

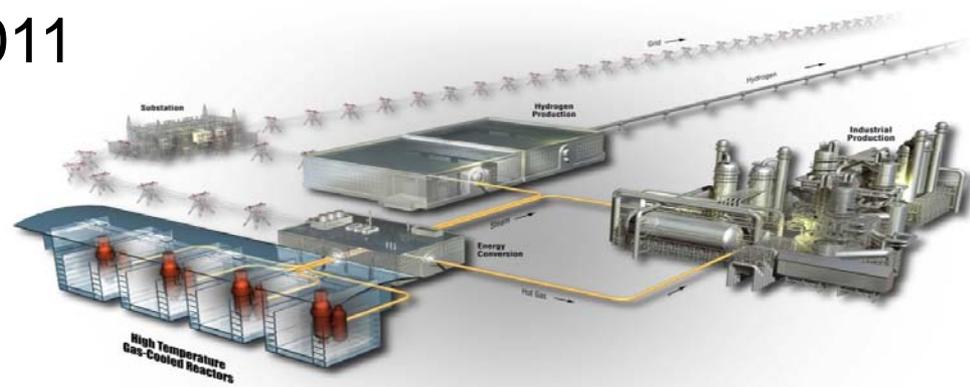
FEBRUARY 8, 2011

ATTACHED ARE THE SLIDES FROM THE
“DETERMINING THE APPROPRIATE EMERGENCY
PLANNING ZONE SIZE AND EMERGENCY PLANNING
ATTRIBUTES FOR AN HTGR” PRESENTATION, WHICH
WAS 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.

Determining the Appropriate Emergency Planning Zone Size and Emergency Planning Attributes for an HTGR

Presentation to NRC Staff by Next
Generation Nuclear Plant Project
January 2011



INL/MIS-10-19799

***Determining the Appropriate Emergency
Planning Zone Size and Emergency Planning
Attributes for an HTGR***

October 2010

NRC ADAMS Accession Number: ML103050268

Emergency Planning White Paper – Overview

- Introduction
 - Objectives of Paper
 - Issues for Discussion
 - Supporting White Papers
- Regulatory Foundation for EPZ Sizing and Emergency Planning Requirements
- NGNP Approach to Emergency Planning
 - EPZ Sizing for HTGRs
 - Applying Graded Approach to Emergency Planning Implementing Guidance
- Issues for Resolution
- Questions

Introduction (Section 1)

Objectives (1.1)

- Summarize issues for sizing the EPZ including policy and technical issues
- Identify NRC precedents involving gas-cooled reactors and LWRs
- Discuss NGNP approach to EPZ sizing
- Present rationale for applying graded approach to emergency planning requirements
- Discuss application of LWR-derived Emergency Action Levels and Initiating Conditions to HTGRs

Issues for Discussion (1.3)

- Appropriately size the plume and ingestion pathway EPZs
- Simplify emergency planning requirements by applying a graded approach for reactors that are designed with significantly enhanced safety margins
- Benefit from HTGR inherent and passive features

Outcome Objectives (Section 1.4)

- Solicit NRC feedback and agreement in the following areas:
 - 1) Application of defense-in-depth methodology for EPZ sizing
 - 2) HTGR design and operating characteristics support the development of emergency planning requirements that are consistent with significantly enhanced safety margins and reduced risk
 - a. Mechanistic source term approach
 - b. Significant release of radioactive materials is prevented

