December 16, 2010

ATTACHED ARE THE SLIDES FROM THE “SMR PRICE-ANDERSON POSITION PAPER OVERVIEW” PRESENTATION, WHICH WAS GIVEN AT THE DECEMBER 16, 2010 PUBLIC MEETING REGARDING GENERIC LICENSING TOPICS FOR SMALL MODULAR REACTORS (MEETING NOTICE ML103370124)

THESE SLIDES WERE PROVIDED ON THE DATE OF THIS COVER SHEET.

SMR Price-Anderson Position Paper Overview

NRC SMR Licensing Public Meeting
December 16, 2010

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SMR Financial Protection: Terminology

- Price-Anderson Act describes financial protection requirements for NRC "licensees" and NRC licensed reactor "facilities"
- The statute uses rated electrical capacity as a descriptor
- Statute and NRC regulations address areas relevant to SMRs
  - Combination of 2 or more facilities located at a single site
  - Each having a rated capacity between 100 and 300 MWe
  - Combined rated capacity of no more than 1300 MWe
  - Also addresses reactors with rated capacities of less than 100 MWe

SMR Financial Protection: Issue Description

- **Small modular reactor industry position:**
  - **Because of differences in design, potential liabilities associated with SMRs are of lower magnitude than those associated with larger light water reactors (LWRs)**
  - **Some statutory and regulatory requirements for nuclear power reactors – such as financial protection and insurance provisions – may not appropriately reflect this difference**
  - **The current legal and regulatory framework for SMR financial protection may result in unwarranted financial burdens and "over-insurance" of SMRs**

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SMR Financial Protection: Position Paper Approach

- SECY-10-0034: SMR insurance issues may warrant Commission consideration
- An industry working group (subset of NEI SMR Licensing Task Force) is evaluating financial protection provisions to determine whether changes to the Price-Anderson Act and/or NRC regulations relating to SMRs are needed
- Working group on financial protection requirements includes NEI staff, SMR vendors, potential utility users and nuclear insurance providers

SMR Financial Protection: Position Paper Approach

- **Fall 2010: Industry working group summarized current financial protection provisions, including those applicable to SMRs, in the Price-Anderson Act and NRC regulations (10 CFR Part 140)**
  - **Liability insurance protection**
  - **Property insurance**
  - **Provisions relevant to SMRs**
  - **Basis for current requirements includes large LWRs, small reactors, research/test reactors**

SMR Financial Protection: Position Paper Approach

- **1Q 2011: Industry working group will compare current financial protection requirements for SMRs and develop recommendations for changes to these requirements in support of SMR community as necessary**
  - **Specialized industry expertise on the Price-Anderson Act and NRC financial protection requirements will be sought to further inform industry's proposals**
  - **SMR community to lead this effort; NEI to coordinate**
  - **NRC expertise and experience would be welcome**

Industry Involvement in Evaluation

- Ensures that diverse needs in this area will be addressed by paper
- SMR Vendors
  - B&W
  - GE-Hitachi
  - Hyperion
  - NuScale
  - Westinghouse
- Utilities
  - Duke
  - Southern
  - SCE
  - TVA
- Nuclear Insurers

Open Questions to be Addressed by SMR Financial Protection Position Paper

- Changes needed to support SMR deployment, if any
  - Statutory (if applicable)
  - Regulatory (if applicable)
    - Potential use of exemption process
- Treatment of non-electric applications

SMR Financial Protection: Position Paper Approach

- Evaluate existing requirements for planned deployment configurations
  - Rated capacity thresholds
  - Financial protection formula
  - Treatment of multi-module licenses and sites
- Determine if requirements are appropriate, with input from insurers, vendors and utilities
- If necessary, evaluate changes and propose alternatives

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SMR Financial Protection: Evaluation of Current Requirements

