



RIC2011

MELCOR DEVELOPMENT STATUS AND CODE APPLICATIONS

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MELCOR Regulatory Applications

- State of the Art Reactor Consequence Analysis (SOARCA)
- MOX/HBU Source Term (revised NUREG-1465)
- Design Certification for New and Advanced Reactor Designs
- BWR MSIV Leakage Analysis (RG 1.183)
- Risk-Informed Regulation (e.g., combustible gas control rulemaking)
- Probabilistic Risk Assessment (e.g., standardized plant analysis risk [SPAR] models)



MELCOR User Community

- Strongly Influenced by Participation of Domestic Users and International Partners through the USNRC Cooperative Severe Accident Research Program (CSARP) and MELCOR Code Assessment Program (MCAP)
 - Development Contributions (new models)
 - Applications
 - Development Suggestions



USNRC Modeling and Analysis of Severe Accidents in Nuclear Power Plants

MELCOR Models

Severe accident codes are the "repository" of phenomenological understanding gained through NRC and international research performed since the TMI-2 accident in 1979

Integrated models required for real time analysis

Important Severe Accident Phenomena

Accident Initiation				
Miscellaneous secondary hydraulics				
Loss of steam generator				
Core meltdown and fission product release				
Reactor vessel failure				
Transport of fission products in RCS and Containment				
Fission product aerosol dynamics				
Molten metal/solids interactions				
Containment thermal hydraulics				
Fission product removal processes				
Reliance of fission products for environment				
Engineered safety systems - sprays, fan coolers, etc				
Iodine chemistry, and more				

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USNRC MELCOR Nodalization

Building block approach (more flexibility => greater user responsibility)

Generic Models (no "built-in" nodalization)

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USNRC MELCOR Development

Code Readiness

- Green: code ready for applications
- Red: code not ready for applications

Code life-cycle

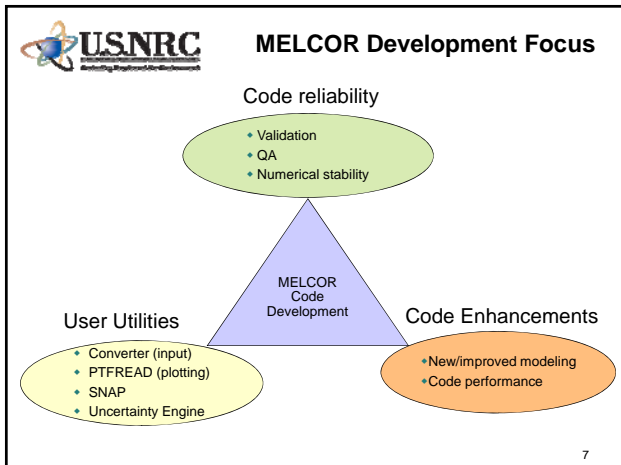
- Blue: code conversion phase
- Yellow: code development phase
- Orange: code maintenance phase

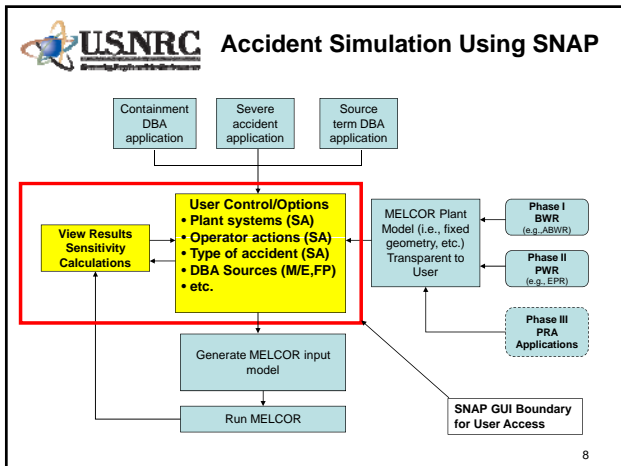
- MELCOR 1.8.6**
 - Molten pool models
 - Core Package upgrade
 - Released Fall 2005
 - Code Maintenance

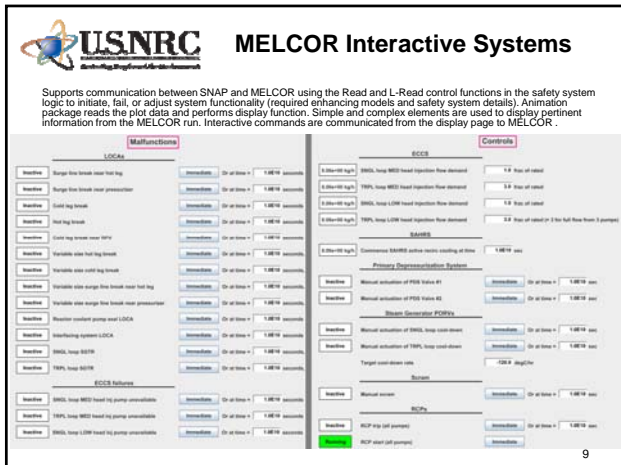
- MELCOR 2.1**
 - FORTRAN 95
 - New input
 - 2.0 beta version released Sept 2006
 - 2.1 Release Sept 2008

