November 2022

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 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

Research Areas:

Digital Infrastructure:

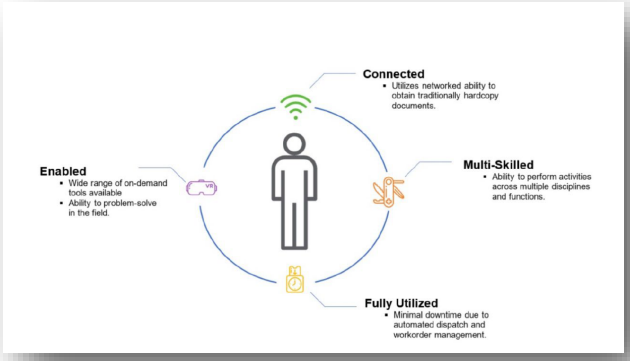
Latest Report: *Digital Infrastructure Industry Engagement*

Recap: This research provides a generic technology strategy and is presented from a technology platform point of view. This platform is ultimately the union of an integrated digital infrastructure (DI) and data architecture and analytics (DA&A) applications selected to operate on it. Specific technologies and software applications are researched, developed, implemented, and then integrated to optimize both the performance of the technology and the capabilities of users who leverage it.

Integrated Operation for Nuclear (ION):

Latest Report: *Integrated Operations for Nuclear Business Operation Model Analysis and Industry Validation*

Recap: This report presents five work reduction opportunities (condition-based maintenance, digital I&C and digital control room, automated planning and scheduling, advanced training technology, and remote assistance and automated troubleshooting) that can be implement in the current nuclear power plant fleet.



Characteristics of the worker of the future

Materials Research Pathway

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

Materials Research Stakeholders Meeting Slides

Research Areas:

Metals– No updates for this month

Concrete– **Stress Corrosion Cracking (SCC) on Ni-base Alloys in PWR Primary Water Containing KOH vs. LiOH** In this report presents a SCC evaluations on selected materials in both LiOH and KOH-containing PWR primary water chemistries. This report documents the research progress accomplished on this topic, focusing on the SCC growth behavior of Alloy X-750, Alloy 718 and Alloy 82H.

Cables: **Inverse Temperature Effects in Nuclear Power Plant Electrical Cable Insulation-** In this report, two electrical cable insulation materials most commonly used in containment in nuclear power plants considering second license renewal, Brand-Rex *Ultrol* cross-linked polyethylene (XLPE) and Samuel Moore *Dekoron* ethylene-propylene diene monomer (EPDM), were investigated to better understand inverse temperature effects in these materials.

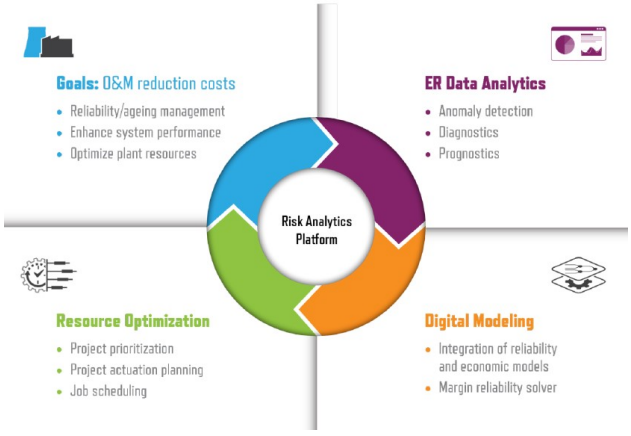
Risk Informed System Analysis (RISA) Pathway

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

Research Areas:

Risk-Informed Asset management:

Bridging Equipment Reliability Data and Robust Decisions in a Plant Operation Context- This report shows the latest improvements on a new risk analytics toolset. This toolset consists of data analytics tools coupled with reliability methods designed to manage plant assets and performances in a predictive maintenance context.



Risk-informed asset management (RIAM) graphical overview

An Integrated Framework for Risk Assessment of High Safety-significant Safety-related Digital Instrumentation and Control Systems in Nuclear Power Plants: Methodology and Demonstration– This report provides a best-estimate, risk-informed capability to quantitatively and accurately estimate the safety margin obtained from plant modernization, especially for the high safety-significant safety-related (HSSSR) DI&C systems and supports and supplements existing advanced risk-informed DI&C design guides by providing quantitative risk information and evidence.

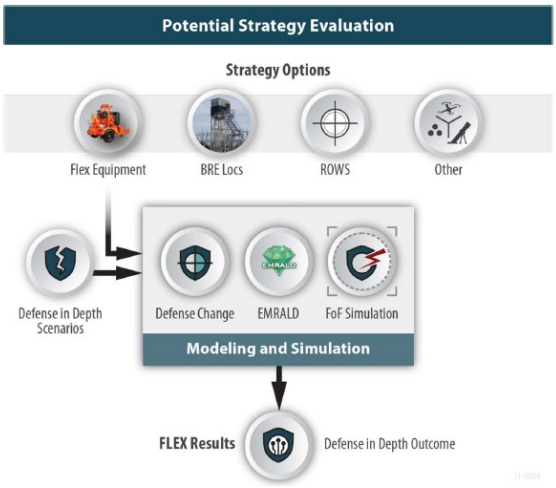
Physical Security Pathway

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

Research Areas

Advanced Security Technologies Safety

Integration of Physical Security Simulation Software Application in a Dynamic Risk Framework - This document presents a dynamic modeling and simulation framework to enable physical security optimization at commercial nuclear power plants. The framework is based on Event Modeling Risk Assessment using Linked Diagrams (EMRALD), the dynamic modeling tool, and is demonstrated for applications that can result in physical security optimization.



Strategy Protection Options Evaluation

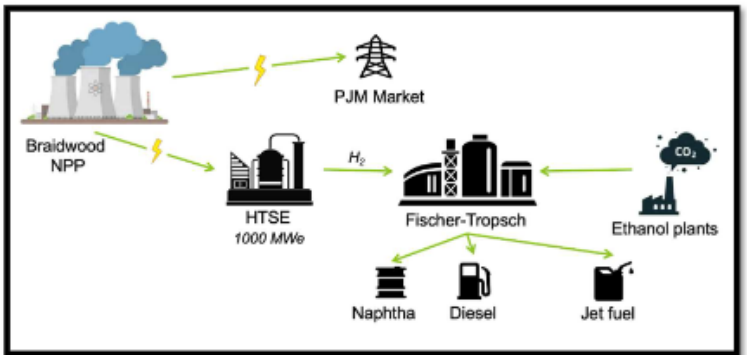
Flexible Plant Operation and Generation Pathway

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

Latest Reports:

***Multi*-Facility Coordinated Thermal Power Dispatch Research Plan**: This report presents a multi-facility coordinated research plan for analyzing integrated electric and thermal power dispatch from commercial light water reactors (LWRs) to tertiary industrial loads.

Production of Fischer-Tropsch Synfuels at Nuclear Plants: This report presents a case study analysis that evaluated nuclear-powered synthetic fuel production in the midwestern United States (U.S.). A Fischer-Tropsch (FT) fuel synthesis plant design was used as the basis for the analysis. The FT plant design was configured to produce a product slate consisting of diesel fuel, jet fuel, and motor gasoline blend stocks from carbon dioxide (CO2) and hydrogen (H2) feedstocks.



Synthetic fuel production process

Prepared by: Ramón L. Gascot (RES/DE/RGPMB)