



# Generic Licensing Topics and Policy Issues for SMRs

Commissioners' Hearing Room

October 4, 2011



# New Plant Licensing for SMRs

Part 50 or Part 52

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Office of New Reactors

## Licensing under Part 50 vs. Licensing under Part 52

- Same – most requirements
- Different – applications, process, timing, finality, & developed for Adv. Rx. designs

## Required for Licensing

- Applicant Qualifications
- Design Acceptability
- Environmental Impacts
- Operational Programs
- Site Safety
- Verification [with ITAAC]

## Licensing Steps under Part 50

- LWA under 10 CFR 50.10
- Construction Permit – 10 CFR 50.35(a)
- Byproduct Material under Part 30
- Source Material under Part 40
- Special Nuclear Material under Part 70
- Operating License – 10 CFR 50.57

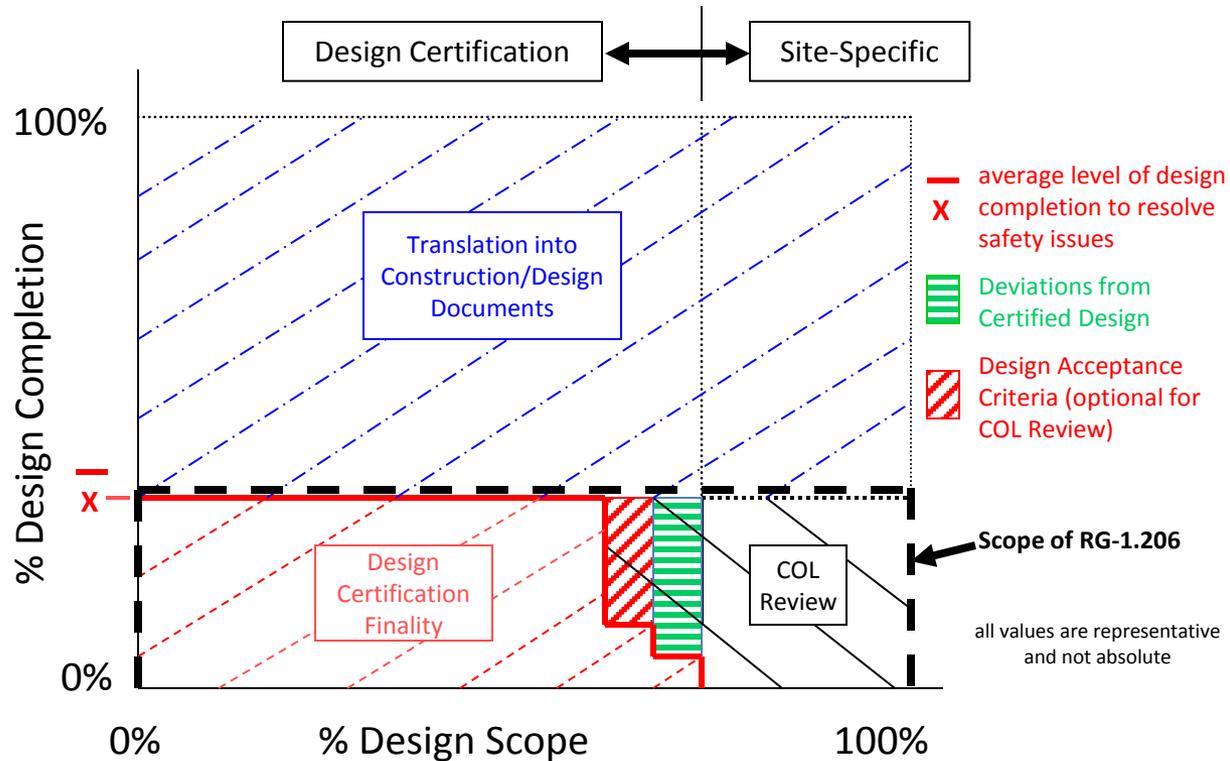
## Part 50 Licensing Process

- **Construction Permit – 50.34(a)**
  - Preliminary Design
  - Site Safety
  - Environmental Impacts
  - Mandatory Hearing
- **Operating License – 50.34(b)**
  - Final Design
  - Operational Programs
  - Emergency Preparedness
  - Optional Hearing

## Licensing under 10 CFR Part 50

- Lack of finality for Construction Permits
- Final safety decisions not made until plant is nearly complete and most construction costs expended
- Construction delay and rework because of design and regulatory changes
- Public participation difficult

# Level of Detail



**Combined License Application Referencing a Certified Design**

## Licensing under 10 CFR Part 52

- Stable and predictable licensing process
- Resolves safety and environmental issues before authorizing construction
- Timely and meaningful public participation
- Standardization of nuclear plant designs
- Reduces financial risk to licensees (COL)