Current Requirements				
Output / Unit	**#Units / Site**	**Gov't Indemnity**	**Primary**	**Secondary Retroactive Liability*** **
600 MWe	1	0	$375 million	$111.9 million x 104+ units
600 MWe	2	0	$375 million/site	$111.9 million x 104+ units
300 MWe	1	0	$375 million	$111.9 million x 104+ units
300 MWe	*2*	*0*	*$375 million/site*	*$111.9 million x 104+ units*
100 MWe	1	0	$375 million	$111.9 million x 104+ units
100 MWe	*2*	*0*	*$375 million/site*	*$111.9 million x 104+ units*
75 MWe*	1	$486 million	$74 million**	$0
75 MWe*	2	$486 million	$74 million/site	$0
75 MWe*	4	$486 million	$74 million/site	$0
50 MWe*	1	$500 million	$55.5 million	$0
50 MWe*	2	$500 million	$55.5 million/site	$0
50 MWe*	6	$500 million	$55.5 million/site	$0
10 MWe*	1	$500 million	$11.1 million	$0
10 MWe*	2	$500 million	$11.1 million/site	$0

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

** Under 10 CFR § 140.12, maximum financial protection is $74 million.

*** Secondary coverage does not include the 5% surcharge.

Challenges in Developing SMR Financial Protection Position Paper

- Complexity of this issue
- Diversity of SMR designs and resulting difficulty in reaching industry consensus
- Need to avoid negative impacts on LWR financial protection requirements

SMR Application Format and Content Position Paper Overview

NRC SMR Licensing Public Meeting

December 16, 2010

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Outline

- Goal: Assure efficient application and review for non-standard small reactors
  - Objectives of the paper
  - Current regulatory framework
  - Scope of Issues
    - Adapting LWR regulations to SMR technology
    - Review of application requirements
    - Expectations for SMRs
    - NRC feedback mechanisms
    - Adapting Standard Application Content
    - Manufacturing license approach
    - Lessons learned from the advanced LWRs
  - Conclusions

Objectives of Paper

- Define process for SMR applications (DC, ML, COL, etc.) for unique features different than near-term (large) LWRs.
  - Application completeness for “N/A’s”
  - Level of detail for new issues
  - Format and content adaptation process
  - Achieve agreement and predictability for application
- Establish pre-application engagement objectives for SMR designs
- Apply lessons learned from the near-term (large) LWR licensing experience

Reasons for Pre-Application Engagement

- SMRs may not always be a "good fit" with the SRP and we need to agree with the NRC staff on how to write the DCD (e.g., clarify applicability of aspects of the guidance)
  - e.g., multi-module issues
- Address issues that represent commercial deployment risk regarding issues unique to SMR technology
  - e.g., human factors issues
- Address specific topics that may require early/ advance assessment (such as acceptability of specific component design and/or analytical methods models/techniques)
  - Fuel qualification issues
  - Source term issues
  - Design basis issues
  - Defense in depth issues
  - Approach to accident selection
  - Classification of SSCs/regulatory treatment of non-safety systems (RTNSS)
  - Evolving codes and standards

Reasons for Pre-Application Engagement

- Confirm long lead prototypes and physical testing plan adequacy:
  - Demonstrate how design will work
  - Understand the phenomena for code validation
  - Test because it's a new component design unfamiliar to NRC
- Identify required changes to policies, regulations, and guidance
  - "Gaps" identified by NEI SMR task force
  - Changes to (exceptions form) SRP/format and content guidance
- Applicant qualifications – QAPD
- Familiarization for the NRC staff
- Alignment of expectations

"No Surprises"

Current Regulatory Framework

- 10 CFR Part 50 or 10 CFR Part 52
  - Two-step or single-step licensing process
- Focusing on licensing processes
  - Early Site Permit
  - Reactor Design Certification
  - Combined License
  - Standard Design Approval
  - Manufacturing License
  - Standardization of Designs (at multiple sites)
  - Construction Permit
  - Operating License

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Current Regulatory Framework

