Generic Licensing Topics and Policy Issues for SMRs

Legacy Meeting Centre

June 15, 2011

iPWR LICENSING

Background, Process Changes, and Tools

Stewart Magruder
Branch Chief
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Background, Process Changes, and Tools

Background

(Why Are We Planning To Do iPWR Licensing Reviews Differently?)

- Directed to do so by the Commission in SRM for SECY 11-0024, "Use of Risk Insights to Enhance the Safety Focus of Small Modular Reactor Reviews"

- To gain review process efficiencies by engaging designers, potential licensees, and stakeholders in meaningful pre-application interactions

- To identify and resolve key technical and policy issues associated with iPWRs as early in the application process as practicable

- To incorporate lessons learned from LLWR licensing reviews

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Background

(What Will Not Change?)

<u>The “foundations” of our licensing process work remain unchanged:</u>

- Safety focus
- Confidence in the quality of our technical reviews and findings
- Maintaining regulatory independence and public trust
- Current regulatory licensing framework (10CFR50 and 10CFR52)

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Key History - ARP iPWR Licensing Activities in 2011

- 2/18/11 - SECY 11-0024 published
- 3/16/11 - ACRS recommendations on SECY sent to Commission
- 4/12/11 - NRO senior managers briefed on SECY by ARP
- 5/11/11 - Commission issued SRM for SECY to staff
- 5/27/11 - ARP staff developed draft SRM implementation process and draft iPWR licensing review tools

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SECY 11-0024 - Overview

Review Framework Principles

- Consistent with current regulations
- Consistent with Commission policy
- No change to safety related/non-safety related determination process
- No change to risk significance determination process

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SECY 11-0024 - Overview

- Staff performs "Risk-Informed and Integrated" review
  - Considers both safety category and risk significance
  - Graded review approach
  - Approach integrates technical reviews and performance-based program requirements
  - Used for 10CFR50 and 10CFR52 application activities
- Near-term focus on iPWR licensing reviews
- Longer-range development of new review framework (non-LWR)

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SECY 11-0024 - Overview

- Standard Review Plan Acceptance Criteria
  - Design-related acceptance criteria (current review process)
  - Performance-related acceptance criteria (integrated review process)

- Acceptance criteria includes performance-based programmatic requirements
  - Technical Specifications
  - Reliability Assurance Program
  - Initial Plant Test Program
  - Availability Controls (e.g., RTNSS)
  - Maintenance Rule
  - ITAAC

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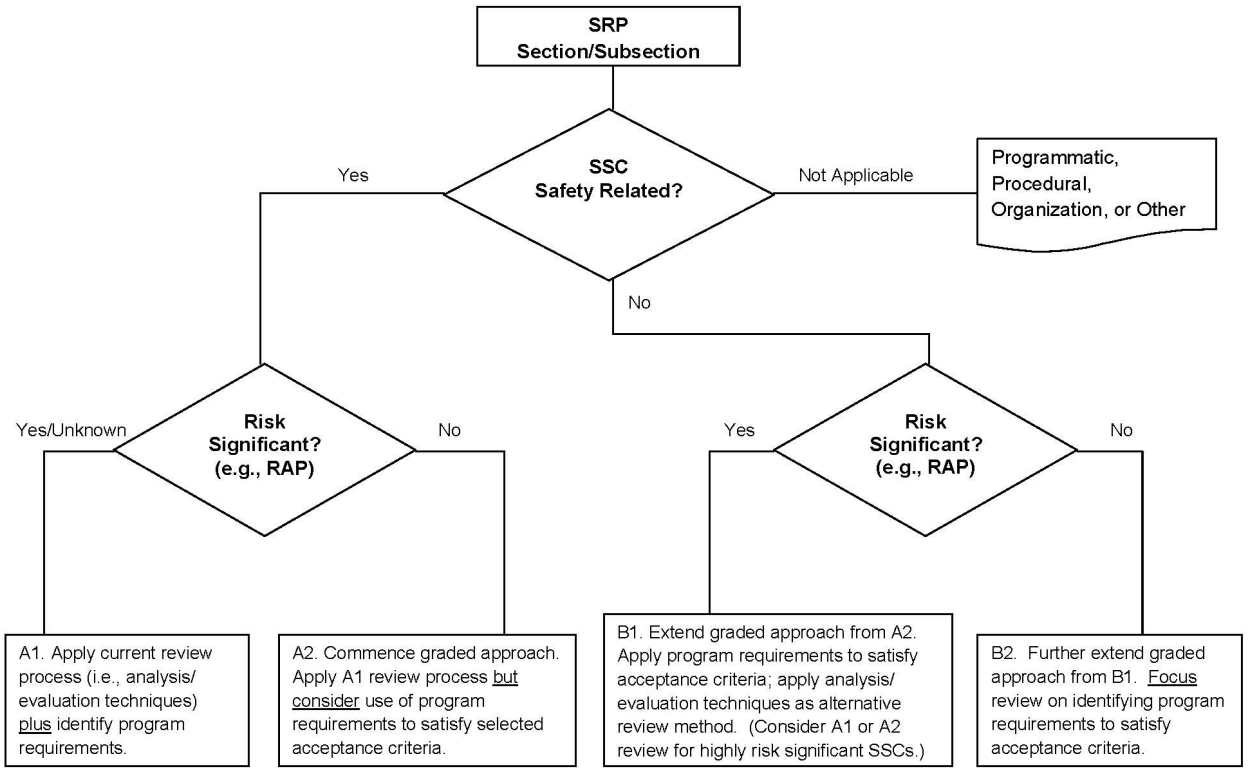
SECY 11-0024 - Risk Informed Categorization



