



RIC 2007

Session: Advanced Reactor Designs

Getting Ready to License Next Generation Non-LWRs: What NRC is Doing Now

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Topics

- Potential future non-LWR applications
- Evolution of non-LWR licensing approaches
- Activities to risk-inform the approach
- “NGNP Licensing Strategy”
- PBMR pre-application review
- Licensing policy issues
- Technical R&D planning activities
- Knowledge management

Non-LWRs: Back to the Future

Past Non-LWR Reviews

- Hallam (SCGM) - Licensing
- Peach Bottom 1 (HTGR) - Licensing
- Fermi 1 (Fast LMR) - Licensing
- Fort St. Vrain (HTGR) - Licensing
- PRISM (Fast LMR) - Pre-Licensing
- MHTGR (Modular HTGR) - Pre-Licensing

Potential Future Non-LWR Applications

- NGNP Prototype Reactor (VHTR - Gas Cooled)
- PBMR (Modular HTGR)
- GNEP Prototype ABR (Fast LMR)
- 4S Reactor (Small Fast LMR)
- HTTTR (HTGR Test Reactor)
- NGNP Commercial Reactor (VHTR - Gas Cooled)
- Generation IV Reactors

The Evolution of Adapting NRC LWR Requirements

	<u>Plant</u>	<u>Approach Used</u>
↓	Fermi 1; Fort St. Vrain Peach Bottom 1	Deterministic
↑	PRISM	Deterministic; PRA provides supplemental information
↑	MHTGR, PBMR	Probabilistic; deterministic engineering judgment to address and bound uncertainties
↓	Next Generation (Commercial)	Probabilistic with deterministic engineering judgment to write new requirements?

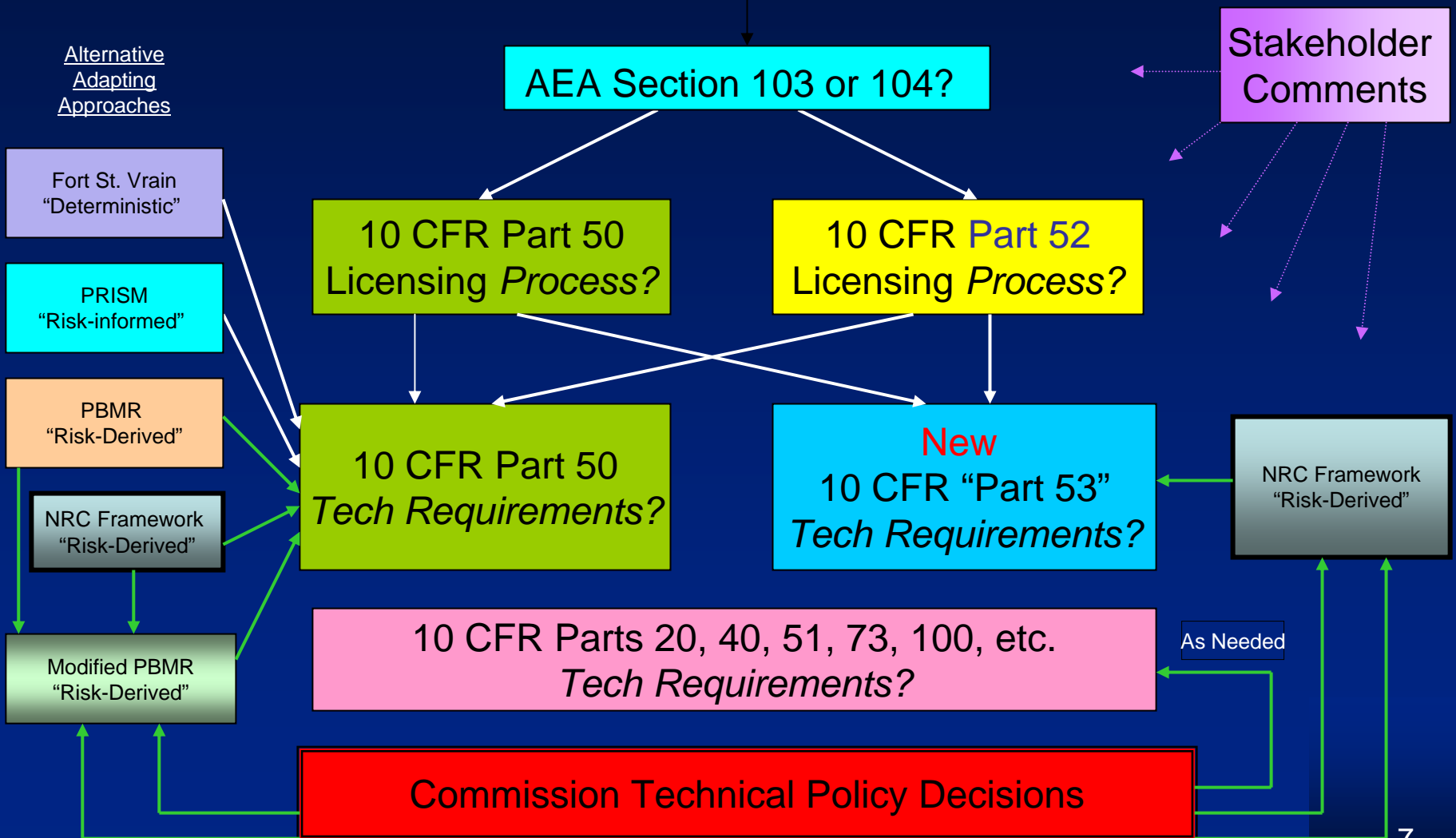
Licensing Approach Development Activities

