FEBRUARY 8, 2011

ATTACHED ARE THE SLIDES FROM THE “NRC SMR LICENSING WORKSHOP” PRESENTATIONS, WHICH WERE GIVEN AT THE JANUARY 26, 2010 PUBLIC MEETING BETWEEN NGNP AND THE NRC (MEETING NOTICE ML110100693)

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

Status of Generic Issues Related to SMR Licensing

NRC SMR Licensing Workshop

January 26, 2011

NUCLEAR ENERGY INSTITUTE

Overview

- NEI SMR Licensing Task Force engaged in effort to develop position papers on multiple generic licensing issues
  - Four industry position papers submitted since November 2010
  - Two more industry position papers forthcoming in near future
  - Five industry position papers slated for completion by mid-2011
- Intent is to maximize efficiency of industry and NRC resources

Completed Position Papers

- NRC Annual Fees (November 2010)
- Decommissioning Funding (November 2010)
- License Structure for Multi-Module Facilities (December 2010)
- Pre-Application Engagement (January 2011)

Near-Term Position Papers

- **Emergency Preparedness Activities**
  - First paper of two planned papers on EP
    - Focuses on activities within the EPZ
    - EPZ sizing being addressed in separate paper forthcoming in mid-2011
  - Anticipated completion of EP activities paper in February
- **Price-Anderson Liability Insurance**
  - Evaluating implications and interpretation of current statute and NRC regulations
  - Coordinating with insurers, vendors, and utilities to review potential recommended changes
  - Anticipated completion of paper in March

NEI

Position Papers Under Development for Mid-2011 Submittal

- EPZ sizing
- Security design and staffing
- Loss of large areas
- Modularity and source terms
- Plant and site staffing

EPZ Sizing

- Complementary to first paper on activities within EPZ
- Will evaluate current basis for EPZ
- Anticipate proposing framework for developing EPZs appropriately-sized for SMRs
- Will be discussing overview of paper later today

Security Design and Staffing

- Focusing on evaluation of current requirements
  - Application of advanced technology
  - Cyber security
  - Aircraft impact
  - Staffing
- May propose framework more appropriate for SMRs

Loss of Large Areas

- Additional generic issue being pursued by industry
  - Following input from staff at December 2010 SMR licensing workshop
  - Will address 10 CFR 50.54(hh)(2) and 52.80(d) as appropriate for SMRs
  - Will evaluate applicability of ISG-16
- Focus of paper will remain generic

Modularity and Source Terms

- Focus of paper will be generic
- Intent is to provide high-level approach applicable to
  - iPWRs
  - Non-LWRs
- Appropriate consideration of
  - Design specific features
  - Delayed and reduced releases
  - SMR-specific accident scenario considerations

Plant and Site Staffing

- Position paper will evaluate minimum site staffing needs
  - Reviewing current regulatory framework
  - In concert with evaluation of emergency planning, security and control room staffing needs
- Propose changes for SMRs as appropriate

Summary

- Several position papers completed to date
- Anticipate two near-term submittals
- New NEI SMR Working Group will provide executive input on direction of activities
- NEI SMR Licensing Task Force planning additional papers to be completed by mid-2011
- Industry looks forward to NRC feedback on all position papers

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Staff Requirements – COMGBJ-10-0004/COMGEA-10-0001

Risk-Informed, Performance Based Licensing Approach

Bill Reckley, NRO/ARP

January 26, 2011

Background: Staff Requirements – COMGBJ-10-0004/COMGEA-10-0001

a) Develop a framework, implementation strategy, and plans and schedules to more fully integrate the use of risk insights into pre-application activities and the review of small modular reactor applications (SMR), consistent with Commission Policy Statements.

b) Align review focus and resources, consistent with regulatory requirements, to risk-significant SSCs and other aspects of the design that contribute most to safety to enhance the efficiency of the review process.

c) Develop risk-informed licensing review plans for each of the SMR reviews including the associated pre-application activities.

d) Develop a new risk-informed regulatory framework building, as a long-term objective, on the SMR reviews, insights gained from the NGNP review activities and the earlier Technology Neutral Framework presented in NUREG-1860.