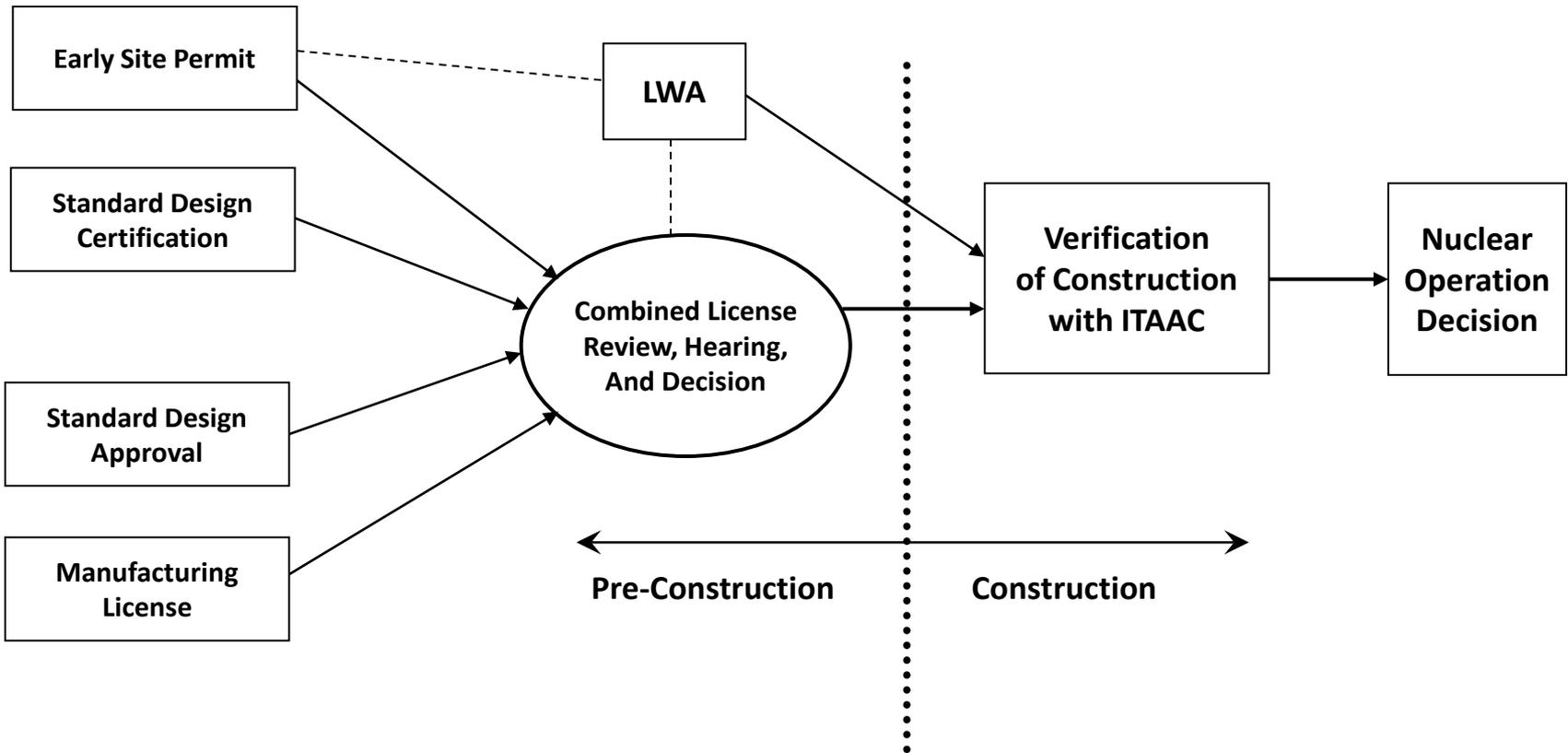
## Conclusions

- CP/OL application requirements in 50.34 were not fully updated post-TMI
- Application guidance out-of-date (RG 1.70)
- Some modern requirements are not clearly applicable, e.g. TMI, PRA, Severe Accidents
- Plant design achieves finality at OL
- Many licensing steps in CP/OL process

