THE NRC STAFF HAS PREPARED THIS DRAFT WHITE PAPER AND IS RELEASING IT TO SUPPORT AN UPCOMING ADVANCED REACTOR STAKEHOLDER MEETING. THE U.S. NUCLEAR REGULATORY COMMISSION (NRC) STAFF INTENDS THIS DRAFT WHITE PAPER TO FACILITATE DISCUSSION AT THE MEETING BUT IS NOT SOLICITING WRITTEN COMMENTS ON IT. THE CONTENTS OF THIS DOCUMENT ARE SUBJECT TO CHANGE AND SHOULD NOT BE INTERPRETED AS OFFICIAL AGENCY POSITIONS. ULTIMATELY, THE NRC STAFF PLANS TO ISSUE GUIDANCE ON THE APPLICABILITY OF CURRENT NRC REGULATIONS TO NON-LIGHT WATER REACTORS AND WILL SEEK PUBLIC COMMENTS ON THE GUIDANCE DOCUMENT.

July 2021

Updated NRC Staff Draft White Paper
Analysis of Applicability of NRC Regulations for Non-Light Water Reactors

Background

This draft white paper updates "NRC Staff Draft White Paper Analysis of Applicability of NRC Regulations for Non-Light Water Reactors" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20241A017) released September 2020. The updates reflect feedback received at advanced reactor stakeholder meetings and from an October 20, 2020, letter from the Nuclear Energy Institute (ADAMS Accession No. ML20308A662).

Approach

This document identifies regulations that are generically applicable and inapplicable to all non-light water reactor (non-LWR) applications for construction permits and operating licenses under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 and standard design certifications, combined licenses, and standard design approvals under 10 CFR Part 52.[1] Applicable, in this context, refers to regulations currently in effect from which non-LWR designs cannot be generically excluded by the terms of the regulations.

This document is based on the NRC's current regulatory framework. Generic changes to the NRC's regulatory framework for non-LWRs, if needed, are best addressed through the rulemaking process. The NRC is undertaking several rulemakings that will provide additional, performance-based options for future non-LWR applicants. One important effort is the Risk-Informed, Technology Inclusive Regulatory Framework for Advanced Reactors (RIN 3150-AK31), which is commonly referred to as the Part 53 rulemaking. Others address emergency planning and physical security. While these rulemakings are pending, exemptions provide the regulatory flexibility that a non-LWR applicant may seek. This approach is consistent with the flexibility provided for any applicant that identifies regulations that are not needed for the applicant's design or site. There are, in addition, procedural alternatives to exemptions that the NRC has used successfully in the past to license new technologies. An applicant may request that the staff develop a rule of particular applicability or an order (for example, as part of the Commission's notice of docketing and opportunity to request a hearing on the application) to identify requirements particular to its design in lieu of or in addition to seeking exemptions from the applicable requirements. Orders and rules of particular applicability are case-specific, do not apply

[1] The NRC staff did not include regulations associated with early site permits, limited work authorizations, and manufacturing licenses under 10 CFR Part 52

generically to all non-LWRs, and would require resources and substantial preapplication engagement. During pre-application engagement, the NRC staff and applicant would work together to identify areas where such an order or rule would be useful to clarify the relationship between current regulatory requirements and a specific design and reduce or obviate the need for exemptions. These options are available for use in connection with a specific application, especially in cases where an applicant has a mature design and desires early Commission engagement. Preapplication engagement should help to determine if these options would be useful in a particular context. If these interactions result in a staff determination that an application-specific order or the like would be useful, the staff would interact with the Commission to develop such an approach. For simplicity, the remainder of this document discusses exemptions, but a prospective applicant applying for a design certification, license, or permit under 10 CFR Parts 50 and 52 could use the same analytical approach to develop the basis for the acceptability of its design and requests for exemptions from regulations as guidance to identify factors that could be addressed in a design- or facility-specific order or rule.

This document considers both 10 CFR Parts 50 and 52, which set forth different possible licensing pathways. In performing the regulatory review documented in this draft white paper, the NRC staff comprehensively addressed 10 CFR Part 50, as it contains the full set of regulations applicable to power reactor applications and is referenced in 10 CFR Part 52 directly in many instances. Separately, the NRC staff reviewed 10 CFR Part 52 as certain regulatory requirements differ between 10 CFR Part 50 and 10 CFR Part 52. Some of these differences are due to NRC's expectation that most new reactor applicants would use 10 CFR Part 52, rather than 10 CFR Part 50, to construct and operate new reactor facilities. The ongoing rulemaking to clarify Parts 50 and 52 and their interrelationship (RIN 3150 AI66) is expected to ensure consistency in new reactor licensing reviews as well as address other new reactor licensing.

The goal of this white paper is to provide guidance about which current regulatory requirements apply to non-LWR applications, but omission of any given regulation from the analysis should not be interpreted as an indication that the omitted regulation does not apply to a non-LWR applicant. For example, while not included in the tables that follow, 10 CFR 52.6, completeness and accuracy of information, applies to all applicants for licenses including non-LWR applicants. This draft white paper is intended to provide guidance and structure regarding the regulations an applicant should address, and the staff will review how an applicant addresses these regulations once a design is mature and an application is received.

Considerations

The NRC expects that specific non-LWR designs may comply with some applicable regulations in new and unforeseen ways. An exemption may not be required if an applicant can justify that a requirement is met for a specific design. The NRC remains receptive to discussing and considering innovative methods for compliance with regulatory requirements. The Appendix to this draft white paper includes examples of demonstrating compliance with regulations that are applicable generically to non-LWR applicants.

The NRC staff acknowledges that some of the regulations identified as generically applicable in the subsequent tables may not serve a purpose for certain non-LWR designs due to their unique design-specific attributes. The NRC staff therefore anticipates that non-LWR applicants will request exemptions from some of these regulations. In order to address the appropriate regulatory requirements, as part of the application, staff anticipates that applicants will provide information related to the overall safety of the design that serves to satisfy multiple requirements

and systematically explain the facility design. In doing so, this information could provide some or all of the basis for exemptions from regulations, and thus an exemption request could be a natural extension of the application. Exemption requests ideally should be in their own section of the application, although the exemption requests need not repeat technical information presented elsewhere in the application (the exemption request can reference the relevant portion of the application). Exemption requests using the same technical justification can be bundled together into a single request at the applicant's discretion.

Applicants will be required to submit on the docket the information needed to support staff's determinations on the acceptability of each exemption request. In reviewing an exemption request in accordance with the regulations, the NRC must determine whether the proposed exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. In addition, the proposed exemption must provide at least one special circumstance identified in 10 CFR 50.12(a)(2). The Commission ultimately determines the acceptability of the exemption in approving or denying the issuance of the design certification rule, permit, or license.

Exemption requests will vary both in content and complexity, and the amount of supporting information needed to justify the technical and regulatory criteria associated with a specific exemption request will vary accordingly. Staff expects some exemption requests to be straightforward, with minimal information needed to meet the information requirements associated with the regulation. Other exemption requests involving extensive technical justification are likely to have more complex information requirements. As long as the administrative record demonstrates that the regulatory requirements are met and the exemption request is justified, the format and content of the exemption may differ and remain acceptable.

In general, to support an exemption request, the application should contain the following:

- A statement identifying the need for the exemption;
- The scope and summary of the requested exemption, including identification of the specific portion(s) of the regulation from which the exemption is requested;
- Relevant justification for the exemption request, with references to regulatory guidance and/or requirements (as applicable);
- A technical justification for the request (which may include references to information in other portions of the application); and
- An evaluation against the exemption criteria in Section 50.12.