Holistic Risk-Informed Review Framework (iPWRs)
[SRM paragraphs a & b]

Current Thinking on Framework Approach:

- Remain consistent with current regulations and Commission Policy
- Retain Standard Review Plan (NUREG-0800) as primary source of review guidance and Acceptance Criteria
- Incorporate risk insights into current review process – passive LWR designs (ESBWR, AP1000), iPWR design features and test facilities
- Identify the regulatory controls which are applicable to specific SRP acceptance criteria for SSCs

  Regulatory Controls include:
  - Technical Specifications
  - Availability Controls (e.g., RTNSS)
  - Startup Test Program
  - Maintenance Rule
  - Reliability Assurance Program
  - ITAAC

Correlation of SRP Acceptance Criteria and Performance Based Program Controls

Acceptance Criteria Attribute	Program Requirements
Capability	Technical Specifications
Availability	Availability Controls
Reliability	Reliability Assurance Program
Maintainability	Maintenance Rule
Codes/Standards	Initial Test Program
Environmental Effects	ITAAC (inspections, tests, analyses and acceptance criteria)

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Holistic Risk-Informed Review Framework (iPWRs)
[SRM paragraphs a & b] - continued

Framework Approach (cont):

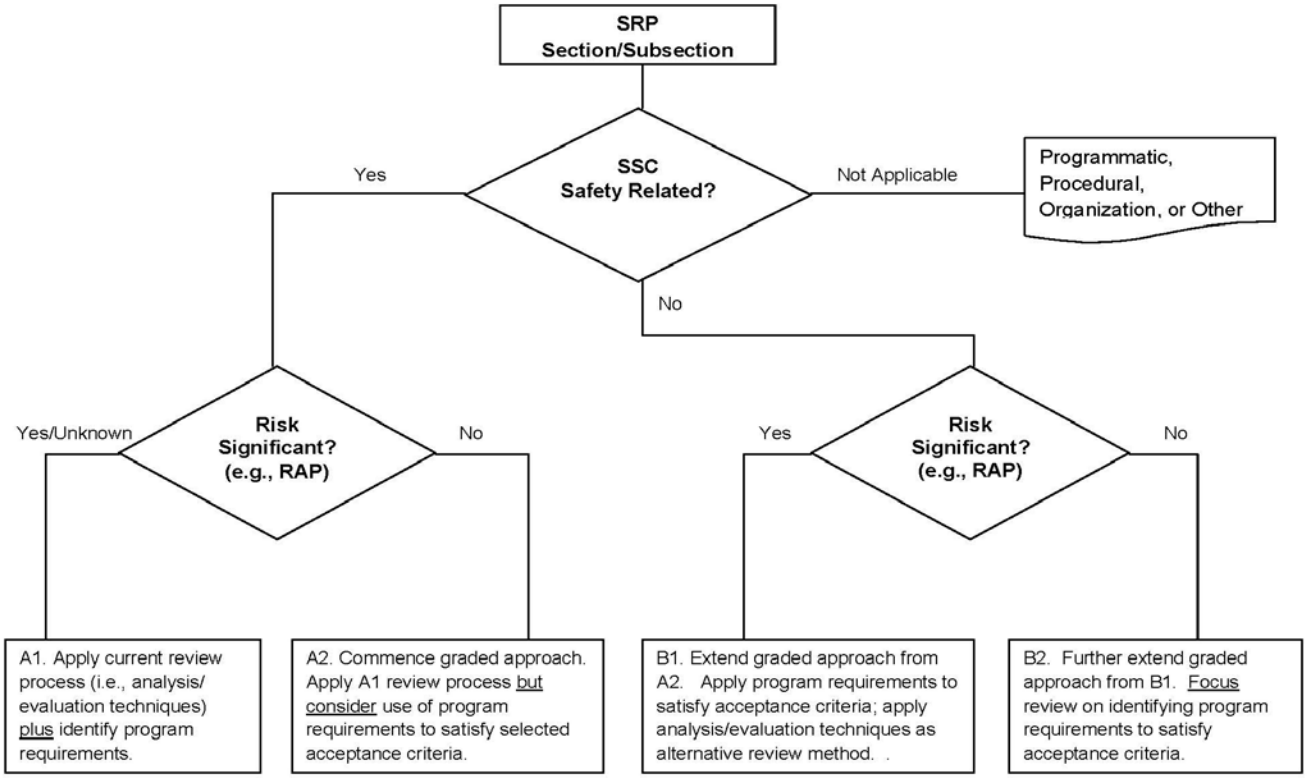
- Risk-inform the current review process by considering risk significance of SSCs to determine the type and depth of review (i.e., “graded review”)
- Perform review of system functions, interactions, and other information needed to assess safety classification and risk significance
- Apply specific regulatory controls to supplement or replace, as appropriate, the current review process technical analysis/evaluation pertaining to specific SRP acceptance criteria
- Retain Safety Evaluation Report as documentation of the “reasonable assurance” finding (updated template)

