



Generic Licensing Topics and Policy Issues for SMRs

North Bethesda Marriott

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Staff Assessment of Selected Small Modular Reactor Issues Identified In SECY-10-0034

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Introduction

- Purpose of Commission Paper
- Background
- Issue Discussion
- Conclusion



Purpose

- To inform the Commission of the staff's assessment of matters identified in SECY-10-0034
 - Prototype License
 - Manufacturing License
 - Operational Programs
 - Installation of Modules during Operation
 - Industrial Facilities Using Process Heat
 - Aircraft Impact
- Scope includes:
 - iPWRs
 - non-LWR SMRs



Background

- SECY-10-0034 described **potential** policy, licensing, and key technical issues.
- Not all of the matters described were policy issues, which would require Commission attention.



Background

- Paper discusses issues which are unlikely to emerge as policy issues in the near term
- For SMRs planned for deployment in the near term, staff will pursue matters as licensing or technical issues
- For non-LWR designs, staff will reduce its level of effort on certain issues until more design information is available.
- Unless policy issue is identified, staff does not plan to address these matters in future Commission papers



License for Prototype Reactors

- **Background**
 - Regulations for licensing a prototype reactor - 10 CFR 50.43(e)
 - Certification/license may be granted after range of tests on a prototype
 - Possible license conditions and restrictions for prototype plants
 - limits on full power
 - operational temperature
 - startup testing
- **Assessment**
 - Existing regulations, guidance, & past practice
 - No policy issues identified yet
 - No SMR designer or potential applicant has indicated intent to submit a license for a prototype plant in the near term



Manufacturing License Requirements for Future Reactors

- Background
 - A manufacturing license (ML) authorizes
 - manufacture of a nuclear power reactor offsite, and
 - shipment to a location that has been issued a CP or COL
 - 10 CFR Part 52, Subsection F addresses essentially complete facilities
- Assessment
 - Existing regulations, guidance, & past practice
 - Manufacturing licenses for essentially complete facilities
 - Offsite manufacture of SMR components
 - Import/export issues
 - No policy issues identified yet
 - No SMR designer or potential applicant has indicated intent to submit an application for a ML in the near term



Operational Programs for Small or Multi-Module Facilities

- **Background**
 - Potential policy issues could involve development of operational programs for SMRs such as inservice inspection and testing, or on-line refueling and increased time between refueling for non-LWRs
- **Assessment**
 - Existing regulations, guidance, & past practice
 - No policy issues have been identified yet
 - For non-LWRs that may be deployed at a later time, there is insufficient information available to identify whether policy issues exist



Installation of Rx Modules during Operation for Multi-Module Facilities

- **Background**
 - Reactor modules could be placed into operation while other previously-installed adjacent modules are operating
 - Concerns include
 - moving heavy loads
 - changes in boundary conditions associated with seismic analysis
 - common mode failures resulting from initiating events affecting more than one module
- **Assessment**
 - Existing regulations, guidance, & past practice
 - No policy issues identified yet



Industrial Facilities Using Nuclear-Generated Process Heat

- **Background**
 - SMRs can be used to produce process heat
 - chemical plants
 - refineries
 - hydrogen production
 - Close coupling of nuclear process and process facility could raise concerns involving interface and regulatory issues
 - The reactor facility could adversely affect the commercial product (i.e. tritium migration)
- **Assessment**
 - Existing regulations, guidance, & past practice
 - Review the effects of the reactor on the commercial product
 - No policy issues identified yet
 - No potential applicant has indicated that it intends to submit application for a reactor to be used as a source of process heat



Aircraft Impact Assessments for Small Modular Reactors

- Background
 - New design and license applicants must perform assessment of the design's ability to avoid or mitigate the effects from an aircraft impact.
 - Aircraft impact issues will have to be addressed for reactors that provide process heat to industrial facilities
- Assessment
 - For SMRs planned in the near term
 - Existing regulations, guidance, & past practice
 - No policy issues have been identified yet
 - No potential applicant has indicated that it intends to submit application for a reactor to be used as a source of process heat
 - For non-LWRs that may be deployed at a later time, there is insufficient information available to identify whether policy issues exist



Conclusions

- These issues are unlikely to result in policy issues in the near term
- For SMRs planned for deployment in the near term, staff will pursue matters as licensing or technical issues
- For non-LWR designs, staff will reduce its level of effort on certain issues until more design information is available
- Unless policy issue is identified, staff does not plan to address these matters in future Commission papers



Questions?