There are a few special cases where something other than a full exemption request may be appropriate. First, some applicable regulations such as definition sections or lists of codes and standards do not impose requirements unless they are referenced in other applicable regulations. The Appendix to this draft white paper provides examples of regulations where no actions are required for regulatory compliance. Second, some regulations may be inapplicable to a particular non-LWR design or application because of entry conditions that are already present in the rule. In these cases, applicants are expected to document and support their claim that a requirement is inapplicable because of the entry condition. Finally, some exemption requests are straightforward enough that providing a basis for them requires little information beyond the description of the design in the final safety analysis report (FSAR) as technical justification. The Appendix discusses regulations of this type.
Examples of information that could be furnished to support a specific exemption request is

provided in the Appendix to this draft white paper. Prospective applicants should engage as soon as practicable with the NRC staff to determine the need for exemptions from specific requirements for a particular design or technology. While some NRC regulations are generically inapplicable to non-LWRs, the NRC staff will review applications to ensure that any particular non-LWR design achieves the underlying safety purpose of each such regulation if needed for adequate protection of public health and safety or the common defense and security.

Guidance document NEI–18–04, Revision 1, "Risk-Informed Performance-Based Guidance for Non-Light Water Reactor Licensing Basis Development," often referred to as the Licensing Modernization Project (LMP), describes a methodology to identify licensing basis events; categorize and establish performance criteria for structures, systems, and components (SSCs); and evaluate defense in depth for advanced reactor designs. The NRC staff endorsed the LMP in Regulatory Guide 1.233, “Guidance for a Technology Inclusive, Risk-informed, and Performance-based Methodology to Inform the Licensing Basis and Content of Applications for Licenses, Certifications, and Approvals for Non-Light-Water Reactors.” Use of the LMP could prompt an applicant to request exemptions from certain regulations, such as the 10 CFR 50.2 definition of “safety-related structures, systems and components.” The Appendix to this draft white paper includes more information on this topic.

Analysis

The NRC staff’s analysis is documented in six tables, which are summarized below. Additional details are provided immediately preceding each table. Table 1 provides a list of 10 CFR Part 50 regulations to be considered by non-LWR designers, Table 2 provides a list of 10 CFR Part 52 regulations to be considered by non-LWR designers, and Table 3 provides a list of regulations by part outside of 10 CFR Part 50 and Part 52 that may apply to non-LWRs.

Table 4 provides a list of 10 CFR 50.34(f) (i.e., Three Mile Island (TMI)) requirements deemed applicable to non-LWRs. Some regulations in Table 4 include “entry conditions” that if met for a given design would make a regulation applicable; if the “entry conditions” are not met then the regulations are considered not applicable.

Table 5 provides regulations and additional context for some areas where exemptions may be used for non-LWR designs. These regulations apply to all reactor designs in regard to their performance standards, but include detailed descriptions of conditions found in LWRs that may not be found in certain non-LWRs or detailed compliance methods that apply to LWRs but not all non-LWRs. Table 6 identifies Part 52 regulations for which an exemption is expected for non-LWRs because the regulations apply by their terms, but cross-reference Part 50 regulations that are applicable to LWRs only. Where an application contains sufficient design information for the NRC staff to determine regulatory applicability and an otherwise acceptable exemption has not been formally requested, the NRC staff plans to proactively evaluate and document the bases for exemptions to the regulations in Table 6 based on design information already required by NRC regulations to be included in the application. When included in an application, such information should form sufficient bases for these exemptions. The staff reserves the right to request that the applicant provide additional information on the docket, where necessary, to support exemptions.

Regulatory Applicability for non-LWRs

In Tables 1 through 3, the applicability of a regulation to a non-LWR is indicated by either “Yes” or “No.” In using the indicated applicability, staff has generated a flow chart to assist in determining how to address regulations based on the provided context. Regulations marked as “Yes” in the last column of Tables 1 through 3 are generically applicable to non-LWRs, and the flow chart in Figure 1 provides various pathways for addressing those regulations based on application-specific considerations. Further detail for some of these pathways is provided in the Appendix. Regulations marked as “No” in the last column of Tables 1 and 2 are generically not applicable to any non-LWR and the application need not include further information to address such a regulation.

Figure 1. Using Regulatory Applicability Tables (Flow Chart)

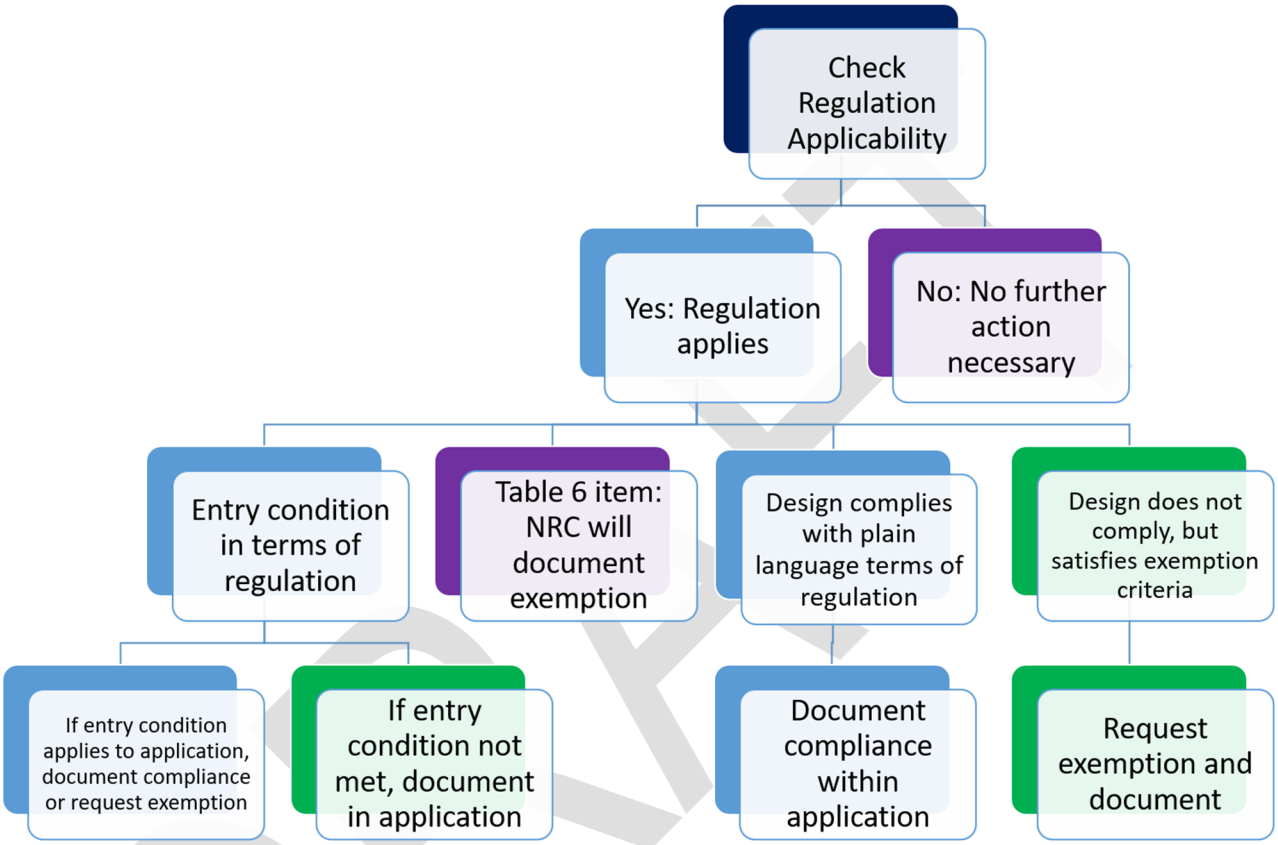

Table 1

Table 1 provides a list of 10 CFR Part 50 regulations to be considered by non-LWR designers, with applicability for each regulation in the table. It lists regulations by 10 CFR citation, provides a brief description of the regulation, and lists applicability (with notes for some regulations).

