April 2024

LWRS Status Highlights

Program Mission

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 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 which extend to the area of light water reactor long-term operation and proposed modification for light water reactor sustainability.

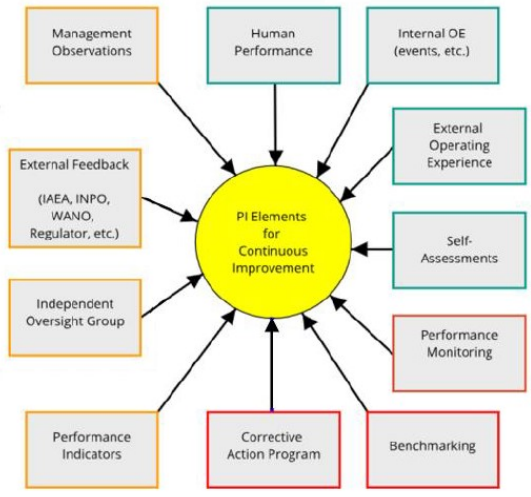
Plant Modernization Pathway

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

Latest Report **:**

Optimizing Information Automation Using a New Method Based on System-Theoretic Process Analysis-

This report describes the interim progress for research supporting the design and optimization of information automation systems for nuclear power plants. It goes on to describes modeling tools and techniques, based on sociotechnical system theory, to support these design goals and their application in the current research effort. The report is intended for senior nuclear energy stakeholders, including regulators, corporate management, and senior plant management. The effort conclude with a set of summary recommendations and an initial draft list of system-level requirements and safety constraints for optimized information automation systems.



Characteristics of a typical performance improvement program

Materials Research Pathway

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

Latest Report:

Assessment of Machine Learning for Ultrasonic Nondestructive Evaluation of Alkali-Silica Reaction in Concrete-

The study summarized herein evaluated the effectiveness of two ML models (i.e., support vector regression (SVR) and deep neural network (DNN)) in predicting concrete material damage induced by ASR based on the long-term ultrasonic monitoring data. Four distinct concrete specimens were cast with artificially induced ASR, and over a period exceeding 500 days, ultrasonic signals and expansion data were continuously collected. Different combinations of training and testing datasets were designed to explore factors influencing prediction performance, including the range of data within training and testing sets, in addition to various signal preprocessing methodologies.

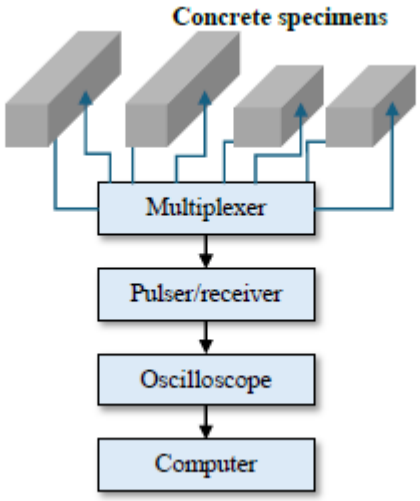


Diagram of the ultrasonic monitoring system for the four concrete specimen

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

Latest Report:

Safety Analysis of Chromium-Coated Accident-Tolerant Fuels with Increased Enrichment and Extended Burnup for PWRs- This report documents research and development conducted in support of deploying accident-tolerant fuels. Specifically, the performance of chromium coating during a beyond design basis accident was investigated. An 18-month reference core was considered, and the performance of cases with and without chromium coating was compared. An extended cycle length of 24-month was then considered with the chromium coating to determine whether the benefit of using the chromium coating was more or less significant than the increased fission product inventory when considering fission product release. The chromium coating model utilized here is a preliminary implementation, and further work is recommended on a more detailed model.

Physical Security Pathway

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

Latest Report:

No report for this issue

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 50% and 70% Thermal Power Extraction Systems- This report presents an engineering assessment of the impacts to the PWR secondary system based on the PEPSE* results for the respective thermal power dispatch (TPD) scenarios. Of particular interest are the impacts on the plant equipment due to thermal and mechanical stresses associated with thermal power extraction. The assessment concludes that the plant would be expected to reasonably accommodate up to 50% thermal power extraction without significant impact to major components, including the high- and low-pressure turbines, main condenser, power train pumps, moisture separator reheaters, drain systems, feedwater heaters, and extraction steam.

*PEPSE is a steady-state energy balance software program that calculates the performance of electric generating plants.

LWRS May Calendar

LWRS Spring Review Meeting— The LWRS Program is hosting a spring meeting. It will be a two-day virtual meeting from 9:00 a.m. to 1:00 p.m. (EST) on Tuesday, April 30th, and 9:00 a.m. to 2:00 p.m. (EST) on Wednesday, May 1st, 2024.
Link for the meetings is here
Agenda will be distributed near the meeting date.

Monthly Calls ***(links on the dates)***

- FPOG Call-*" Fire protection issues for co-location of a hydrogen facility near a NPP" - May 27, 2024- 10:00-12:00 AM*
- RISA Call *" Plant outage optimization"– May 28, 2024-1:00-2:00 PM*

Past Issues

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