

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. The NRC and the DOE has 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.

Plant Modernization Pathway

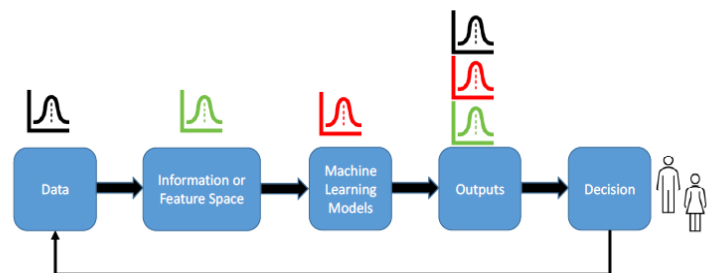
Main Goal: enable plant efficiency improvements through a strategy for long-term modernization

Research Areas:

Data Architecture:

Latest Report: *Technical Basis for Advanced Artificial Intelligence and Machine Learning Adoption in Nuclear Power Plants*

Recap: This report presents the technical basis for developing explainable and trustable artificial intelligence (AI) and machine learning (ML) technologies. The technical basis will lay the foundation for addressing the technical and regulatory adoption challenges of AI/ML technologies across plant assets and the nuclear industry at scale and to achieve seamless cost-effective automation without compromising plant safety and reliability. Report [here](#):



Forward-backward process to ensure reproducibility and interpretability of AI/ML technologies

Integrated Operation for Nuclear (ION):

Latest Report: *Using Information Automation and Human Technology Integration to Implement Integrated Operations for Nuclear*

Recap: This report develop and demonstrate an approach to the design and implementation of advanced, automated systems intended to increase operational efficiencies at nuclear power plants. Report [here](#).

Materials Research Pathway

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

Research Areas:

Metals– Microstructural Characterization of Second High Fluence Baffle-Former Bolt Retrieved from Westinghouse Two-loop Downflow Type PWR- This report present a microstructural characterizations of the second high fluence baffle-former bolt. Analytical electron microscopy and atom probe tomography characterization were performed. Report [here](#).

Concrete- No updates for this month

Cables: Inhomogeneous Aging of Nuclear Power Plant Electrical Cable Insulation- This report documented the results of nuclear cables insulation samples subjected to thermal aging at temperatures like those used in historic environmental qualification. The aged materials were characterized for effects of aging using the conventional tensile elongation at break for all samples. Report [here](#).

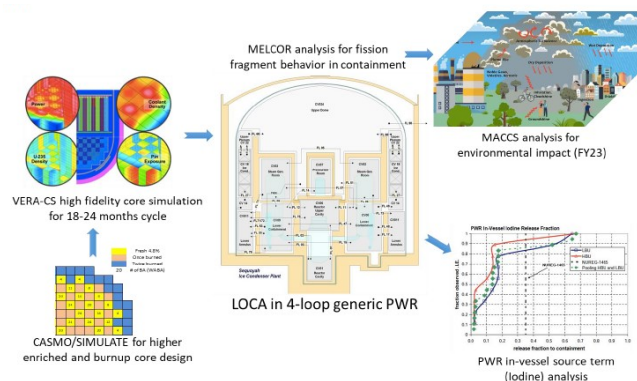
Risk Informed System Analysis (RISA) Pathway

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

Research Areas:

Enhanced Resilient Systems:

Safety Analysis for Accident-Tolerant Fuels (ATF) with Increased Enrichment and Extended Burnup- This report presents a safety analyses of ATFs with increased enrichment and extended burnup to provide scientific knowledge of the ATF fuel performance, failure mechanisms, and results from fuel failure source terms during a severe accident. Report [here](#).



Schematic diagram of ATF loaded PWR with extended burnup safety analysis

Risk-Informed Asset management:

Risk-Informed Initiating Events Accident Response– This report documents the economic benefits potentially available from the application of concepts associated with a modernized regulatory framework developed for advanced reactors to the existing light water reactors. Timing factors were utilized to demonstrate the complexity of the existing risk assessments and described how these complexities affect regulatory compliance activities at the plants. Report [here](#).

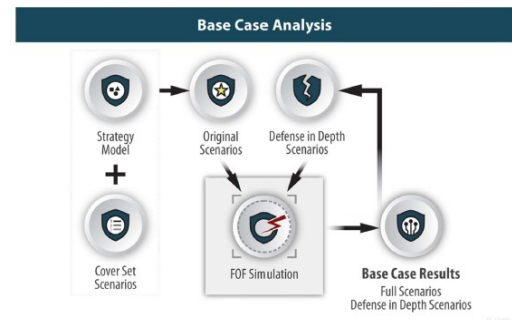
Physical Security Pathway

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

Research Areas

Advanced Security Technologies Safety

Guidance Document for Using Dynamic Force-on-Force (FOF) Tools- This document provides a guidance for using the dynamic computational framework for optimizing physical security at nuclear power plants. The instructions in this document cover the FOF tools that are used by a majority of U.S. commercial plants for their physical security modeling and assessment. Report [here](#).



Flow for creating a base case comparison results

Risk-Informed Physical Security

Risk-Informed Adversary Timeline Tool- This report has a focus on reducing conservatisms in adversary timelines which potentially lead to over protection of a potential attack path resulting in inefficiencies in areas of a plant's security posture. Report [here](#).

Flexible Plant Operation and Generation Pathway

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

Latest Report: *Plan for Scaling Up Hydrogen Production with Nuclear Power Plants*

Recap: This report outlines the opportunity for Nuclear Power Plants to participate in the commercial nuclear hydrogen project intended to create a regional clean hydrogen hubs. Report [here](#).

Updates: Based on the latest meeting within the industry and the agency

- INL Publication on 100 MW nominal design report and generic 10 CFR 50.59 evaluation will be finalized by November.

Upcoming Events

2022 US Department of Energy Light Water Reactor Sustainability (LWRS) Program Materials Research Pathway Virtual Stakeholder Engagement meetings:

- **Concrete:** November 7th 2022-12:00 PM– 5:30 PM [Scheduler and Agenda](#)
- **Metals:** November 9th, 2022-12:00 PM– 5:30 PM [Scheduler and Agenda](#)
- **Cables:** November 10th, 2022-12:00 PM– 5:30 PM [Scheduler and Agenda](#)