

LWRS Status Highlights

Program Mission

The Light Water Reactor Sustainability (LWRS) is a Department of Energy (DOE) program conducting research to develop technologies and other solutions to improve the economics and reliability, sustain the safety, and extend the operation of our nation's fleet of nuclear power plants (NPP). The NRC and the DOE have a [Memorandum of Understanding](#) (MOU) on Nuclear Innovation that allow the entities to share expertise and knowledge on advanced nuclear reactor technologies and nuclear energy innovation which extend to the area of light water reactor long-term operation and proposed modification for light water reactor sustainability

Plant Modernization Pathway

Main Goal: enable plant efficiency improvements through a strategy for long-term modernization

Pathway Multi-Year Outcomes:

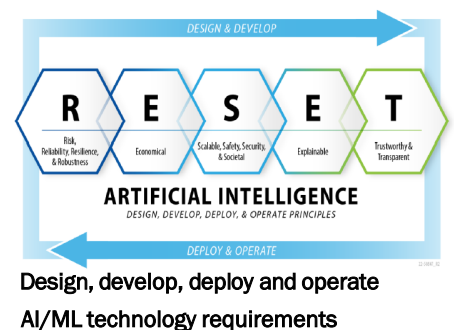
Digital Infrastructure

- ⇒ Continue Digital Infrastructure upgrades collaboration and share lessons learned with nuclear industry (2024)
- ⇒ Collaborate with participating utilities to develop a best practice strategy for maintaining and upgrading LWR Digital Infrastructure (2025)
- ⇒ Assist a utility in the implementation of an integrated digital infrastructure strategy (2025)

Latest Report :

[Data Architecture and Analytics Requirements for Artificial Intelligence \(AI\) and Machine Learning \(ML\) Applications to Achieve Condition-Based Maintenance](#)

– This report identifies some of the important requirements that need to be considered as part of the data evolution for the condition-based maintenance application on a circulating water system in a nuclear power plant. The concept of data evolution converts data into information which in turn is converted into insight, decision, and action.



Materials Research Pathway

Main Goal: understand and predict long-term behavior of materials in nuclear power plants

Materials Research Planned Multi-Year Outcomes:

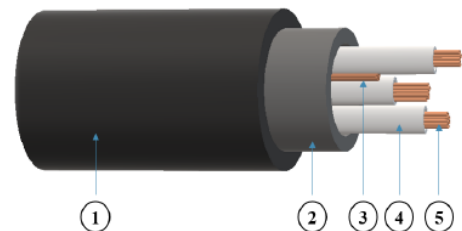
Concrete

- ⇒ Development of code to improve Microstructure Oriented Scientific Analysis of Irradiated Concrete (MOSAIC) parallelization capabilities to enable large 3D simulations (FY23)
- ⇒ Development of methodological guidelines for industry for experimental and predictive assessment of irradiated concrete (FY23)

Latest Report:

[Dose Rate Effects on Degradation of Nuclear Power Plant Electrical Cable Insulation at a Common Dose](#)

– The intent of this report is to address an identified knowledge gap in relating accelerated aging of nuclear electrical cables to service aging: dose rate effects (DRE).



1. CSPE Jacket
2. Binder Tape
3. Copper Ground Wires
4. Insulation Material – XLPE or EPDM
5. Conductor

Schematic of low-voltage nuclear grade electrical cables and their exposed components

Risk Informed System Analysis (RISA) Pathway

Main Goal: develop safety analysis methods and tools to optimize the safety, reliability, and economics of nuclear power plants

RISA Planned Multi-Year Outcomes:

Evaluation of Accident Tolerant Fuel (ATF)

- ⇒ Support of ATF deployment to the industry (FY24)
- ⇒ Enable Power uprated and longer refueling cycles (FY24)

Risk Informed Compliance

- ⇒ Automation of self-assessment and inspections activities, simplification of data processing and trend generation via AI/ML (FY 23-24)

Latest Report:

[Summary of Technical Peer Review on the Risk Assessment Framework proposed in Report INL/RPT-22-68656 for Digital Instrumentation and Control System](#)

– The objective of this technical peer review is to obtain representative feedback on the proposed framework to improve the technical qualities of its methodology and readiness for deployment to the industry. Feedback may identify potential areas for improvement and further development. The subject-matter experts were invited to review the latest project report documenting the methodology developed in the project and provide evaluations of the technical qualities of the proposed framework and relevant methods.

Physical Security Pathway

Main Goal: develop technologies and technical bases to optimize physical security

New Project Update:
CARBON Wireless

This project aims to provide highly-reliable wireless communication links for nuclear security operations and applications.

FY 23 Efforts

- Evaluate security applications of CARBON Wireless at nuclear utilities
 - ◊ Ability to disable compromised wireless/radio equipment
- Conduct jamming and cyber-attacks at INL
 - ◊ Geolocation studies of jamming locations
- Conduct a pilot study at one collaborating nuclear utility
 - ◊ Integration study with DMA

Flexible Plant Operation & Generation (FPOG) Pathway

Main Goal: enable diversification and increase revenue of light water reactors to produce non-electrical products

Latest Report:

Preconceptual Designs of Coupled Power Delivery between a 4-Loop PWR and 100-500 MWe High-Temperature Steam

Electrolysis (HTSE) Plants- This study develops a preconceptual design for the integration between a large-scale high temperature electrolysis facility and a NPP. Two hydrogen facility sizes are considered: 100 MW_{nom} and 500 MW_{nom}, where the subscript "nom" refers to the nominal size of the high temperature electrolysis facility (HTEF). Both steam supply designs use cold reheat steam extraction from the turbine system as a heat source. A brief comparison to supply from main steam is also included

LWRS June Calendar

RISA Monthly Call

"Automation of unavailability data processing" – June 13, 2023 1:00-2:00 pm

