



**RIC 2009
NRC Research in Support of the
NGNP Licensing Strategy**

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1



Outline

- NRC Safety R&D Objectives
- NGNP and PIRT
- Evaluation Model
- HTGR R&D
- Thermal-fluids
- Fuels & Fission Products Transport
- Other Research Areas

2



NRC Safety R&D Objectives

- **Develop staff knowledge, expertise, capabilities and review guidance**
- **Independently confirm technical basis for requirements and criteria**
- **Develop independent analytical capabilities**
- **Confirm/interpret technical information for which there is significant uncertainty**
- **Validate/scope-out technical issues requiring follow-up resolution by an applicant**

3



ARRP Structure and Scope (HTGR)

- In-depth Research Infrastructure Needs Assessment
- HTGR-specific, reactor, materials/fuel cycle aspects
 - Generic aspects (e.g., I&C, human factors, PRA)

- NRC Research & Development Plans
- HTGR-specific, reactor safety review needs emphasis
 - Generic aspects (e.g., I&C, human factors, PRA)

4



What is NGNP and What is PIRT?

- Next Generation Nuclear Plant (NGNP)
 - An advanced reactor concept for nuclear electricity production and hydrogen cogeneration
 - Very high-temperature gas-cooled reactor (VHTR)
- Phenomena Identification and Ranking Technique (PIRT)
 - A structured elicitation process to identify safety relevant phenomena and assess their importance
 - A tool for identifying and prioritizing research needs
 - Results documented in Phenomena Identification and Ranking Tables

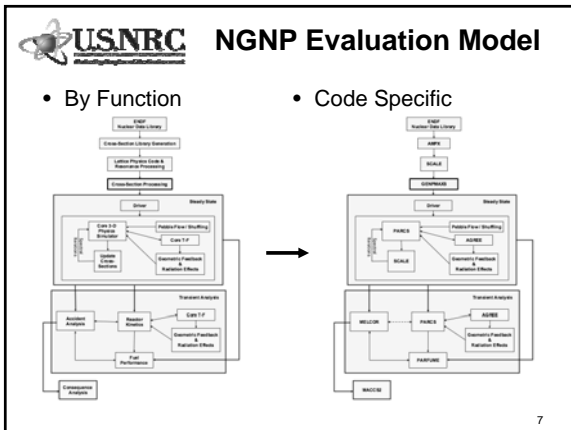
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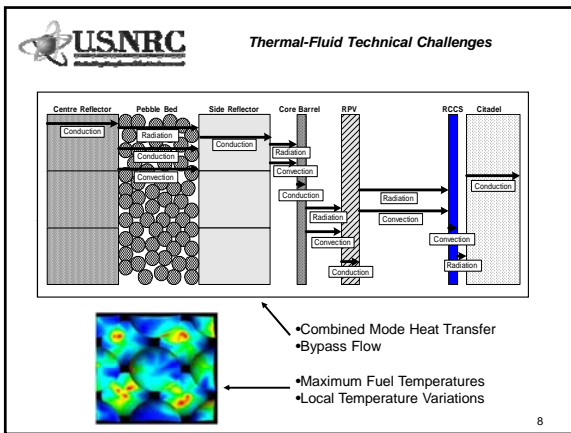


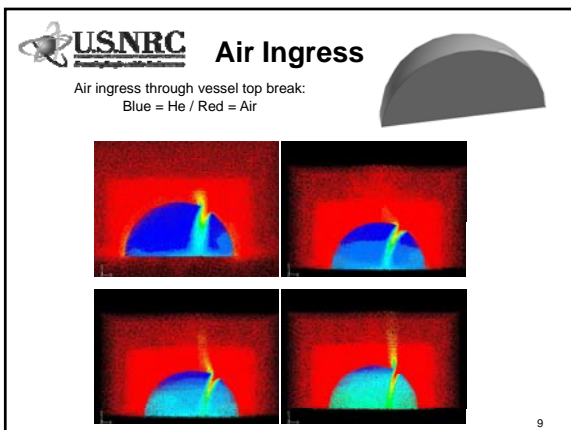
Reactor Plant Systems Analysis

- Evaluation Models
 - Normal Operations
 - Determines the source term for the initial release.
 - i.e., the generation and distribution of FPs, magnitude and distribution of plate-out & absorbed FPs within He pressure boundary, circulating activity, coolant contaminant & erosion activation products, and dust-born radionuclides.
 - Initial Release
 - Models the release of circulating activity including dust mobilization and plate out lift-off; large/rapid reactivity events that result in CFP failures.
 - Delayed Release
 - Models the release of FPs from intact & failed CFPs during core heat up and with or without or steam ingress; models FP hold-up and retention within the helium pressure boundary and the confinement.

6









MELCOR Development Activities for NGNP

- Completed Activities
 - Pebble-Bed Core Model
 - Prismatic Core Model
 - Improved Helium Properties
 - Point Reactor Kinetics Model
 - Graphite Oxidation Model
- Future Activities
 - Empirical CFP failure Model
 - FP diffusion model for CFPs
 - Reactor Cavity Cooling System Model
 - Balance of Plant Models (e.g., IHX)
 - Improved FP lift-off and re-suspension models
 - Improved numerics for long transients
 - Lock-exchange model (air ingress)

13



Closing

- Research is underway to support the NGNP Licensing Strategy
- Cooperative research with DOE / INL
- International collaboration

14
