

South Texas Project Innovation Focus Areas

- Reduce Activities – Maintenance and Operations
- Digitize Paper Processes and Enable Mobile Worker
- AI – Figure Out How it Fits In
- Training Modernization*
- Power Uprate Opportunities
- Hydrogen Production Opportunities*
- Rethinking Work Management

* Direct LWRS involvement

Comanche Peak Nuclear Power Plant Modernization

Idaho National Laboratory Collaboration

Taylor Smith, PMP

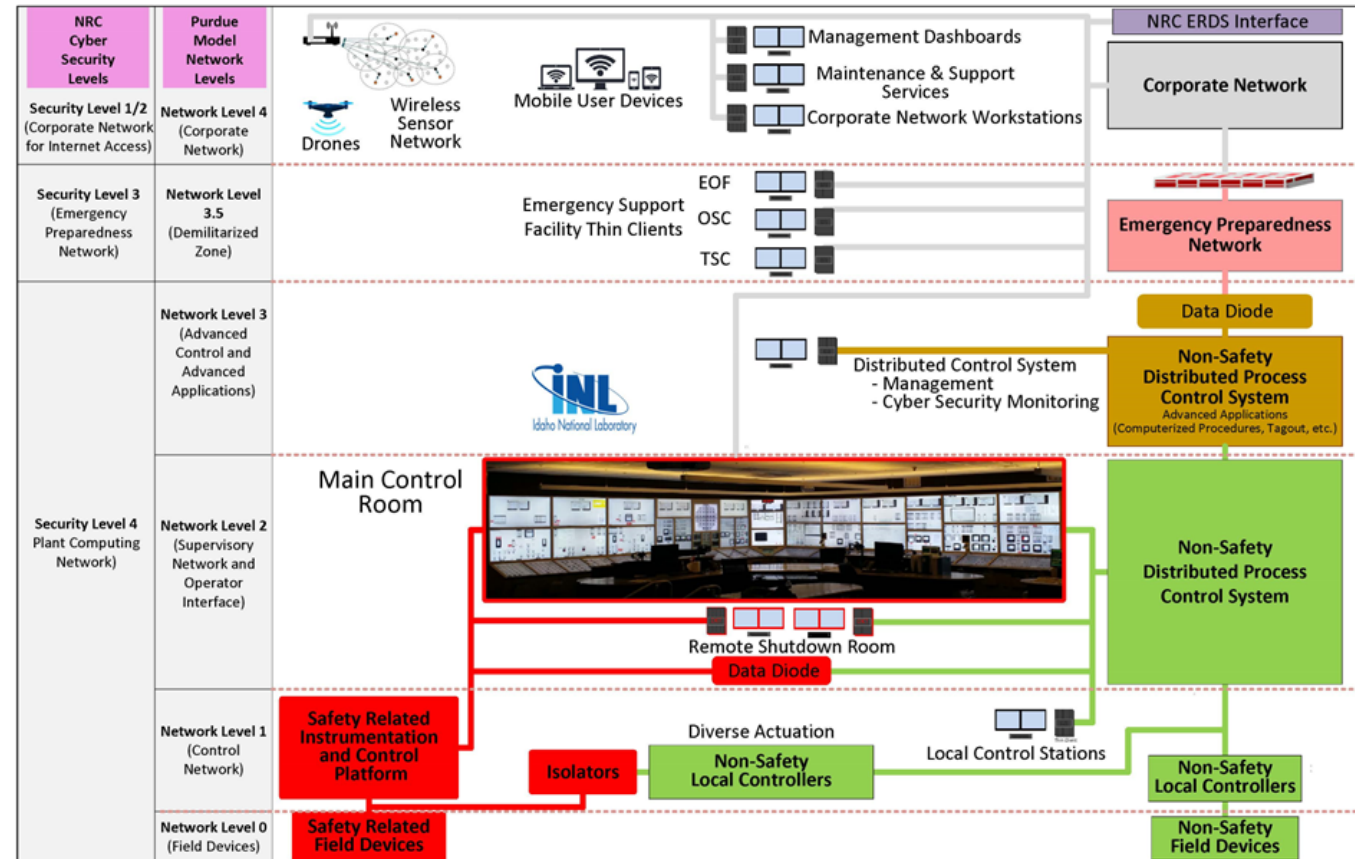
License Renewal Lead

Long Term Operations

Engineering Manager

Digital Upgrades At Vistra: Scope & Strategic Direction

- Comanche Peak initial license renewal (2030-2050).
- Safety-related and non-safety I&C systems at are obsolete and need to be upgraded.
- Vistra is establishing a fleet-wide modernization approach (6 units) led by Comanche Peak as initial pilot
- Vistra is engaging INL Plant Modernization Pathway expertise to maximize the aggregate impact of plant modernization efforts to lower nuclear plant costs:
 - Digital Infrastructure (DI)
 - Data Architecture & Analytics (DA&A),
 - Human Factors Engineering (HFE)
 - Integrated Operations for Nuclear (ION).
- Vistra and INL are finalizing a Cooperative Research and Development Agreement to formalize collaborative efforts going forward.



INL Digital Infrastructure Migration Framework.