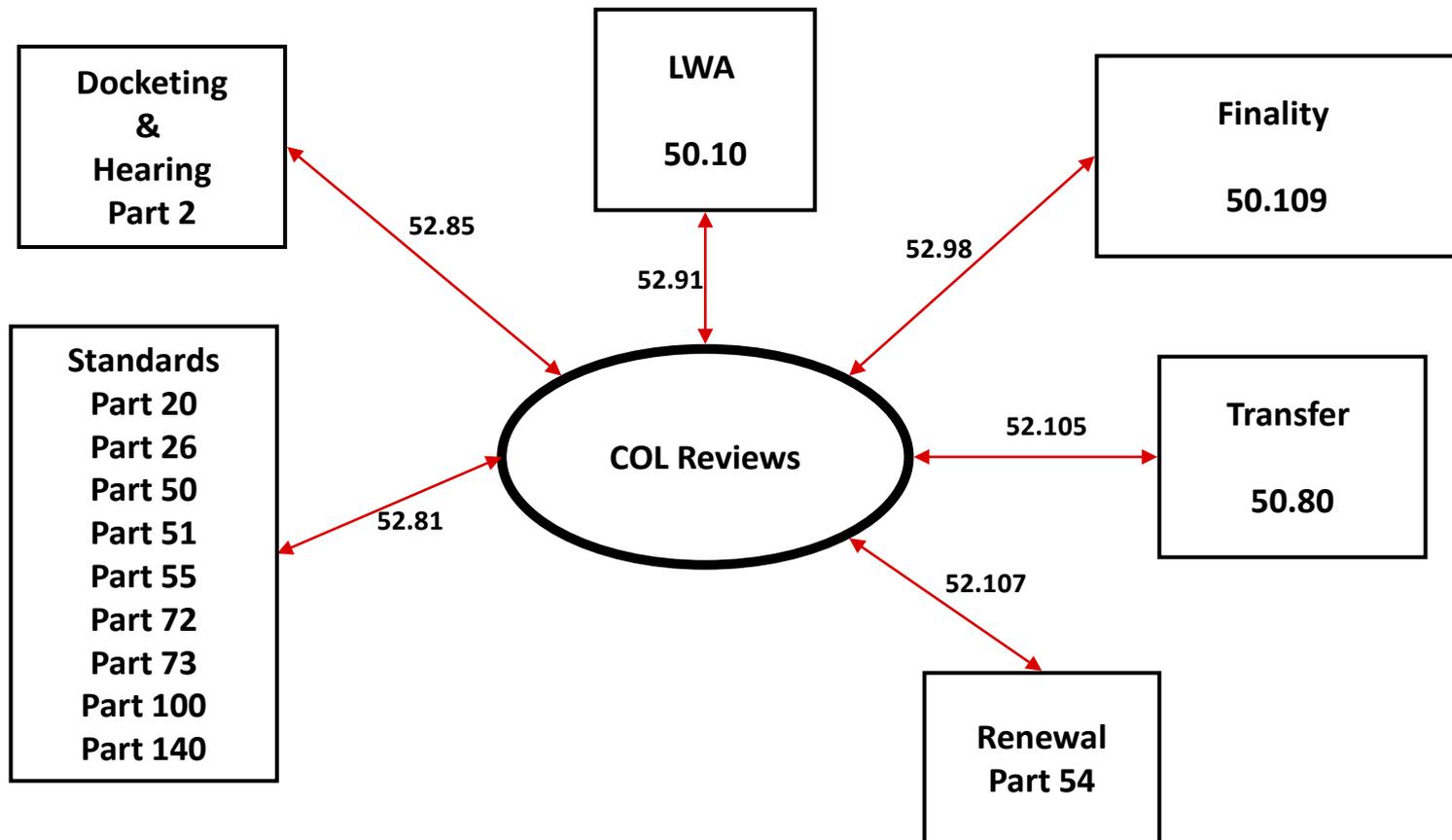


# Background Slides

# Part 52 Licensing Process

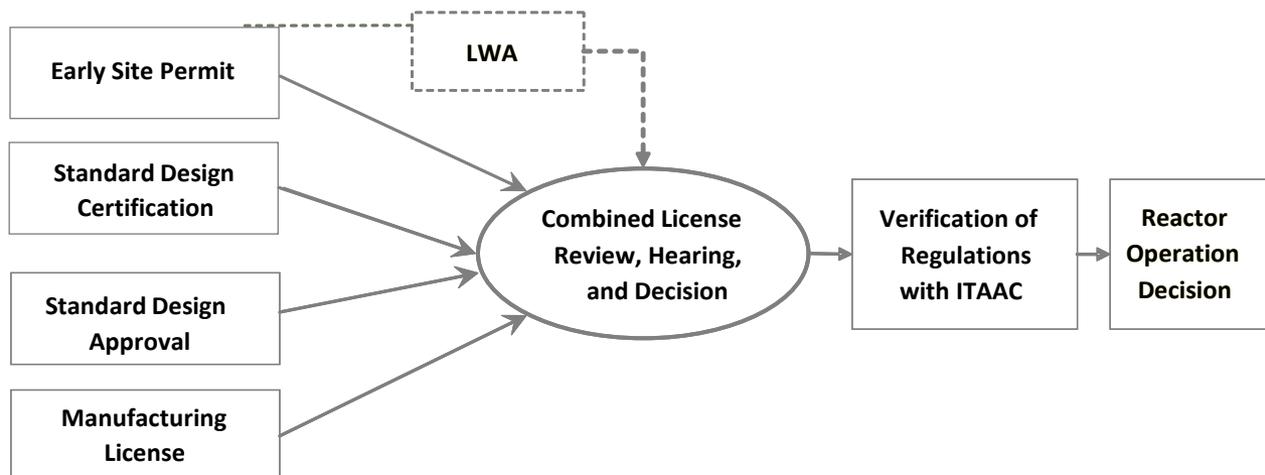


# Part 52 uses other Regulations



# Limited Work Authorization (LWA)

- May request LWA in advance of COL or CP
- Safety review of requested activities
- EIS for requested activities
- Site Redress Plan
- Bifurcated hearing on LWA activities





# Environmental Reports in Licensing Applications

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## Environmental Reports in Licensing Applications

10 CFR 51.45 requires that Environmental Reports (ERs) must be submitted as part of a licensing application for a construction permit, early site permit, limited work authorization, or combined license.

## Environmental Reports in Licensing Applications

- 51.53 contains requirements for Postconstruction Environmental Reports.
- 51.54 contains requirements for Environmental Reports for manufacturing license applications and
- 51.55 contains requirements for Environmental Reports for a standard design certification.

# Environmental Reports in Licensing Applications

- Guidance for developing Environmental Reports and the information to be included is contained in:
  - Reg Guide 4.2, Rev 2, Preparation of Environmental Reports for Nuclear Power Plants, July 1976, identifies the information needed by the staff in its assessment of the potential environmental effects of the proposed nuclear facility and establishes a format acceptable to the staff for its presentation.
  - Reg Guide 4.7, Rev. 2. General Site Suitability Criteria for Nuclear Power Stations, 1998, discusses the major site characteristics related to public health and safety and environmental issues that the NRC staff considers in determining the suitability of sites for nuclear power stations.

# Environmental Reports in Licensing Applications

- Guidance for developing Environmental Reports and the information to be included is contained in: (cont'd)
  - Reg Guide 4.11, Rev. 1. Terrestrial Environmental Studies for Nuclear Power Plants, provides technical information for the design and execution of terrestrial environmental studies for nuclear power stations.
  - Reg Guide 1.23, On-site Meteorological Programs, describes a suitable onsite meteorological program to provide meteorological data needed to estimate potential radiation doses in determining the suitability of a site for a power reactor.
  - Reg Guide 1.206, Combined License Applications for Nuclear Power Plants, provides guidance regarding the information to be submitted in a COL application for a nuclear power plant.