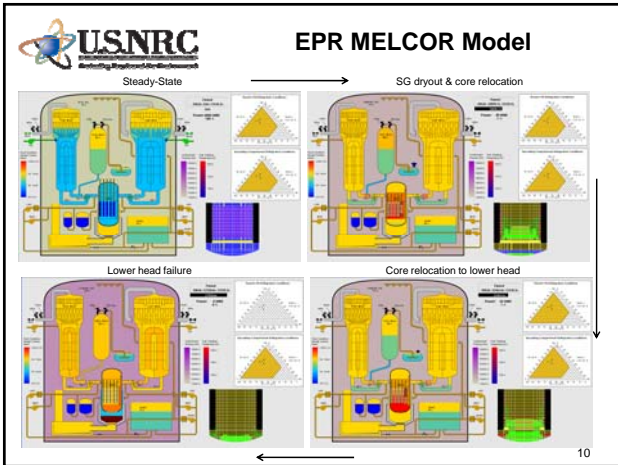
- MELCOR 3**
 - Current developmental version

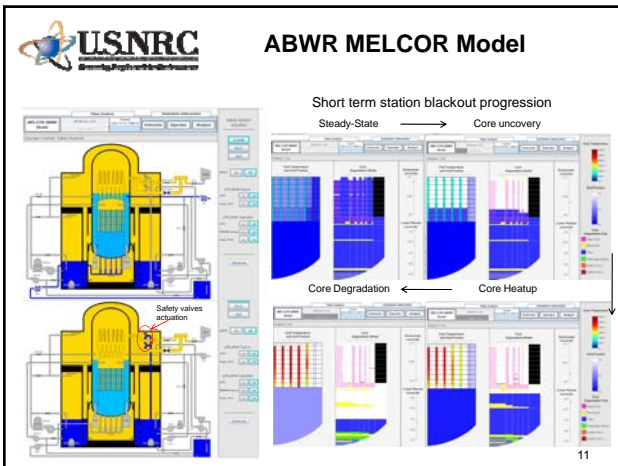
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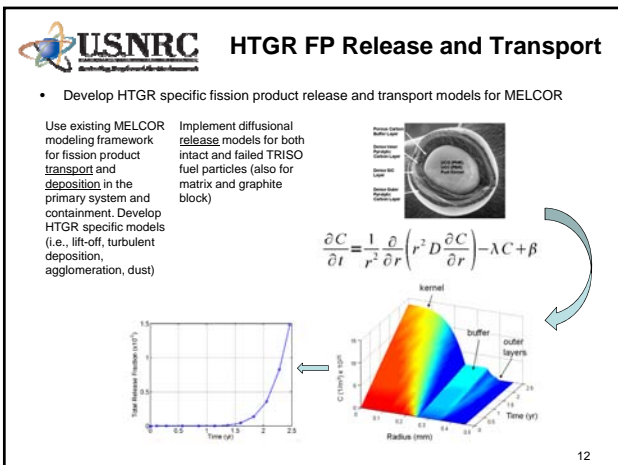














PRA Application

- Improve the technical basis for, and increase the consistency of, Standardized Plant Analysis Risk (SPAR) models for selected probabilistic risk assessment (PRA) sequences of interest. Results published as NUREG-1953 (draft report for comment).

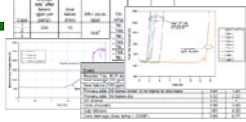
Plant Information



MELCOR Model



SPAR Model Confirmation or Upgrade



Thermal Hydraulic Analysis



Summary

- MELCOR ongoing code development and enhancement in response to regulatory needs and user participation
- Code flexibility allows its use for a variety of applications
- MELCOR/SNAP integration provides an easy to use graphical user interface for accident simulation and visualization



Acronyms

- BWR Boiling water reactor
- DBA Design basis accident
- ECCS Emergency core cooling system
- FP Fission product
- GUI Graphical user interface
- HTGR High temperature gas reactor
- LOCA Loss of coolant accident
- M/E Mass/Energy (sources)
- PORV Power (or pilot) operated relief valve
- PRA Probabilistic risk assessment
- PWR Pressurized water reactor
- QA Quality assurance
- RCP Reactor coolant pump
- SA Severe accident
- SG Steam generator
- SNAP Symbolic nuclear analyzer package
- SPAR Standardized plant analysis risk
- SRV Safety relief valve
