



Advisory Committee on Reactor Safeguards (ACRS)
Future Plant Designs Subcommittee

10 CFR Part 53
“Licensing and Regulation of
Advanced Nuclear Reactors”

November 18, 2021

Agenda

9:30am – 9:40am

Opening Remarks & Staff Introductions

9:40am – 1:00pm

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

1:00pm – 2:00pm

Lunch Break

2:00pm – 4:00pm

Subpart F, “Requirements for Operations,” Sections related to staffing, training, personnel qualifications, and human factors

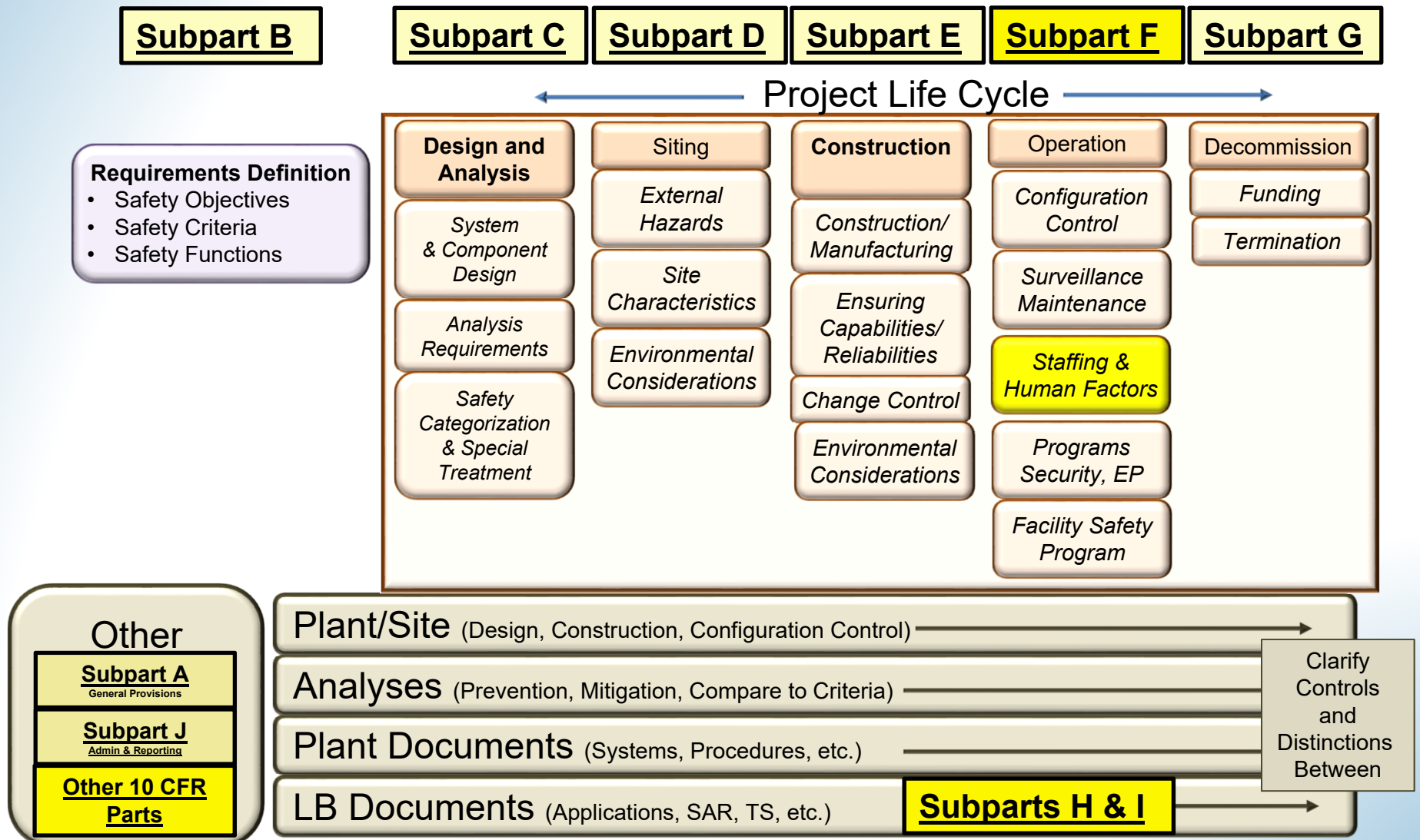
4:00pm – 5:15pm

Subpart H, “Licenses, Certifications, and Approvals,” Sections related to Manufacturing Licenses, Construction Permits, Operating Licenses, and Combined Licenses

5:15pm – 5:30pm

Adjourn

NRC Staff Plan to Develop Part 53



Current Status

Subpart	Subpart Description	Status
A	General Requirements	Released 1st iteration, including initial definitions (April 2021)
B	Safety Criteria	Released 3rd iteration (August 2021)
C	Design and Analysis	Released 3rd iteration (August 2021)
D	Siting	Released 1st iteration (April 2021)
E	Construction	Released 1st iteration (April 2021)
	Manufacturing	Released 1st iteration (April 2021)
F	SSCs	Released 1st iteration (April 2021)
	Personnel	Released 1st iteration (October 2021)
	Programs	Released 1st iteration (April 2021)
G	Decommissioning	Under development (Planned release December 2021)
H	Licensing (LWA, ESP, SDA, DC)	Released 1st iteration (August 2021)
	Licensing (ML, CP/OL, COL)	Released 1st iteration (October 2021)
I	Maintaining Licensing Basis	Released 1st iteration (August 2021)
J	Reporting & Financial	Released 1st iteration (August 2021)
Part 5X	Deterministic Alternative	Released 1st iteration (October 2021)
Part 73	Physical Security	2nd iteration planned release November 2021
	Cyber Security	2nd iteration planned release November 2021
	Access Authorization	Released 2nd iteration (November 2021)
Part 26	Fitness-for-duty	Under development (Planned release December 2021)
Other	Conforming Changes	Under development
	SOC	Under development
	Regulatory Analysis	Under development

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- NRC staff have received comments from stakeholders suggesting that a probabilistic risk assessment (PRA) should not be required in a leading role for licensing.
- Some stakeholders have also expressed a desire for a streamlined application for US/international designs.
- As a result, the staff have developed initial rule language for deterministic licensing framework for advanced reactors.
- This framework aims to be technology-inclusive with PRA used in a supporting role, and leverage Parts 50 and 52 regulations while aligning with IAEA standards.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- Including a traditional, deterministic option for advanced reactors includes:
 - Plan to leverage flexibility by considering dose-oriented emergency preparedness/siting/security (similar to ongoing rulemakings and what is being considered in Part 53)
 - Shared Parts 50 and 53 aspects: enable flexibility in meeting codes and standards (including those related to quality assurance requirements); addition of functional containment concept to make technology inclusive

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- General Layout:
 - § 5X.210 Applicability
 - § 5X.220 Definitions
 - § 5X.230 Requirements
 - § 5X.240 Principal design criteria
 - § 5X.250 Anticipated Operational Occurrences and Design Basis Accidents
 - § 5X.260 Beyond design basis event sequences
 - § 5X.270 Severe accidents
 - § 5X.280 Functional containment
 - § 5X.290 Design requirements
- Staff is seeking feedback from stakeholders on the appropriate location for this preliminary proposed rule language (e.g., Part 50, Part 53, new Part).