Integrating New Digital Technologies and Operational Concepts to Reduce Plants Costs

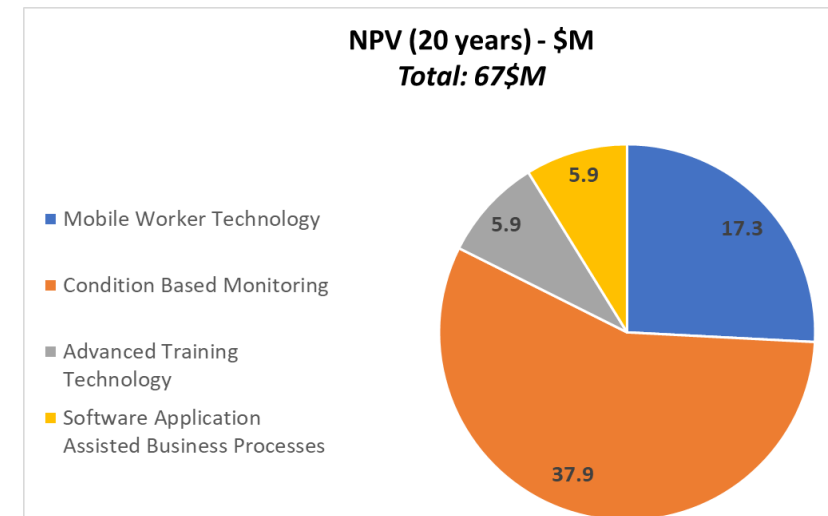
Vistra and LWRS Program researchers performed a DI Business Case Analysis (BCA) at Comanche Peak.

- Existing safety-related (SR) and non-SR-related instrumentation and control (I&C) system were evaluated.
- The Comanche Peak BCA includes lost generation impacts if I&C upgrades are not performed, contributing to a more realistic result.
- The team is also integrating ION with DI research to maximize the aggregate impact of digital upgrades to lower nuclear plant costs.
- By integrating ION concepts into the DI, Vistra identified priority work reduction opportunities to pursue for significant cost reductions.

INL's efforts directly contributed to including the full I&C upgrade project scope in the Vistra Long-Range Plan. Without INL, our station would not have seen the big picture and the benefits of common platform I&C systems. Industry will also benefit as the methods and techniques used in this effort have been made [publicly available](#).

Scenario Title	Payback Period	Net Present Value (NPV)
Baseline (30 years of continued operation)	17.8 years	\$74M
Baseline (50 years of continued operations)	17.8 years	\$685M

NPV of I&C Digital Modernizations. Digital I&C upgrades pay for themselves and provide increasing returns as plant life is extended.



