



NRC's Long Term Research Program



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NRC Research Activities

- NRC has three common methods for identifying research
 1. User need requests from licensing offices (i.e., NRR, NMSS, NRO, etc.)
 - Objectives and deliverables are developed jointly between RES and user office
 - RES initiates and oversees research
 - Examples: PWSCC, xLPR, long-term operations research
 2. Formal agreements with US or international organizations
 - Objectives and deliverables are explicitly defined
 - Activities often support user need requests
 - Examples: Zorita Internals Research Program, Halden Research Group
 3. Long Term Research Plan
- Vast majority of research supports user need requests





NRC's Long-Term Research Plan (LTRP)

- **Definition of Long-Term Research:** Research not already planned or underway to provide fundamental insights and information needed to address potential technical issues or identified gaps in support of anticipated future (>5 years) NRC regulatory needs
- **Background:**
 - 2006: Commissioner Klein requested development of LTRP
 - 2007: First LTRP drafted and yearly selection process developed
 - 2009: Inaugural LTRP projects began
 - 2008 – present:
 - Yearly LTRP project recommendations are provided to the Commission
 - Projects are planned to initiate 2 years after approval





LTRP Purpose

- Determine research needs to prepare for the future
 - Meet licensing decision needs
 - Confirmatory information or tools
 - Identify research to support potential regulatory submittals
 - More efficient review and decision-making
 - Develop or improve infrastructure or processes
- Identify who (i.e., industry, NRC, academia) needs to conduct this research
- Identify when research needs to begin





LTRP Scope

- Focus on innovative technologies that may become important 5-10 years in the future
- Scoping in nature
 - Establish feasibility and likelihood
 - Identify technical gaps or potential safety issues
 - Complete project within 1 – 2 years
- Subsequent actions
 - Terminate activity
 - Transition research activity to industry, if appropriate
 - Develop follow-on NRC research program, if necessary, using conventional processes (i.e., user need request or formal agreements)





LTRP Process

1. Solicit proposals from all NRC staff, including the regions
2. Review and rank proposals
 - Review Committee comprised of representatives from all major technical offices within NRC (i.e., RES, NRR, NRO, NMSS, FSME, NSIR)
 - Ranking criteria
 - A. Leverage resources
 - B. Advance state-of-the-art
 - C. Provide independent tools
 - D. Apply to more than one program area (e.g., reactors, materials)
 - E. Address technical and/or regulatory gaps
3. Recommendations provided to Commission for review after concurrence from major technical offices.





LTRP Projects

- FY-2009
 - Advanced Level 2/3 Probabilistic Risk Assessment (PRA) Modeling Techniques
 - Integral Effects Test Facilities for Advanced Non-Light-Water Reactors
- FY-2010
 - Long-term cask demonstration program
 - **Extended In-Situ Real-Time Monitoring**
 - Fire Safety of Digital Instrumentation and Control and Electrical Systems
 - **Advanced Fabrication Techniques**





Extended In-Situ Real-Time Monitoring

- **Objective**
 - Identify advanced techniques that could improve plant monitoring capabilities and appear to be commercially viable
- **Scope**
 - Real-time materials degradation, severe accident conditions, fuel performance in long-term dry cask storage, and early detection of abnormal radionuclide releases from nuclear power plant (NPP) systems, structures, and components.
- **Motivation for Long-Term Research**
 - Variety of possible techniques and applications makes it necessary to identify those most likely to be employed by the nuclear industry before conducting confirmatory research
 - Timeframe associated with possible implementation is several years away
- **Anticipated Regulatory Product**
 - A technical basis will be developed, either by industry-sponsored or NRC-sponsored research (or a combination thereof) to determine if any proposed monitoring techniques are acceptable for nuclear plant applications.





Advanced Fabrication Techniques

- **Objective**
 - Coordinate among NRC, DOE, and the nuclear industry to identify new construction and component manufacturing techniques planned for both LWRs and advanced (i.e., Generation IV) reactors
 - Identify and prioritize safety issues unique to NPP fabrication and operation
- **Motivation for Long-Term Research**
 - New techniques being proposed for NPP construction have been used in other industries, but unique safety concerns may exist
 - Industry plans for NPP construction and fabrication are still evolving and the implementation of these techniques is still several years away
- **Anticipated Regulatory Products**
 - A plan to address any safety issues identified in initial study will be developed
 - Execution of this plan, either by industry-sponsored or NRC-sponsored research (or a combination thereof) will provide the technical basis for determining if these proposed techniques are acceptable for NPP applications.





LTRP Projects, cont.

- FY-2011
 - BWR Burnup Credit and Evaluation of Newly Available Isotopic and Criticality Data
 - Advanced PRA
 - Smoke Effects and Transport
 - Advanced Light Water Reactor Fuels
 - **Nondestructive Evaluation (NDE) and Surveillance of Civil Structures**
 - Materials Behavior in Performance Assessment
 - Uncertainty Methods for PRA
- FY-2012
 - Advanced Reprocessing
 - Safety and Regulatory Issues of the Thorium Cycle





NDE and Surveillance of Civil Structures

- **Objective**

- Evaluate the effectiveness of advanced NDE technologies to monitor, detect, and measure changes in concrete structure performance at NPPs and for cement grout performance in waste structures

- **Motivation for Long-Term Research**

- Access too many of these structures is severely constrained
- NDE techniques require advanced approaches that can be used to provide long-term measurement of parameters that may be precursors to impending failure.

- **Anticipated Regulatory Products**

- A plan will be developed
 - Identify those NDE techniques and/or combinations of techniques and sensors that may be amenable to obtaining quantitative data for service-life modeling of concrete.
 - Identify needed improvements and technical gaps prior to implementation.
- Execution of this plan, would be valuable in developing regulatory tools for use by the NRC staff for the service-life evaluations of concrete structures





Summary

- LTRP Objectives
 - Address possible safety issues associated with technologies that are expected to require regulatory action within 5 to 10 years
 - Address infrastructure needs or process improvements
- LTRP Process and Scope
 - Identify new projects yearly through consensus recommendations
 - Projects are scoping in nature
 - Projects typically last 1 -2 years
- LTRP Outcomes
 - Activities terminated
 - Transitioned to industry-sponsored research
 - Developed into conventional NRC-sponsored research