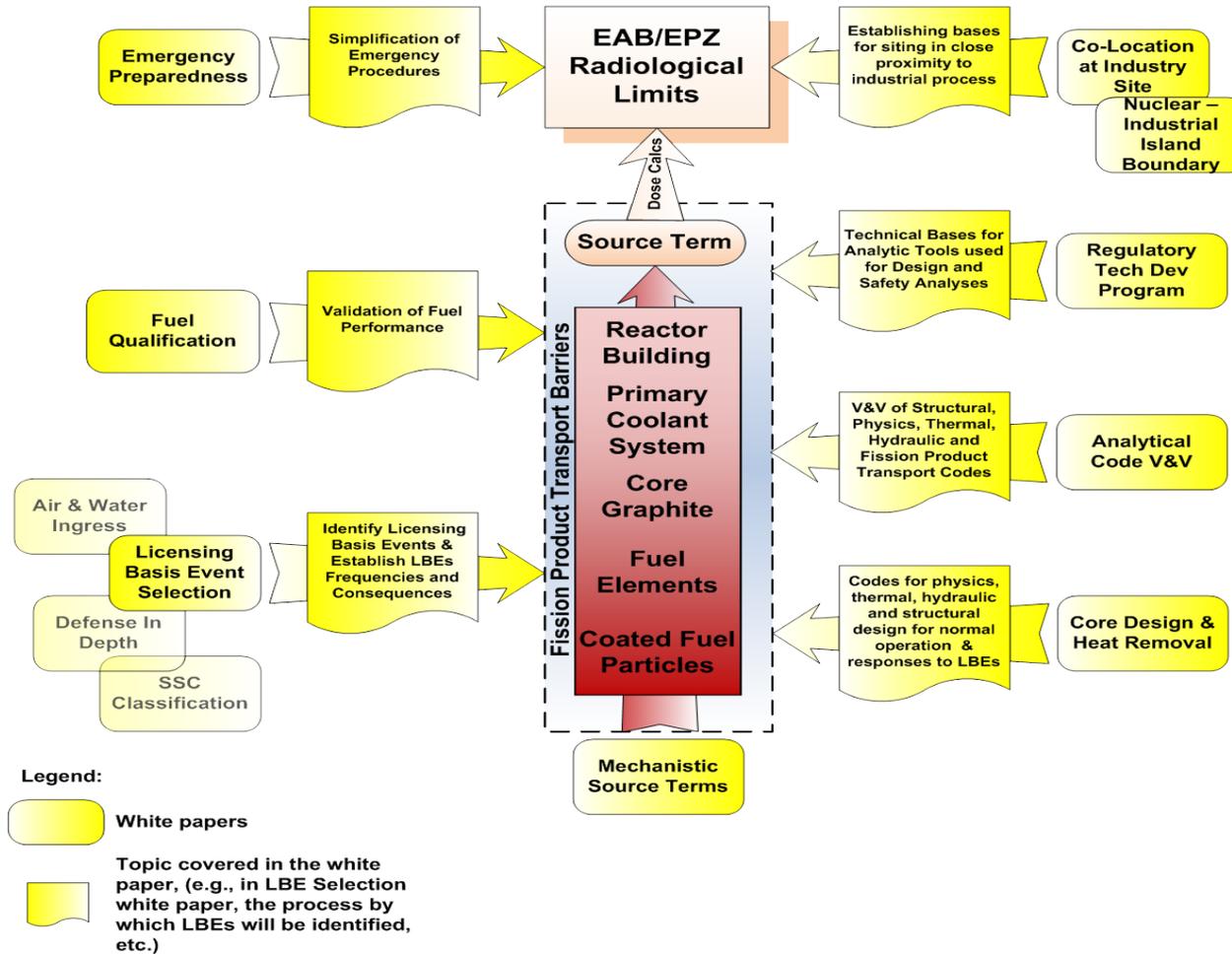
Outcome Objectives (Section 1.4)

- Solicit NRC feedback and agreement in the following areas (continued):
 - 3) EPZ sizing should be determined, in part, from evaluation of offsite dose consequences from licensing basis events
 - 4) The absence of a significant radiological release during an accident provides technical justification for appropriate EPZ size
 - 5) HTGR design supports graded approach to implementation of EP requirements

Supporting NGNP White Papers (1.5)

- Key Supporting White Papers
 - NGNP Defense-in-Depth
(INL/EXT-09-17139) – Dec 9, 2009
 - NGNP Mechanistic Source Terms
(INL/EXT-10-17997) – Jul 21, 2010
 - NGNP Fuel Qualification
(INL/EXT-10-17686) – Jul 21, 2010
 - NGNP Licensing Basis Events
(INL/EXT-10-19521) – Sep 16, 2010

Key Relationships to Other White Papers



Regulatory Foundation (Section 2)

Regulatory Basis for EPZ Sizing and EP Requirements (2.1)

- NUREG-0396 (1978) sets the stage for the EPZ concept:
The EPZ recommended is of sufficient size to provide dose savings to the population in areas where the projected dose from design basis accidents could be expected to exceed the applicable PAGs under unfavorable atmospheric conditions.
- EPA Protective Action Guides (1992)
 - 1 rem total effective dose equivalent from external radiation exposure to the plume and from inhalation of radioactive material in the plume.
 - 5 rem committed dose equivalent to the thyroid from inhalation of iodine radioisotopes in the plume.