- **Application Format and Content Guidelines**
  - **Standard Review Plans**
    - **NUREG-0800**
    - **NUREG-1555**
  - **Regulatory Guide 1.70**
    - **Addresses nuclear safety aspects of application filed under Part 50**
    - **Last revised in 1978**
  - **Regulatory Guide 1.206**
    - **Addresses broader aspects beyond nuclear safety aspects of applications filed under Part 52**
    - **Includes elements of the safety analysis**
    - **Completed in 2007**
  - **Plus many other Regulatory Guides, Interim Staff Guidance, generic communications, acceptance review procedures, and NEI templates**

Adapting LWR Regulations to SMRs

- Determine during pre-application phase
  - Shapes expectations for applicants and NRC – "no surprises"
  - Guides development and review of application
- Incorporate risk-informed, performance-based insights
  - To better understand events to include in licensing basis
  - To provide structure for assuring a complete description of the unique features design
  - To integrate new or unique design features into the application framework
  - To focus resources on the most safety significant features

Review of Application Requirements

- For designs that differ significantly from existing LWR designs
  - For example:
    - Must provide essentially complete nuclear power reactor design per 52.47(c)(2)
    - Must meet requirements of 50.43(e)
      - Safety features demonstrated through either analysis, test programs, experience or combination
      - Interdependent effects of safety features demonstrated by analysis, test programs, experience for combination
      - Assessment of analytical tools over range of conditions
      - In lieu of the above, acceptable testing of a prototype plant

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Perform Regulatory Gap Analysis

Demonstrate the Standard Review Plans remain primary foundation

- **Produce amended format and content guide**
  - **Identify current design related regulations**
    - **Fully applicable**
    - **Partially applicable**
    - **Not applicable; or**
  - **Identify design features not addressed by standard format**
    - **Agree on what to add**
    - **Agree on where to locate**
    - **Agree on how much detail**

Pre-Application Engagement Tools

- Licensing Topical Reports
  - Supplement document for technical nuclear safety topics
  - Embrace use of unique or new safety analysis codes, confirmation of adequacy of test data, etc.
  - Protects proprietary information
  - Approved by NRC in advance or in parallel of application
  - Become formal licensing basis
- Technical Reports
  - Safety evaluation can be incorporated into SER for DC/COL/ML
  - Does not always require separate NRC SER
  - Protects proprietary information

Pre-Application Engagement Tools

- White Papers
  - Valuable during pre-application engagement
  - It's the first step
  - Shape new issues where regulatory framework is uncertain or unknown
  - Suggests strategic approaches that have the potential to influence commercial deployment
- Workshops and meetings

Pre-application engagement helps establish alignment and mitigates risks of very long review times

NRC Feedback Options

- **Pre-applicant should be clear about desired feedback mechanism**
  - Public meetings and workshops
  - Application orientation meetings
  - NRC status review letters
  - Interim Staff Guidance
  - Safety Evaluations
  - Commission SRM

Preferred option is dependent on what the issue is and is the one that provides reasonable stability, predictability for "no surprises" during application review

Adapting Standard Application Content

- Capture all pre-application agreements that impact format and content in one document
  - "SMR *x* – format and content fixed"
  - Treat as work product to come to final document agreement
  - Down to the *x, y, z* level
  - Submit final 60 days after "Regulatory Freeze Date"
- Deviations for regulatory requirements and guidance
  - Set of Conformance Evaluation Tables
  - FSAR Section 1.9
  - Annotate detailed section x, y, z changes to reflect proposed approach for unique features
  - Add unique features at the end of the chapter
- Format tools
  - Don't change chapter/section numbering for "N/A's"
  - Incorporation by reference
  - Electronic links
  - Left margin annotations
  - Use of precedent

Near-Term (Large) LWR Lessons Learned

There are many lessons learned from the advanced LWR licensing applicable to SMR licensing

- Conform to applicable regulations
- Confirm design-specific list of applicable regulatory documents
- Use systematic decision-making process
- Capture and document agreements
- Establish numbering system consistent with SRP sections
- Distinguish between topical reports and technical reports; review timeframes and documentation (endorsement, approval, acceptance)