Small Modular Reactor License Structure for Multi Module Facilities

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Small Modular Reactor License Structure for Multi Module Facilities

SECY-11-0079, License Structure for Multi-Module Facilities Related to Small Modular Nuclear Power Reactors

- Signed by EDO on June 12, 2011

Small Modular Reactor License Structure for Multi Module Facilities

Alternative 1: Single Facility License

- Approach proposed and accepted for isotope production reactors (licensed under 10 CFR Part 50).
 - SECY-09-0101, “Licensing of a Babcock and Wilcox Medical Isotope Production System”
- Common systems, structures, and components can be more easily addressed
- License term based on the first operating module
 - Possible reduced lifetime for subsequent modules

Alternative 2: Master Facility License and Individual Reactor Module Licenses

- Not previously used for reactor licensing
- Master facility license would be valid for the entire life of the plant
 - No authorization to operate a nuclear reactor
 - Not limited to the 40-year term
- Individual licenses for each reactor module
 - Reference the master facility license for site or facility requirements
- Develop processes and possibly new regulations to define how it would fit within the existing technical and legal requirements.

Alternative 3: Individual Reactor Module Licenses

- Approach endorsed by NEI and NGNP
 - Single license review, SER and a hearing
 - Precedence: large light water reactor (LWR) COL applications
- Alternative 3A
 - Address common SSCs primarily in the license for the first module.
 - Issues by the end of license term for the first module
 - Work with industry for alternate approaches to address the license renewal of common SSCs
 - Subsequent years after the license have been issued

Alternative 3: Individual Reactor Module Licenses

- **Alternative 3B**
 - Define license conditions for common SSCs on a license appendix
 - Performance-based criteria as well as aging management provisions
 - Incorporated by reference into the license for each reactor module



Small Modular Reactor License Structure for Multi Module Facilities

Staff Evaluation

- Best Approach: Option 3
 - License for each reactor module
- Engage stakeholders to discuss the alternatives
 - Absent of compelling arguments for other alternatives the staff will develop the specific aspects of Alternative 3
 - Submit a specific proposal to the Commission



Questions?



Preliminary Staff Assessment of Insurance & Liability Issues For SMRs

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Introduction

- Purpose
- Background
- Preliminary Staff Assessment
- Conclusion



Purpose

- To provide feedback on insurance & liability issues position paper submitted by NEI
- To identify NRC staff concerns for certain SMR design configurations



Background

- SECY-10-0034 indicated that insurance & liability issues for SMRs could involve **potential** policy, licensing, and key technical issues.
- NEI position paper - June 6, 2011
“...existing financial protection requirements for SMRs are adequate, and does not recommend statutory or regulatory changes **at this time.**”



Background (continued)

- SECY-10-0034 identified potential issues including
 - amount of liability insurance required for an SMR facility
 - application of the Price-Anderson statute & Commission's regulations to commercial SMRs that do not generate electrical energy
- Clarification of the Price-Anderson Act may be needed to ensure that SMRs would be appropriately subject to the retrospective insurance pool and appropriate public liability requirements.
- Concerns raised now to ensure that issues relating to Price-Anderson be raised early
 - legislation
 - rulemaking



Preliminary Assessment

- Staff generally agrees with NEI paper (subject to final review)
 - regulations should accommodate most of the proposed SMR designs planned for near-term deployment
 - primary insurance requirements will be based on consideration of the reactor size and population density around the site in accordance with 10 CFR 140.12



Preliminary Assessment

- Staff concerned about whether the Price-Anderson Act and 10 CFR Part 140 require sufficient insurance for certain planned SMR configurations in which
 - reactor modules share safety-related equipment
 - individual reactor module < 100 MWe, but combined power level for the entire facility > 100 MWe
 - required liability coverage significantly less than that required of other SMR designs of comparable power levels.
- Staff also concerned about applicability of the Price-Anderson Act to reactors used to produce process heat



Preliminary Assessment (continued)

NEI Position Paper, Table 1: Examples of Financial Protection for Small Reactors

Output/Unit	#Units/Site	Primary	Secondary**	NRC Indemnification
311 MWe	1	\$375 million	\$111.9 million	\$0
311 MWe	2	\$375 million/site	\$111.9 million/unit	\$0
125 MWe	1	\$375 million	\$111.9 million	\$0
125 MWe	2	\$375 million/site	\$111.9 million/site	\$0
125 MWe	4	\$375 million/site	\$111.9 million/site	\$0
45 MWe*	1	\$50 million	\$0	\$500 million
45 MWe*	12	\$50 million/site	\$0	\$500 million
45 MWe*	24	\$50 million/site	\$0	\$500 million
25 MWe*	1	\$27.8 million	\$0	\$500 million
25 MWe*	2	\$27.8 million/site	\$0	\$500 million

* Assumes MWt is three times the MWe and a population factor of 2.