Holistic Risk-Informed Review Framework (iPWRs) [SRM paragraphs a & b] - continued

Framework Documentation:

- Standard Review Plan – revised SRP Introduction (i.e., "chapter 0") to describe new review framework and provide guidance to reviewers
  - Draft to be issued for public comment, ACRS review, etc.
- Standard Review Plan – revised individual SRP sections/sub-sections (include in Design-specific Review Plans) to incorporate:
  - Risk insights from passive LWR designs (ESBWR, AP1000)
  - Risk insights associated with iPWR design features
  - Regulatory controls pertaining to Acceptance Criteria
- Safety Evaluation Report – revise template to address regulatory controls

Holistic Risk-Informed Review Framework (iPWRs) [SRM paragraphs a & b] – continued



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

Holistic Review Framework (iPWRs)
[SRM paragraph c]

Design-specific review plan includes:

- Standard Review Plan "tailored" to design (i.e., SRP sections added/deleted/modified as appropriate to design)
- Schedule(s) for pre-application and application activities
- Safety Evaluation Report template "tailored" to design (correspond to tailored SRP sections)

Pre-application activities include:

- Topical/technical reports – vendor submittal and staff review
- Audits of vendor information, programs, and processes
- Review of conceptual/draft/preliminary design information
- Determination (preliminary) of SSCs – safety-related or non-safety-related; risk significant or non-risk significant
- Requests for additional information (informal)
- Documentation of pre-application review in SER template format

Holistic Review Framework (iPWRs)
[SRM paragraph c] – continued

Post-application activities include:

- Application Acceptance Review
- Requests for additional information
- Determination (final/confirmatory) of SSCs – safety-related or non-safety-related; risk significant or non-risk significant
- ACRS meetings
- Review of completed/finalized application information
- Preparation of final SER

Coordination with Application

- Activities directed at improving effectiveness and efficiency of NRC review process (i.e., no changes to regulatory requirements applicable to SSCs or applications)
- **BUT**
  - Changes in NRC staff review (e.g., increased coordination of performanced-based programmatic controls) would be helped by improved coordination of SSCs and programmatic controls in applications
  - Improved coordination in applications likely means improved coordination in design and licensing processes
- NRC willing to explain review approach and broader licensing topics to broader audiences (generic or design specific)

Risk-informed Regulatory Framework – non-LWRs
[SRM paragraph d] - continued

Longer Term Development of Risk-Information regulatory framework:

- Consolidate insights from
  1) iPWR pilot review,
  2) NGNP pre-application activities,
  3) NGNP comparison review, and
  4) LMR pre-application activities
- Develop staff recommendation to Commission for:
  - technology-neutral framework – or
  - multiple-technology framework – or
  - technology-specific frameworks – or
  - no action
- Schedule – FY2015

Questions ?

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

10 CFR 20.1406 – Minimization of Contamination

Edward Roach
Ronald LaVera
Division of Construction Inspection
Health Physics Branch
Office of New Reactors

10 CFR 20.1406

Applies to all license applications and design certifications after August 20,1997. The application must describe how facility design and operation will:

Facilitate decommissioning

Minimize

- Contamination of the facility
- Contamination of the environment
- Generation of waste

U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
Protecting People and the Environment

Principles Embodied in RG 4.21

- **Prevent** -- unintended release, through design features and operational processes, programs or procedures

- **Detect** -- early detection if there is unintended release of radioactive contamination,

  and

- **Correct** -- unintended release of radioactive contamination by prompt and aggressive action when warranted [risk should be considered].

RG 4.21 Design Review Objectives Part 1

1. Minimize and contain leaks and spills in areas where such events might occur.
2. Provide adequate leak detection capability to provide prompt detection of leakage from any structure, system, or component that has the potential for leakage.
3. Use leak detection methods

   (e.g., instrumentation, automated samplers) capable of early detection of leaks in areas where it is difficult (inaccessible) to conduct regular inspections (such as spent fuel pools, tanks that are in contact with the ground, and buried, embedded, or subterranean piping) to avoid release of contamination.