Net Present Value of Priority Work Reduction Opportunities (Vistra Comanche Peak Plant)

Current Efforts: Select Work Reduction Opportunity Demonstration

- Vistra and INL are investigating select DI-enabled ION related Work Reduction Opportunities
 - **Lifecycle support services for modernized I&C Systems**
 - Identify and document the scope of vendor offered, design enabled, lifecycle support services.
 - Determine services with most cost saving potential to drive a business case analysis.
 - **Artificial intelligence tool practical application:**
 - Populate and configure an available AI (LLM) Platform with nuclear plant data sets used to perform work.
 - Engage station personnel to evaluate the AI tool practicality/usefulness to reduce workload.
 - Identify most promising AI tool use cases for search capabilities, document drafting, and content recommendations.
 - Enable business case analyses for those use cases.

Questions?

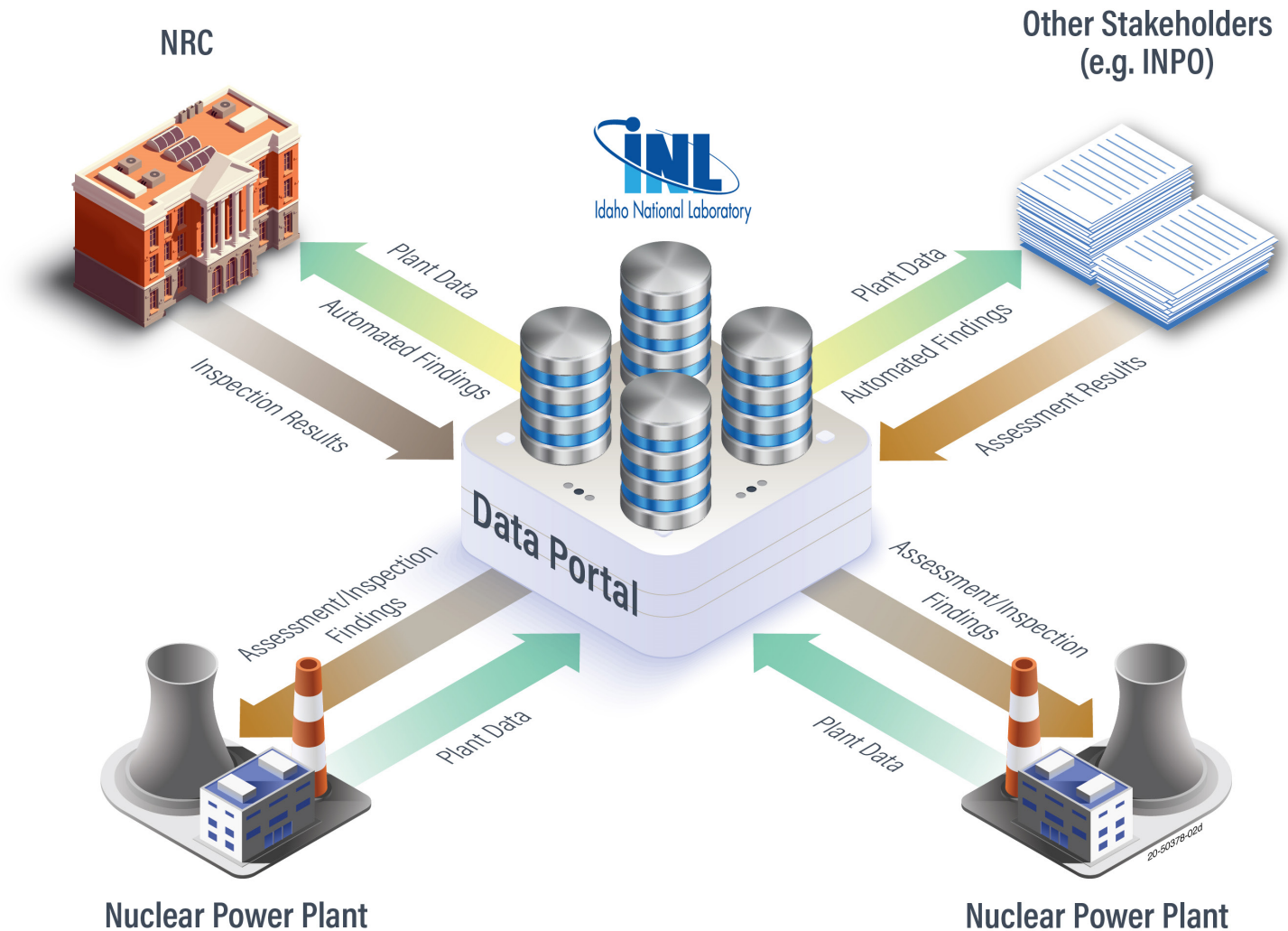
Thank you.