# Environmental Reports in Licensing Applications

- Guidance for developing Environmental Reports and the information to be included is contained in: (cont'd)
  - NUREG-1555, Environmental Standard Review Plan, contains the environmental standard review plans (ESRPs) that constitute a series of instructions developed for the NRC staff to use when conducting environmental reviews of applications related to nuclear power plants.
  - *Addressing The Construction And Preconstruction Activities, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, The Need For Power, Cumulative Impact Analysis And Cultural/Historical Resources Analysis Issues In Environmental Impact Statements* (ML110380369) is guidance issued to NRC staff for incorporating and addressing construction and preconstruction activities; greenhouse gas issues; general conformity determinations; environmental justice; need for power; cumulative impact analysis; and cultural/historical resource analysis issues in environmental impact statements.

# Environmental Reports in Licensing Applications

## Regulatory Requirements

- In accordance with § 51.45, the ER shall contain a description of the proposed action, a statement of its purpose, a description of the environment affected, and discuss the following considerations:
  - The impact of the proposed action on the environment
  - Any adverse environmental effects which cannot be avoided should the proposal be implemented
  - Alternatives to the proposed action
  - The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity
  - Any irreversible and irretrievable commitments of resources
  - An analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects.

# Environmental Reports in Licensing Applications

## Design Certification Applications

- In § 51.55 Environmental Report – standard design certification, severe accident mitigation design alternatives (SAMDA) must be addressed in ERs for design certifications. Specifically, the ER must address the costs and benefits of SAMDA, and the bases for not incorporating SAMDA in the design to be certified.
- If an applicant submits an amendment to a Design Certification application, the application must contain an ER which identifies a new SAMDA or if the design change renders a SAMDA previously rejected as becoming cost beneficial.

# Environmental Reports in Licensing Applications

## Limited Work Authorization

- § 51.49 requires an ER for an LWA must at least evaluate the environmental impacts and proposed alternatives attributable to the activities proposed for the LWA.

# Environmental Reports in Licensing Applications

## Construction Permit

- For a construction permit, §51.50 requires that an ER contain the information specified in §51.45 (discussed above) but also must use Tables S-3 (§51.51) and S-4 (§51.52) as the basis for evaluating the contribution of the environmental effects of uranium mining and milling. §51.50 also requires that the ER for a construction permit shall identify procedures for reporting and keeping records of environmental data, and any conditions and monitoring requirements for protecting the non-aquatic environment.

# Environmental Reports in Licensing Applications

## Early Site Permit

- For an ESP, 51.50 requires the information specified in 51.45, 51.51, 51.52 as modified below:
- The ER must contain a discussion of alternative sites, may address environmental effects of the reactor(s) with the plant parameter envelope, and need not address economic, technical or other benefits ( i.e. need for power) and costs of the proposed action. The ER for an ESP must identify procedures for reporting and keeping records of environmental data, and any conditions and monitoring requirements for protecting the non-aquatic environment.

# Environmental Reports in Licensing Applications

## Combined License

- The ER for a COL must contain the information specified in 51.45, 51.51, 51.52. The ER may also reference information contained in a FEIS previously prepared by the NRC staff.

## Postconstruction Environmental Report for Operating License Stage

- 51.53(b) requires the information specified in 51.45, 51.51, 51.52 but only to the extent that the information differs from that previously discussed in the FEIS for the CP or reflects new information in addition to that discussed in the FEIS for the CP.
- No discussion of need for power, alternative energy sources, alternative sites or any aspect of the storage of spent fuel is required in this report.

# Environmental Reports in Licensing Applications

## Staff Review of the ER

- Staff reviews the ER to see if it meets the requirements of Reg Guide 4.2 and also looks for sensitive unclassified non-safeguards information (SUNSI) material.
- If the staff determines that the ER meets the requirements of RG 4.2, that info is provided to the appropriate mgmt staff.
- If the accompanying SAR is also determined to be acceptable, the application is docketed.
- Once the ER is accepted, the staff relies on the guidance in NUREG-1555 to determine if all the information needed to complete the Draft EIS is included in the ER.

## Lessons Learned From Environmental Reviews

- Early interaction with NRC and other Federal and State agencies.
- Requirements from other permitting agencies can require significant revision to a project.
- Delays result from not working out issues with other agencies (USACE, Clean Water Act permitting agency, etc.)

## Lessons Learned

It's not *Just* NEPA  
and it's not just the NRC involved  
in the environmental review

## Other Laws

- Clean Water Act (FWPCA) – Section 401 Certification
- Endangered Species Act – Consultation
- Magnuson-Stevens Fishery Conservation Act – Consultation
- Executive Order 12898 – Environmental Justice – Consideration
- National Historic Preservation Act – Consultation
- Clean Air Act – General Conformity Determination
- And More (Wildlife Coordination Act, Bald and Golden Eagle Protection Act, Marine Mammal Protection Act, Migratory Bird Treaty Act )

## Purpose and Need

- Understand how the Purpose and Need Statement drives the alternative analysis, the Need for Power, and the Cost Benefit analysis.
- Lack of understanding can result in unacceptable siting studies, or other alternatives.

## Understand the NRC and USACE Decision Standard

- NRC and USACE cooperate on EIS if a CWA 404 permit is needed.
- NRC uses environmentally preferable/obviously superior standard.
- USACE uses least environmentally damaging practicable alternative (LEDPA).
- Siting must satisfy both standards.