* For programmatic, procedural, organization, or other non-SSC topics (e.g., quality assurance, training, human factors engineering, health physics programs, operating procedures), the current review process is applied as provided in the SRP.

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Implementation Example – Station Service Water System

Acceptance criterion	Current Review	Risk-Informed Review
GDC 2 – protection against natural phenomena	Technical analysis and evaluation	Technical analysis and evaluation
GDC 4 – environmental and dynamic effects	Technical analysis and evaluation	Technical analysis and evaluation
GDC 45 - inspection	Technical analysis and evaluation	Programmatic requirements (initial plant testing, ITAAC)
GDC 46 - testing	Technical analysis and evaluation	Programmatic requirements (reliability assurance program, ITAAC)

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Pre-Application Coordination

- Potential efficiency gains in review process by working activities in pre-application phase
- Review process aided by improved documentation in applications (e.g., fewer RAIs)
- Earlier engagement of public stakeholders in the review process
- Vendor participation required for success

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Current Licensing Review Process

Pre-Application Phase Activities

- Limited contact with potential Licensees and Applicants
- Limited topical/technical report reviews and feedback to potential Licensees and Applicants
- Existing review tools and processes used for all potential Licensees and Applicants
- Existing technical review methodology used as historically applied

iPWR Licensing Review Process

Pre-Application Phase Activities

- Extensive coordination between NRC and potential Licensees and Applicants
- NRC more engaged in review of technical design development - direct feedback to potential Licensees and Applicants
- Technical review guidance documents and regulations compared to potential designs to determine changes needed
- Updated technical review methodology incorporating Commission direction for use of risk-informed review approaches

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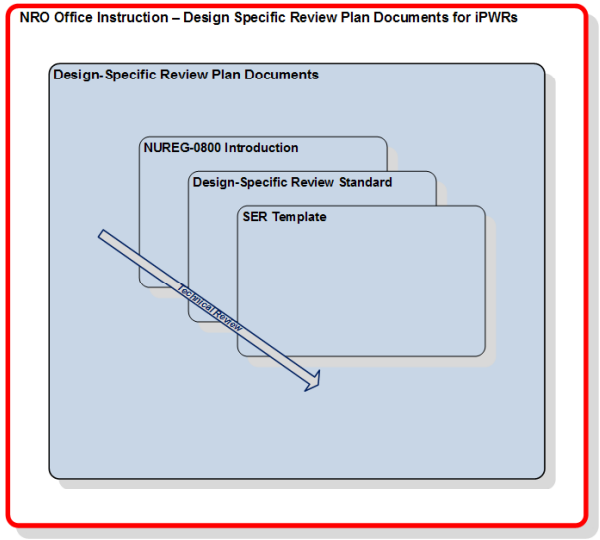

New NRO Office Instruction – NRO-REG-3XX Preparing, Maintaining, and Updating Design-Specific Review Plan Documents for Integral Pressurized Water Reactors

- The Office Instruction (OI) provides an overview of the technical review process and tools.

- The OI provides direction on development and use of the Design-Specific Review Plan (DSRP) supporting documents. Like other OI's, it also defines organizational roles and responsibilities.

- The OI does not specify how to perform a technical review – that information is already provided in NUREG-0800 Introduction.