PILOT DEMONSTRATION OF DATA PORTAL FOR NRC INSPECTION PREPARATION

Vision for Data Portal

- Used in parallel with Focused Self Assessment for upcoming NRC Problem Identification and Resolution (PI&R) inspection at Monticello
- Information incorporated in the portal included Corrective Action Program documents, work requests and work orders



Benefits / Limitations Identified

1. Comprehensive Review through Portal

- FSA traditionally utilized a representative sample approach; potential unidentified regulatory vulnerability
- Portal can consume all CAP data and then allows FSA to focus on outliers through comprehensive review

		Machine Prediction	
		CAQ	NCAQ
Human Prediction	CAQ	1xxx	2xx
	NCAQ	xxx	45xx

2. 'Black Magic' of AI and Building Trust

- Significant work will be required to validate the results provided by the portal to build end-user trust

3. Portal is not Direct FSA Replacement

- Portions of inspection manual require interviews; review of closure notes, etc.

Next Steps / Future Vision

1. Expand **Use** of the Portal with Xcel Energy
 - Use for data validation through FSA review and upcoming NRC inspection
2. Evaluate FSA process for **Efficiencies**
 - 'Continuous' review versus a focused week with sequestered team
 - Ability to identify / correct issues when identified via the portal (i.e., CAQ / NCAQ)
 - CAP Generation Rate trends compared to industry
3. **Validation** of Portal AI Algorithms Based on Regulatory Vulnerability
 - Select target algorithms to review based on available resources to build confidence in portal results while preparing for inspection



QUESTIONS?

Molly.J.Strasser@xcelenergy.com



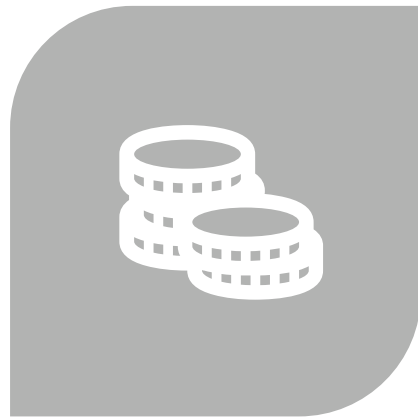
Work Week Management Process Innovation

John McCague, PE
Sargent & Lundy
Digital Modernization & Consulting

May 2024



Why deploy AI/ML and Automation Tools?