# Construction Inspection And ITAAC For SMRs

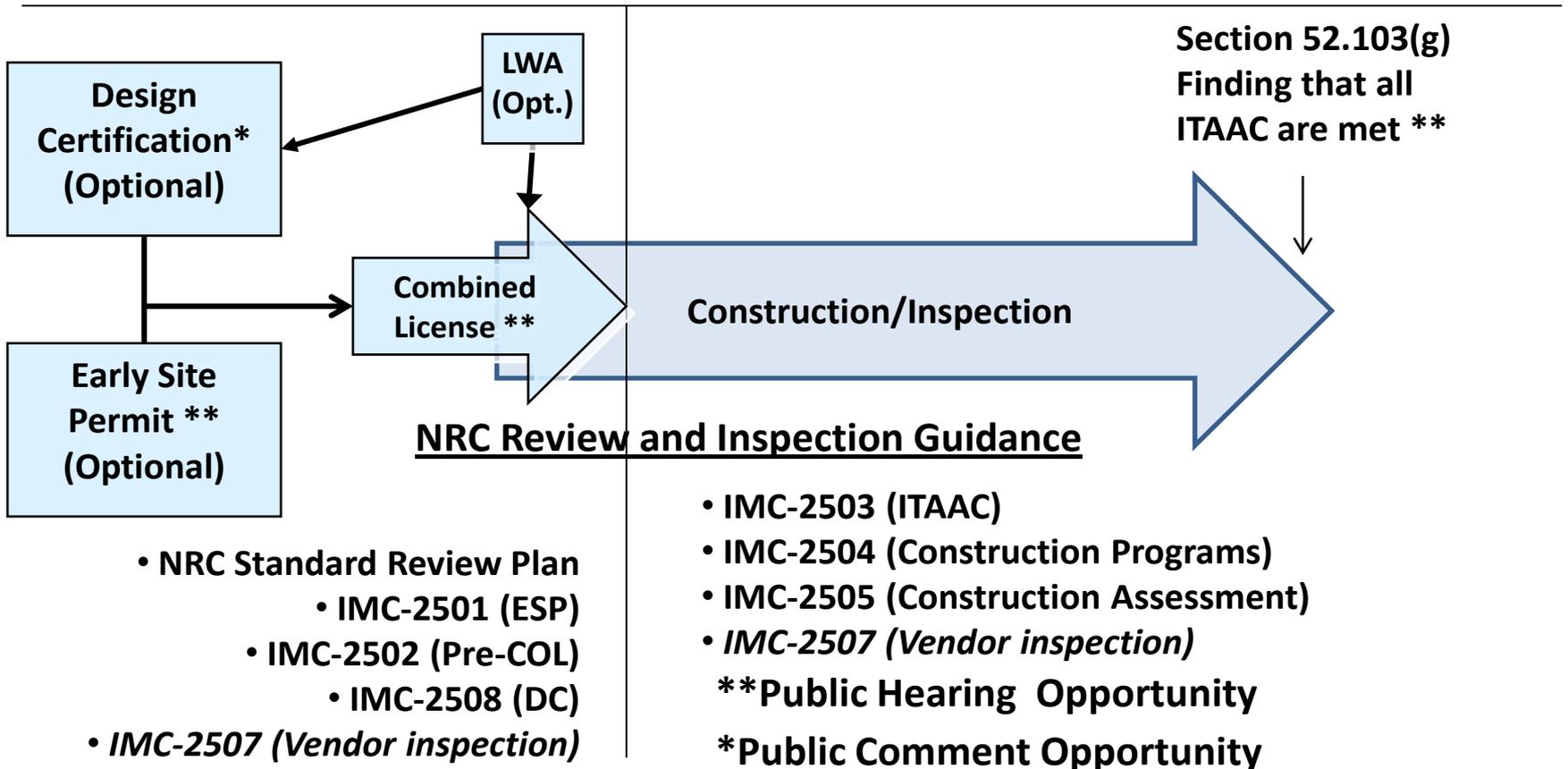
Carl Weber  
Reactor Operations Engineer  
NRO/DCIP/CIPB

- Inspection Program Under Part 52
- ITAAC
- Inspections At Vogtle and VC Summer
- Differences Under Part 50
- Challenges
- Conclusions

## Part 52 (Existing Program)

- IMC 2501 Construction Inspection Program: Early Site Permit (ESP)
- IMC 2502 Construction Inspection Program: Pre-Combined License (Pre-COL) Phase
- IMC 2503 Construction Inspection Program: Inspections of Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)
- IMC 2504 Construction Inspection Program - Inspection of Construction and Operational Programs
- IMC 2505 Periodic Assessment of Construction Inspection Program Results
- IMC 2506 Construction Reactor Oversight Process General Guidance and Basis Document
- IMC 2507 Construction Inspection Program: Vendor Inspections
- IMC 2508 Construction Inspection Program: Design Certification

# Part 52 (Existing Program)



## Part 52 (Existing Program)

- Pre-Docket Audit
- Inspections During Application Review
- ITAAC-related Inspections (pre and post license)
- Construction Program Inspections
- Operational Program Inspections
- Vendor Inspections
- Assessment
- Non-Cited Violations

- ITAAC:
  - Completed By Licensee
  - Inspected On a Sample Basis
  - All ITAAC Reviewed For Completion
- Defined Acceptance Criteria
- Inspection Sample - Targeted ITAAC
- Value of Inspection
- Scheduling
- Completion of Required Inspections