- Risk-informed, performance-based framework
- ANPR: Approaches to risk-inform and performance-based requirements for nuclear power reactors
- “PBMR licensing approach” pre-application focus topic reviews
- NGNP licensing strategy development
- Commission technical policy decisions

“NGNP Licensing Strategy”

1. How should current LWR licensing requirements be adapted?
2. What analytical tools does the NRC need to review the design and safety performance?
3. What other R&D will the NRC need to review the application?
4. How much will cost?

“NGNP Licensing Approach” Decisions



PBMR Pre-Application Focus Topics

1. Technical basis for the full scope PRA
2. Use of the PRA for LBE (e.g., DBA) selection
3. Use of the PRA for SSC safety classification and special treatment requirements
4. Defense-in-depth approach

Licensing Policy Issues (Examples)

- Minimum level of safety; integrating the risk
- Construction of a frequency-consequence limit curve
- Applying a PRA to select LBEs, classify SSCs
- Achieving adequate defense-in-depth
- Technical acceptability for full-scope PRA
- Containment functional performance requirements
- Security requirements, EP requirements
- Integrating safety, security and EP with DID
- When, if at all, and how, should rulemaking proceed?

Technical R&D Plans

- NRC Advanced Reactor Research Program Plan Update:
 - HTGR technical needs and R&D plans updated
 - LMR technical needs survey added
- Applicant has principal responsibility for R&D to support the technical bases for the application
- NRC safety review role defines NRC R&D scope, content
- Cooperative research strategy to leverage NRC resources
- NRC R&D will be prioritized/implemented based on available resources
- Draft NRC R&D plan will be made public in near future

HTGR R&D Needs Assessment Arenas

- Fuel Performance
- Nuclear Analysis
- Source Term Analysis
- Graphite Components
- Metallic Components
- Structural/Seismic
- Thermo-Fluid Analysis
- H₂ Production Facility
- Review Infrastructure
- PRA
- Human Factors
- Advanced I&C
- Consequence Analysis
- Fuel Cycle/Materials Safety
- Material Protection

NRC/DOE Joint PIRTs

- Phenomena Identification and Ranking Tables (PIRTs)
- Purpose of PIRTs is to inform NGNP reactor licensing strategy:
 - Analytical tools the NRC will need to develop
 - Other R&D the NRC will need to conduct
- PIRT Topics*:
 - Thermal-fluids and accident analysis
 - High temperature materials (metal, graphite) analysis
 - Fission product transport and consequences analysis
 - Process heat and co-generation safety analysis
- PIRTs to be completed by June 2007

* Fuel analysis PIRT completed by NRC Oct 2003

Knowledge Management

- Maintaining/updating domestic & international safety technology info
- Analysis tools are being documented for retrieval by staff in the future
- Knowledge from earlier staff work is being preserved for later staff access
- New hires are assigned technology development tasks
- Safety technology training via workshops and seminars
- Digital video recordings of workshops and seminars viewable on NRC internal web portal
- Training course program plan to be developed
- White papers on safety technology topics being written by outside technical experts
- Virtual “Communities of Practice” established to peruse, retrieve, share information on NRC knowledge center web portal
- HTGR KM activities well underway; LMR KM just getting started