REDUCE O&M
COST

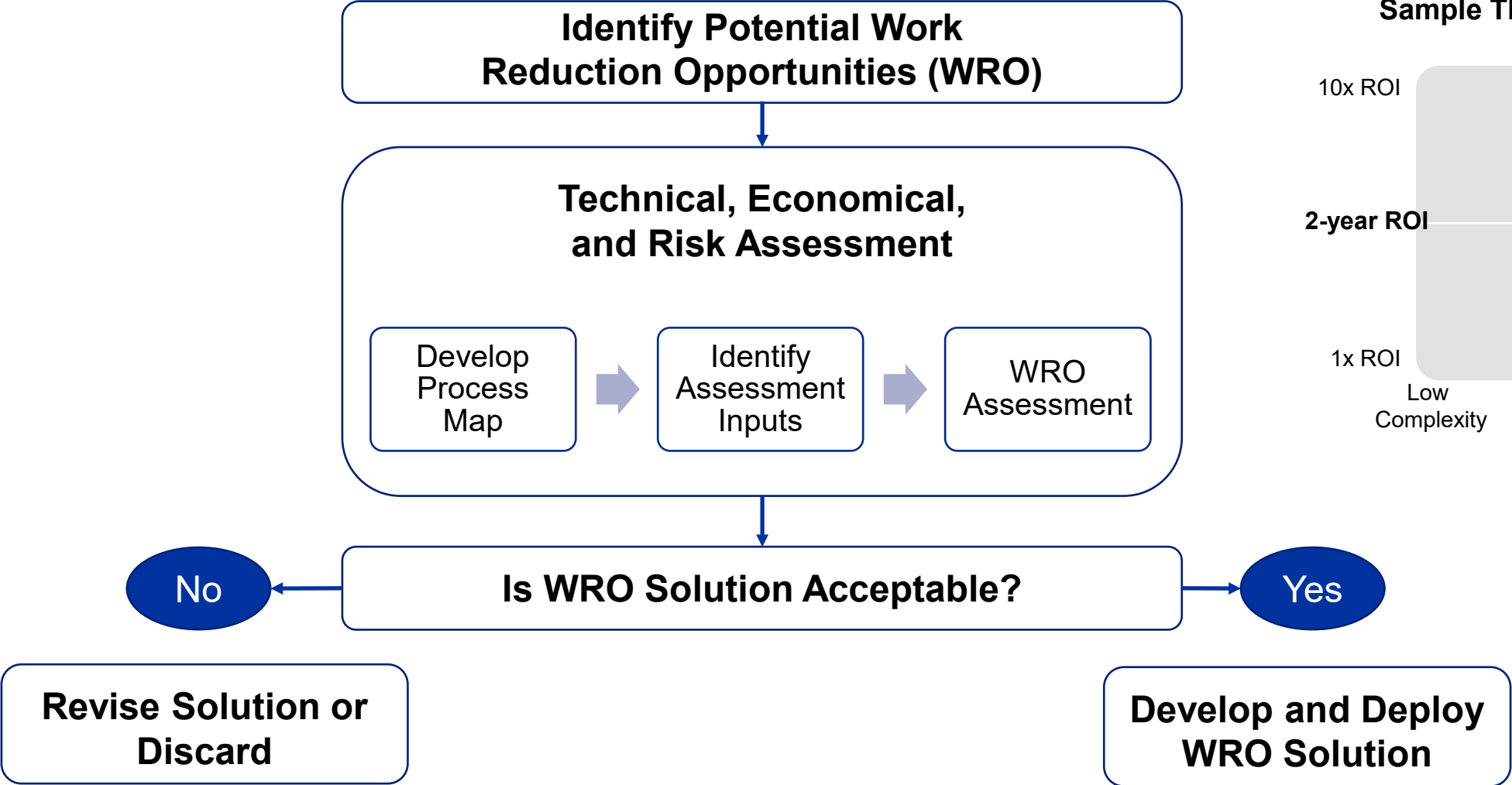


KNOWLEDGE
RETENTION TOOL

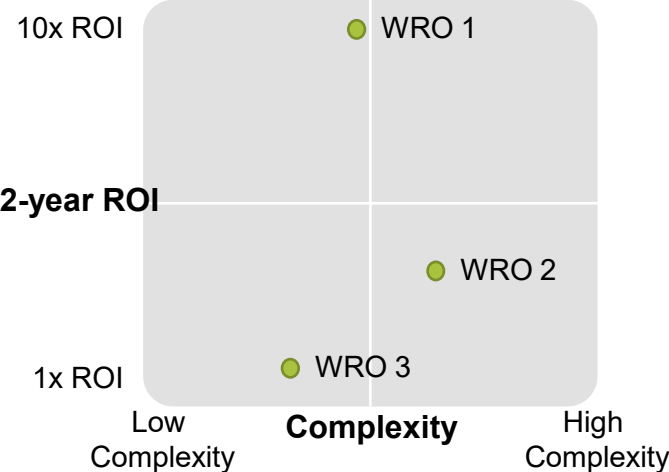


INCREASE PLANT
RELIABILITY

TERA Process Pilot: SNC



Sample TERA Process Results



Work Week Management Solutions



Workflow Automation & Tracking




Databases –
Maximo, INPO




Condition
Reports




Resource
Availability




Triggers




Logic




Actions




Natural Language
Processing



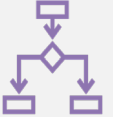
Automated
Alerts



Schedule Bunting



Visualization



New Work
Screening

- **Significantly Streamlined Workflows**
- **Expedited maintenance response**
- **Deployable cross-industry**