Table 1. 10 CFR Part 50 Requirements, as applicable to applications under Part 50 for non-LWRs[2]

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.2	Definitions	Yes, all definitions are applicable to all designs, but most definitions do not themselves create requirements.
10 CFR 50.3	Interpretations	Yes
10 CFR 50.4	Written communications	Yes
10 CFR 50.5	Deliberate misconduct	Yes
10 CFR 50.7	Employee protection	Yes
10 CFR 50.9	Completeness and accuracy of information	Yes
10 CFR 50.10	License required; Limited work authorization (LWA)	Yes, as applicable if requested
10 CFR 50.11	Exceptions and exemptions from licensing requirements	Yes
10 CFR 50.12	Specific exemptions	Yes
10 CFR 50.13	Attacks and destructive acts by enemies of the United States; and defense activities	Yes
10 CFR 50.20	License classification	Yes
10 CFR 50.21	Class 104 licenses for commercial and industrial facilities	Yes
10 CFR 50.22	Class 103 licenses for commercial and industrial facilities	Yes

[2] Omission of any given regulation from the tables should not be interpreted as a non-applicability.

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.23	Construction permits (CPs)	Yes (for CPs)
10 CFR 50.30	Filing of application; oath or affirmation	Yes
10 CFR 50.31	Combining applications	Yes
10 CFR 50.32	Elimination of repetition	Yes
10 CFR 50.33	Applicant information	Yes
10 CFR 50.34(a)	PSAR	Yes (for CPs)
10 CFR 50.34(b)	FSAR	Yes (for OLs)
10 CFR 50.34(b)(1)	Site Evaluation (10 CFR Part 100) for Operating License Applications	Yes
10 CFR 50.34(b)(2)	FSAR description of SSCs	Yes
10 CFR 50.34(b)(3)	Kinds and quantities of radioactive materials (10 CFR Part 20)	Yes
10 CFR 50.34(b)(4)	Analysis of SSCs and Emergency Core Cooling System (ECCS) evaluation	See Analysis of SSCs and ECCS Evaluation in Table 5
10 CFR 50.34(b)(5)	Description and evaluation of applicable programs including research and development	Yes
10 CFR 50.34(b)(6)	Facility operation documentation (programs, TS, etc.)	Yes
10 CFR 50.34(b)(7)	Technical qualifications	Yes
10 CFR 50.34(b)(8)	Operator requalification program	Yes
10 CFR 50.34(b)(9)	Description of pressurized thermal shock	See Pressurized Thermal Shock Events in Table 5

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.34(b)(10)	Earthquake engineering criteria in Appendix S of 10 CFR Part 50	Yes
10 CFR 50.34(b)(11)	Siting criteria	Yes
10 CFR 50.34(b)(12)	Aircraft impact	Yes
10 CFR 50.34(c)	Physical security plan	Yes (for OLs)
10 CFR 50.34(d)	Safeguards contingency plan	Yes (for OLs)
10 CFR 50.34(e)	Protection against unauthorized disclosure	Yes (for OLs)
10 CFR 50.34(f)	TMI requirements	See footnote[3]
10 CFR 50.34(g)	Combustible gas control	Yes
10 CFR 50.34(h)	Conformance with the Standard Review Plan (SRP)	No
10 CFR 50.34(i)	Mitigation of beyond-design-basis events	Yes
10 CFR 50.34a	Design objectives for equipment to control releases of radioactive material in effluents	Yes
10 CFR 50.36	Technical specifications	Yes
10 CFR 50.43(e)(1)	Additional standards and provisions affecting class 103 licenses and certifications for commercial power	Yes

[3] Although not required for applications under 10 CFR Part 50, the Commission direction in the Staff Requirements Memorandum to SECY-15-0002 confirmed that its earlier directions for the 10 CFR Part 52 new power reactor applications be applied consistently to 10 CFR Part 50 new power reactor applications. In addition, the Commission approved revision of the regulations in 10 CFR Part 50 for new power reactor applications to more closely align with requirements in 10 CFR Part 52, incorporating the requirements identified by the staff in SECY-15-0002, including the TMI-related items under 10 CFR 50.34(f) and the PRA requirements under section 50.71(h).

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.43(e)(2)	Additional standards and provisions affecting class 103 licenses and certifications for commercial power	Yes
10 CFR 50.44(a)	Combustible gas control for nuclear power reactors	Yes
10 CFR 50.44(b)	Combustible gas control for nuclear power reactors	No
10 CFR 50.44(c)	Combustible gas control for nuclear power reactors	No
10 CFR 50.44(d)	Combustible gas control for nuclear power reactors	Yes
10 CFR 50.45	Standards for construction permits, operating licenses, and combined licenses	Yes
10 CFR 50.46	Acceptance criteria for emergency core cooling systems	No
10 CFR 50.46a	Acceptance criteria for reactor coolant system venting systems	Yes, but only required (per the text in the regulation) for a design where the accumulation of noncondensible gases would cause the loss of function of the core cooling systems
10 CFR 50.46a(a)	Acceptance criteria for reactor coolant system venting systems	See Analysis of SSCs and ECCS Evaluation in Table 5
10CFR 50.46a(b)	Acceptance criteria for reactor coolant system venting systems	See Analysis of SSCs and ECCS Evaluation in Table 5
10 CFR 50.46a(c)	Acceptance criteria for reactor coolant system venting systems	See Analysis of SSCs and ECCS Evaluation in Table 5
10 CFR 50.47	Emergency plans	Yes
10 CFR 50.48(a)	Fire protection plan	Yes

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.48(b)	Fire protection (Appendix R)	No
10 CFR 50.48(c)	National Fire Protection Association Standard (NFPA) 805	No, NFPA 805 is specific to Light Water Reactors
10 CFR 50.49	Environmental qualification of electric equipment important to safety for nuclear power plants	Yes, except as noted below
10 CFR 50.49(g)	Environmental qualification of electric equipment important to safety for nuclear power plants	No
10 CFR 50.49(h)	Environmental qualification of electric equipment important to safety for nuclear power plants	No
10 CFR 50.49(i)	Environmental qualification of electric equipment important to safety for nuclear power plants	No
10 CFR 50.49(k)	Environmental qualification of electric equipment important to safety for nuclear power plants	No
10 CFR 50.50	Issuance of licenses and construction permits	Yes
10 CFR 50.51	Continuation of license	Yes
10 CFR 50.52	Combining licenses	Yes
10 CFR 50.53	Jurisdictional limitations	Yes
10 CFR 50.54	Conditions of licenses	Yes, (for operating licenses/combined licenses (OLs/ COLs) as described in the text of the regulation)
10 CFR 50.54(a)	Quality assurance	Yes
10 CFR 50.54(j)	Reactivity manipulation	Yes

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.54(k)	Operator at the controls	Yes
10 CFR 50.54(m)	Staffing requirements	Yes
10 CFR 50.54(o)	Primary containment/Appendix J applicability	No
10 CFR 50.54(ff)	Seismic	Yes
10 CFR 50.54(hh)	Aircraft Impact	Yes
10 CFR 50.55	Conditions of construction permits, early site permits, combined licenses, and manufacturing licenses	Yes
10 CFR 50.55a(a)	Codes and standards	Yes, the provision provides a list of standards approved for incorporation by reference but does not itself impose requirements
10 CFR 50.55a(b)	Codes and standards - use and conditions on the use of standards	No[4]
10 CFR 50.55a(c)	Codes and standards - reactor coolant pressure boundary	No
10 CFR 50.55a(d)	Codes and standards - Quality Group B components	No
10 CFR 50.55a(e)	Codes and standards - Quality Group C components	No
10 CFR 50.55a(f)	Codes and standards – preservice and inservice testing requirements	No

[4] Note that these standards marked as "No" do not apply as requirements to non-LWRs, but some non-LWRs may elect to use these codes and standards to demonstrate quality and capability of structures, systems, or components. In these cases, standards should incorporate conditions in the regulations (such as those in section 50.55a(b)) as applicable to the design. Staff encourages the use of existing codes and standards when relevant, as doing so can provide a recognized quality standard and alleviate much of the need to justify component quality on a specific basis at the design stage.

