



NRC Advanced Reactor Research Program

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NEW & ADVANCED REACTOR SAFETY RESEARCH

"Supporting Future Reactor Licensing"



NGNP vs. Current LWRs

- Passive and simpler safety systems
- Different reactor/power system layouts, core geometry
- Different fuel designs, moderator and coolant materials
- Higher operating and accident temperatures
- Greater use of PRA; emphasis on accident prevention
- Mechanistic, event-specific accident source term
- Highly automated with extensive use of digital I&C
- Modular fabrication and construction; longer cycles
- Deeply embedded/underground plant structures
- Additional reactor/BOP system interactions
- Limited operating and PRA experience
- Current NRC safety research infrastructure is for LWRs



Infrastructure Assessment & Plan



- Identifies research to provide a sound technical basis for safety, regulatory and policy decisions for licensing
- Includes HTGR, LWR-specific and generic research
- Technical scope is comprehensive
- Technical, safety and policy issues identified
- Safety research gaps identified
- Safety research plan developed and implemented
- Cooperative safety research strategy
- Assessment and plan update planned for non-LWRs
- HTGR knowledge management program established

Safety Research Program Arenas



- Technology-neutral regulatory framework
- PRA analysis methods
- Human factors and advanced I&C
- Nuclear, T-H, accident analysis methods
- Coated particle fuel performance analysis
- Metals, graphite materials performance analysis
- Structural performance analysis
- Consequence analysis
- Fuel cycle nuclear materials safety
- Physical and materials protection



Regulatory Framework Issues



- Level of safety, integrated risk, risk metrics
- Licensing basis event selection
- SSC safety classification and special treatment
- Defense-in-depth; containment performance standards
- Integrating safety, security and emergency preparedness; security performance standards
- PRA quality and completeness

* NGNP licensing to be based on adapting current LWR requirements

Illustrative Technology Research Needs



- Test data to develop and assess nuclear, T-H, transient and accident analysis models; uncertainties and biases
- Test data to develop and assess radionuclide transport models for source term calculation; uncertainties and biases
- Fuel irradiation and accident simulation test data for fuel qualification and fuel performance analysis code development and assessment.
- Environmental test data to support performance analysis models for metallic pressure boundary components
- Develop and assess methods to monitor pressure boundary integrity
- Graphite irradiation test data for materials and structural performance analysis
- Develop PRA models and tools for passive system performance and human reliability



Conclusion

- Significant challenging safety research will be needed to provide an adequate technical basis for an NGNP license application and an NRC safety evaluation.