Thank You

Modernization Efforts at the NRC and in the Industry

Zack Hollcraft
Office of Nuclear Reactor Regulation
Division of Reactor Oversight
Inspection Branch

Plant Modernization from an NRC Perspective

Nuclear Reactor Regulation

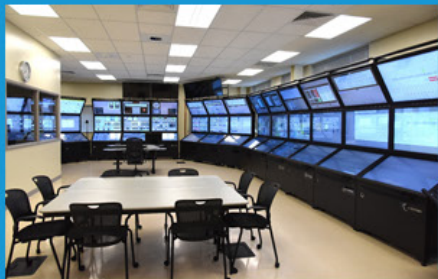
Light Water Reactor Sustainability (LWRS)

Sponsored by the U.S. Department of Energy (DOE) and coordinated through a variety of mechanisms and interactions with industry, vendors, suppliers, regulatory agencies, and other industry research and development (R&D) organizations, the LWRS program involves research to develop technologies and other solutions to improve economics and reliability, sustain safety, and extend the operation of the Nation's fleet of nuclear power plants.

NRR Involvement in LWRS Plant Modernization Pathway

In addition to Office of Nuclear Regulatory Research efforts already underway, the Office of Nuclear Reactor Regulation (NRR) began communicating with the DOE and Idaho National Laboratory (INL) in early 2020 with an intent to better understand LWRS activities and determine their effects on the NRC's licensing and oversight of operating nuclear power plants. There is a robust, multidisciplinary team of NRC subject matter experts engaged with DOE at this time. The NRR staff frequently meet with and provide NRC inputs and feedback to INL on research conducted under the INL Plant Modernization Pathway.

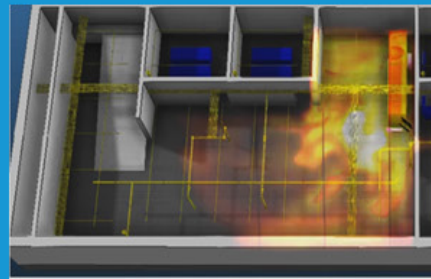
LWRS Research Areas



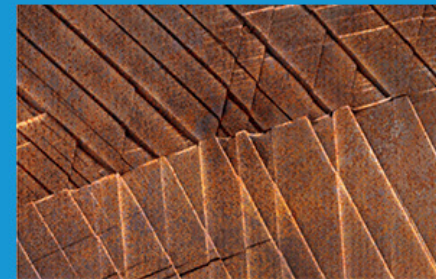
Plant Modernization



Flexible Plant Operations & Generation



Risk-Informed Systems Analysis



Materials Research



Physical Security

Applying the NRC Principles of Good Regulation to Cooperation with the DOE's LWRS Program

Independence

The NRC is not a formal active participant in the LWRS Plant Modernization Pathway. The NRC provides no funding, nor does it have any control over DOE or INL research.

Efficiency

The LWRS Plant Modernization Pathway has the potential to increase the NRC's inspection efficiency by leveraging innovative technology in the way the NRC interacts with licensees during inspections.

Reliability

The NRC will make no change to its oversight of LWRs without ensuring that it maintains its current standard to protect public health and safety.

Openness

The NRC is ensuring that stakeholders understand its involvement in LWRS through public meetings and events such as the RIC.

Clarity

The NRC hopes to communicate any potential concerns about plant modernization efforts in advance to ensure that stakeholders understand the regulator's position before implementation.