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.55a(g)	Codes and standards – Preservice and inservice inspection requirements	No
10 CFR 50.55a(h)(2)	Codes and standards	No
10 CFR 50.55a(h)(3)	Codes and standards	Yes
10 CFR 50.55a(z)	Codes and standards	Yes
10 CFR 50.56	Conversion of construction permit to license; or amendment of license	Yes
10 CFR 50.57	Issuance of operating license	Yes
10 CFR 50.58	Hearings and report of the Advisory Committee on Reactor Safeguards	Yes
10 CFR 50.59	Changes, tests and experiments	Yes
10 CFR 50.60	Acceptance criteria for fracture prevention measures for LWRs for normal operation	No
10 CFR 50.61	Fracture toughness requirements for protection against pressurized thermal shock events	No
10 CFR 50.61a	Alternate fracture toughness requirements for protection against pressurized thermal shock events	No
10 CFR 50.62	Requirements for reduction of risk from Anticipated Transient Without Scram (ATWS) events for LWRs	No
10 CFR 50.63	Loss of all alternating current power	No
10 CFR 50.65	Maintenance rule	Yes, also see Reactor Coolant Pressure Boundary in Table 5 as applicable

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.66	Requirements for thermal annealing of the reactor pressure vessel	No
10 CFR 50.67	Accident source term	No
10 CFR 50.68	Criticality accident requirements	Yes, See Criticality in Table 5
10 CFR 50.69	Risk-informed categorization and treatment of SSCs	Yes, voluntary and optional
10 CFR 50.70	Inspections	Yes
10 CFR 50.71	Maintenance of records, making of reports	Yes
10 CFR 50.71(h)(1)	Probabilistic risk assessment (PRA)	Yes[3], an exemption may not be required if a Level 3 PRA is done because the scope of the Level 3 PRA encompasses the Level 1 and Level 2 PRAs.
10 CFR 50.72	Immediate notification requirements for operating nuclear power reactors	Yes (for OLs/COLs)
10 CFR 50.73	Licensee event report system	Yes (for OLs/COLs)
10 CFR 50.74	Notification of change in operator or senior operator status	Yes
10 CFR 50.75	Reporting and recordkeeping for decommissioning planning	Yes
10 CFR 50.76	Licensee's change of status; financial qualifications	Yes
10 CFR 50.78	Facility information and verification	Yes
10 CFR 50.80	Transfer of licenses	Yes
10 CFR 50.81	Creditor regulations	Yes
10 CFR 50.82	Termination of license	Yes

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR 50.83	Release of part of a power reactor facility or site for unrestricted use	Yes
10 CFR 50.90	Application for amendment of license, construction permit, or early site permit	Yes
10 CFR 50.91	Notice for public comment; State consultation	Yes
10 CFR 50.92	Issuance of amendment	Yes
10 CFR 50.100	Revocation, suspension, modification of licenses, permits, and approvals for cause	Yes
10 CFR 50.101	Retaking possession of special nuclear material	Yes
10 CFR 50.102	Commission order for operation after revocation	Yes
10 CFR 50.103	Suspension and operation in war or national emergency	Yes
10 CFR 50.109	Backfitting	Yes
10 CFR 50.110	Violations	Yes
10 CFR 50.111	Criminal penalties	Yes
10 CFR 50.120	Training and qualification of nuclear power plant personnel	Yes (for OLs)
10 CFR 50.150	Aircraft impact	Yes (for OLs/COLs)
10 CFR 50.155	Mitigation of beyond-design-basis events	Yes

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR Part 50 Appendix A	General Design Criteria	No[5]
10 CFR Part 50 Appendix B	Quality assurance	Yes
10 CFR Part 50 Appendix C	Financial data and qualifications	Yes
10 CFR Part 50 Appendix E	Emergency planning	Yes
10 CFR Part 50 Appendix F	Fuel reprocessing plants and related waste management facilities	Yes
10 CFR Part 50 Appendix G	Fracture toughness requirements	No
10 CFR Part 50 Appendix H	Reactor vessel material surveillance program requirements	No
10 CFR Part 50 Appendix I	ALARA	No
10 CFR Part 50 Appendix J	Primary reactor containment leakage testing for water-cooled power reactors	No
10 CFR Part 50 Appendix K	ECCS evaluation models	No
10 CFR Part 50 Appendix N	Standardization of nuclear power plant designs	Yes
10 CFR Part 50 Appendix Q	Preapplication early review of site suitability issues	Yes
10 CFR Part 50 Appendix R	Fire protection	No

[5] While Appendix A is not a requirement, applicants for Part 50 or Part 52 reactor licenses are required to provide principal design criteria (PDC). 10 CFR Part 50, Appendix A states that the General Design Criteria (GDC) are also considered to be generally applicable to these other types of nuclear power units. In developing PDC, applicants should consider the GDC as applicable.

Table 1: Regulation	Topic	Applicability to non-LWRs
10 CFR Part 50 Appendix S	Earthquake engineering criteria	Yes

Table 2

Table 2 includes select regulations for 10 CFR Part 52, Subpart B, "Standard Design Certifications"; Subpart C, "Combined Licenses"; and Subpart D, "Standard Design Approvals" because these are the types of Part 52 applications expected by the NRC staff for most non-LWRs. Similar or additional requirements may exist for manufacturing licenses. Table 2 lists regulations by topic, provides associated 10 CFR citations, and identifies expected applicability (with notes for some regulations).

Table 2. Selected 10 CFR Part 52 Requirements, as applicable to non-LWR Standard Design Certifications, Combined Licenses and Standard Design Approvals applications[6]

Table 2. Topic	**Regulation**	**Applicability to non-LWRs**
Analysis of SSCs and ECCS Evaluation	10 CFR 52.47(a)(4) 10 CFR 52.79(a)(5) 10 CFR 52.137(a)(4)	See Analysis of SSCs and ECCS Evaluation in Table 5
Applicability of SRP	10 CFR 52.47(a)(9) 10 CFR 52.79(a)(41) 10 CFR 52 137(a)(9)	No
Combustible Gas Control	10 CFR 52.47(a)(12) 10 CFR 52.79(a)(8) 10 CFR 52.137(a)(12)	Yes
Pressurized Thermal Shock	10 CFR 52.47(a)(14) 10 CFR 52.79(a)(7) 10 CFR 52.137(a)(14)	See Pressurized Thermal Shock Events in Table 5
Anticipated Transient Without Scram (ATWS)	10 CFR 52.47(a)(15) 10 CFR 52.79(a)(42) 10 CFR 52.137(a)(15)	See ATWS in Table 5
Station Blackout (SBO)	10 CFR 52.47(a)(16) 10 CFR 52.79(a)(9) 10 CFR 52.137(a)(16)	See SBO in Table 5
Criticality Accident Requirements	10 CFR 52.47(a)(17) 10 CFR 52.79(a)(43) 10 CFR 52.137(a)(17)	See Criticality in Table 5

[6] Omission of any given regulation from the tables should not be interpreted as a non-applicability.

Table 2. Topic	Regulation	Applicability to non-LWRs
Fire protection	10 CFR 52.47(a)(18) 10 CFR 52.79(a)(6) 10 CFR 52.137(a)(18)	Yes, in part – The requirements associated with 10 CFR 50.48 are applicable. The General Design Criteria (GDC) in Appendix A are not a requirement for non-LWRs, but consistent with this regulation and the staff guidance in RG 1.232, staff anticipates that applicants will provide a Principal Design Criterion (PDC) that is representative of Criterion 3. See Appendix for further details.
Fire Protection Program	10 CFR 52.79(a)(40)	Yes
Unresolved Safety Issues (USI) Resolution	10 CFR 52.47(a)(21) 10 CFR 52.79(a)(20) 10 CFR 52.137(a)(21)	Yes
Operating Experience	10 CFR 52.47(a)(22) 10 CFR 52.79(a)(37) 10 CFR 52.137(a)(22)	Yes
Severe Accident Considerations	10 CFR 52.47(a)(23) 10 CFR 52.79(a)(38) 10 CFR 52.137(a)(23)	No
Conceptual Design Information Not Part of the Certification	10 CFR 52.47(a)(24)	Yes
Interface requirements to be met by those portions of the facility that are not part of the certification	10 CFR 52.47(a)(25), (26)	Yes
PRA	10 CFR 52.47(a)(27) 10 CFR 52.79(a)(46) 10 CFR 52.137(a)(25)	Yes
ITAAC	10 CFR 52.47(b)(1) 10 CFR 52.80(a)	Yes