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.210 Applicability
- § 5X.220 Definitions
 - New definition of “reactor coolant pressure boundary”; alternative definition of “safety related” for non-light water reactors (non-LWRs)
- § 5X.230 Requirements
 - Overarching elements in line with existing requirements, identified separately in this section due to conflicts with existing language or for emphasis.
 - Consistent with the Commission policy, it is expected that the any plant under this section will reflect through its design, construction, and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.240 Principal design criteria
 - This section more directly calls out principal design criteria and their role. Use of a deterministic approach is likely to rely more on top level design goals in the form of design criteria as opposed to a more integrated assessment.
 - This language would allow for the use of the criteria in IAEA SSR 2/1 - the applicable standards envisioned for use include but are not limited to: the existing general design criteria, Regulatory Guide 1.232, and IAEA SSR 2/1.
 - Staff is still evaluating how to include light water reactors (LWRs) in applying this section

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.250 Anticipated Operational Occurrences and Design Basis Accidents
 - (b)(1): These requirements are consistent in concept with existing regulations and international standards for these classes of events. Applicants should provide analysis for anticipated operational occurrences (AOOs) and design basis accidents (DBAs), and features used to mitigate and prevent these events should be safety related.
 - (b)(5)-(7) The requirements provide an avenue for an applicant to provide bounding analyses for some or all of the analytical requirements for this part.
 - To some extent, this is consistent with existing practice – a single analysis to cover a category of event (e.g., overcooling) is often provided as part of a safety analysis. This would go a step further and allow for bounding analyses (potentially involving non-realistic assumptions) to be provided to cover larger portions of the AOO and DBA analytical space, provided the analysis envelopes the full range of conditions it is stated to bound.
 - This section incorporates requirements adapted from § 50.46 - applicants are required to identify surrogate safety acceptance criteria, akin to peak cladding temperature for LWRs, and track and report errors in the analysis for these acceptance criteria. For LWRs, staff expects § 50.46 criteria will be the ones chosen.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.260 Beyond design basis events
 - This section replaces station blackout and anticipated transient without scram regulations with a broader category of events and draws on the international concept of defense-in-depth (DID) level 3b or 4a.
 - Requires applicants to evaluate and provide prevention/mitigation features (non-safety related) against events more severe than DBAs based on operating experience, engineering judgement, and sequence-based assessment. These structures, systems and components (SSCs) that are credited should have quality treatments in accordance with their function.
 - (c): The bounding analyses that may be used for AOO or DBA requirements may be expanded for use by applicants here.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.270 Severe accidents
 - These requirements replace existing severe accident requirements. This section borrows from the international concept of DID level 4 or 4b.
 - Severe accidents for non-LWRs are not defined to the same degree as LWRs; events evaluated in this section should involve some level of fuel or core damage, based on the event criteria outlined in this section.
 - (b): Requires applicants consider DID (no reliance on a single SSC/barrier) and mitigate against more severe potential scenarios. Provides avenues for crediting barrier mitigation and excluding some events. Staff expects there would be a frequency threshold for this exclusion for applicants leveraging a PRA. The “residual risk” portion is subject to change.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- § 5X.280 Functional containment
 - These requirements replace containment-related regulatory requirements. They establish what constitutes a functional containment and makes functional containment SSC qualification commensurate with the purpose of the component (safety related for AOOs/DBAs, special treatment for beyond design basis events (BDBEs))
- § 5X.290 Design requirements
 - Limiting condition for operation (LCO) criteria (A) relates to the reactor coolant pressure boundary; LCO criteria (D) is based on PRA and operating experience. This provision would drop those, provided barrier requirements are captured.
 - (b) – This serves to catch additional Part 50 regulations that conflict with this section and could change as the Part 53 provisions are added.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

Additional areas being explored for use from Part 53:

- Special treatment – In addressing the requirements associated with paragraph (e) of this section, applicants are required to identify appropriate treatments for SSCs relied on to mitigate these events. In identifying these treatments, applicants may use the framework set forth in § 53.YYY.
- Siting considerations – In lieu of (*identify full set of 50/52 siting requirements*), applicants may apply § 53.5XX to determine site boundary areas and populations considerations.
- Emergency preparedness (EP) requirements – In lieu of §§ 50.54(q), 50.54(t) (*identify full set of 50/52 EP requirements*), applicants may apply § 53.5XX to determine EP requirements.
- Security requirements – As an alternative to the requirements set forth in §§ 50.34(c), 52.79(a)(35), and (*identify other appropriate requirements here*), applicants may apply § 73.YY in lieu of the requirements necessary to satisfy the cited physical security requirements.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

Major themes from the feedback received during the October 28th public meeting with stakeholders:

- Part 5X scopes in applicants and licensees beyond just advanced reactors, which goes beyond the intent of NEIMA and Commission direction for the Part 53 rulemaking.
- The term “PRA” encompasses a lot of elements: PRA tools vs. PRA insights vs. a full PRA. All parties need to be more precise when referring to this term to avoid misunderstandings.
- Instead of “parallel paths” for Part 5X and Part 53, Part 53 should be modified to allow for Part 5X approaches.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

Major themes from the feedback received during the October 28th public meeting with stakeholders:

- The NRC has created a binary choice for how PRA is used, when in reality designers are using PRA and deterministic tools in a more collaborative fashion.
- The NRC should set boundaries and standards and leave decisions about the approach to meet those boundaries and standards up to the applicant and licensee.
- The preliminary proposed rule language reads as if the NRC is over-regulating the design of reactors when the agency’s focus should be on evaluating the safety case.
- Part 5X brings BDBEs into the design basis when it could be treated as a licensing basis issue with mitigation.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

- Next steps on the preliminary proposed deterministic option include:
 - Evaluate feedback from stakeholders and continue to iterate on the proposed rule language in order to produce a high quality, usable option.
 - Assessing the placement of the traditional, deterministic option within the NRC’s regulations.