** The secondary coverage does not include the potential surcharge (maximum 5%).



Conclusions

- Staff is evaluating concerns
 - Implications to rulemaking and regulations
 - Statutory changes
- Staff plans to develop Commission paper



Questions?



NRC's Environmental Review Program

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NRC's Environmental Review Program

NRC's Mission



- Protect public health and safety;
- Promote common defense and security;
- Protect the environment.



NRC's Environmental Review Program

National Environmental Policy Act (NEPA)

- NEPA requires Federal agencies to use a systematic approach to consider environmental impacts
- 10 CFR Part 51 implements NEPA for NRC's domestic licensing actions
- An Environmental Impact Statement (EIS) is required for major Federal actions that may significantly affect the quality of the human environment
- Issuing a construction permit, early site permit, operating license, or a combined license is considered a major Federal action

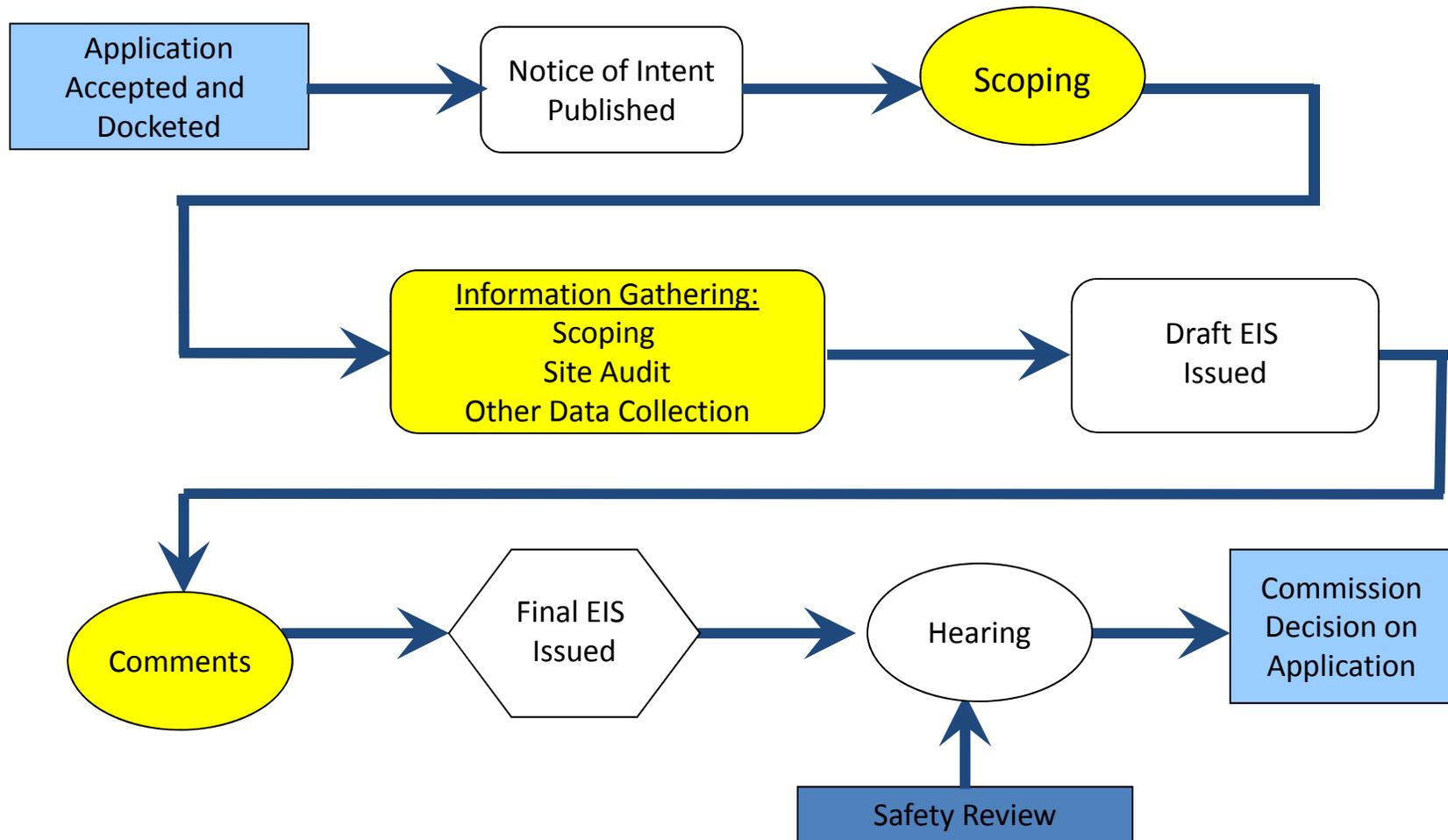


NRC's Environmental Review Program

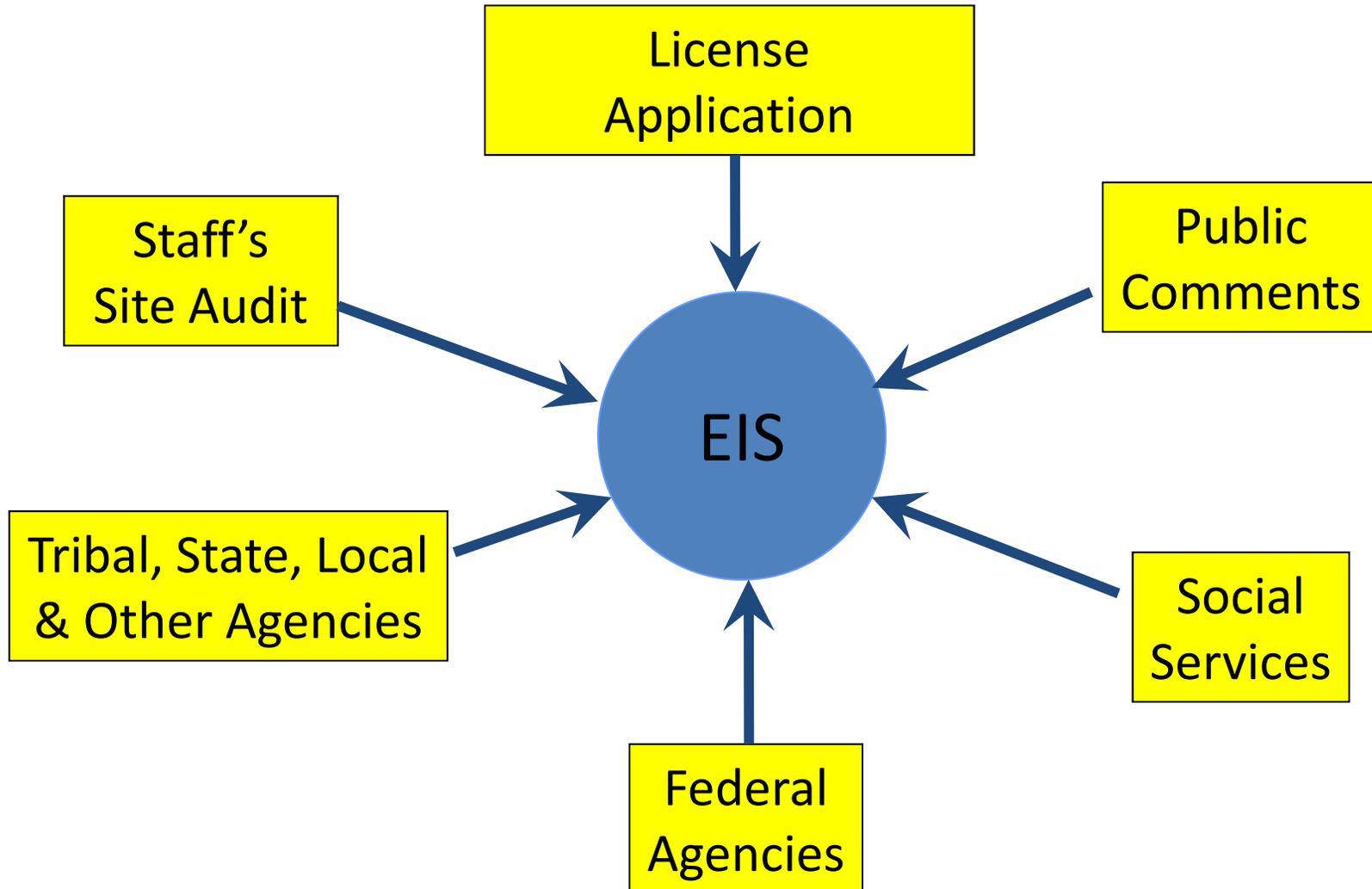
Important Points about NEPA

- NEPA is a disclosure tool for informing decision makers and the public about the anticipated impacts from a proposed project
- NEPA requires public participation in the process
- Process is the same for large reactors or small modular reactors