# ITAAC

## Partial ITAAC Matrix

ITAAC Matrix	A) As-Built Insp	B) Welding	C) Const Testing	D) Oper Testing	E) Qual Criteria	F) Design/ Fab Req
01) Foundations & Buildings	14				1	4
02) Structural Concrete			1			
03) Piping	11	10	10	5		18
04) Pipe spt & Restraints						8
05) RPV & Intl's	7	2	1	2	1	4
06) Mech Comp	27	5	6	24	4	22
07) Valves	8	4	6	30	13	20
08) Elec Comp & Systems	15		5	25	8	8
09) Elec Cables	28		1			11
10) I&C Comp & Systems	61		36	70	16	9

# Vogtle Inspections

- Limited Work Authorization
  - Backfill
  - Shear Wave Test
  - Waterproof Membrane
- QA
- Security (Fitness for Duty) Safeguards
- ESP/LWA ITAAC
- ITAAC Related Qualification Tests (Vendor)
- Upcoming – Welding of Containment Vessel Bottom Head

# Vogtle Inspections

## Vogtle



# VC Summer Inspections

- No LWA
  - Excavation
  - No Construction
- Geologic Mapping
- Upcoming – Welding of Containment Vessel Bottom Head

## VC Summer Geologic Mapping



## Program Under Part 50

- IMC 2511 LWR Inspection Program Pre-CP Phase – Inspection Activities (deleted)
- IMC 2512 Light Water Reactor Inspection Program - Construction Phase
- IMC 2513 Light Water Reactor Inspection Program - Preoperational Testing And Operational Preparedness Phase
- IMC 2514 Light Water Reactor Inspection Program -- Startup Testing Phase
- IMC 2517 Watts Bar Unit 2 Construction Inspection Program

## Part 50 and 52 Differences

### Part 50

- Pre-Docket Audit
- Inspections During Application Review
- QA Focused Inspections
- Pre-Op Testing
- Operational Readiness
- Start-up Testing
- Vendor Inspections
- Assessment

### Part 52

- Pre-Docket Audit
- Inspections During Application Review
- ITAAC related Inspections (pre and post license)
- Construction Program Inspections
- Operational Program Inspections
- Vendor Inspections
- Assessment

# Challenges

- General
  - Existing Procedures
  - Offsite Fabrication
  - Operational Programs
  - ITAAC Prioritization
- Part 50
  - Existing Procedures/Inspection Manual Chapters
  - Acceptance Criteria
  - Inspection Sample
  - Value of Inspection
  - Scheduling
  - Completion of Required Inspections (Ready for Operations)

## Conclusion

- General Overview Of The Construction Inspection Program As It Exists Today
- Programs Need To Be Adapted For SMRs
- Basis For Future Discussion
- Stakeholder Feedback Is Important
- Feedback On Future Public Meeting Topics
- Questions?



# Issue Identification and Ranking Program (IIRP)

Wesley Held  
Project Manager  
NRO/ARP/ARB1

## Background

- SECY 10-0034 listed a number of potential policy issues and assigned a level of importance to each
- ARP staff had conducted previous evaluations of the regulations to identify potential policy issues, but generally did not include experienced technical staff

- Purpose
  - Identify issues that have not been considered during previous evaluations
  - Prevent licensing delays associated with resolving policy or technical issues while a review is already underway

- Topics Evaluated or Being Evaluated
  - Emergency Preparedness
  - Control Room Staffing
  - Security
  - Source Term
  - Cross-Organizational Issues
  - Environmental (project in beginning stages)

- Process
  - Form Working Group consisting of staff members with extensive experience in areas of focus (~8 members)
  - Conduct brainstorming sessions to identify potential issues
  - Rank issues under a variety of criteria and apply a weighting factor to determine final values
    - Impact on safety/security
    - Impact on licensing
    - Time to resolution
    - Resources needed

- Process (cont'd)
  - Other factors considered but not ranked
    - Knowledge gap
    - Cross-cutting issues
  - Final report
    - Explains process
    - Describes issues
    - Provides table listing final ranking values

- Next Steps
  - Identify path forward on issues
    - Research
    - Rulemaking
    - Guidance Development or Revision
    - Commission Decision
  - Work towards resolution of highly-ranked issues based on identified path forward



# IIRP - Security

Wesley Held  
Project Manager  
NRO/ ARP / ARB1

- Process
  - Gather staff with experience across entire fuel cycle
    - Security experts
    - OGC
  - Identify unique attributes of SMRs
    - Underground siting, modular construction and deployment, reduced staffing, etc.
  - Evaluate each attribute against applicable regulations
    - Parts 50, 52, 70, 72, 73, 74, 100
  - Main focus on iPWRs

- Results
  - 13 iPWR issues identified and ranked
    - The majority of the issues were determined to have a low impact on security and time to license, which led to a low overall ranking.
    - The issue that ranked highest overall was the use of a shared pool, as the staff lacks familiarity with that particular design approach
  - Several non-iPWR issues were identified and captured in the report, but not ranked.
    - Will be further evaluated as applications draw closer and more design details are made available