Part 5X Supplement, “Technology-inclusive alternative requirements for commercial nuclear plants”

Discussion



MEETING BREAK

Meeting to resume in 1 hour

Part 53 General Layout

- Subpart A, General Provisions
- Subpart B, Technology-Inclusive Safety Objectives
- Subpart C, Design and Analysis
- Subpart D, Siting Requirements
- Subpart E, Construction and Manufacturing Requirements
- **Subpart F, Requirements for Operation**
 - **Staffing, Training, Personnel Qualifications, and Human Factors Requirements**
- Subpart G, Decommissioning Requirements
- Subpart H, Applications for Licenses, Certifications and Approvals
- Subpart I, Maintaining and Revising Licensing Basis Information
- Subpart J, Reporting and Administrative Requirements

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

Overview of §§ 53.750-799 Structure and Key Content

- §§ 53.750-759: General Requirements
 - § 53.753: Technical Requirements for operating license (OL) and combined license (COL) Applicants
 - Human Factors Engineering (HFE) design requirements
 - Human-System Interface (HSI) design requirements
 - Concept of Operations (ConOps), Functional Requirements Analysis (FRA), and Function Allocation (FA) requirements
 - Staffing Plan requirements
 - Licensed & Certified Operator program requirements
 - § 53.755: Conditions of Licenses for OL and COL Holders
 - Provisions for not using licensed operators and criteria
 - Provisions for load-following
- §§ 53.760-769: Operator Licensing Requirements.
 - Training, examination, requalification, and simulator requirements.
- §§ 53.770-779: Operator Certification Requirements.
- §§ 53.780-789: General Training and Qualification Requirements.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.750-759: “General Staffing, Training, Personnel Qualifications, and Human Factors Requirements”

- This section fulfils a role similar to certain aspects of the § 50.34(f) post-Three Mile Island requirements, § 50.54 conditions of facility licenses requirements, and Part 55 operator licensing requirements.
- A major difference is that the requirements established in areas of HFE, staffing, and operator qualification are directly linked to design-specific safety functions and their fulfillment.
 - HFE is required where needed to support safety functions, versus being generically applied to a control room.
 - Operator staffing is required to the extent necessary to support design-specific needs for safety function fulfillment, versus relying upon a prescribed number of reactor operators (RO) and senior reactor operators (SRO).
 - The fundamental role of the licensed operator centers around the management and fulfillment of safety functions, in addition to the manipulation of facility controls.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.750, “General Staffing, Training, Personnel Qualifications, and Human Factors Requirements”
 - Contains applicability and definitions
- § 53.751, “Communications,” and § 53.752, “Information Collection”
- § 53.753, “Defining, fulfilling, and maintaining the role of personnel in ensuring safe operations”
 - Requires OL and COL applicants to develop, implement, and maintain specific measures (covered by §§ 53.753(a)–(g)) to ensure that human actions needed to fulfil safety functions, prevent or mitigate licensing basis events (LBE), or otherwise meet safety criteria are satisfied.
 - § 53.753(a) is the HFE design requirement (serving a similar role to that of § 50.34(f)(2)(iii)) and is performance-based. Facility designs must reflect state-of-the-art human factors principles for safe and reliable performance in all settings that human activities are expected for performing or supporting the continued availability of plant safety or emergency response functions.
 - Guidance for reviewing this performance-based HFE requirement in a scalable manner is being developed by the staff via an Interim Staff Guidance (ISG).

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.753, “Defining, fulfilling, and maintaining the role of personnel in ensuring safe operations” (continued)
 - § 53.753(b) contains HSI design requirements (similar to elements of § 50.34(f)) and requires facility designs to provide for the following to support operators in monitoring plant conditions and responding to plant events:
 - features for displaying to operators a minimum set of parameters that define the safety status of the plant,
 - automatic indication of bypassed and operable safety system status,
 - direct indication of SSC status that relates to the ability of the SSC to perform its safety function,
 - instrumentation to measure, record, and readout key plant parameters related to the performance of SSCs and the integrity of barriers important to fulfilling safety functions,
 - leakage control and detection in the design of systems that pass-through barriers to the release of radionuclides, and
 - monitoring of in-plant radiation and airborne radioactivity as appropriate for a broad range of routine and accident conditions.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.753, “Defining, fulfilling, and maintaining the role of personnel in ensuring safe operations” (continued)
 - § 53.753(c) requires an applicant to provide a ConOps.
 - The ConOps must address the following:
 - facility goals,
 - the roles and responsibilities of personnel and automation that are responsible for completing plant functions,
 - staffing, qualifications, and training,
 - the management of normal operations,
 - the management of off-normal conditions and emergencies,
 - the management of maintenance and modifications, and
 - the management of tests, inspections, and surveillance tasks.
 - § 53.753(d) requires FRA & FA
 - FRA must address how safety functions are satisfied.
 - FA must describe how safety functions will be assigned to human action, automation, active safety features, passive safety features, or inherent safety characteristics.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.753, “Defining, fulfilling, and maintaining the role of personnel in ensuring safe operations” (continued)
 - § 53.753(e) requires a description of the program for evaluating/applying operating experience.
 - § 53.753(f) requires a staffing plan that describes the numbers, positions, and qualifications of licensed operators and senior licensed operators or, if applicable, certified operators across all modes of plant operations.
 - The staffing plan must also describe personnel providing support in areas such as plant operations, equipment surveillance and maintenance, radiological protection, chemistry control, fire brigades, engineering, security, and emergency response.
 - Plants that require licensed operators must also describe how the proposed licensed operator staffing will be sufficient to provide assurance that plant safety functions can be maintained; this must be supported by HFE analyses and assessments.
 - This provision for flexible licensed operator staffing is a significant change from current § 50.54(m) control room staffing requirements.
 - Guidance for evaluating these staffing plans is being developed by the staff in the form of an ISG to be used in conjunction with NUREG-1791

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.753, “Defining, fulfilling, and maintaining the role of personnel in ensuring safe operations” (continued)
 - While not addressed by the staffing plan requirements of § 53.753(f), it is important to note that, at present, the staff preliminarily do not intend to require the Shift Technical Advisor (STA) position for Part 53 applicants.
 - 1985 Policy Statement on engineering expertise on shift (50 FR 43621) stated that the STA requirement was an interim measure until goals that included upgrading HSI and operator training were achieved.
 - Current staff perspective is that the upgrades to HSI and operator training envisioned within this Policy Statement will be the norm under Part 53 and driven by multiple regulatory requirements.
 - This represents a policy issue and the staff intend to use the Part 53 rulemaking process as a vehicle for Commission engagement.
 - § 53.753(g) requires applicants to describe their programs for the operator licensing initial training program, the operator licensing examination program, and the operator licensing requalification program.
 - Facilities using certified operators (a new, non-licensed role) must instead submit the corresponding programs for operator certification.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.754, “General Exemptions”
- § 53.755, “Conditions for Operations Staffing for OLs and COLs”
 - § 53.755(a) requires facility licensees to have licensed operators unless they can meet criteria contained in § 53.755(b) to use certified operators.
 - § 53.755(b) contains the requirements that must be met in order to justify not using any licensed operators as a part of facility staffing.
 - There are presently two different staff proposals for these criteria.
 - The first proposal would require the following:
 - No human actions for event mitigation required to meet safety criteria, achieve safety functions, or provide DID.
 - PRA demonstrating the evaluation criteria for each event sequence can be met without human action for mitigation;
 - LBE response not needing human action for SSCs to perform.
 - The second proposal would require the design-basis accident safety criteria to be met without mitigation by human actions, active engineered features, or passive design features (except passive features that can survive LBEs and not be defeated by credible human errors).