RG 4.21 Design Review Objectives Part 2

4. Reduce the need to decontaminate equipment and structures by decreasing the probability of any release, reducing any amounts released, and decreasing the spread of the contaminant from the source.
5. Facilitate decommissioning by
   a) minimizing embedded and buried piping, and
   b) designing the facility to facilitate the removal of any equipment or components that may require removal or replacement during facility operation or decommissioning.
6. Minimize the generation and volume of radioactive waste during operation and decommissioning (by minimizing the volume of components and structures that become contaminated during plant operation).

RG 4.21 Evaluation - ISG 06

- Acceptance Criteria
- Adequate Design features provided
  - Supplemented with processes/programs as necessary
- Early detection of leaks
  - Small leaks – several gallons per week
- Design features for leak detection consider Site Conceptual Model
- Describe the Design Features to facilitate decommissioning
- General SSC Screening
- Examples of SSCs for 20.1406 review
- Operating Experiences

ISG 06 SSC Screening Criteria **Systems and Components**

If it potentially contains Radioactive material:

- Is it separated from the environment by a single barrier?
  - Tank/sump on exterior wall/floor
  - Single wall pipe not in an inspectable area.

OR

- Located outside of a structure designed to contain a release of Rad Material?

OR

- OE exists regarding release of Rad Material

ISG 06 SSC Screening Criteria **Structures**

If it potentially contains Radioactive material:

- Are there below grade penetrations to the environment?
  - Pipe or conduit

OR

- Are there below grade concrete joints that connect to the environment?
  - Floor to floor, floor to wall

OR

- Is it separated from the environment by a single barrier?
  - Retention pond with liner
  - Rad waste pipe running between buildings.

RG 4.21 Design Review Acceptance

1. Adequate design features are specified

   or:

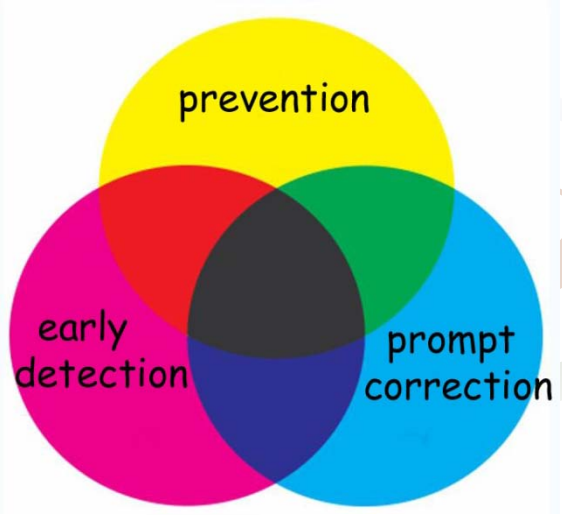
2. Design does not completely address 4.21 considerations:
   a) Improve the design
   b) Implement programs/processes to monitor/maintain (COL Action).

   or:

3. Insufficient information available in DCD Phase
   a) COL Action to provide design information for review.

Demonstrating Compliance

- Explore opportunities to minimize contamination before application
- Risk-informed approach
- By using “sound” engineering and science
- By application of the guiding principles in RG 4.21



Structure of RG 4.21

- The Regulatory Position parallels the organization of 10 CFR 20.1406
  - C.1. Minimize contamination of the facility
  - C.2. Minimize contamination of the environment
  - C.3. Facilitate decommissioning
  - C.4. Minimize waste generation

- Each section of the Regulatory Position describes an objective. An appendix contains examples of measures to consider for achieving compliance with 10 CFR 20.1406.
  - **NOTE:** this appendix is not intended as a review checklist.

C.1 Minimization of Facility Contamination

- Design to limit radioactive leakage and to control spread of contamination (C.1.2)
- Prevent through inspection and maintenance programs (C.1.3)
- Provide for early detection of leaks (C.1.4)

C.2 Minimization of Environmental Contamination

- Conceptual Site Model Development (C.2.1)
  - Based on site characterization and facility design and construction
- Detection
  - For areas that are hard to inspect (C.2.2)
- Final Site Configuration (C.2.3)
  - Used to develop an onsite monitoring program

The Conceptual Site Model

- A conceptual site model based on site characteristics and facility design will assist in: (1) understanding site performance, and (2) planning for corrective measures

- Applicants should:

  - Establish background for the conceptual site model
  - Identify potential release mechanisms and possible locations of contaminant releases
  - Develop conceptual site model of ground-water system and identify potential contamination pathways
  - Assess site changes due to construction

C.3 Facilitate Decommissioning

- Begin at design stage.
  - Material selection to reduce contamination (e.g. low cobalt)
  - Material selection for reliability (e.g. pipe material, sump liners)
  - Component configuration to reduce contamination (e.g. surface finish)
  - Component configuration for removal/replacement
- Ensure throughout life of the facility that design minimizes the amount of residual radioactivity that will require remediation at time of decommissioning.