NRC's Environmental Review Program



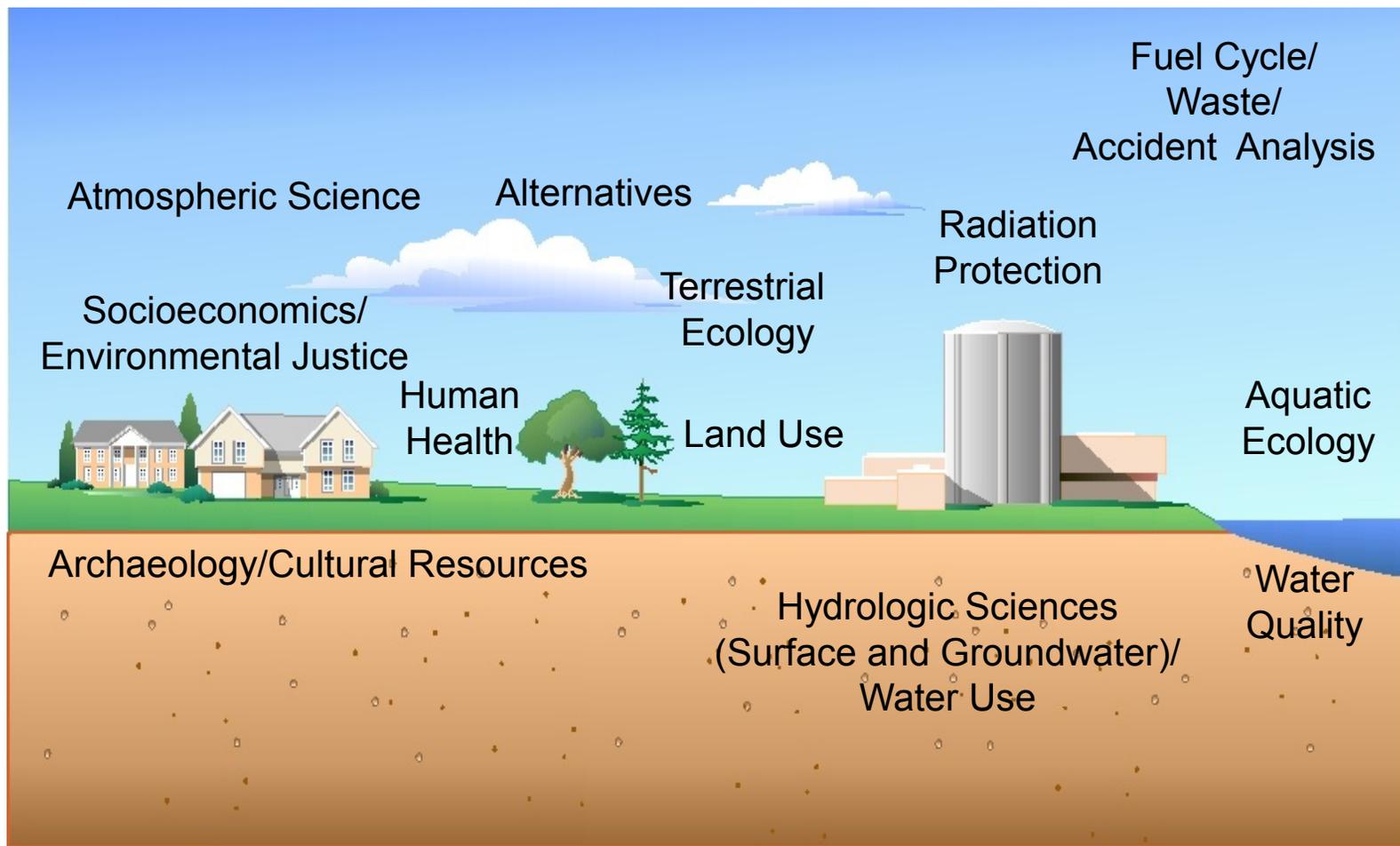
NRC's Environmental Review Program





NRC's Environmental Review Program

NRC Review Team Expertise





NRC's Environmental Review Program

Environmental Review Schedule

- For an EIS for a construction permit, early site permit, or a combined operating license, the schedule is approximately 30 months
- For a supplemental EIS for an operating license or a combined operating license referencing an early site permit, the schedule is approximately 18-24 months
- The schedule is driven by the process, not by the size of the reactors being licensed



NRC's Environmental Review Program

Environmental Issues for SMR Licensing

- Issue permit or license under either 10 CFR Part 50 or Part 52
 - For Construction Permit and Operating License under Part 50, two EISs
 - For Early Site Permit and subsequent Combined Operating License under Part 52, two EISs
 - For Combined Operating License under Part 52, one EIS
 - For Design Certification, one Environmental Assessment



NRC's Environmental Review Program

Environmental Issues for SMR Licensing

- Areas Common to Safety and Environmental Review
- Defining Project Purpose and Need
- Alternatives (energies and sites)
- Need for Power
- Fuel Cycle sections of the EIS
- Implementation of the LWA rule
- Cumulative Impacts



Environmental Issues (Its not just the NRC)

- Need to satisfy other Federal and State Agencies
 - Army Corps of Engineers (Wetlands)
 - FWS and NMFS (Endangered Species Act)
 - State (Clean Water Act, CZMA)
 - EPA (CWA if not delegate to State)
 - National Historic Preservation Act (NHPA)
- Engage other agencies early in planning process!



Questions?



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

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Issue Identification and Ranking Project for Small Modular Reactor Cross Organizational Issues

- Background
- Objective
- Approach
- Examples
- Potential Results
- Report To NRC Management
- Results
- Summary

Background

- Advanced Reactors have benefitted from Commission Guidance – Policy Statement
 - NRC to provide for early identification of regulatory requirements for advanced reactors (NRC-2008-0237)