Table 2. Topic	Regulation	Applicability to non-LWRs
Environmental report	10 CFR 52.47(b)(2) 10 CFR 52.80(b)	Yes
Designs that Differ Significantly from LWRs Must Meet Section 50.43(e)	10 CFR 52.47(c)(2) 10 CFR 52.79(a)(24)	Yes
Environmental Qualification of Electrical Equipment	10 CFR 52.47(a)(13) 10 CFR 52.79(a)(10) 10 CFR 52.137(a)(13)	Yes
American Society of Mechanical Engineers (ASME) Code Programs	10 CFR 52.79(a)(11)	Yes[7]
Maintenance Rule	10 CFR 52.79(a)(15)	Yes, also, see Reactor Coolant Pressure Boundary in Table 5 as applicable
Control of Effluents	10 CFR 52.47(a)(10) 10 CFR 52.79(a)(16)(i) 10 CFR 52.137(a)(10)	Yes
Effluents Monitoring and Sampling Program	10 CFR 52.79(a)(16)(ii)	See Effluent Monitoring and Sampling Program in Table 5
TMI Requirements	10 CFR 52.47(a)(8) 10 CFR 52.79(a)(17) 10 CFR 52.137(a)(8)	Yes, see Table 4
Risk-Informed Categorization of SSCs	10 CFR 52.79(a)(18)	Yes, voluntary and optional
Emergency Plans	10 CFR 52.79(a)(21)	Yes
Multi-Unit Sites	10 CFR 52.79(a)(31)	Yes
Physical Security Plan	10 CFR 52.79(a)(35)	Yes

[7] Note that these standards from 10 CFR 50.55a that are marked as "No" in Table 1 do not apply as requirements to non-LWRs, but some non-LWRs may elect to use these codes and standards to demonstrate quality and capability of SSCs. In these cases, standards should incorporate conditions in the regulations (such as those in section 50.55a(b)) as applicable to the design. Staff encourages the use of existing codes and standards when relevant, as doing so can provide a recognized quality standard and alleviate much of the need to justify component quality on a more specific basis at the design stage.

Table 2. Topic	Regulation	Applicability to non-LWRs
Safeguards Contingency Plan	10 CFR 52.79(a)(36)	Yes
Aircraft Impact Assessment	10 CFR 52.47(a)(28) 10 CFR 52.79(a)(47) 10 CFR 52.137(a)(26)	Yes
Limited work authorization	10 CFR 52.80(c)	Yes
Mitigation of Beyond-Design-Basis Events	10 CFR 52.80(d)	Yes

Table 3

Table 3 includes regulations, by part, other than those in 10 CFR Part 50 and Part 52 that may apply to non-LWRs at some stage in the licensing process. It lists regulations by 10 CFR citation, provides a brief description of the regulation, and lists applicability.

Table 3. Other regulations that may apply to non- LWRs[8]

Table 3. Regulation	Topic	Applicability to non-LWRs
10 CFR Part 2	Agency rules of practice and procedure	Yes
10 CFR Part 9	Public records	Yes
10 CFR Part 11	Criteria and procedures for determining eligibility for access to restricted data or national security information or an employment clearance	Yes
10 CFR Part 19	Notices, instructions and reports to workers: inspection and investigations	Yes
10 CFR Part 20	Standards for protection against ionizing radiation	Yes
10 CFR Part 21	Reporting of defects and non-compliance	Yes
10 CFR Part 25	Access authorization	Yes
10 CFR Part 26	Fitness for duty programs	Yes
10 CFR Part 30	Rules of general applicability to domestic licensing of byproduct material	Yes
10 CFR Part 31	General domestic licenses for byproduct material	Yes
10 CFR Part 37	Physical protection of Category 1 and Category 2 quantities of radioactive material	Yes
10 CFR Part 40	Domestic licensing of source material	Yes

[8] Omission of any given regulation from the tables should not be interpreted as a non-applicability.

Table 3. Regulation	Topic	Applicability to non-LWRs
10 CFR Part 51	Environmental protection regulations for domestic licensing and related regulatory functions	Yes
10 CFR 51.51	Environmental fuel cycle environmental data	No
10 CFR 51.52	Environmental effects of transportation of fuel and waste	No
10 CFR Part 54	Requirements for renewal of operating licenses for nuclear power plants	Yes
10 CFR Part 55	Operators' licenses	Yes
10 CFR Part 70	Domestic licensing of special nuclear material	Yes
10 CFR Part 71	Packaging and transportation of radioactive material	Yes
10 CFR Part 72	Licensing requirements for the independent storage of spent nuclear fuel and high-level radioactive waste, and reactor-related greater than Class C waste	Yes
10 CFR Part 73	Physical protection of plants and materials	Yes, as applicable
10 CFR Part 74	Material control and accounting of special nuclear material	Yes
10 CFR Part 81	Standard specifications for the granting of patent licenses	Yes
10 CFR Part 95	Facility security clearance and safeguarding of national security information and restricted data	Yes
10 CFR Part 100	Reactor site criteria	Yes
10 CFR Part 110	Export and import of nuclear equipment and material	Yes

Table 3. Regulation	Topic	Applicability to non-LWRs
10 CFR Part 140	Financial protection requirements and indemnity agreements	Yes
10 CFR Part 170	Fees for facilities, materials, import and export licenses, and other regulatory services under the Atomic Energy Act of 1954, as amended	Yes
10 CFR Part 171	Annual fees for reactor licenses	Yes

Table 4

Requirements under 10 CFR 50.34(f) (i.e., Three Mile Island (TMI) requirements) are only applicable for 10 CFR Part 52 applications. See Footnote 3 on page 4 for a discussion of applicability to 10 CFR Part 50 applicants. Applicants are required to demonstrate compliance with the technically relevant TMI items. Use of the term "technically relevant" in the text of the regulation allows for a greater degree of flexibility in meeting the regulation. If a sound case can be made that the requirement in question is not technically relevant to a design under review, the requirement is satisfied without a need for an exemption. Table 4, below, provides generic applicability determinations for non-LWRs, with entry conditions for technical relevancy listed for some items. If the "entry conditions" are not met, then the regulations are considered not applicable. The 10 CFR 50.34(f) citations not listed in Table 4 are considered not applicable.

As part of the review of the 10 CFR 50.34(f) requirements, staff found instances where the requirement in Section 50.34(f) could partially duplicate other requirements for some applicants, conditional on compliance with other regulations. These regulations are marked with an asterisk (*) in the table below. For example, 10 CFR 50.34(f)(1)(i) requires, in part, that an applicant perform a plant/site specific probabilistic risk assessment to seek improvements in the reliability of heat removal systems. But an applicant for a COL also needs to meet Section 52.79(a)(46), which requires an applicant to provide a description of the design-specific probabilistic risk assessment (PRA) and its results. Likewise, 10 CFR 50.34(f)(3)(iii) requires in part that an applicant establish a quality assurance (QA) program based on a set of specified criteria, and an applicant for a CP/OL is also required to meet:

- 50.34(a)(7), which requires a description of the quality assurance program to be applied to the design, fabrication, construction, and testing of the SSCs of the facility;
- 50.34(b)(6) which requires an applicant provide information concerning the applicant's organizational structure, allocations or responsibilities and authorities, and personnel qualifications requirements, and managerial and administrative controls to be used to assure safe operation; and
- 10 CFR Part 50 Appendix B, which provides the QA criteria to be applied to the design, fabrication, construction, and testing of the SSCs of the facility.

Thus, an applicant may demonstrate compliance with Section 50.34(f) requirements in some cases by meeting other existing requirements and referencing the portions of the application that demonstrate how these other requirements are satisfied.