C.3 Facilitate Decommissioning (cont)

- Properly designed facilities will support efficient decommissioning as well as reducing generation of radioactive waste.

C.4 Minimize Waste Generation

- Life-cycle approach should be taken in identifying all components used in the facility and all waste that will result from system operations and processing.
- Life-cycle waste management planning should be carried out for any new waste stream to define the strategy for its conditioning, storage, or disposal.
- System designs should enable operators to perform decontamination efficiently while minimizing doses and production of radioactive waste.

Summary of RG 4.21 Objectives

- Minimize leaks and spills and provide containment of leaks
- Provide for adequate leak detection capability to provide prompt detection of leakage from any SSC
- Provide leak detection methods capable of early detection of leaks where regular inspections are impossible or difficult

QUESTIONS?

Points of contact:

Ed Roach at Edward.Roach@nrc.gov	301-415-1973
Sara Bernal at Sara.Bernal@nrc.gov	301-415-1027
Charles Hinson at Charles.Hinson@nrc.gov	301-415-1845
Ron LaVera at Ronald.LaVera@nrc.gov	301-415-5306

Emergency Planning Activities for Small Modular Reactors

NRC SMR Licensing Workshop

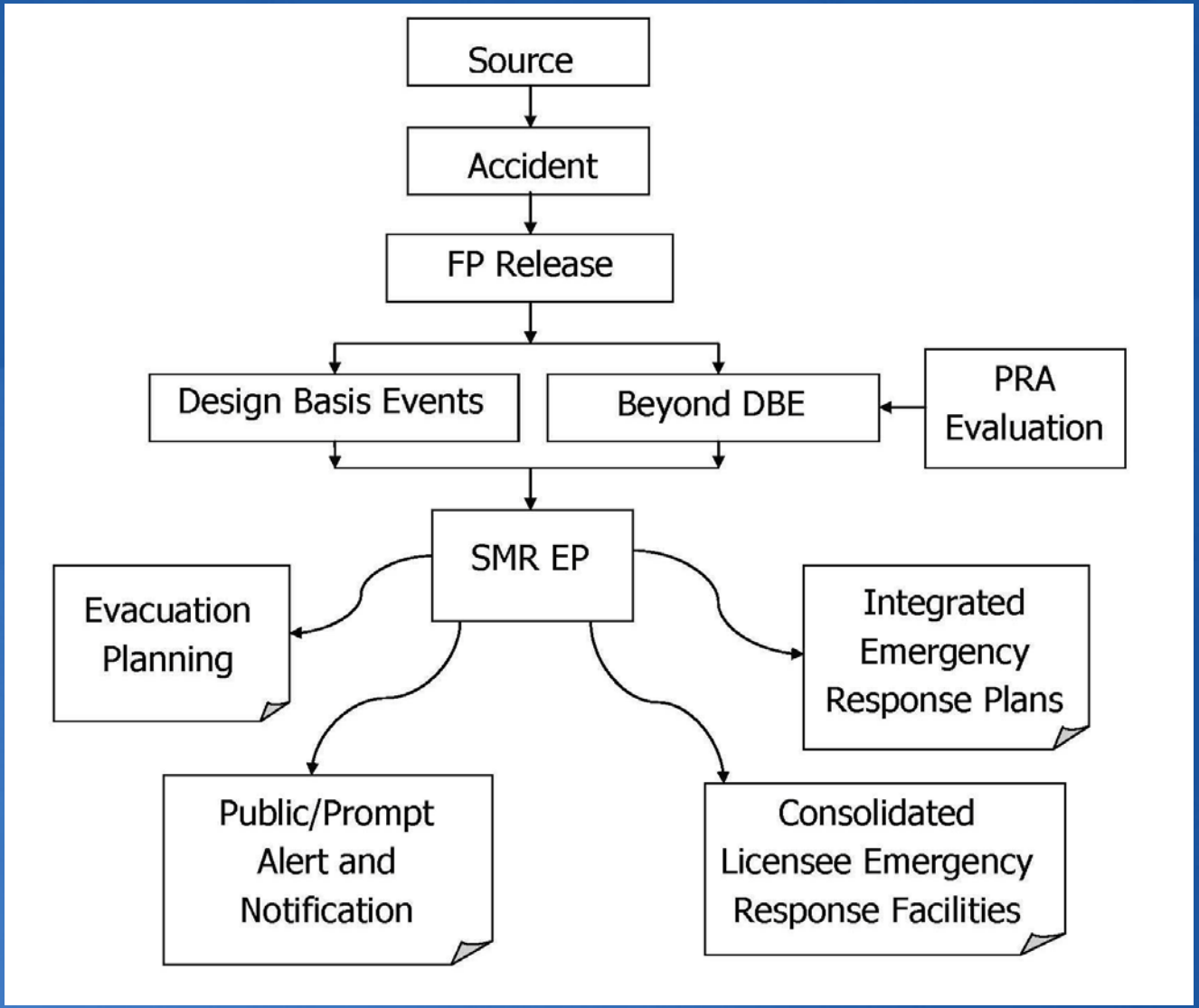
January 26, 2011

NUCLEAR ENERGY INSTITUTE

Emergency Planning Activities Paper

- Content – Outline discussed in November
  - Scope: Approach to EP activities for SMRs
  - EPZ sizing to be addressed in follow-on paper
- Draft paper undergoing industry review – Expect to submit to NRC in February
- Paper provides information related to the development of EP programs for SMRs based on design and analysis considerations

SMR Emergency Planning



Design Basis Events

- Uncontrolled fission product releases are delayed
- Objectives for doses are less than:
  - 1 rem total effective dose equivalent
  - 5 rem committed dose equivalent to the thyroid
- Updated guidance may need to be developed to support this

Beyond Design Basis Events

- Evaluate accident sequences based on frequency and consequences (e.g., PRA)
  - Mean core damage frequency
  - Cumulative core damage frequency and dose
- Risk-informed approach will be pursued