Regulatory Basis for EPZ Sizing and EP Requirements (cont.)

- EPA Protective Action Guides (1992)
 - 0.5 rem total effective dose equivalent from ingestion of contaminated food and water.
 - 1.5 rem committed dose equivalent to the thyroid from ingestion of contaminated food and water.
- 10 CFR 50.33(g) allows the EPZ size for gas-cooled reactors to be considered on a case-by-case basis.
 - Fort St. Vrain: 5 mile plume exposure EPZ; 30 mile ingestion pathway EPZ

Regulatory Basis for EPZ Sizing and EP Requirements (cont.)

- 10 CFR 50.34(a)(1)(ii)(D) requires evaluation of postulated fission product release to determine that an individual at the *exclusion area* boundary, in any 2 hour period following the onset of the release, would not receive a dose greater than 25 rem total effective dose equivalent
- 44 CFR 350.7(b) requires state and local agencies to determine exact size and configuration of the EPZ in consultation with FEMA and NRC.

Regulatory Basis for EPZ Sizing and EP Requirements (cont.)

- 10 CFR 50.47(b) provides 16 standards that must be included in nuclear power plant emergency plans.
- Additional regulatory requirements related to these standards are provided in Appendix E to Part 50.
- Implementing guidance presented in NUREG-0654/FEMA-REP-1, includes 16 planning standards and associated evaluation criteria.

Regulatory Basis for EPZ Sizing and EP Requirements (cont.)

- Other Regulatory Basis References
 - NUREG-1338 (Draft Pre-application Safety Evaluation Report (PSER) for the MHTGR)
 - NUREG-1368 (PSER for PRISM)
 - SECY 97-0020, Results of Evaluation of Emergency Planning for Evolutionary and Advanced Reactors

Regulatory Basis for EPZ Sizing and EP Requirements (cont.)

- No changes to regulations are necessary to address the NGNP approach

NGNP Approach to Emergency Planning (Section 3)

NGNP Approach to EPZ Sizing (3.1)

- Factors that influence EPZ size and offsite emergency planning include:
 - Source term and release characteristics
 - Performance of HTGR functional containment
 - Fuel Kernel
 - Fuel Particle Coatings
 - Matrix/Graphite
 - Helium Pressure Boundary (Primary Circuit)
 - Reactor Building
 - Timing of release
- } Prismatic or Spherical Fuel Element

NGNP Approach to EPZ Sizing (cont.)

- Other factors influencing the EPZ size and offsite emergency planning include:
 - Co-location at an existing industrial facility
 - Control of access to the site

NGNP Approach to EPZ Sizing (cont.)

- Identify the applicable source terms
 - Determine the credible licensing basis event scenarios
 - NGNP Licensing Basis Events white paper (INL/EXT-10-19521) – Sep 16, 2010
 - Determine the radiological release source terms for each accident scenario and the time from the start of the accident to the time when a radiological release begins
 - NGNP Mechanistic Source Terms white paper (INL/EXT-10-17997) – Jul 21, 2010

NGNP Approach to EPZ Sizing (cont.)

- Identify the applicable source terms (cont.)
 - Evaluate offsite dose consequences for each accident and determine the distance at which the lower limit EPA PAGs are met for each accident scenario
 - Use standard dose calculation methodology
 - Meet EPA PAG plume exposure doses of 1 rem total effective dose equivalent (TEDE) and 5 rem CDE to the thyroid, which are the lower thresholds for taking protective actions

NGNP Approach to EPZ Sizing (cont.)