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.755, “Conditions for Operations Staffing for Operating or Combined Licenses under this Part” (continued)
 - § 53.755(c) restricts control manipulations to licensed or certified operators.
 - § 53.755(d) requires operator requalification training programs to commence concurrent with when licensing or certification exams are first administered.
 - § 53.755(e) requires that operations (other than control manipulations) affecting reactor power level only occur while plant conditions are being monitored by a licensed or certified operator.
 - However, load-following is permitted if one of the following can immediately refuse demands from the grid operator when they could challenge safe operation or if precluded by equipment conditions:
 - the actuation of an automatic protection system,
 - an automated control system; or
 - a licensed or certified operator.
 - § 53.755(f) requires plants with licensed operators to include SROs.
 - § 53.755(g) requires that the facility licensee must maintain the staffing complement described under their approved facility staffing plan.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.755, “Conditions for Operations Staffing for Operating or Combined Licenses under this Part” (continued)
 - § 53.755(h) requires SRO supervision of core alterations (e.g., refueling).
 - Those facilities that do not require any licensed operator staffing are instead required to use a certified operator in an equivalent manner.
 - This does not apply to facilities capable of refueling online/at power.
 - § 53.755(i) contains specific requirements for plants using certified operators
 - Certified operator are responsible for specified administrative functions.
 - Certified operator staffing must provide for continuity of responsibility for facility operations at all times during the operating phase.
 - Continuous monitoring of fueled units with the following capabilities:
 - receiving plant operating data and parameters
 - the ability to immediately initiate a reactor shutdown
 - the ability to promptly dispatch ops and maintenance personnel
 - the ability to implement any emergency plan responsibilities
 - conducting reactivity manipulations that require human action

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.755, “Conditions for Operations Staffing for Operating or Combined Licenses under this Part” (continued)
 - Allowing non-licensed, certified operators to manipulate plant controls and conduct reactivity changes represents a policy issue; the staff intend to use the rulemaking process as a vehicle for Commission engagement.
 - § 53.755(j) allows facility licensees to take reasonable actions that depart from license conditions and technical specifications (TS) in emergency situations when the action is immediately needed to protect the public health and safety.
 - This is comparable to the provision of § 50.54(x)
 - § 53.755(k) limits the authority to invoke (j) above to an SRO, a certified operator, or at those plants which have permanently ceased operations, to a senior licensed operator, a certified operator, or a certified fuel handler, as applicable.
 - This is comparable to the requirement of § 50.54(y).

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.756, “Medical Requirements”
 - § 53.756(a) requires that applicants for RO and SRO licenses must have medical examinations by a physician; licensed ROs and SROs must have ongoing medical examinations by a physician every two years.
 - In a comparable manner, certified operators must have a medical examination prior to certification and every two years thereafter.
 - The physician must determine that the individual’s medical condition and general health will not adversely affect the performance of assigned operator job duties or cause operational errors endangering public health and safety.
 - § 53.756(b) requires facility licensees to submit the medical certifications that are required for licensed operators to the Commission.
 - These submittals are not required for certified operators.
 - § 53.756(c) requires facility licensees to retain the results of medical examinations for both licensed and certified operators and to provide the documentation to the Commission upon request.
- § 53.757, “Violations,” and § 53.758, “Criminal Penalties”

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.760-769: Operator Licensing Requirements (for Part 53 facilities)

- § 53.760, “Operator Licensing”
 - Describes applicability of the requirements in §§ 53.760-769.
- § 53.761, “License Requirements”
 - Requires facility licensees to authorize SROs and ROs to perform roles.
- § 53.762, “Completeness and Accuracy of Information ”
- § 53.763, “Incapacitation Because of Disability or Illness”
 - Requires Commission notification for permanent medical conditions.
- § 53.764, “Applications for licensed operators”
 - § 53.764(a) describes how to apply and what must be included:
 - NRC Form 398 (the staff intend to provide guidance on content)
 - Evidence of competence in control manipulations (no prescribed number) via either the facility or a simulation facility.
 - Medical certification
 - § 53.764(b) describes the disposition of applications.
 - § 53.764(c) describes the re-application process (no waiting periods)

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.760-769: Operator Licensing Requirements (continued)

- § 53.765, “Training Program” (for Licensed Operators)
 - § 53.765(a) requires initial licensed operator training programs to:
 - Be based upon a systems approach to training
 - Ensure that license applicants at the facility will possess the knowledge, skills, and abilities necessary to:
 - protect the public health, and
 - maintain design-specific plant safety functions
 - Be approved by the Commission prior to use for license training
 - § 53.765(b) requires facilities to establish a licensing examination program to test the knowledge, skills, and abilities for ROs and SROs.
 - This must include the exam methods and criteria used to assess passing performance and have Commission approval before use.
 - Guidance for reviewing these facility-developed operator licensing exam programs is being developed by the staff via an ISG.
 - Facility licensees will be allowed to administer licensing exams; however, the Commission will reserve the ability to do so also.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.765, “Training Program” (for Licensed Operators) (continued)
 - § 53.765(c) requires facilities to establish requalification training programs for licensed operators. These programs must:
 - Be based on a systems approach to training
 - Ensure that ROs and SROs maintain the knowledge, skills, and abilities necessary to protect the public health and maintain those plant safety functions specific to the facility design.
 - Be conducted for a continuous period not to exceed 24 months.
 - Be approved of by the Commission.
 - Facilities must propose a biennial requalification exam program for testing topics from the requalification training program, including both the exam methods and criteria to be used to assess passing performance. This program must be approved by the Commission and exams must be administered biennially.
 - Guidance for reviewing these facility-developed, licensed operator requalification exam programs is being developed by the staff via an ISG.
 - § 53.765(d) requires examination integrity (similar to § 55.49)

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

- § 53.765, “Training Program” (for Licensed Operators) (continued)
 - § 53.765(e) establishes simulation facility requirements for plants required to have licensed operator staffing (separate, less stringent, simulation facility requirements are provided for plants with certified operators). Key aspects are:
 - Full-scope simulators are not mandated; partial scope simulators may be acceptable provided that the scope is adequate to meet intended usage.
 - Simulation facilities must be approved by the Commission if the facility licensee will rely upon them for training purposes, meeting experience requirements (e.g., reactivity changes), or for initial or requalification examinations.
 - Use of a simulation facility for conducting HFE analyses or assessments requires demonstrating that adequate simulator scope is provided as well.
 - Prior to initial fuel load, simulator models are allowed to replicate intended initial core loads; this supports operator licensing during construction.
 - § 53.765(f) establishes requirements for waivers of exam requirements, including those instances when additional units are constructed at multi-unit sites.
 - § 53.765(g) requires that facilities establish Commission-approved programs for both maintaining and re-establishing licensed operator proficiency.
 - This is a different that the prescriptive approach of Part 55 for proficiency. 38

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.760-769: Operator Licensing Requirements (continued)

- § 53.766, “Conditions of Licensed Operator and Senior Licensed Operator Licenses”
 - Comparable to the corresponding requirements of Part 55
- § 53.767, “Expiration and Renewal of Licenses”
- § 53.768, “Issuance, Modification, and Revocation of Licenses”
- In general, it should be noted that §§ 53.760-769 propose a framework for an operator licensing pathway independent of that contained within Part 55. However, the extent to which this operator licensing pathway will remain independent from Part 55 is an area of ongoing work by the staff and is subject to change under future iterations of the preliminary rule language.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements

- Certified operators (defined under Part 53) are individuals certified to manipulate facility controls but not licensed by the Commission.
 - Certified operators are not credited for fulfilling safety functions.
- § 53.770, “Operator Certification”
 - Describes applicability of §§ 53.770-779.
- § 53.771, “Certification Requirements”
 - Requires individuals to hold a certification issued by the facility licensee (not the Commission) to perform the function of a certified operator.
 - Requires the processes used by facilities to establish, administer, and maintain their certified operator programs to comply with Part 53.
- § 53.772, “Incapacitation Because of Disability or Illness ”
 - Requires facility licensees to immediately remove individuals from the performance of certified operator duties in that event that medical requirements are not met due to permanent physical or mental conditions.
 - Allows for medical restrictions if they can accommodate the medical issue, provided that compliance with restrictions are maintained.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements (continued)

- § 53.773, “Training Program” (for Certified Operators)
 - § 53.773(a) requires initial operator certification training programs to:
 - Be based upon a systems approach to training
 - Ensure that certified operator trainees will possess the knowledge, skills, and abilities necessary to protect the public health.
 - Be approved by the Commission prior to use.
 - § 53.773(b) requires facilities to establish an examination program to test the knowledge, skills, and abilities for certified operators.
 - This must include the exam methods and criteria used to assess passing performance and have Commission approval before use.
 - Guidance for reviewing these facility-developed, certified operator exam programs is being developed by the staff via an ISG.
 - Facilities would develop, administer, and grade certification exams.
 - Facilities would also issue operator certifications (not the NRC).
 - The Commission would reserve the ability to observe the process.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements (continued)

- § 53.773(c), requires facilities to establish continuing training programs for certified operators. These programs must:
 - Be based upon a systems approach to training
 - Ensure that certified operators maintain the knowledge, skills, and abilities necessary to protect the public health
 - Be approved by the Commission prior to use.
- Facility licensees must also propose a requalification exam program for testing continuing training topics. This program must include the examination methods and criteria to be used to assess passing performance.
 - Facilities must also propose the periodicity for requalification exam administration (a difference from licensed operator requalification exam periodicity).
 - This program must be approved by the Commission prior to its use.
 - Guidance for reviewing these facility-developed, certified operator requalification exam programs is being developed by the staff via an ISG.
 - As operator certifications do not have renewal requirements, continuing training program records are instead retained while operators remain certified at the facility (different from licensed operator requalification programs).

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements (continued)

- § 53.773(d), requires examination integrity (similar to § 55.49)
- § 53.773(e), establishes simulation facility requirements for plants with certified operators (separate simulation facility requirements are provided for plants with licensed operators). Key aspects are:
 - Full-scope simulators are not mandated; partial scope simulators may be acceptable provided that the scope is adequate for intended usage.
 - The simulation facilities at those facilities using certified operators do not require Commission approval. However, certain requirements apply if the facility will use them for training, meeting experience requirements (e.g., reactivity changes), or for initial/requalification exams.
 - Using a simulation facility for conducting HFE analyses or assessments requires demonstrating that adequate simulator scope is provided.
 - Prior to initial fuel load, simulator models are allowed to replicate the intended initial core load; this supports operator certification during construction.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements (continued)

- § 53.773(f), allows the facility licensee to waive examination requirements in accordance with their approved training and qualification program.
- § 53.765(g) requires that facilities establish a program for maintaining certified operator proficiency on position functions and plant status, as well as for re-establishing certified operator proficiency when needed.
 - This program does not require Commission approval (different from the requirement for facilities with licensed operators).
- § 53.774, “Issuance of Certificates” (for Certified Operators)
 - Requires that facility licensees ensure that individuals meet the following requirements prior to being issued operator certifications:
 - completion of either a high school diploma or GED
 - satisfactory completion of the approved initial training program
 - passing of an initial operator certification examination
 - demonstration of competence in conducting control manipulations
 - meeting medical condition requirements (restrictions allowed)

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.770-779: Operator Certification Requirements (continued)

- § 53.775, “Conditions of Certificates”
 - Establishes requirements that facility licensee must ensure are met for each certificate it issues to certified operators. These include:
 - Limiting certifications to the facility specified in the certificate (but no limit is placed on how many facilities individuals can certify at).
 - Completion of the continuing training program.
 - Passing of the periodic continuing training examination.
 - Biennial medical examination.
 - Maintaining proficiency in accordance with the facility program.
 - Fitness for Duty requirements regarding drug and alcohol usage.
 - Commission notification for felony convictions.
- § 53.776, “Expiration”
 - Operator certifications must be terminated at the end of employment or upon determination by that the individual no longer needs certification.
 - Commission renewal and revocation are not applicable to certifications.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

§§ 53.780-789 Training and Qualification of Commercial Nuclear Plant Personnel

- Addresses personnel training requirements other than those directly associated with the training of licensed and certified operators.
- This section fulfils a role similar to that of the § 50.120 training rule.
- § 53.780, “Operator Certification”
 - Describes applicability of §§ 53.780-789.
- § 53.781, “Training and Qualification Requirements”
 - Requires training programs to be established with sufficient time to provide trained and qualified personnel to operate the facility prior to fuel load (a difference compared to 18-month requirement of § 50.120).
 - Requires use of a systems approach to training.
 - Requires the training and qualification of supervisors, technicians, and other appropriate operating personnel to be provided for.
 - Categories of personnel are more generic than § 50.120 to accommodate greater flexibilities in roles and responsibilities.
 - Requires record retention to allow for NRC inspection of programs.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

Major themes from the feedback received during the October 26th public meeting with stakeholders:

- Clarify independence from Part 55 – identify areas of needed distinction between Part 55 and Part 53, and potential changes resulting from them.
- Part 53 requirements are more complex than Part 55 requirements.
- Why is there an expansion of human factors to response facilities/offsite included in the rule?
- Do the criteria for not having licensed operators set too high of a bar?
- Consider autonomous operations for Part 53.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

Major themes from the feedback received during the October 26th public meeting with stakeholders:

- Clarify criteria for no licensed operators (e.g., clarify human actions).
- Clarify extent of HFE requirement in plant designs.
- Ensure that these requirements are consistent with security requirements.
- Safety functions are not all equal in terms of risk (e.g., AOO vs. DBA), but the NRC does not seem to be appropriately distinguishing as it creates requirements.
- Concern that licensed/certified operator requirements extend to general plant operations, not just areas connected to nuclear safety.