Summary

- SMRs are expected to have small and delayed source term releases
  - Predicted onsite and offsite doses are significantly lower than those used in the basis for current approach
  - Same goals can be met with a risk-informed approach
- Extremely low frequency for beyond design basis events maintains defense-in-depth
- The SMR EP Paper is intended to continue dialog with various stakeholders to develop appropriate regulatory bases for supporting SMR EP development in light of very low anticipated dose impacts
  - Elements of this paper will be integrated into follow-on paper on EPZ sizing

NEI

Overview of NEI SMR EPZ Sizing Paper

NRC SMR Licensing Workshop

January 26, 2011

NUCLEAR ENERGY INSTITUTE

Sizing Paper Outline - Introduction

- Current EP requirements
- Current basis for 10 mile EPZ (NUREG-0396 and NUREG-0654)
- Describe importance of appropriate (i.e., modernized) EPZ for SMRs
- Scope of this position paper
  - Informed by NGNP EP white paper
  - Expands first NEI paper to include EPZ sizing
  - Applicable to iPWRs and non-LWR SMRs

Sizing Paper Outline – Rationale and Concept

- Rationale for different EP requirements for SMRs
  - Existing EP regulatory requirements and recent staff work recognize smaller plant characteristics, i.e., SMRs can potentially have different EP
  - Technical rationale for pursuing different EP
  - Impact on stakeholders
- Concept for Appropriate EP for SMRs
  - Briefly summarize the concept by referring to the requirements discussed in first paper plus add sizing considerations

NEI

Sizing Paper Outline – Generic Framework

- **Framework for Generic SMR Approach**
  - Complete elimination of nuclear EP is neither necessary nor desirable - part of defense-in-depth safety strategy
  - More appropriate EP can be achieved through emphasizing protective action close to site
  - Describe characteristics of revised EP basis for SMRs

Sizing Paper Outline – Illustration of Approach

- **Illustration of Possible Generic SMR Approach**
  - **Address the four main considerations in Section I.D.2 of NUREG 0654**
  - **Apply risk-informed, performance-based approach using more realistic methods and updated understanding of severe accidents**