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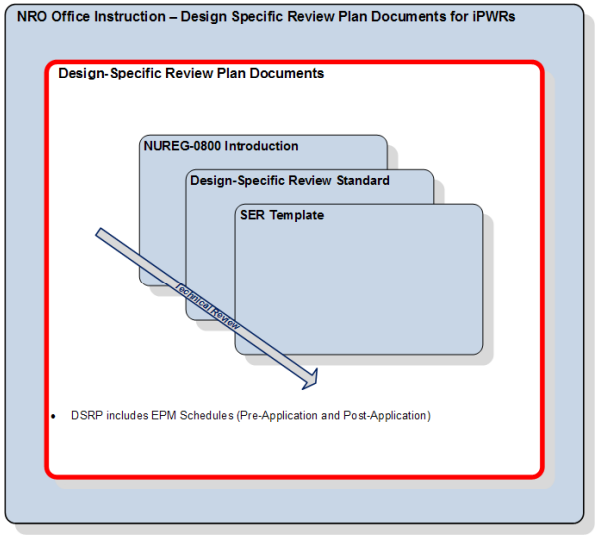

Design-Specific Review Plan Documents (DSRP)

- The DSRP documents are the group of documents guiding pre-application activities and the acceptance and technical review processes for an application.

- Comprised of NUREG-0800 Introduction (updated for SECY 11-0024), EPM schedules, a Design-Specific Review Standard (DSRS), and a design-specific SER Template (SER-T).

- Prepared and maintained by ARP with inputs from technical staff.

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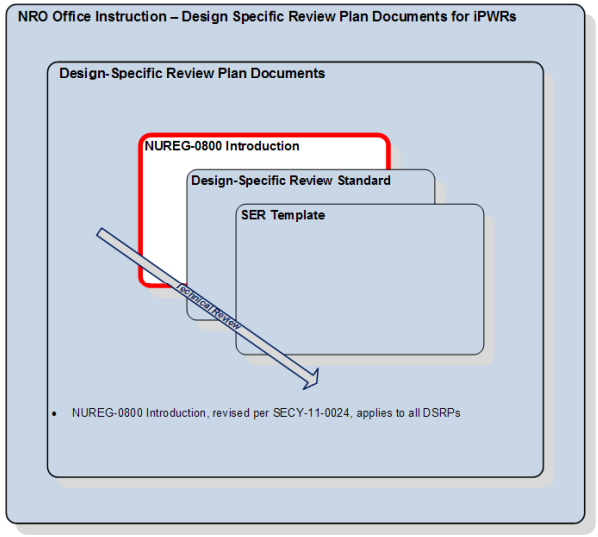

NUREG-0800 Introduction

• The current version of the NUREG-0800 Introduction will be revised to incorporate the Commission direction for performing "risk-informed" reviews of applications (response to SECY-11-0024). A draft revision to the Introduction was submitted with SECY-11-0024.

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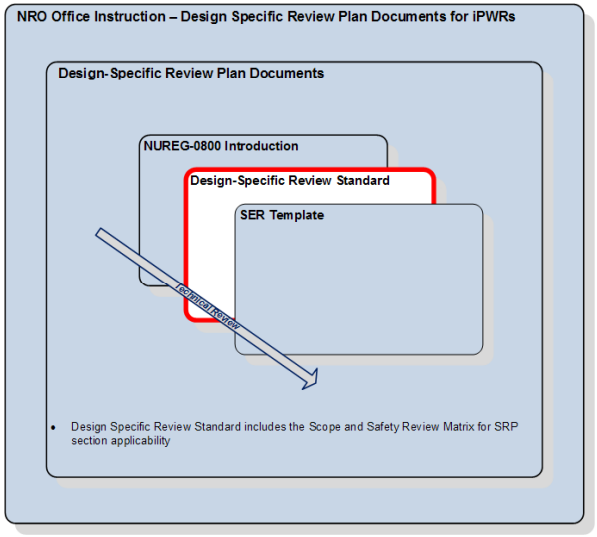

Design-Specific Review Standard (DSRS)

• The DSRS function is similar to the Standard Review Plan (SRP) in the current licensing process, but is adapted for a specific design. A matrix is included to document the applicability of SRP chapters/sections to the design-specific review.