Subpart F – Staffing, Training, Personnel Qualifications, and Human Factors Requirements

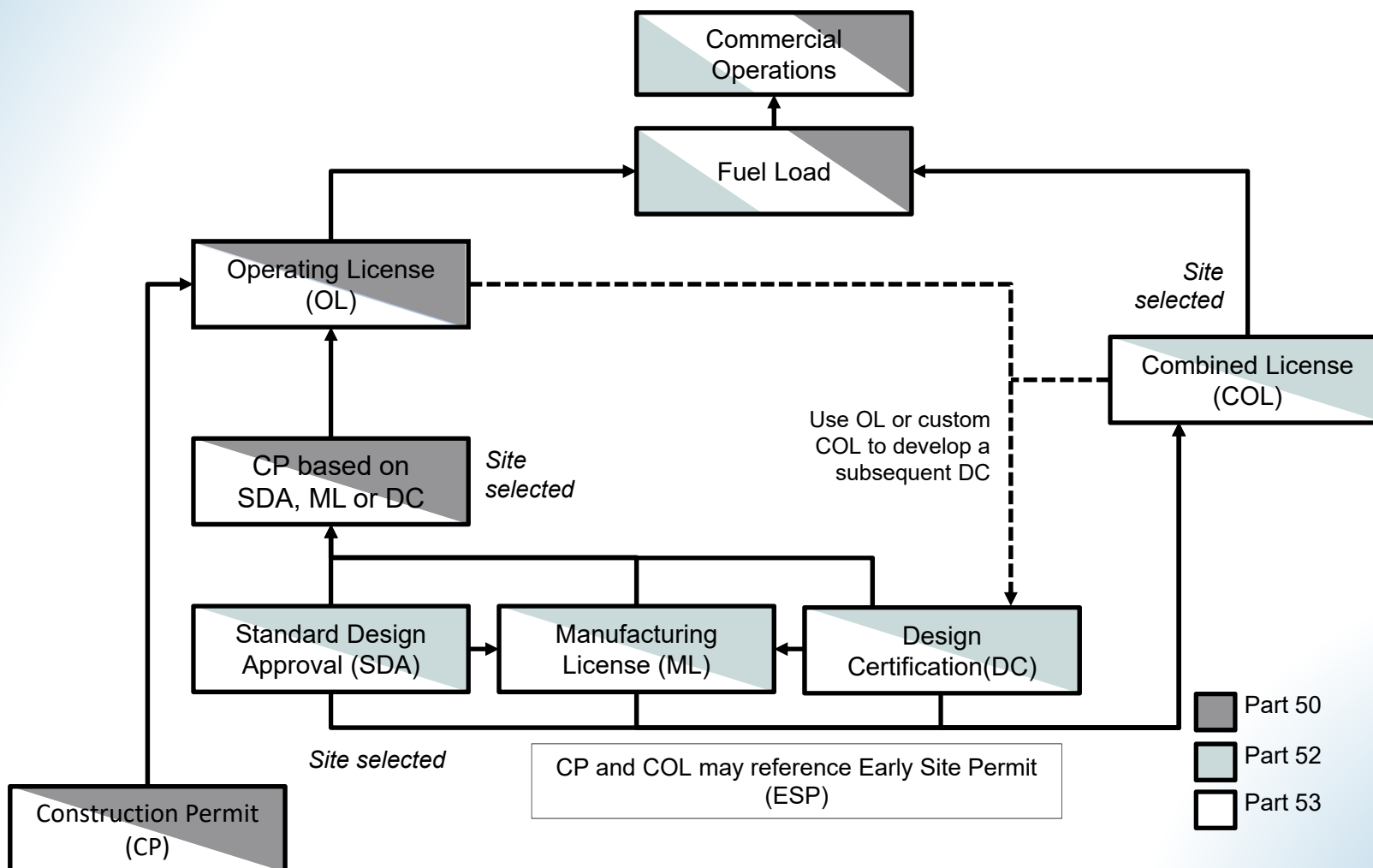
Discussion

Part 53 General Layout

- Subpart A, General Provisions
- Subpart B, Technology-Inclusive Safety Objectives
- Subpart C, Design and Analysis
- Subpart D, Siting Requirements
- Subpart E, Construction and Manufacturing Requirements
- Subpart F, Requirements for Operation
- Subpart G, Decommissioning Requirements
- **Subpart H, Licenses, Certifications and Approvals**
 - Manufacturing Licenses, Construction Permits, Operating Licenses, and Combined Licenses
- Subpart I, Maintaining and Revising Licensing Basis Information
- Subpart J, Reporting and Administrative Requirements

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

Leveraging and Combining Existing Licensing Processes



Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- As noted in the Subpart H Part 1 discussion, several issues relate to items being addressed in the ongoing lessons learned rulemaking for Parts 50 and 52 and reconciliation will occur later.
 - The first iteration of Subpart H largely reflects the current version of Parts 50 and 52.
- Application requirements tailored to match Part 53 technical requirements.
 - Goal is to not have technical requirements only contained in Subpart H content of application sections
- Guidance for the technology inclusive content of application project (TICAP) and advanced reactor content of application project (ARCAP) will support Part 53.

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

General format for contents of applications sections for each permit / license type:

- **Section for general information**
 - Supplement the information required by § 53.1130 Contents of applications; general information—Provides the equivalent of § 50.33 for general content information applicable to all applications or a subset of applications.
- **Section for technical information in the safety analysis report (SAR)**
 - Site information—equivalent to that required for an ESP as base-line
 - Design information—equivalent to that required for a DC as base-line
 - Staff is considering how to address the role of CP in Part 53, especially with respect to application aspects that are not yet fully developed
- **Section for other application content**
 - Examples: environmental report; TS; availability controls; inspections, tests, analyses, and acceptance criteria (ITAAC) (for COLs)

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- **§ 53.1162 Relationship between sections**
 - This is a new section that will be updated to include text from other Part 52 sections on “Relation to other subparts,” as well as explain relationships with Part 50 licensing processes.
 - Discussions on the interrelationships for MLs and CPs is warranted
 - Addressing references in an OL application (e.g., ESP) that were not included at the CP stage
 - Staff is considering incorporating concept of referencing an ESP and/or DC generically upfront in this section (§ 53.1162, Relationship between sections)

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- §§ 53.1240-53.1249 Manufacturing Licenses
 - Using term “reactor module”—part of the plant that is subject to ML
 - Accommodates factory installation of fuel
 - Appropriate licenses must be issued (e.g., Part 70)
 - § 53.1245 Contents of Applications; Technical Information in Final Safety Analysis Report
 - (b)(3)(i) Interface requirements
 - Guidance will be needed to address how to make the construct of interface requirements workable for an ML that is referenced in a CP/OL (normally addressed through ITAAC).
 - (d) Deployment of the completed nuclear reactor module
 - Designer, manufacturer, and applicant for a facility could all be separate entities—interface requirements will be important based on different deployment strategies
 - (e) Special considerations for factory fueling

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- §§ 53.1240-53.1249 Manufacturing Licenses
 - § 53.1245 Contents of Applications; other application content
 - Application that includes the installation of fuel at the factory
 - Must discuss severe accident mitigation design alternatives for the reactor module while at the factory
 - Must discuss severe accident mitigation alternatives for the facility itself
 - § 53.1247 Standards for Review of Applications, Referral to ACRS, and Issuance of a Manufacturing License
 - This section does not address the potential removal of the manufactured reactor module from the operating site.
 - Interface requirements important for manufacture, transport, storage (at site), installation, operation, removal, storage (at site), transport, refurbishment, and disposal of a reactor module.
 - Part 53 may not address the back end of this cycle.