Manufacturing License Approach

- ML applicant address the design and manufacturing issues
- SMR customer addresses all site specific issues
  - Environmental
  - Siting
  - Construction
  - Operation issues
- COL application must demonstrate that the design of the facility falls within the site characteristics and design parameters specified in the FSAR or ESP for the site

Pre-application process described could be equally adopted

Conclusions

- Unique aspects of each SMR technology require individual pre-application engagement to define how to utilize existing application guidance
  - Perform gap analysis of all regulations
  - Use of risk-informed licensing approach
  - Address scalable modular application topics – 10CFR52.47(c)(3)
  - Incorporate agreements from pre-application engagement in one place

Conclusions

- A well-planned approach is essential for complete application development and enables a subsequent efficient regulatory review process and regulatory certainty for designs that differ from near-term (large) LWRs
  - Make the most of the pre-application period
  - Agree on application section requirements to address multi-modular configurations
  - Agree on long-lead physical test programs
  - Agree on topical and technical reports submitted prior to application
  - Obtain NRC endorsement of the documented set of revised application requirements
  - Obtain NRC endorsement of Format and Content Guide for a specific design
  - Establish revised expectation agreement prior to submittal

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Next Steps

- Desired outcome: NRC agreement on process for adapting existing regulatory framework and the application format and content
  - Incorporate comments to white paper
  - Submit white paper – January 5
  - Discuss NRC response – January 26
  - Implement process

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Application General Discussion

COL Application

Part 0	Cover Letter, Affidavits, etc
Part 1	Administrative and Financial Information
Part 2	Final Safety Analysis Report (FSAR)
Part 3	Environmental Report
Part 4	Technical Specifications
Part 5	Emergency Plan
Part 6	Limited Work Authorization
Part 7	Departures and Exemption Requests
Part 8	Safeguards/Security Plans
Part 9	-- Sensitive Information –
Part 10	ITAAC
Part 11	Enclosures

Part 2 – FSAR

1 Introduction and General Description of the Plant
2 Site Characteristics
3 Design of Structures, Systems, Components, and Equipment
4 Reactor
5 Reactor Coolant and Connecting Systems
6 Engineered Safety Features
7 Instrumentation and Controls
8 Electric Power
9 Auxiliary Systems
10 Steam and Power Conversion System
11 Radioactive Waste Management
12 Radiation Protection
13 Conduct of Operations
14 Verification Programs
15 Transient and Accident Analyses
16 Technical Specifications
17 Quality Assurance and Reliability Assurance
18 Human Factors Engineering
19 Probabilistic Risk Assessment and Severe Accident Evaluation

Guidance & Insights from New Reactor Pre-Application Interactions and Subsequent Reviews

- Standard Review Plan
  - Branch Technical Positions
- Regulatory Guides
- Interim Staff Guidance
- Industry Codes and Standards
- Regulatory Guide 1.206
- NRC Safety Evaluation Reports
- Applications, RAIs, Responses & Revisions

Preliminary Gap Analyses

- Recent assessment performed by NRC contractors (labs) for some reactor designs
  - Sharing with specific vendors
- Previous assessments (different reactor types) at regulations and GDC levels are publicly available
- Previous submittals and NRC assessments are publicly available (e.g., NUREGs 1338 and 1368)
- Applications and NRC SERs for evolutionary designs (passive features) are publicly available
- Application guidance being prepared by NEI working group and NGNP

Innovative Design Features

10 CFR 50.43

(e) Applications for a design certification, combined license, manufacturing license, or operating license that propose nuclear reactor designs which differ significantly from light-water reactor designs that were licensed before 1997, or use simplified, inherent, passive, or other innovative means to accomplish their safety functions, will be approved only if:

(1)(i) The performance of each safety feature of the design has been demonstrated through either analysis, appropriate test programs, experience, or a combination thereof;