• Each SRP section is reviewed against the design and classified in the DSRS as follows:

- The SRP section is to be used as-is
- The SRP section is to be modified into an "SRP-like" section in the DSRS
- A new "SRP-like" section is to be developed for the DSRS
- The SRP section is not used in the DSRS (not applicable)

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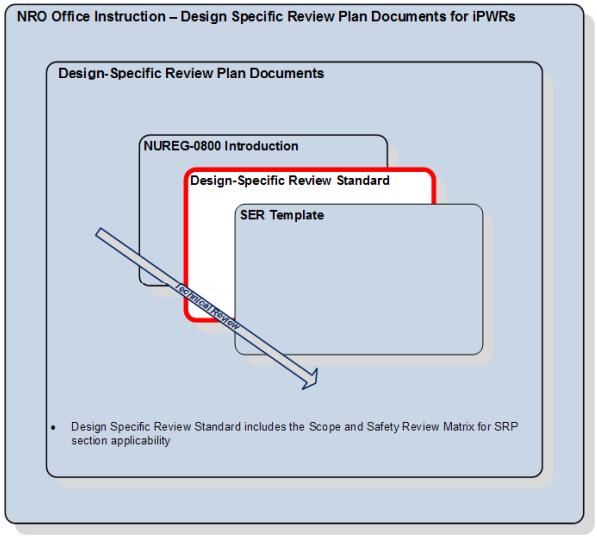

Design-Specific Review Standard (DSRS)

• Individual sections of the DSRS will include a description of the safety and risk categorization for each SSC.

• SRP chapters that address programmatic topics are not likely to include the safety/risk categorization.

- Chapter 2 – Site Characteristics
- Chapter 13 – Conduct of Operations
- Chapter 14 – Initial Test Program and ITAAC
- Chapter 16 – Technical Specifications
- Chapter 17 – Quality Assurance
- Chapter 18 – Human Factors Engineering
- Chapter 19 – Severe Accidents

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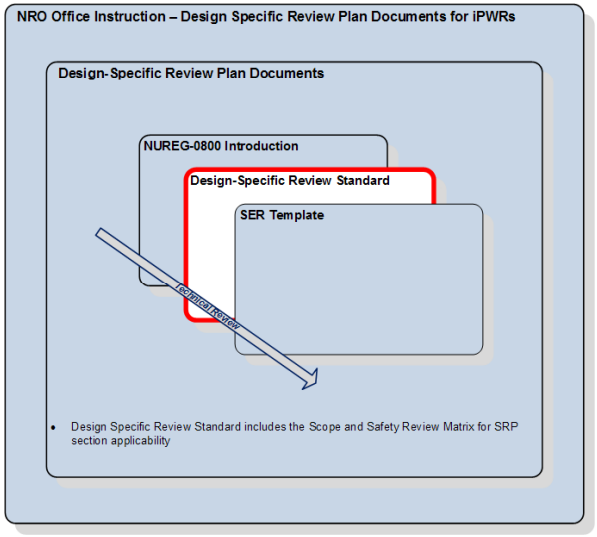

Design-Specific Review Standard (DSRS)

What Has Been Done So Far?

- Initial work has been performed by DOE labs (ORNL, BNL, SNL, PNNL) under guidance of ARP for review and consideration by technical staff.

- Draft DSRS section 9.3.4 for mPower RCIPS has been developed as a template for preparation of remaining DSRS sections.

- SRP chapters 1 - 19 and document references have been reviewed against mPower and NuScale designs. "First-look" results have been compiled in a database identifying potential impacts on SRP sections and associated references.

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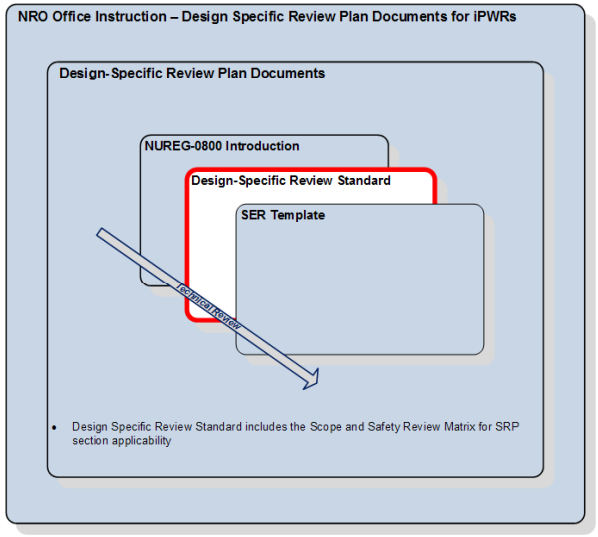

Design-Specific Review Standard (DSRS)

What Still Needs To Be Done?

- Technical staff consider draft DSRS sections as they are developed. A proposed schedule of revisions is available.

- Discuss draft DSRS sections with vendors at public meetings as developed.

