuclear Society
ANSI	American National Standards Institute
ARCAP	advanced reactor content of application project
CFR	<i>Code of Federal Regulations</i>
COL	combined license
CP	construction permit
DC	design certification
DG	draft regulatory guide
HFE	human factors engineering
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
SAT	systematic approach to training
SDA	standard design approval
SSC	structure, system, or component
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 (Agencywide Documents Access and Management System (ADAMS) Accession

- No. ML23277A139).
4. U.S. Nuclear Regulatory Commission, DANU-ISG-2022-06, "Chapter 12 'Post-manufacturing and construction Inspection, Testing, and Analysis Program'"
  5. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," Washington, DC
  6. American National Standards Institute/American Nuclear Society, ANSI/ANS-3.2-2012, "Managerial, Administrative, and Quality Assurance Controls for Operational Phase of Nuclear Power Plants."
  7. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 13.1.1, "Management and Technical Support Organization"
  8. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 13.1.2 - 13.1.3, "Operating Organization"
  9. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 13.5.1.1, "Administrative Procedures – General"
  10. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Section 13.5.2.1, "Emergency and Operating Procedures"
  11. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.8, "Qualification and Training of Personnel for Nuclear Power Plants," Washington, DC
  12. U.S. Nuclear Regulatory Commission, NUREG-1791, "Guidance for Assessing Exemption Requests from the Nuclear Power Plant Licensed Operator Staffing Requirements Specified in 10 CFR 50.54(m)."
  13. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors," Washington, DC
  14. Institute of Electrical and Electronics Engineers Standard 603–1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations."
  15. U.S. Nuclear Regulatory Commission, NUREG-0711, "Human Factors Engineering Program Review Model."
  16. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Chapter 18, "Human Factors Engineering."
  17. U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Chapter 1, "Introduction and Interfaces."

18. American National Standards Institute/American Nuclear Society, ANSI/ANS-3.1-2014, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants."
19. 10 CFR Part 26, "Fitness for Duty Programs."
20. U.S. Nuclear Regulatory Commission, NUREG-1021, "Operator Licensing Examination Standards for Power Reactors."
21. 10 CFR Part 55, "Operators' Licenses."
22. "Memorandum of Agreement Between the Institute of Nuclear Power Operations and the U.S. Nuclear Regulatory Commission," (ADAMS Accession No. ML20125A374).
23. Nuclear Energy Institute, NEI 06-13A, "Template for an Industry Training Program Description."
24. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.149, "Nuclear Power Plant Simulation Facilities for Use in Operator Training, License Examinations, and Applicant Experience Requirements," Washington, DC
25. U.S. Nuclear Regulatory Commission, "Commission Policy Statement on Engineering Expertise on Shift," *Federal Register*, Vol. 50, October 28, 1985, pp. 43621–43623 (Available at <https://www.nrc.gov/reading-rm/doc-collections/commission/policy/50fr43621.pdf>).
26. U.S. Nuclear Regulatory Commission, NUREG-0737, "Clarification of TMI Action Plan Requirements," November 1980 (ADAMS Accession No. ML051400209).
27. U.S. Nuclear Regulatory Commission, Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests."

**Appendix A****Draft Advanced Reactor Content of Application Project (ARCAP) Guidance Documents Under Development as of May 2023**

The purpose of this appendix is to provide a list of draft guidance documents that are under consideration for future updates to this ISG. These draft documents are under development and have not received a complete staff review; therefore, they do not represent official NRC staff positions. If an applicant relies on these draft documents, it will be at risk that a final NRC position will conflict with the position provided in the draft document.

Item #	Draft Document Being Considered for Possible Update	Application Content Area	Comments
1	DRO-ISG-2023-03, "Development of Scalable Human Factors Engineering Review Plans, Draft Interim Staff Guidance"	Section 11.3 - Human Factors Engineering	Draft of ISG was issued September 29, 2022 (ADAMS Accession No. ML22272A051)