Recent Success: Automated Inspection Reports

- In 2017 and 2018 the NRC updated its inspection procedures, report format and inspection tracking application to allow for automatic report generation
- Reports are shorter, easier to read and quicker to generate

1R05 Fire Protection (71111.05)

.1 Routine Quarterly Resident Inspector Tours (71111.05Q)

a. Inspection Scope

The inspectors conducted fire protection walkdowns which were focused on availability, accessibility, and the condition of firefighting equipment in the following risk-significant plant areas:

71111.05AQ—Fire Protection Annual/Quarterly

Quarterly Inspection (4 Samples)

The inspectors evaluated fire protection program implementation in the following selected areas:

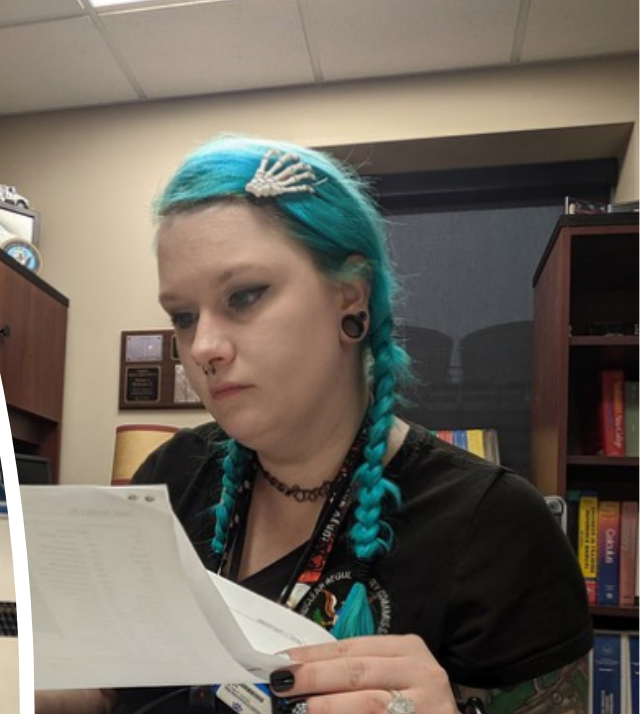
- (1) Fire Area 41A, Screenhouse, Elevation 695’;
- (2) Fire Area 18, Relay and Cable Spreading Room, Elevation 715’;
- (3) Fire Detection Zone 11, Fire Areas 20 & 81; Bus 15 & 16 Switchgear Rooms, Elevation 715’; and
- (4) Fire Zone 97, D5/D6 EDG Building.

Inspectors selected fire areas based on their overall contribution to internal fire risk as documented in the plant’s Individual Plant Examination of External Events (IPEEE) with later additional insights, their potential to impact equipment which could initiate or mitigate a plant transient, or their impact on the plant’s ability to respond to a security event. Using the documents listed in the Attachment to this report, the inspectors verified that fire hoses and extinguishers were in their designated locations and available for immediate use; that fire detectors and sprinklers were unobstructed; that transient material loading was within the analyzed limits; and fire doors, dampers, and penetration seals appeared to be in satisfactory condition. The inspectors also verified that minor issues identified during the inspection were entered into the licensee’s CAP. Documents reviewed are listed in the Attachment to this report.

These inspections constituted five quarterly fire protection samples as defined in IP 71111.05–05.