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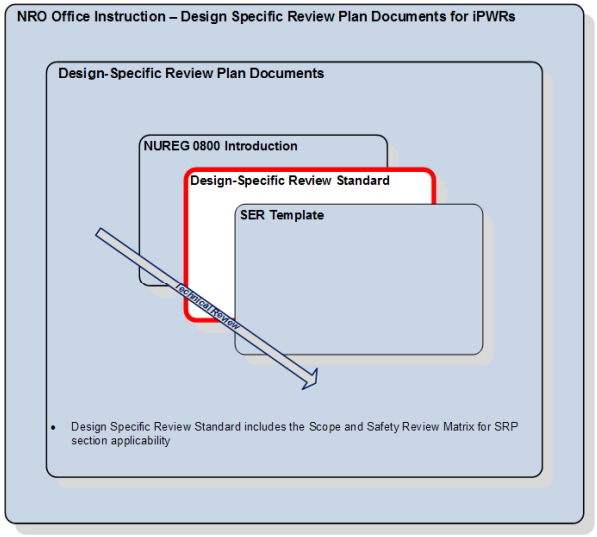

Design-Specific Review Standard (DSRS)

What Still Needs To Be Done?

- Draft mPower DSRS publication target – November 2012 (one year prior to anticipated application receipt). Public comment/resolution period and concurrence by NRO/NSIR/OGC obtained prior to issuance.

- Brief draft DSRS sections with ACRS for meetings consistent with their level of interest in specific topics/areas.

- Develop and issue final DSRS. Concurrence by NRO/NSIR/OGC obtained prior to issuance. Updates to final DSRS will be made using ISG process.

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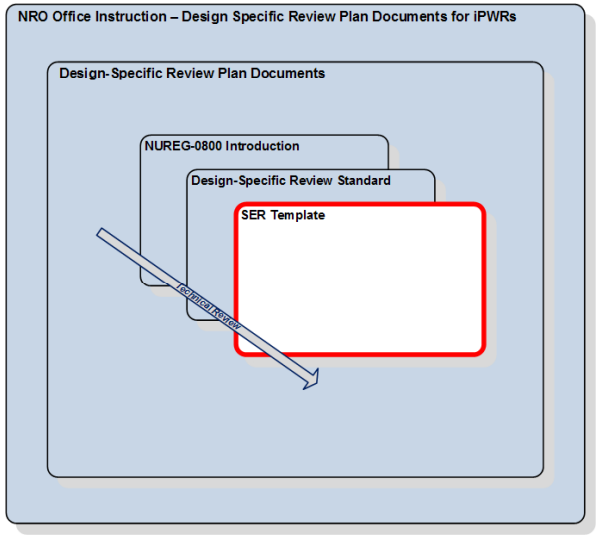

SER Template (SER-T)

• "Tailored" to design – corresponds to design-specific review sections

• Similar to SER standard format (LWR DC & COL) –

- Introduction
- Regulatory Basis
- Tech. Evaluation
- Conclusion
- Application Summary
- Program Requirements (new)
- COL Items

• Program Requirements

  • Specific to SSC

  • Technical Specifications; Availability Controls; Test Program; ITAAC; Reliability Assurance Program; Maintenance Rule

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Summary

• The iPWR licensing process approach is being revised in accordance with Commission direction.

• NRO management's goal is to "bring forward" as much review infrastructure development as possible into the pre-application phase and to incorporate lessons learned from LLWR reviews.

• ARP has lead responsibility for development of the Design-Specific Review Plan Documents in coordination with technical staff.

•Industry/vendor participation is essential for success.

Issue Identification and Ranking Program (IIRP)

James Shea
Project Manager, Source Term Issue
NRO/ARP/ARB1

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ARP - IIRPs

SECY-10-0034, MARCH 28, 2010

"POTENTIAL POLICY, LICENSING, AND KEY TECHNICAL ISSUES FOR SMALL MODULAR NUCLEAR REACTOR DESIGNS"

ARP - IIRPs

SECY 10-0034 Issues Subset with ARP PMs Assigned

- Defense in Depth
- Emergency Planning
- Fees
- Insurance
- Manufacturing License
- Multi Module License Structure
- PRA
- Prototype
- Risk-Informed Licensing
- Security
- Source Term
- Staffing

ARP - IIRPs

SECY 10-0034

Commission stated, "Early resolution or identification of a clear path to resolution for issues related to SMRs will enable designers to incorporate appropriate changes during the development of their designs before submitting a design or license review application".