Table 4 - Applicability of 10 CFR 50.34(f) "TMI Requirements" to non-LWRs under Part 52

Table 4. Regulation	**Topic**	**Applicability to non—LWRs** (See above for discussion of *)
10 CFR 50.34(f)(1)(i)	PRA to seek improvements in reliability of heat removal systems	*Yes
10 CFR 50.34(f)(1)(iii)	Reactor coolant pump seal damage	Yes (entry condition: only for reactor designs that have a coolant pump with seals that retain inventory credited for core cooling)
10 CFR 50.34(f)(2)(i)	Control room simulator	*Yes
10 CFR 50.34(f)(2)(ii)	Plant procedure improvement program	Yes
10 CFR 50.34(f)(2)(iii)	Control room human factors	Yes
10 CFR 50.34(f)(2)(iv)	Safety parameter display system	Yes
10 CFR 50.34(f)(2)(v)	Automatic indication of status of safety systems	Yes
10 CFR 50.34(f)(2)(vi)	High point venting of reactor coolant system (RCS)	Yes (entry condition: only if reactor coolant flow is credited for core cooling and coolant flow can be impeded by noncondensible gases)
10 CFR 50.34(f)(2)(vii)	Radiation shielding design review	Yes
10 CFR 50.34(f)(2)(viii)	Post-accident sampling	Yes
10 CFR 50.34(f)(2)(x)	Relief and safety valves	Yes (entry condition: only if RCS has relief valves and failure of these valves would lead to core cooling challenges)
10 CFR 50.34(f)(2)(xi)	Relief and safety valves	Yes (entry condition: only if RCS has relief valves and failure of these valves would lead to core cooling challenges)

Table 4. Regulation	**Topic**	**Applicability to non—LWRs** (See above for discussion of *)
10 CFR 50.34(f)(2)(xiv)	Containment isolation	Yes (entry condition: only for designs that use a traditional containment rather than a functional containment approach)
10 CFR 50.34(f)(2)(xv)	Containment purging	Yes (entry condition: only for designs that use a traditional containment rather than a functional containment approach)
10 CFR 50.34(f)(2)(xvii)	Control room instrumentation for containment functions	Yes (entry condition: only for designs that use a traditional containment rather than a functional containment approach)
10 CFR 50.34(f)(2)(xviii)	Coolant instrumentation	*Yes
10 CFR 50.34(f)(2)(xix)	Post-accident monitoring	Yes
10 CFR 50.34(f)(2)(xxvi)	Leakage control outside containment	Yes (entry condition: only for designs that have SSCs capable of circulating radioactive materials resulting from an accident outside of qualified barrier(s) to radioactive release)
10 CFR 50.34(f)(2)(xxvii)	In-plant Radiation Monitoring	Yes
10 CFR 50.34(f)(2)(xxviii)	Preclude control room habitability issues during accidents	*Yes
10 CFR 50.34(f)(3)(i)	Industry experience	Yes
10 CFR 50.34(f)(3)(ii)	Quality assurance (QA) list includes all SSCs important to safety	Yes
10 CFR 50.34(f)(3)(iii)	QA program	*Yes
10 CFR 50.34(f)(3)(iv)	Dedicated containment penetrations	Yes (entry condition: only for designs that use a traditional containment rather than a functional containment approach)

Table 4. Regulation	**Topic**	**Applicability to non—LWRs** (See above for discussion of *)
50.34(f)(3)(vi)	Containment	Yes (entry condition: only for designs with external hydrogen mitigation systems with a traditional containment)
50.34(f)(3)(vii)	Management plan for design and construction activities	Yes

Table 5

Table 5 lists the regulations associated with three topical areas (fission product release, criticality, and the reactor coolant pressure boundary) for which the underlying regulatory basis applies to all reactor designs, but the regulations contain language that is specific to LWR designs. A generic resolution for each of these items is currently complicated by design-specific considerations and the relative importance of each concept in the overall safety demonstration of the specific design. For this reason, the NRC staff anticipates that non-LWR applicants will request exemptions from these regulations, but the precise nature of each requested exemption will depend on the specific technology and how other regulations are being met. The NRC staff will engage with non-LWR applicants with the goal of affording applicants as much flexibility as possible in implementing solutions to meet the underlying purpose of these regulations. The staff emphasizes the importance of early engagement on these topics to facilitate an efficient and effective review.

Table 5 – Areas with anticipated exemptions

Table 5. Topical Area	Regulation	Discussion
Fission Product Release	10 CFR 50.34(a)(1)(ii)(D) 10 CFR 52.47(a)(2)(iv) 10 CFR 52.79(a)(1)(vi)	These provisions require that an applicant assume a fission product release from the core into the containment and that the applicant perform an evaluation and analysis of the postulated fission product release using the expected demonstrable containment leak rate and any fission product cleanup systems intended to mitigate the consequences of the accidents. This language is LWR-centric and the prescriptive nature is not consistent with the Commission policy in staff requirements memorandum (SRM)-SECY-18-0096 that would allow functional containment for fission product retention rather than assuming that the facility would include a containment building. Further, the concept of core damage for a non- LWR design may differ dramatically from that normally described for an LWR design. These regulations still require an applicant to evaluate how it will mitigate the radiological consequences of accidents. Additionally, addressing the regulation will likely involve addressing defense-in-depth considerations.

Table 5. Topical Area	Regulation	Discussion
Criticality Monitoring	10 CFR 50.68(b) 10 CFR 52.47(a)(17) 10 CFR 52.79(a)(43) 10 CFR 52.137(a)(17)	Regulations in 10 CFR 50.68(a) require that licensees meet the requirements in 10 CFR 70.24 or the requirements in 10 CFR 50.68(b). Paragraph (b) of 10 CFR 50.68 sets forth conditions for criticality safety based on the presence of borated or unborated water (and "low-density hydrogenous fluid"), i.e., LWR conditions, in lieu of monitoring to detect criticality. Non-LWR fuel differs significantly from traditional fuel types used in LWRs and in many cases has higher enrichment. The NRC staff recognizes that the requirements in 10 CFR 50.68(b) were added to provide clear methods for precluding criticality that would obviate the need for monitoring criticality in stored fuel and anticipates that non-LWR applicants could provide similar criteria for specific non-LWR fuel designs as necessary through exemptions. In the absence of an exemption, a non-LWR application will be required to describe criticality monitoring required by 10 CFR 70.24. The corresponding regulations in 10 CFR Part 52 that cite 10 CFR 50.68 would be included in the exemption, if applicable.
Reactor Coolant Pressure Boundary	10 CFR 50.2 (Definitions – Basic Component) 10 CFR 50.2 (Definitions – Safety-related SSCs) 10 CFR 50.36(c)(2)(ii) 10 CFR 50.49(b) 10 CFR 50.65 10 CFR Part 50 Appendix S	The reactor coolant pressure boundary for an LWR provides a fission product retention barrier for the release of radionuclides. However, in some non-LWRs, the reactor coolant boundary would not serve this function. Fission product retention is provided by the functional containment. Therefore, for these designs, the statement in 10 CFR 50.2 (2 instances), 10 CFR 50.49(b), and 10 CFR 50.65, "The integrity of the reactor coolant pressure boundary" is not necessary and an exemption is anticipated. In 10 CFR 50.36(c)(2)(ii), "significant abnormal degradation of the reactor coolant pressure boundary" is likewise not a safety consideration for some non-LWRs and can be replaced by "significant abnormal degradation of the functional containment" via an exemption. The corresponding regulations in 10 CFR Part 52 that cite 10 CFR Part 50 regulations to the left would also need to be included in the exemption if applicable. For simplicity, the 10 CFR Part 52 regulations are not included in the listing.

Table 6

Table 6 provides a list of the regulations in 10 CFR Part 50 and Part 52 that apply to all power reactors but reference a 10 CFR Part 50 regulation that refers specifically to LWRs. Because these regulations apply to all power reactors, non-LWR power reactor applicants seeking a permit, license, design certification, or standard design approval under 10 CFR Parts 50 or 52 would likely request exemptions from these requirements or could choose to demonstrate compliance. The NRC staff will evaluate and document exemptions to the regulations in this table. If the application contains the design information already required by NRC regulations to be included in the application, such information should form sufficient bases for these exemptions.