(ii) Interdependent effects among the safety features of the design are acceptable, as demonstrated by analysis, appropriate test programs, experience, or a combination thereof; and

(iii) Sufficient data exist on the safety features of the design to assess the analytical tools used for safety analyses over a sufficient range of normal operating conditions, transient conditions, and specified accident sequences, including equilibrium core conditions; or

(2) There has been acceptable testing of a prototype plant over a sufficient range of normal operating conditions, transient conditions, and specified accident sequences, including equilibrium core conditions. If a prototype plant is used to comply with the testing requirements, then the NRC may impose additional requirements on siting, safety features, or operational conditions for the prototype plant to protect the public and the plant staff from the possible consequences of accidents during the testing period.

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Loss of Large Areas – 10 CFR 50.54(hh)(2)

December 16, 2010

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Regulatory Requirements

- Effective on May 26, 2009.
- Section 50.54(hh)(2)
- Section 52.80(d)

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Guidance for Operating Reactors

- "Phase 1" for operating reactors in February 2005

- NEI 06-12, "B.5.b Phase 2 & 3 Submittal Guideline," Rev 2, December 2006
  - Phase 2 includes specific measures to restore/maintain cooling of fuel in the spent fuel pool
  - Phase 3 includes specific measures to restore/maintain cooling of fuel in the reactor vessel and to minimize radiological release

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Guidance for New Reactors

- NEI 06-12, Chapter 4 + template for submittals
- NEI submitted NEI 06-12, Revision 3 to NRC for endorsement on July 17, 2009
- Interim Staff Guidance (ISG)-16

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Generic Policy Issues Status

William D. Reckley
Advanced Reactor Program
Office of New Reactors

Generic Licensing Issues

- NRC annual fees
  - Preparing Commission Paper
  - Issuance expected in January 2011
- Liability & property insurance requirements
  - Awaiting NEI Position Paper
  - Limited assessment of approaches/options
- Decommissioning Funding
  - Reviewing NEI Position Paper
  - Evaluating Appropriate Response
    - Guidance Documents

Generic Licensing Issues

- Multi-Module Licensing
  - Reviewing NGNP White Paper
  - Awaiting NEI Position Paper
  - Preparing Commission Paper
  - Issuance expected in Spring 2011
- Risk Informed Licensing Approach
  - Includes defense-in-depth, PRA
  - SRM Response
  - Reviewing NGNP White Papers
  - Preparing Commission Paper
  - Issuance expected in February 2011

Generic Licensing Issues

- Key Component and System Design Issues
  - Identifying key technical issues
    - NRC staff, National Laboratories
  - Initiating appropriate internal & external discussions
  - Some may involve Commission notifications and/or policies; many should involve significant pre-application interactions

Generic Licensing Issues

- Appropriate Source Term
  - Reviewing NGNP White Paper (mechanistic)
  - Awaiting information regarding iPWRs
  - Evaluating Possible Approaches/Options
  - Important Relationships to Other Issues
- Emergency Preparedness
  - Reviewing NGNP White Paper
  - Awaiting NEI Position Paper
  - Evaluating Possible Approaches/Options
  - Propose meeting in January 2011 (w/ NGNP)
  - Framework SECY Paper in Spring 2011

Generic Licensing Issues

- Operator Staffing
  - Ongoing interactions with vendors
  - Developing approach to assess staffing proposals
  - Interactions with NRC Office of Nuclear Regulatory Research, other research activities
  - Will engage stakeholders
    - Position Papers, Topical Reports, etc.
  - To prepare one or more Commission Paper
  - Issuance Expected by Summer 2011
- Other staffing requirements?

Generic Licensing Issues

- Industrial Facilities/Process Heat
  - NGNP Interactions
- Security and Safeguards Requirements for SMRs
  - Assessing Possible Approaches/Options
  - SGI Protection Programs – Information to Vendors
- Aircraft Impact Assessments for SMRs
- *Loss of Large Areas Due to Fires/Explosions*
- Operational Programs