ARP - IIRPs

SECY 10-0034

"The NRC staff plans to develop proposed resolutions to these potential policy issues and will inform the Commission and other stakeholders of its activities and progress on resolving them".

ARP - IIRPs

Background:

- As a supplement to the ARP policy issue resolution plans stemming from SECY 10-0034, an IIRP was implemented for Tier 1 Topics.
- The process being implemented is similar to that of a traditional Phenomena Identification and Ranking Table Process (PIRT) but for the **ARP SMR Licensing issues only.**
- The goal is to ensure all issues and questions have been identified that would need to be addressed prior to issuing a licensing decision on DCs & COLs for SMR's.
- This project requires coordination among NRC Offices.

ARP - IIRPs

- Issues Identification and Ranking Program (IIRP) Charter Document

  – ARP has initiated the IIRP Program to take a second look for potential non-technical issues that could have a significant impact on NRC **resources or schedule**.

ARP - IIRPs

- A process to implement the IIRP has been developed and applied to Tier 1 topics:
  - Emergency Planning
  - Source Term
  - Security
  - Staffing

ARP - IIRPs

- Types of potential impacts the IIRP is searching for include:
  - Effect on design decisions and associated impact on NRC resources
  - Need for legislation
  - Need for rulemaking or policy changes
  - Need for NRC confirmatory research
  - Dependencies on other policy or technical issues (e.g., source term)

ARP - IIRPs

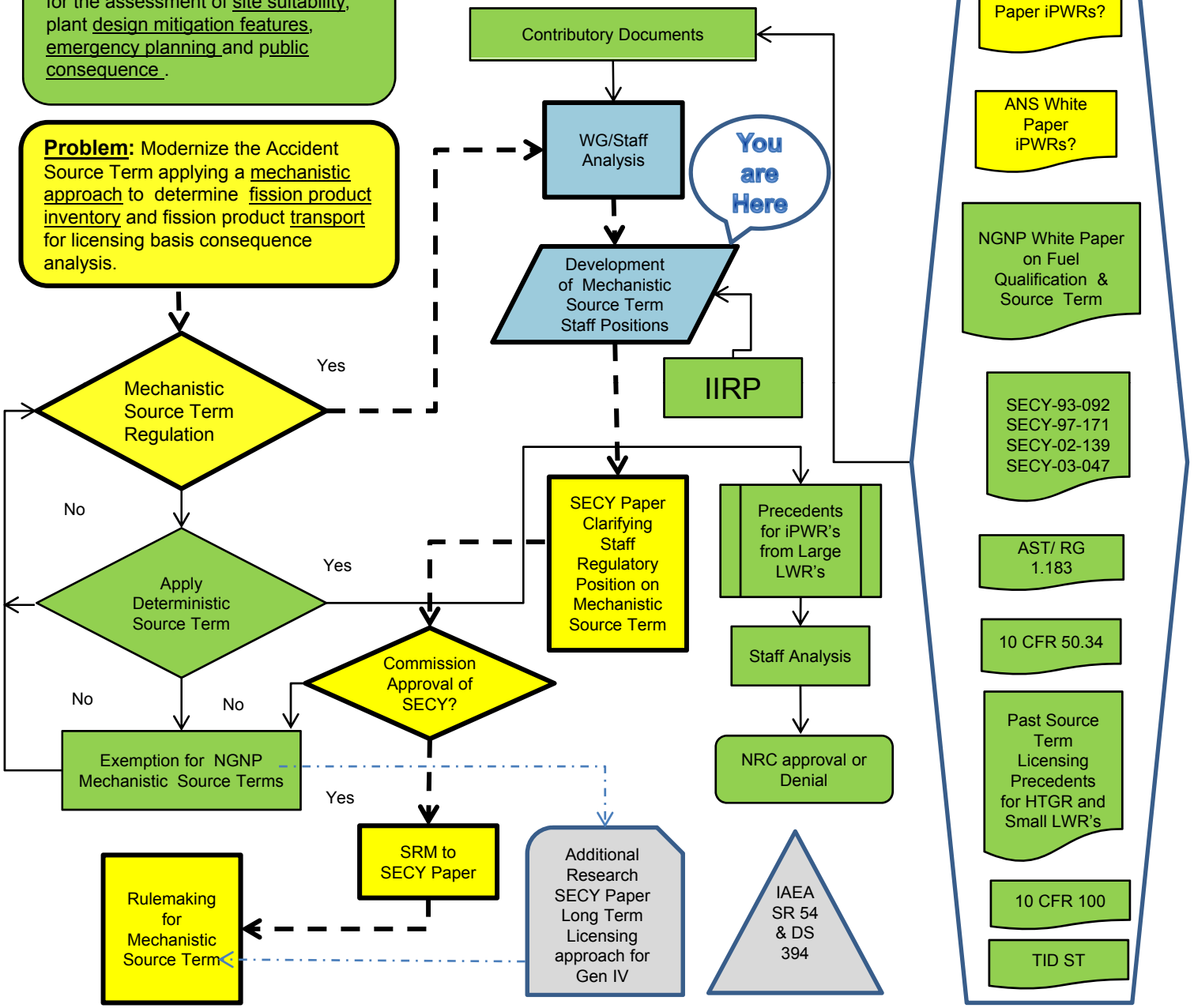
Status:

- Emergency Planning- Complete
- Source Term – Complete – June 30, 2011
- Security - In progress
- Staffing - Complete

ACCIDENT SOURCE TERM ISSUES RESOLUTION

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.



INTERELATIONSHIPS

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

Security: Source Term for DBT for SMR

TABLE 3

ARP IIRP Ranking Criteria MST	40%	20%	20%	20%	Weighting Factor	
Issue Description Summary	**Safety**	**Impact on Licensing**	**Time to Resolution**	**Resources Needed**	**Total**	**Level of Knowledge**
Modularity	**5**	**5**	**5**	**3**	4.6	**H**
					0	
					0	
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					0	

Ranking Criteria number system lowest to highest Rank 1-5

Knowledge Level L-Low - M-Moderate H- Hight


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Questions?

Feasibility Study: Including Risk Information in Categorizing SSCs as Safety-Related or Nonsafety-Related for Small Modular Reactors

Gregory Cranston

Senior Project Manager

NRR/ARP/ARB2

SSC – Structures, Systems, and Components

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Staff Requirements Memorandum SECY-11-024

- Commission Guidelines - Feasibility study should:
  - address potential applicability to overall regulatory framework;
  - not be limited to SMRs;
  - review previous Commission policies regarding use of SR or NSR SSC classification as part of the policy resolution for new or advanced reactors.

SR – Safety-Related
NSR – Non-Safety-Related
SMR – Small Modular Reactor

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Feasibility Study

- Including risk information in categorization of SSCs as SR and NSR for SMR review plans
  - short and long term
  - regulatory infrastructure changes
  - resource requirements
  - timing for implementation
- Consider legal obstacles
  - Impact on NRC Rules
- Include stakeholder input

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Feasibility Study – Cont'd

- Short term – maximize use of existing risk informed policy and guidelines
- Long Term – possible rule and policy changes
  - NGNP and others
  - Operating reactors
  - Transition from traditional safety categorization

Feasibility Study Team

- Will include a multi-Office, multi-Division NRC Feasibility Study Team
  - Office of New Reactors (NRO)
  - Office of Nuclear Reactor Research (RES)
  - Office of Nuclear Reactor Regulation (NRR)
  - Office of General Counsel (OGC)
- Stakeholder input will be considered using periodic public meetings

Schedule

- Final Commission Paper due to Commission October 11, 2011
  - Team kickoff meeting June 14, 2011
  - Public stakeholder engagement meeting
    - Next SMR Licensing Workshop
  - Feasibility Study complete August 2011

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Summary

- Risk-informed and integrated review
- Aggressive schedule
- Stakeholder involvement
- Short term and long term objectives
- Consider legal obstacles
- Consider all options for NGNPs and beyond

NRC Risk Management Task Force

Bill Reckley

June 15, 2011

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Task Force Charter

- The task force should identify the options and specific actions that the NRC could pursue to achieve a more comprehensive and holistic risk-informed, performance-based regulatory structure. The task force will address the following basic questions:

1. Are the current practices adequate for accomplishing the goal of a holistic risk-informed and performance-based regulatory structure?
2. How effective have past and on-going risk-informed initiatives been? What are the relevant lessons learned from these initiaitives?
3. Should the use of risk information continue to be voluntary?
4. How effective have recent major deterministic licensing actions (i.e., license renewals, power uprates, B5b mitigation strategies) been? What are the relevant lessons learned from these actions?
5. What are the visions for a holistic risk-informed, performance-based regulatory structure for reactors, materials, waste, fuel cycle, and security?
6. How can the transition from the current system to a more holistic risk-informed, performance-based regulatory structure be optimized?
7. What is the schedule for achieving this regulatory structure?
8. How should this structure be implemented?
9. How should stakeholder input be considered?
10. In each area, what are the capabilities and limitations of current probabilistic risk assessment methodologies?