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- **§§ 53.1240-53.1249 Manufacturing Licenses**
 - § 53.1249 Duration, transfer, and renewal of manufacturing licenses
 - Based on Part 52 requirements
 - (c)(iii) prohibits beginning manufacture of a reactor module less than 6 months before the expiration of the license (revised from 3 years in Part 52)

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- **§§ 53.1260-1269.1 Construction Permits**
 - § 53.1265 Contents of applications; technical information in preliminary safety analysis report
 - (a) Site information—equivalent to that required for an ESP as base-line
 - (b) Design information—equivalent to that required for a DC as base-line
 - May include aspects of the design that are not fully developed—completed design described in the final safety analysis report (FSAR) that supports the OL application
 - Plan for future analysis, research and development, test programs, and/or experience that required demonstration for design features that fulfill functional design criteria—available for the OL application
 - PRA and its results required by § 53.450(a) for plants prior to construction based on the design and information available at the time of the application.
 - PRAs inherently less detailed and supported by a list of assumptions that will be subsequently verified or revised when the plant is built.
 - The updated information and results will be described in the FSAR.

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- **§§ 53.1260-1269.1 Construction Permits**
 - § 53.1265 Contents of applications; technical information in preliminary safety analysis report.
 - As previously noted, staff is considering how to address the role of the CP in Part 53, including interfaces with other licensing processes
 - Some expected changes to DC application requirements include:
 - Adding provisions to address design requirements in § 53.440 such as fire protection, degradation mechanisms, and minimization of contamination (§ 20.1406)
 - Adding a provision for designs needing to periodically replace major components to describe design elements and associated programmatic controls needed to support the removal, replacement, and storage of the subject components.
 - A description of the assessment related to the role of personnel in ensuring safe operations considering the analyses required by § 53.753. This preliminary assessment for a CP will include initial estimates of staffing plans and the anticipated operations staffing using the criteria in § 53.755.

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- §§ 53.1270-1279 Operating Licenses
 - § 53.1275 Contents of applications; technical information in final safety analysis report
 - Revised like other sections to reference ESPs and DCs as baseline and supplement for content of application.
 - The FSAR will include and, as needed, update information provided in the preliminary safety analysis report which was submitted and reviewed to support the CP.
 - As previously noted, staff considering how to address references in an OL application (e.g., ESP) that were not included at the CP stage

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

- **§§ 53.1280-1310 Combined Licenses**
 - § 53.1289 Contents of applications for combined licenses; technical information in final safety analysis report
 - (a)(1) and (a)(2) reference DC for design information and ESP for site information, respectively, as baseline
 - (d), (e), (f), and (g) provide requirements that apply if the COL application references an ESP, SDA, DC, and/or ML, respectively
 - Considering if this can be done generically upfront for all license types
 - § 53.1304 Finality of combined licenses; information requests
 - Paragraphs (b), (c)(2) and (d)(2) may need to be updated if all applicable change processes are not captured in Subpart I.
- **§ 53.1400 Standardization of Nuclear Power Plant Designs: Licenses To Construct and Operate Nuclear Power Reactors of Identical Design at Multiple Sites**

Subpart H – Licenses, Certifications, and Approvals Part 2: MLs, CPs, OLs, and COLs

Discussion

Final Discussion and Questions



Acronyms and Abbreviations

ACRS	Advisory Committee on Reactor Safeguards
AOO	Anticipated operational occurrence
ARCAP	Advanced reactor content of application project
BDBE	Beyond design basis event
CFR	Code of Federal Regulations
COL	Combined license
ConOps	Concept of operations
CP	Construction permit
DBA	Design basis accident
DC	Design certification
DID	Defense-in-depth
EP	Emergency preparedness

ESP	Early site permit
FA	Function allocation
FRA	Functional requirements analysis
FSAR	Final safety analysis report
HFE	Human factors engineering
HSI	Human-system interface
IAEA	International Atomic Energy Agency
ISG	Interim staff guidance
ITAAC	Inspections, tests, analyses, and acceptance criteria
LB	Licensing basis
LBE	Licensing basis event
LCO	Limiting condition for operation

Acronyms and Abbreviations

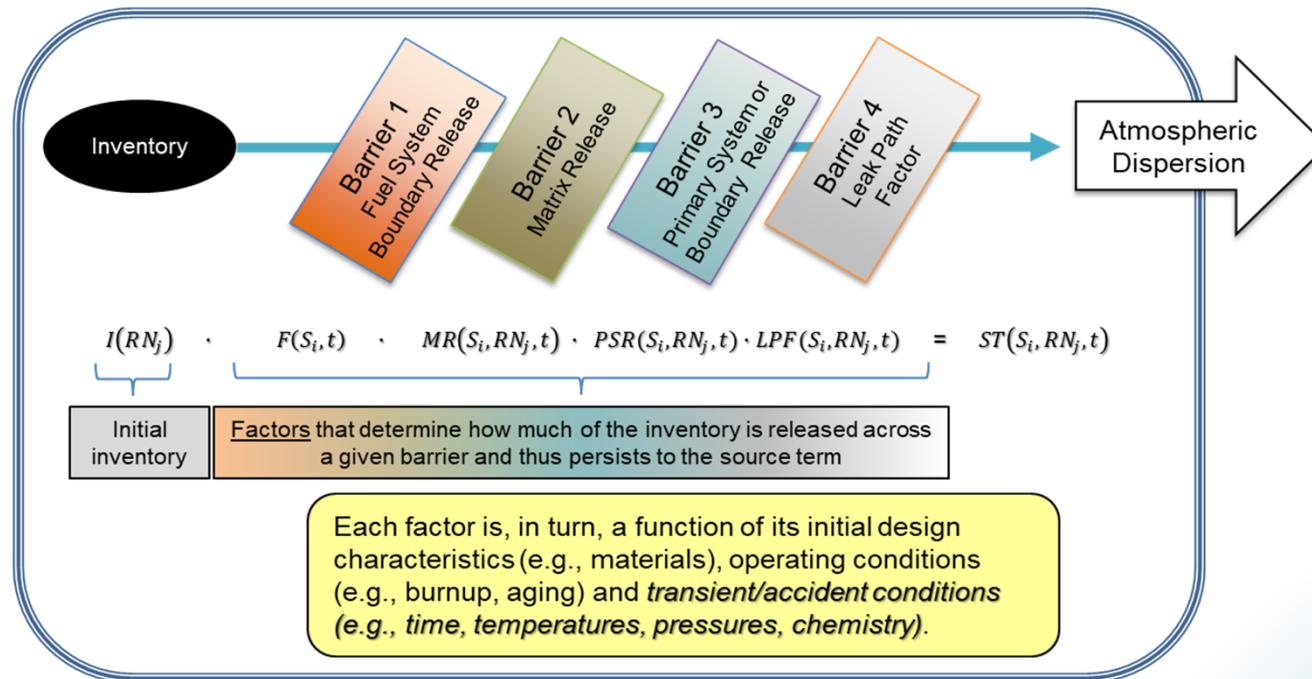
LWR	Light water reactor
ML	Manufacturing license
NEIMA	Nuclear Energy Innovation and Modernization Act
non-LWR	Non-light water reactor
NRC	U.S. Nuclear Regulatory Commission
NUREG	U.S. Nuclear Regulatory Commission technical report designation
OL	Operating license