- Staff Identified Key Policy and Technical Issues
 - SECY-10-0034 : “Potential Policy, Licensing, and Key Technical Issues For Small Modular Nuclear Reactor Designs”
- NRO/ARP developed and is implementing project plans and schedules
- Other IIRPs

Objective

- The overall objective of the issues and identification project (IIRP) for small modular reactor (SMR) cross organizational issues (COI) and its associated working group (WG) is to identify and prioritize NRC regulations, guidance, resources or schedules that could have a significant or potential impact on the SMR industry.

Approach

- Internal: Broad look across NRC organizations
- Issues that could impede design, licensing, construction, operation, or export of SMRs
- Initial focus on iPWRs but cognizance of other technologies (HTGR and fast reactors)
- Participating Offices: NRO, NRR, NMSS, RES, NSIR, FSME, OGC, OHR, OIP, Region II
- PIRT like process includes safety, security, impact on licensing, time to resolution and resources rankings

Examples

- Resident Inspectors for plants?
- Resident Inspectors for manufacturing facilities?
- Training courses for staff? When to expand training to non-LWR technology?
- What is needed to support the HQ Ops Center?
- Spent fuel storage and transportation
- Fuel fabrication for non-LWR designs – timing
- DOE vision of a thousand SMRs – implications for NRC?

Potential Results

- Impact on SMR design decisions
- Need for legislation
- Need for rulemaking or policy changes
- Need for NRC confirmatory research
- Dependencies on other policy or technical issue (e.g., source term impact on Emergency Preparedness)

Report To NRC Management

- Final report will have consensus by group members from Offices and Region II
- Additionally identified cross organizational issues will be prioritized by rankings similar to PIRT
- Recommendations will be considered for scheduling and budget resources needed

Summary

- NRC is thinking expansively to identify additional issues impacting SMR licensing
- Industry and other stakeholders should explore identifying issues and look broadly for impediments to SMR licensing
- NRC is listening to all stakeholders



Questions?