For Table 6 regulations, applicants do not need to include the exemption information described in the bullets listed on page 3. Instead, applicants may include a statement requesting an exemption to the items in Table 6 because the design is a non-LWR and therefore, not subject to the referenced Part 50 regulations.

Separately, the underlying safety purpose behind the concept of some of these regulations (e.g., ATWS) remains a consideration in the staff's review in reaching an adequate protection finding. A non-LWR applicant need not comply with the prescriptive requirements listed in the table, but if a similar type of event could present a safety issue for a non-LWR design, the applicant may instead describe how the design either prevents or mitigates that event.

Table 6. Part 52 Regulations Referencing Part 50 Regulations Limited to LWRs

Table 6. Topical Area	Regulation	Discussion
Analysis of SSCs and ECCS Evaluation	10 CFR 50.34(a)(4) 10 CFR 50.34(b)(4) 10 CFR 52.47(a)(4) 10 CFR 52.79(a)(5) 10 CFR 52.137(a)(4)	These regulations apply to all power reactors. The second sentence of each provision requires a description of the analysis and evaluation of the ECCS cooling performance in accordance with 10 CFR 50.46, which is only applicable to LWRs. .
Anticipated Transient Without Scram (ATWS)	10 CFR 52.47(a)(15) 10 CFR 52.79(a)(42) 10 CFR 52.137(a)(15)	These regulations apply to all power reactors. These provisions reference 10 CFR 50.62, which is only applicable to LWRs.
SBO	10 CFR 52.47(a)(16) 10 CFR 52.79(a)(9) 10 CFR 52.137(a)(16)	These regulations apply to all power reactors. These provisions reference 10 CFR 50.63, which is only applicable to LWRs.

Table 6. Topical Area	Regulation	Discussion
Pressurized Thermal Shock Events	10 CFR 50.34(b)(9) 10 CFR 52.47(a)(14) 10 CFR 52.79(a)(7) 10 CFR 52.137(a)(14)	These regulations apply to all power reactors. These provisions require a description of protection against pressurized thermal shock events and reference 10 CFR 50.60 and/or 10 CFR 50.61, which are only applicable to LWRs. All non-LWR designs the NRC staff is aware of operate at conditions that do not support pressurized thermal shock events.
Containment Leak Rate	10 CFR 52.79(a)(12)	These regulations apply to all power reactors. The regulation references 10 CFR Part 50 Appendix J, which is only applicable to LWRs.
Reactor Vessel Surveillance Program	10 CFR 52.79(a)(13)	These regulations apply to all power reactors. The regulation references 10 CFR Part 50 Appendix H which is only applicable to LWRs.
Effluent Monitoring and Sampling Program	10 CFR 52.79(a)(16)(ii)	These regulations apply to all power reactors. The regulation references 10 CFR Part 50 Appendix I which is only applicable to LWRs.

Appendix: Examples Demonstrating Regulatory Compliance and Exemptions

A regulation with "Yes" in the last column of Tables 1 through 3 of the draft white paper is generically applicable to non-LWRs and applications will need to include information to demonstrate on a design-specific basis that (1) the proposed design complies with the regulation in question or (2) the application provides technical justification for an exemption from the regulation. The application should contain information to address the regulations in the manner chosen by the applicant, and the NRC encourages interaction with the staff to align on any areas where information is not initially clear. Some examples of how non-LWR applicants might address specific regulations follow.

Regulatory Compliance

In many cases, the regulations are written such that any reactor applicant – LWR or non-LWR – will be able to explain how the regulation in question is met. Often, this is clear; for other regulations, the distinction between whether compliance is achieved or whether an exemption is needed may be less clear. In order to provide additional clarity, the NRC staff provides the following examples for the level of detail acceptable to the staff for justifying compliance with a set of regulations:

- 10 CFR 50.55a(a) provides a list of codes and standards approved for incorporation by reference into NRC regulations but does not itself impose requirements. It is applicable to non-LWRs. Regulations in 10 CFR 50.55a(b)-(h) and (z) prescribe the use of the codes, but only 10 CFR 50.55a(h) and (z) are applicable to non- LWRs. A designer of a non-LWR or applicant for a license for a non-LWR design may elect to apply the provisions of the American Society of Mechanical Engineers (ASME) Code, OM Code, or ASME NQA-1, but § 50.55a does not impose those provisions on non-LWR designs, even if incorporated by reference into 10 CFR 50.55a. Alternatively, an applicant could choose to request to apply an international standard or develop its own standards, which it would have to technically justify. For standards listed as requirements in 10 CFR 50.55a that do not apply to non-LWR designs (see Table 1 above), no action is required; for those that do, compliance is required.

- 10 CFR 50.46a requires in part that:
  "Each nuclear power reactor must be provided with high point vents for the reactor coolant system, for the reactor vessel head, and for other systems required to maintain adequate core cooling if the accumulation of noncondensible gases would cause the loss of function of these systems."

  By its plain text, the regulation is applicable to "each nuclear power reactor" regardless of reactor technology. However, high point vents for the reactor coolant system need only be supplied if the accumulation of noncondensible gases could cause the loss of function of the systems required to maintain adequate core cooling. Accordingly, to demonstrate compliance with this regulation, an applicant can either:

  - Provide high point vents for the reactor coolant system, the reactor vessel head (if applicable), and other systems required to maintain adequate core cooling, or
  - Provide a justification that noncondensible gases cannot cause a loss of function for the above systems. For some non-LWR designs, this justification

might be straightforward (e.g., those with a low pressure reactor coolant system and an external core cooling system not susceptible to gas binding) and therefore involve a simple statement in the application with a reference to the appropriate system technical description. For other non-LWR designs, this justification might be more involved and call for additional description in the application.

- 10 CFR 50.44 governs the requirements associated with combustible gas control. Sections 50.44(a) through (c) apply only to water-cooled reactor designs, but 10 CFR 50.44(d) also applies to non-water-cooled reactor applicants and provides that applications subject to Section 50.44(d) must include:

  (1) Information addressing whether accidents involving combustible gases are technically relevant for their design, and

  (2) If accidents involving combustible gases are found to be technically relevant, information (including a design-specific probabilistic risk assessment) demonstrating that the safety impacts of combustible gases during design-basis and significant beyond design-basis accidents have been addressed to ensure adequate protection of public health and safety and common defense and security.

  All non-LWR applications must contain information to address the technical relevance of accidents involving combustible gases to the safety of the design. The extent of this information will depend on the specific design. For some non-LWR designs, if combustible gases cannot be generated by any means, a short statement to that effect coupled with any necessary references to supporting technical material could be sufficient to address the regulation. As the relevance of combustible gases to the design increases, additional information becomes necessary to meet the regulation (up to safety and risk assessments associated with combustible gases during accident conditions).

- 10 CFR 52.79(a)(4)(i) requires that applicants provide PDC for the facility, and further states that Appendix A to Part 50, "General Design Criteria for Nuclear Power Plants," provides guidance to applicants in establishing principal design criteria for types of nuclear power units other than water-cooled reactor designs similar to those for which the Commission has previously issued a construction permit. Requirements in 10 CFR Part 50, Appendix A states that the GDC are also considered to be generally applicable to these other types of nuclear power units.

  In satisfying the requirement that an application include PDC, applicants should consider the concepts of the existing GDC in Appendix A as guidance as noted in the regulation. One acceptable means of considering this guidance is through use of RG 1.232, "Guidance for Developing Principal Design Criteria for Non-Light-Water Reactors." RG 1.232 is guidance, and as such represents only one means for satisfying the regulation. If an applicant elects not to consider RG 1.232 in developing its PDC, it should ensure it has adequately addressed the safety concepts described in 10 CFR Part 50, Appendix A, as applicable to the applicant's specific reactor technology. In particular, several of the existing GDC are not technology-specific (such as Criteria 1-5, Protection by Multiple Fission Product Barriers, Protection and Reactivity Control Systems), and applicants should provide PDC that address these concepts.