- Other factors that influence EPZ sizing:
 - Evaluate any security, geographic, or travel route limitations that would affect the establishment of the EPZ
 - Evaluate whether a design basis threat has the potential to cause the lower limit PAGs to be exceeded

Applying Graded Approach to Emergency Planning Implementing Guidance (3.2)

- Emergency planning requirements can be simplified by applying a graded approach to addressing guidance used in demonstrating compliance with existing regulatory requirements
- Existing offsite plans under the National Response Framework can handle an HTGR emergency
 - Address 16 planning standards in 10 CFR 50.47
- Simplification of onsite and offsite emergency response organization

Applying Graded Approach to Emergency Planning Implementing Guidance (cont.)

- Potential areas where graded approach may be applied:
 - Potential reduction of on-shift staffing requirements
 - Extended staffing augmentation times
 - Offsite fire/rescue and medical facility capabilities consistent with existing industrial hazard plans
 - Potential reduction in number of participating agencies and jurisdictions
 - Potential reduction in the need for prompt notification and evacuation planning

Applying Graded Approach to Emergency Planning Implementing Guidance (cont.)

- Potential areas where graded approach may be applied (cont.):
 - Consolidation and simplification of emergency response facilities
 - Offsite response and protective action strategy commensurate with the risk and potential impact of a radiological release
 - Simplification of training, exercise, and drill requirements.

Applying Graded Approach to Emergency Planning Implementing Guidance (cont.)

- Application of LWR-derived Emergency Action Levels and Initiating Conditions to HTGRs

Applying Graded Approach to Emergency Planning Implementing Guidance (cont.)

- Emergency plans must be coordinated among all levels of government to ensure an effective response
- The goal is to ensure the effectiveness of combined federal and state, territorial, tribal, and local operations through integration and synchronization.
- This integration is achieved through FEMA's Comprehensive Preparedness Guide on *Developing and Maintaining State, Territorial, Tribal, and Local Government Emergency Plans* (CPG-101) (FEMA 2009) and the National Response Framework

Issues for Resolution (Section 4)

Discussion Topics (4.1)

- It is justifiable and desirable to appropriately size the plume and ingestion pathway EPZs and potentially simplify emergency planning requirements for reactors that are designed with greater safety margins
- The HTGR design places a greater emphasis on prevention through inherent and passive features to reduce the dependence on active systems thereby creating safety value without sacrificing defense-in-depth capability
- Emergency planning requirements can be simplified, when compared to current emergency plans for LWRs, by applying a graded approach to addressing guidance used in demonstrating compliance with existing regulatory requirements consistent with reduced risk associated with a reactor design with greater safety margins.

Summary of Outcome Objectives (4.2)

- The following are specific areas where agreement on the NGNP Project approach to establish the EPZ sizes is being sought:
 - 1) Application of the defense-in-depth methodology developed for the HTGR provides a foundation for technical justification for EPZ sizing
 - 2) HTGR design and operating characteristics support the development of emergency planning requirements that are consistent with significantly enhanced safety margins and reduced risk
 - 3) Confirmation that EPZ sizing should be determined, in part, from offsite dose consequences of LBEs and design basis threats to determine the distance at which the lower limit EPA PAGs are met for each event scenario

Summary of Outcome Objectives (cont.)

- The following are specific areas where agreement on the NGNP Project approach to establish the EPZ sizes is being sought (cont.):
 - 4) Concurrence that technical justification for the appropriate EPZ size can be based on the absence of a significant radiological release during an accident thus potentially allowing offsite emergency response to be accommodated, in part, through existing all-hazards plans
 - 5) Compliance with the emergency planning requirements in 10 CFR 50 can be applied on a graded approach, when compared to current emergency plans for LWRs, that allows for site and offsite emergency plans to be developed commensurate with the HTGR design

Summary of Outcome Objectives (cont.)

- For HTGR designs, no appreciable core damage is expected to occur for any DBE or BDBE
 - There are no credible accident scenarios that involve severe core damage with a large early radiological release

Summary of Outcome Objectives (cont.)

- The multiple barriers to fission product release and radionuclide transport form a functional containment
- The fuel has very large temperature margins to prevent radioactivity release in normal and accident conditions
- The response times of the reactor during transients are very long (hours or days versus seconds or minutes for current LWRs)

Summary of Outcome Objectives (cont.)

- No changes to regulations are necessary to address the NGNP approach

Emergency Planning White Paper

Questions?