Regulatory Programs

- Reactors
  - Operating
  - New Reactors
    - Existing
    - Near Term (e.g., iPWRs)
  - Future Reactors (Gen IV)
- Materials
- Waste
- Fuel Cycle
- Transportation

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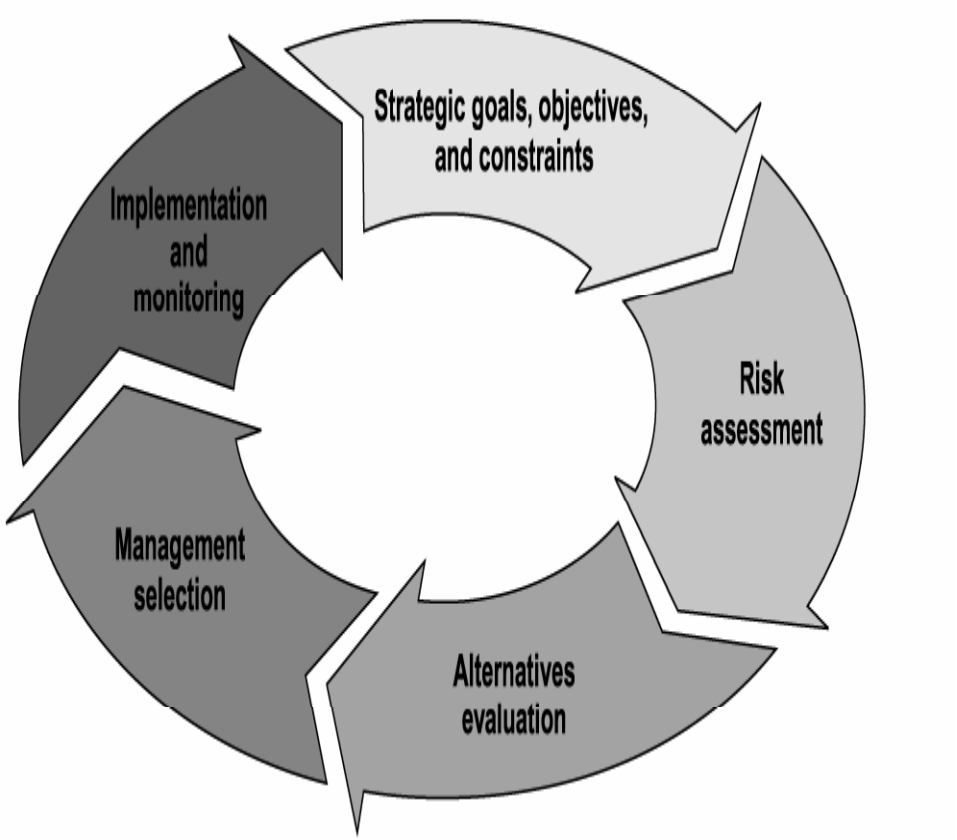
GAO Risk Management Framework



Source: GAO.

Risk Assessments (Part of Overall Risk Management)

- ISO 31010, "Risk Management – Risk assessment techniques," discusses various techniques to assess risks

Discussions and brainstorming	Expert elicitation
Hazard analyses	Scenario analyses
FMEAs	Fault tree analyses
Event tree analyses	Decision trees
Monte Carlo simulations	Cost/benefit analyses
Frequency-consequence curves	Risk indices

NRC Activities

- Regulations & Guidance
- Licensing
- Environmental Reviews
- Oversight
- Other (e.g., Operating Experience)

Regulated Activities

- Design
- Configuration Management
- Operations
- Radiation Protection
- Other (e.g., EP, Security)

Safety Classification (SRM)

- Safety Related
- Non-Safety Related

50.69

- Safety Related Safety Significant
- Safety Related Low Safety Significance
- Non Safety Related Safety Significant
- Non Safety Related Low Safety Significance

Traditional

- Important to Safety
  - Safety Related
- Non-Safety Related

NUREG 1860

- Safety Significant
- Non-Safety Significant

Passive Plants

- Important to Safety
  - Safety Related
  - RTNSS
- Non-Safety Related

IAEA DSG

Type of Safety Function	*Consequences*		
	High	*Med*	*Low*
Preventive	1	2	3
AOO Mitigation	1	2	3
DBA Mitigation (control)	1	2	3
DBA Mitigation (SSD)	2	3	3
Design Extension	4	4	NSR

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Next Steps

- Solicit Views
  - Upcoming Federal Register Notice
- Develop Options
- Complete Report (early 2012)