- 10 CFR 52.79(a)(6) requires that the application contain a description and analysis of the fire protection design features for the reactor necessary to comply with 10 CFR Part 50, Appendix A, GDC 3, and 10 CFR 50.48. The requirements associated with Section 50.48 are applicable, and while compliance with GDC 3 itself is not a requirement, staff anticipates that applicants will provide a PDC that is representative of Criterion 3 or provide justification for not doing so (consistent with the discussion regarding PDC previously). Section 52.79(a)(41) does not require non-LWR applicants to evaluate the proposed facility against the Standard Review Plan (SRP) (NUREG-0800). Nonetheless, SRP Section 9.5.1 provides staff review guidance that is, in large part, technology neutral for helping the staff determine whether fire protection objectives are met. Accordingly, evaluation in the application of the proposed facility against SRP Section 9.5.1 and identification of differences in design features, analytical techniques, and procedural measures proposed for a facility and the corresponding design features, analytical techniques, and procedural measures described in the SRP would assist the staff in its review.

Exemptions

- For emergency response, emergency preparedness, and emergency planning zone regulations (e.g., those in 10 CFR 50.33(g), 50.47(b), 50.47(c)(2), and Part 50, Appendix E), existing requirements may not account for design-specific features for some non-LWR designs. The staff will not describe here the specific portions of the regulations from which an applicant might take an exemption (those will be up to an applicant to select and justify), but such topics may include a reduced emergency planning zone, changes to offsite emergency response, or other specific exemptions from those regulations.

  Because the NRC understands that the existing emergency planning regulations may not fully account for design features for new reactor technologies, the staff, as part of ongoing regulatory efforts, has undertaken a rulemaking entitled “Emergency Preparedness for Small Modular Reactors and Other New Technologies” (85 FR 28436, docket ID NRC-2015-0225). In the SRM for SECY-15-0077 “Options for Emergency Preparedness for Small Modular Reactors and Other New Technologies” (ADAMS Accession No. ML15216A492) (SECY-15-0077 is available at ADAMS Accession No. ML15037A176), the Commission stated, “[f]or any small modular reactor [(SMR)] reviews conducted prior to the establishment of a rule, the staff should be prepared to adapt an approach to emergency planning zones for SMRs under existing exemption processes, in parallel with its rulemaking efforts.” Exemptions that conform to this proposed rule will be evaluated on a case-by-case basis and, use of the proposed rule to inform the exemption can streamline the exemption request process.

  Accordingly, the staff expects many non-LWR applicants to apply for exemptions from portions of the current emergency preparedness regulations. In order to facilitate an efficient review of these exemptions, applicants should provide the following as part of their exemption requests (keeping in mind the general exemption content guidance above):
  - Specifically identify the portions of the regulations from which the applicant is requesting an exemption (either by citing regulatory text or striking through text from which the applicant proposes an exemption).
  - A description of how the exemption request satisfies the regulatory acceptance

criteria associated with the request (e.g., Section 50.12). This description would need to include a description of how the exemption is authorized by law, will not present an undue risk to public health and safety, and is consistent with the common defense and security. Further, special circumstances must be present; of the listed special circumstances, staff expects most applicants to cite that "[a]pplication of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule." (This is one example; exemption requests may be based on other special circumstances.)

- For exemption requests of this nature, applicants should provide a consequence- and risk-oriented justification, including a quantitative assessment of the dose at the proposed emergency planning zone boundary. See 85 FR 28436 (describing the performance-based approach in the proposed rule "Emergency Preparedness for Small Modular Reactors and Other New Technologies.")

- Current NRC regulations include definitions that align with LWR technology, and some non-LWR designs may have design features that do not align with current regulatory definitions or are distinct in terms of safety importance from similar features in LWRs. One example is in the definition of safety-related SSCs, and components, in which one set of safety-related SSCs is defined as those that are relied upon to remain functional following design-basis events to assure "(1) the integrity of the reactor coolant pressure boundary." Some non-LWRs do not have a reactor coolant pressure boundary, while others have a coolant pressure boundary that does not or only partially performs any safety function. Applicants for licenses for these designs may need to request exemptions from this definition.

  Because the definition itself does not directly impose any regulatory requirements and the definition is then used in a variety of different regulations that do impose requirements, an exemption from the definition is complex. In the case of the definition of "safety-related" SSCs, an applicant has another option besides requesting an exemption: the applicant could follow the process laid out in 10 CFR 50.69 to classify the system as Risk-Informed Safety Class (RISC) 3, safety-related but performing low safety significant functions (or possibly RISC-4). Alternately, in taking an exemption from this definition, an applicant should (continuing to consider the general exemption content guidance above):

  - Clearly define the scope of the requested exemption – evaluate what portions of the definition do or do not apply to the design, then provide a revised definition that will apply. It is helpful to include any technical references to relevant portions of the application.
  - Evaluate how changing the definition affects regulatory requirements that apply to the design. In this case, as an example reviewing 10 CFR Part 50, the safety-related SSC definition affects the following:
    - Section 50.10, Limited work authorizations
    - Section 50.49, Environmental qualification of electric equipment
    - Section 50.55a, Codes and standards
    - Section 50.65, Maintenance rule
    - Section 50.69, Risk-informed categorization of SSCs
    - Section 50.72, Immediate notification requirements
    - Section 50.73, License event report system

- Appendix B
- Appendix S

These may or may not all apply to a given application – an applicant should review all applicable regulations (not just Part 50) for applicability to its design or facility. The staff can clarify the effect of an exemption from a definition on applicable requirements in pre-application engagement. If a current NRC regulation applies to its design, an applicant should evaluate how requesting an exemption from the definition, e.g., of "safety-related SSC," affects the requirements of that regulation.

- Provide a description of how the exemption request satisfies the regulatory requirements associated with the request (e.g., Section 50.12), considering both the definition and any of the regulations mentioned above (e.g., by justifying how application of the regulation in the particular circumstances associated with the design would not serve the underlying purpose of the rule).
- Finally, it is helpful, as part of the discussion of the "special circumstances" demonstration, for an applicant to provide in its technical justification a discussion of the safety significance of the proposed exemption. Such a discussion could include how the proposed exemption is justified for the design, either by demonstrating that the safety significance of the reactor coolant boundary is sufficiently low considering the other portions of the safety-related definition and any of the affected regulations, or by providing alternate acceptable reasoning for the exemption (i.e., that the design in question does not have a reactor coolant system with a pressure boundary).

- In some cases, non-LWR designs may include margins of safety that, in the applicant's view are sufficient to address specific event-based regulatory requirements without providing for additional design features beyond those incorporated into the design. An example of where this might be relevant is 10 CFR 50.155(b)(2), which requires in part that each applicant or licensee shall develop, implement, and maintain strategies and guidelines to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities under the circumstances associated with loss of large areas of the plant impacted by the event, due to explosions or fire, including firefighting, operations to mitigate fuel damage, and actions to minimize radiological release.

  In the case of this specific regulation, an applicant would have the option of compliance through implementing a relatively simple set of strategies and guidelines that demonstrate that core cooling, containment, and spent fuel pool cooling capabilities are maintained. Nonetheless, an exemption could be justified if the loss of large areas of the plant do not result in dose consequences despite the failure of SSCs to perform their safety functions. In appropriate circumstances, an applicant may wish to seek an exemption from this regulation. Staff anticipates an exemption request to this effect would include the following:

  - A clear exemption request, with the application providing the portions of the regulation that are applicable and to which the exemption request applies. Staff anticipates an exemption request of this nature would involve substantial technical justification, though not necessarily as part of the exemption itself – any exemption to this effect would be inextricably tied to the overall safety of the design and thus would be expected to reference other portions of the application.

- A description of how the exemption request satisfies the regulatory requirements associated with the request (e.g., Section 50.12). Staff anticipates that the special circumstance cited could be to demonstrate application of the regulation in the particular circumstances associated with the design would not be necessary to serve the underlying purpose of the rule.
- In addressing the special circumstances justifying the exemption, the applicant's justification could demonstrate that strategies and guidelines are not necessary for the loss of large areas because the public health consequences of a loss of large areas of the plant are bounded by an analysis already conducted for another event, with appropriate justification and reference to that event.