PRA	Probabilistic risk assessment
RO	Reactor operator
SAR	Safety analysis report
SDA	Standard design approval
SRO	Senior reactor operator
SSCs	Structures, systems, and components
STA	Shift technical advisor
TICAP	Technology inclusive content of application project
TS	Technical specifications

Background Slides

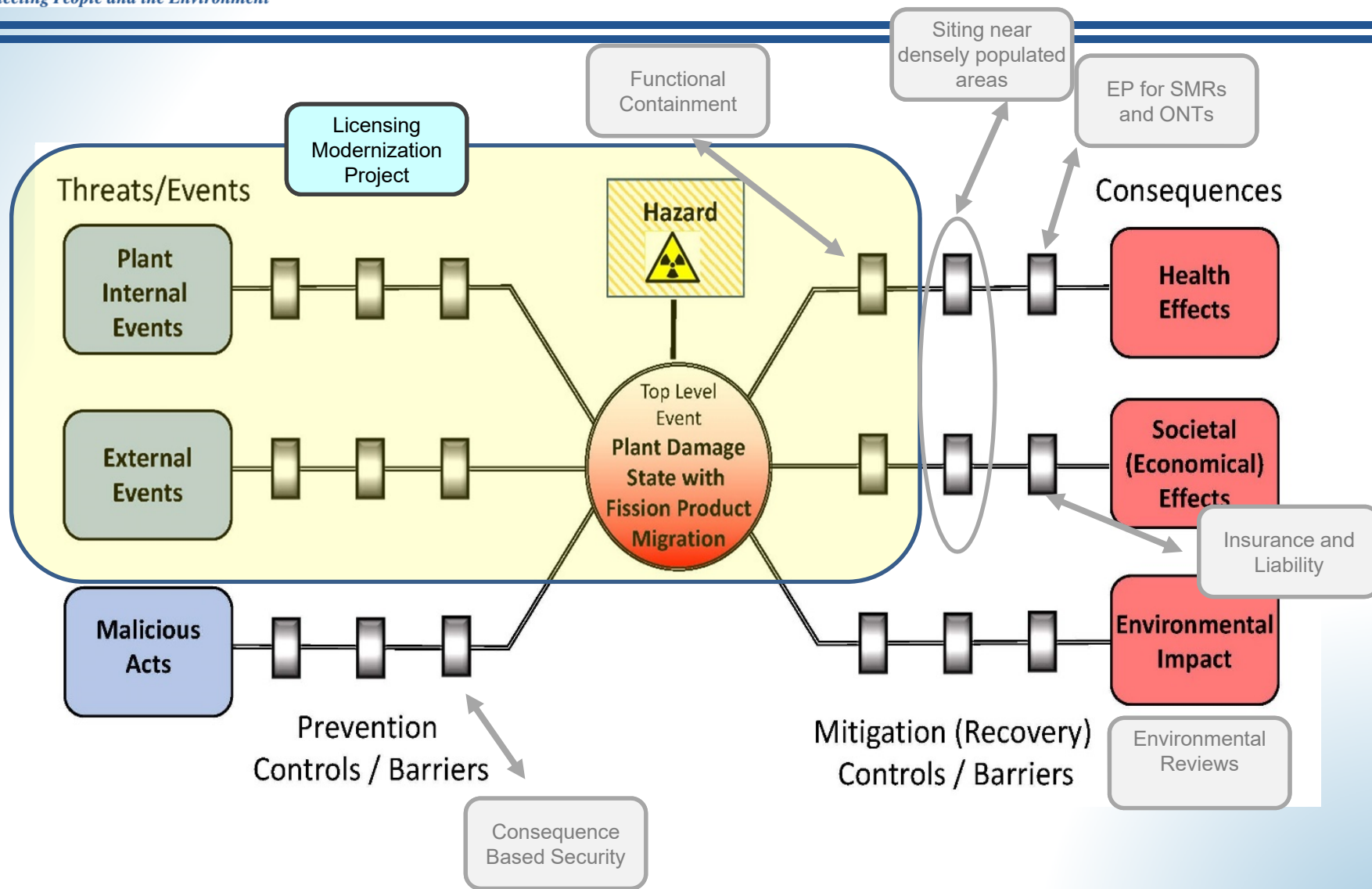
First Principles

Recent NRC activities related to advanced reactors (e.g., functional containment performance criteria, possible changes to emergency planning & security, and DG-1353) recognize the limitations of existing LWR-related guidance, which requires a return to first principles such as fundamental safety functions supporting the retention of radionuclides



See: SECY-18-0096, “Functional Containment Performance Criteria for Non-Light-Water-Reactors,” and INL/EXT-20-58717, “Technology-Inclusive Determination of Mechanistic Source Terms for Offsite Dose-Related Assessments for Advanced Nuclear Reactor Facilities”

Integrated Approach



Background

- Nuclear Energy Innovation and Modernization Act (NEIMA; Public Law 115-439) signed into law in January 2019 requires the NRC to complete a rulemaking to establish a technology-inclusive, regulatory framework for optional use for commercial advanced nuclear reactors no later than December 2027
 - (1) **ADVANCED NUCLEAR REACTOR**—The term “advanced nuclear reactor” means a nuclear fission or fusion reactor, including a prototype plant... with significant improvements compared to commercial nuclear reactors under construction as of the date of enactment of this Act, ...

Severe Accidents

- Severe Accident Policy Statement
 - Although in the licensing of existing plants the Commission has determined that these plants pose no undue risk to public health and safety, this should not be viewed as implying a Commission policy that safety improvements in new plant designs should not be actively sought. The Commission fully expects that vendors engaged in designing new standard (or custom) plants will achieve a higher standard of severe accident safety performance than their prior designs.
- 10 CFR 52.47(a)(23)
 - For light-water reactor designs, a description and analysis of design features for the prevention and mitigation of severe accidents, e.g., challenges to containment integrity caused by core-concrete interaction, steam explosion, high-pressure core melt ejection, hydrogen combustion, and containment bypass
- NUREG-1226 (Development and Utilization of the NRC Policy Statement on the Regulation of Advanced Nuclear Power Plants; Executive Summary)
 - (4) While the Final Policy Statement encourages innovative reactor designs and safety criteria, the review of advanced reactor designs will still require satisfactory consideration of the Commission's regulations, regulatory guides and other guidelines, such established and developing criteria as the defense-in-depth philosophy, standardization, the Commission's safety goal and severe accident policies, and applicable industry codes and standards.