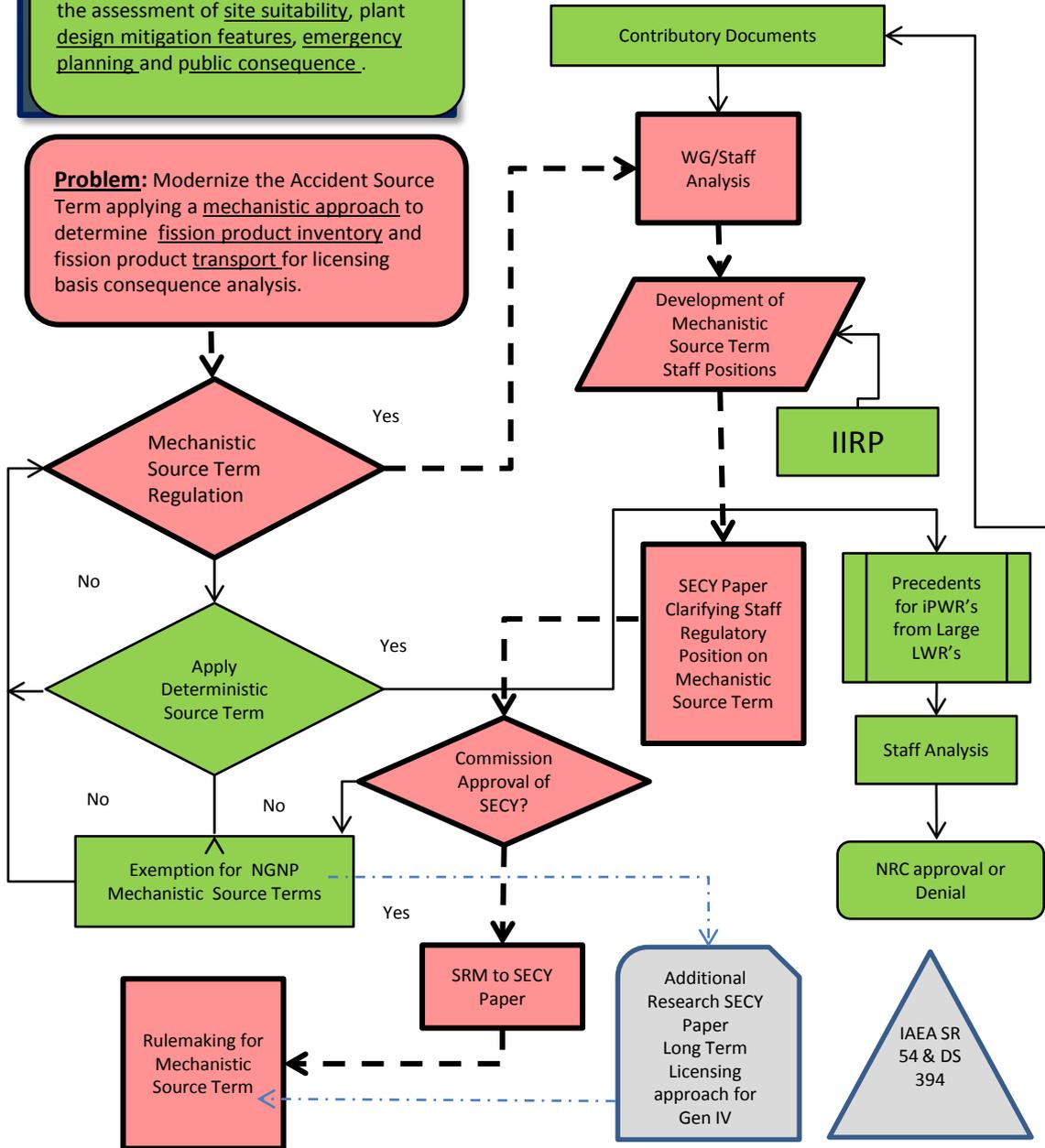
# IIRP - Source Term

James Shea  
Sr. Project Manager  
NRO/ ARP / ARB1

# ARP IIRP Source Term

**Accident source terms** are used for the assessment of site suitability, plant design mitigation features, emergency planning and public consequence.

**Problem:** Modernize the Accident Source Term applying a mechanistic approach to determine fission product inventory and fission product transport for licensing basis consequence analysis.



- NEI Position Paper iPWRs?
- ANS White Paper iPWRs?
- NGNP White Paper on Fuel Qualification & Source Term
- SECY-93-092  
SECY-97-171  
SECY-02-139  
SECY-03-047
- AST/ RG 1.183
- 10 CFR 50.34
- Past Source Term Licensing Precedents for HTGR and Small LWR's
- 10 CFR 100
- TID ST

## INTERRELATIONSHIPS

**Modularity:** impacts on Consequence Analysis for one or all modules

**Co-Location:** impacts on Consequence Analysis for siting with industrial sites.

**NGNP Fuel Qualification**  
TrisoFuel Diffusion of radioisotopes during Operation

**Risk Informed**: Licensing Basis Event Selection for NGNP

**NRC Mechanistic Source Term Modeling** for Confirmatory Calculations  
  
NGNP - In progress  
iPWR - Basic Modeling

**EP:** BDBE Consequence Analysis directly impacts Emergency Planning Issue for SMR

# ARP IIRP Source Term (ST) Project Results

The ARP IIRP ST Working Group in its ranking of issues identified by consensus the following potential non-technical licensing issues as the highest priority related to implementation of a mechanistic ST:

- Dose consequence from shutdown operations as well as spent fuel pool
- Multimodal accident consequence treatment in licensing requirements
- iPWR-specific below grade effects on source term transport and
- The NGNP issue related to a confinement versus a containment structure.