Operator Staffing for Small or Multi-Module Reactors

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Operator Staffing for Small or Multi-Module Reactors

Background:

- Current operator staffing requirements prescriptive; for example:
 - Staffing table defines min. number of operators for a set of operating units and control room configuration
 - Regulation does not address operating >3 units from a single control room
- Multiple designers have expressed desire to request exemptions from current staffing requirements



Operator Staffing for Small or Multi-Module Reactors

Recent NRC Activities:

- Control Room Staffing IIRP
 - Completed March 2011
 - Final Report Issued June 2011 (ML111470784)
- SECY on Operator Staffing



Operator Staffing for Small or Multi-Module Reactors

IIRP

- Early focus on identification of policy, regulatory, and technical issues related to Control Room Staffing
- IIRP identified issues directly involving or related to control room staffing
- Issues ranked based on priority ranking criteria then weighted them emphasize their relative importance
- Weighting factors included safety, impact on licensing, time to resolution, and resources needed

Operator Staffing for Small or Multi-Module Reactors

IIRP

- Eleven issues identified and ranked
 - Three highly critical issues: Scaling, Integration, and Design Basis
 - Two high impact-to-safety: Multi-module Human Systems Interface and Mixed Technologies
 - Six issues to be further reviewed but initially prioritized to require a low level of urgency

Operator Staffing for Small or Multi-Module Reactors

IIRP

Highly Critical Issues:

- **Scaling** – As the number of modules increase at an SMR plant, how do an operator's roles, responsibilities, and interactions with other operators and external organizations (e.g. EP, security) change?
- **Integration** – Instead of prescriptive regulatory requirements, should a fully integrated staffing analysis be required for SMRs that accounts for control room tasks as well as interfaces with external entities?
- **Design Basis** – How should design basis be defined for SMRs?

Operator Staffing for Small or Multi-Module Reactors

IIRP

High Impact-To-Safety Issues:

- **Multi-Module Human Systems Interface**
 - Technical basis for determining if something is allowed in HSI in a multi-module plant?
- **Mixed Technologies**
 - Impacts on I&C, HSI, and operator training?
 - Complexity and safety implications in the event of an accident or other nonsteady-state scenarios?

Operator Staffing for Small or Multi-Module Reactors

Summary Rankings

Overall Rank	Issue Heading and Descriptions	40%	20%	20%	20%	0%	100%	Relatedness
		Safety	Impact on Licensing	Time to Resolution	Resources Needed	Knowledge Gap	Total	Staffing (S), Cross-Cutting (X), or Other (O)
1	<i>D. Scaling</i>	5.00	5.00	5.00	4.00	3.00	4.80	S,X
2	<i>E: Integration</i>	5.00	5.00	5.00	4.00	1.00	4.80	S,X
3	<i>K: Design Basis</i>	5.00	4.67	4.00	3.00	1.00	4.33	S,X
4	<i>B. Multi-Module Human-Systems Interface (HSI)</i>	5.00	4.20	3.00	2.60	2.00	3.96	S,X
5	<i>J: Mixed Technologies</i>	4.33	3.00	4.00	2.67	3.67	3.67	S,X
6	<i>I: Completeness of Task, Job, and Workload Analyses</i>	3.67	3.00	3.00	2.67	1.33	3.20	S,X
7	<i>G: Control Room Design and Crowding</i>	3.67	3.33	2.67	2.33	1.33	3.13	S,X
8	<i>F: Operator Attentiveness</i>	3.67	3.00	2.33	2.00	1.33	2.93	S
9	<i>H: SMRs for Non-Electrical Generation and Mixed Use</i>	2.33	2.67	2.67	1.33	1.33	2.27	S,X
10	<i>A. Reverse Transferability of Staffing Determination</i>	1.00	2.60	1.60	1.00	2.00	1.44	S
11	<i>C. Research Test Reactors as an Example for SMRs</i>	1.00	1.33	1.67	1.00	1.33	1.20	X

Operator Staffing for Small or Multi-Module Reactors

IIRP Recommendations/Conclusions

- Pre-application engagement is extremely important
- Current guidance (NUREGs 0711 & 1791) and pre-application interaction with stakeholders, applicants, public are suitable to address operator staffing concerns in the short term
- Critical issues need to be addressed early for successful reviews of operator staffing exemption requests
- Long term resolution path needs to be identified

Operator Staffing for Small or Multi-Module Reactors

Next Steps

- SECY Paper
- Revisions to NUREG-0800, NUREG-9711, and NUREG-1791
- Identify differences in SMR designs that could impact operator performance and staffing levels
- Continued engagement with external stakeholders
- Long term rulemaking proposal



Questions?