

# 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 of safety and reliability while maintaining the safety standards; improve the efficiency of physical security; 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:

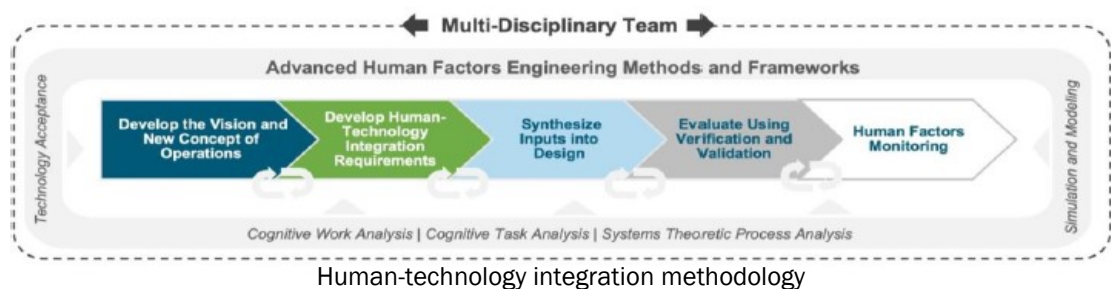
Human and Technology Integration:

**Latest Report:** [Demonstration and Evaluation of the Human-Technology Integration Function Allocation Methodology](#)

**Recap:** This documents presents a demonstration of the human-technology guidance developed by the Light Water Reactor Sustainability Program from a first-of-a-kind digital I&C up-

grade, specifically addressing function analysis and allocation

for a new digital I&C system that included changes in automation levels.



*Data Architecture and Analytics:*

**Latest Report:** [Process Anomaly Detection for Sparsely Labeled Events in Nuclear Power Plants](#)

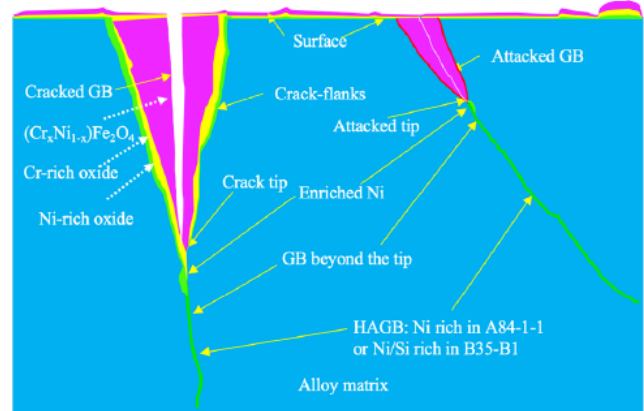
**Recap:** This report presents an anomaly detection semi-supervised machine learning method to fuse partial labeling with sensor data in order to test the hypothesis that partially labeled anomalies can improve anomaly detection performance.

## Materials Research Pathway

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

### Research Areas:

**Metals– Toward an understanding of straining mode, grain boundary oxidation and localized deformation on intergranular cracking of neutron irradiated austenitic stainless steels**– this report identifies the mechanism of irradiation-assisted stress corrosion cracking (IASCC) in highly irradiated solution-annealed 304 and cold-worked 316 stainless steels in PWR primary water environment and to recommend mitigation strategies.



Schematic drawing summarizing the general features of the attacked and cracked grain boundaries

**Concrete**– No updates for this month.

**Cables**– No updates for this month.

## Risk Informed System Analysis (RISA) Pathway

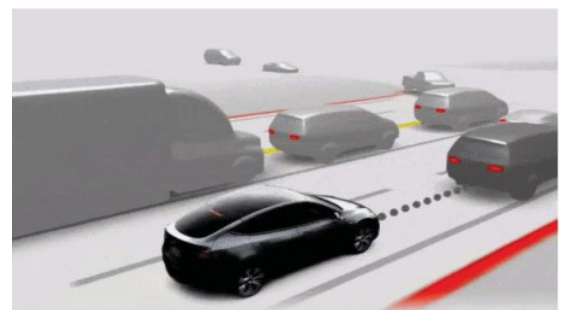
**Main Goal:** develop safety analysis methods and tools to optimize the safety, reliability, and economics of nuclear power plants.

### Research Areas:

*Plant Fuel Reload Optimization:*

**Development and Demonstration of a Risk-Informed Approach to the Regulatory Required Fuel Reload Safety Analysis** This report presents a reload optimization framework development project which aims to build a reactor core designing tool that integrates reactor safety and fuel performance analyses and uses artificial intelligence to support optimization of core design solutions.

*Enhanced Fire Probabilistic Risk Assessment:*  
**Industry Level Feasibility of LiDAR Data into Fire Modeling Using Fire Risk Investigation in 3D (FRI3D)**– This research explores the ability to provide a simple way for the user to tag items and verify plant data, capturing both the speed of AI and human verification. The report also presents the development of an interface for importing pieces needed for modeling and simulation.



Example of Tesla's real-time vehicle classification

## Physical Security Pathway

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

The Physical Security Pathway will have two half-day Stakeholder Meetings on January 31, 2023 and February 1, 2023. If someone is interested in attend, please contact Al Tardiff at [Al.Tardiff@nrc.gov](mailto:Al.Tardiff@nrc.gov). Meeting Agenda [here](#).

## Flexible Plant Operations and Generation Pathway

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

No updates or reports for the ***Flexible Plant Operations and Generation*** in this issue.