# Issues Identification and Ranking Project for Small Modular Reactor Cross- Organizational Issues

Arlon Costa  
Sr. Project Manager  
NRO/ARP/ARB1

## IIRP - Cross-Organizational Issues

- Background
- Potential issues
- Review of results
- Report
- Summary

## Background

- Issue Identification and Ranking Project (IIRP) for Small Modular Reactor (SMR) Cross-Organizational Issues - Previous discussions
- Potential issues impacts – proactive position (Advanced Reactor Policy Statement, NRO project plan and SECY-10-0034)

## Potential Issues

- Identified 30 main issues and associated subordinate issues
- Focused attention on near-time potential of SMR licensing and deployment
- Recognized broad range of issues and that other potential SMR issues may surface
- No focus on issues addressed by other IIRPs

# IIRP - Cross-Organizational Issues

## Potential Issues

- Broad description of main issues:

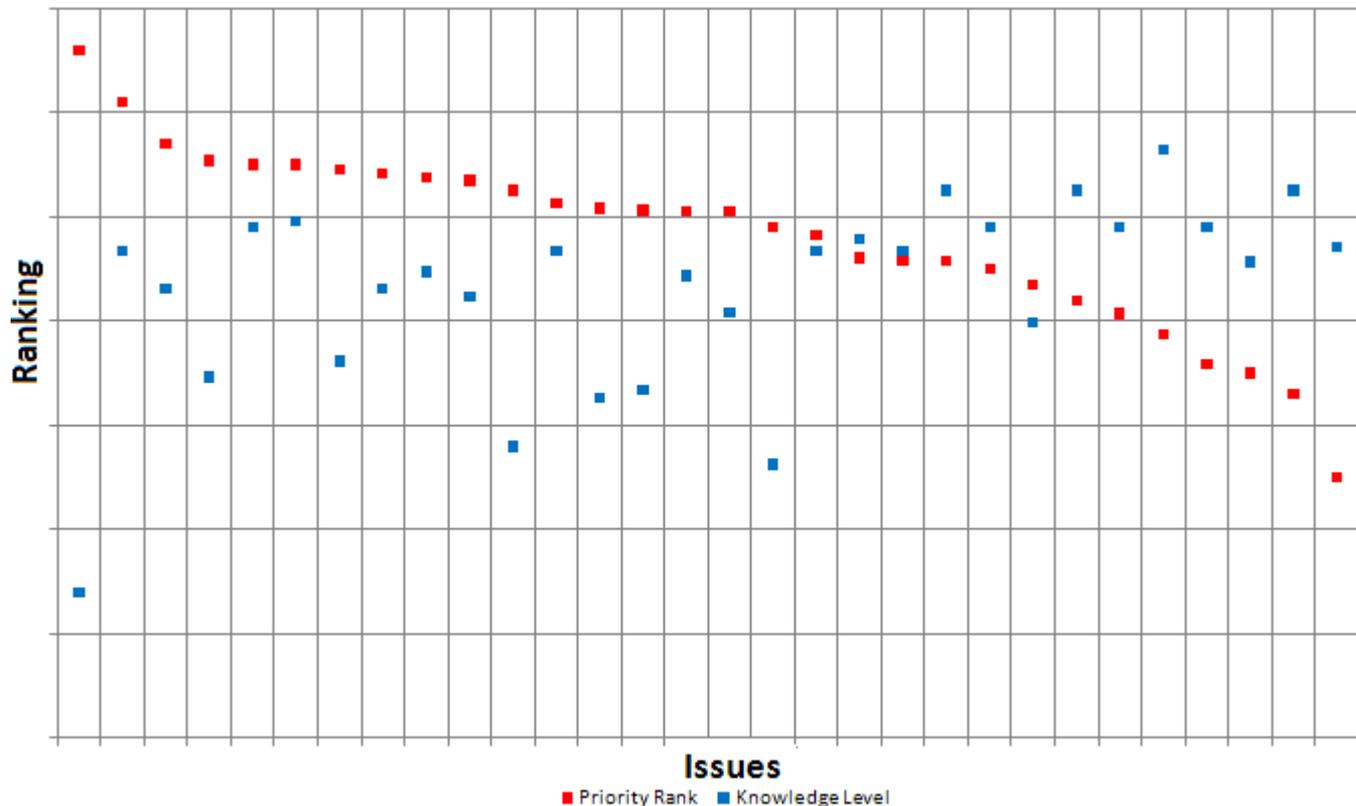
Applicability of regulatory guides and regulations	Financial process and procedures	Longer reactor transient response time	Plans and costs for resident inspectors	Reactor Oversight Process
Construction activities	Control room design	Remote monitoring	Reprocessing and storage	NRC staff training
Academia	Risk insights	Oversight	Transportation	Fuel cycle facility
Environmental Assessment	Radioactive waste disposal	Operator licensing	Expandability of modules	Site support
Modifications to the NRC Operations Center and Region IV Backup Operations Center	Differing reactor fuel designs associated with advanced reactor or SMR technologies	Lessons learned from the accident at Fukushima Dai-ichi in Japan and considerations to SMRs	Federal, State, Tribal, local, and nongovernmental organization involvement	Applicant requests to import an SMR from or export one to a foreign country
Refueling	Outreach	Collocation	Policy decision	Management

## Review Of Results

- Consensus:
  - PIRT-like approach - adaptation
  - Subordinate issues considered in ranking main issues
  - Priority ranking assignment

## Review Of Results (Cont'd)

- Priority ranking of main cross-organizational issues:



## Report

- Issues identification and ranking were established in WG charter and centered in NRC's mission
- Final report represents a WG consensus approach
- Recommendations intended for NRC management consideration, mainly to address near-term iPWR issues and possible incorporation into resolution plans
- The final report is currently not public

## Summary

- NRC is considering a programmatic approach towards the initiative by:
  - Continuing to listen to all stakeholders
  - Assessing the IIRPs by looking back at structure
  - Considering ways to engage stakeholders in comparable issues identification initiatives or methods
- Industry and other stakeholders should:
  - Look broadly for impediments to SMR licensing
  - Explore issues (pre-licensing up to deployment)