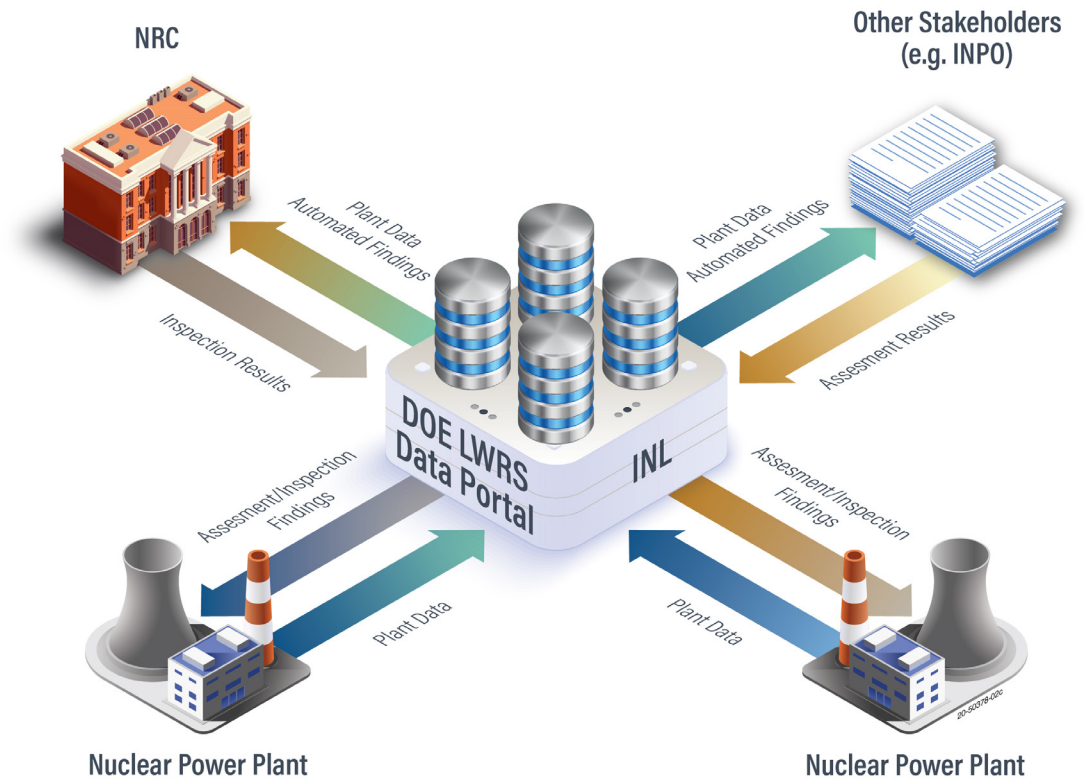
Problem Identification and Resolution Biennial Inspection Procedure (IP 71152)

- Current Inspection process
 - Site visit by team lead (bagman trip)
 - Long and complex request for documents
 - Preparation and mid week see numerous new information requests
 - Onsite weeks see a mix of in person interviews, walkdowns and more document requests
 - Usually the inspector requests are to the licensee support team via email and an application is used to track and answer data requests
 - Inspectors may use licensees' data bases, if they take the time to learn the interface, or the licensee teaches them



A vision for Future Inspection

- An AI enabled data portal with licensee corrective action databases automatically uploaded
- Inspectors can directly query the system for their data requests, and update them real time to adapt to changing inspection focus
- System provides automatic responses to queries without need for licensee assistance
- Single user interface that does not need to be relearned inspection to inspection
- Inspector and licensee staff can focus on issues rather than information flow



AI Use Cases at the NRC

- On October 30, 2023, [Chair Hanson tasked the EDO](#) with developing a broader list of NRC-specific AI use cases
- Deliverables included **develop** a list of recommended AI applications that would benefit the NRC the most, and include a **summary** of
 - Proposed effort
 - Potential benefits and drawbacks
 - Projected cost and savings
 - Timeframe for implementation
 - Consider proper AI usage, policy implications, and data privacy need to ensure responsible and sustainable AI implementation
- These recommendations are in SECY-24-0035, “Advancing use of Artificial Intelligence at the U.S. Nuclear Regulatory Commission,” the publicly available portions will be out in the next week.



Modernizing How We Regulate



Discussion

LWRS Plant Modernization Pathway

Plant Modernization Pathway

The Plant Modernization Pathway conducts targeted R&D to address aging and reliability concerns with the legacy instrumentation and control (I&C) and related information systems of the U.S. operating light-water reactor (LWR) fleet. The objective of these efforts is to develop, demonstrate, and support deployment of new digital I&C technologies for nuclear process control; enhance worker performance; and provide enhanced monitoring capabilities to ensure the continued safe, reliable, and economic operation of the Nation's nuclear power plants.

Objectives

Plant Modernization Research Objectives and Goals

Develop technology modernization solutions that address aging and obsolescence challenges

Deliver a sustainable business model that enables the US nuclear industry to remain cost competitive

Research Areas

I&C Architecture

Digital Architecture

Human & Technology Integration

Integrated Operation for Nuclear

Outcomes

A sustainable I&C architecture

Advanced sensor, monitoring, and data processing replace labor-intensive plant support tasks

Maximize plant operation efficiency and reduce human error

LWR fleet electric market competitiveness