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Plant Modernization Pathway Lead

April 30, 2025

Enhancing Economic Competitiveness

Agenda

Implementing Efficiency Through Digital Modernization

Mark Samselski, Constellation Energy

AI Business and Use Cases for Efficiencies in the Nuclear Fleet

Taylor Smith, Vistra Energy

Demonstrated Value in Training Modernization

Brad Conner, STPEGS

Using AI to Improve Equipment Maintenance Strategies

Matt Brunner, Xcel Energy

Using AI in Internal Audits

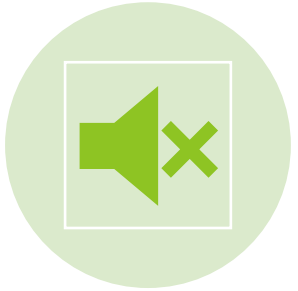
Chris Esser, Xcel Energy

Welcome

Each presentation/talk is for 10 minutes.

Questions, comments, and suggestions will be answered in chat or towards the end of the session.

Please turn off camera during the presentation to save bandwidth



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LWRS
LIGHT WATER REACTOR SUSTAINABILITY

Mark Samselski
Constellation Energy

April 30, 2025

Implementing Efficiency Through Digital Modernization

AI in the Nuclear Workspace Analysis

AI Business and Use Cases for Efficiencies in the Nuclear Fleet

Taylor Smith

Sr. MGR Fleet License Renewal and Innovation

Taylor.Smith@Vistracorp.com

AI / LLM Project Overview

- AI LLM Model
  - Custom model trained on 1.4 Million Nuclear specific documents
    - (WOs, Procedures, Vendor Manual, CRs, NRC documents, and Design Documents)
- Scope
  - Review business case analysis on nuclear applications for a sample population.
    - BORIC ACID
    - MAINT RULE
    - 50.59
  - Initial Findings
    - All used cases that involve research and technical writing are the best quick wins.
      - The Analysis shows time savings for product creation ranging from 10 to 60%
      - Nuclear is a great application for LLM usage with extensive validated documentation and extensive writing and research tasks.
    - With Nuclear O&M Costs at ~ 50% in Labor
      - Developing AI tools that bring data to knowledge is the next evolution to nuclear.

DEMONSTRATED VALUE IN TRAINING MODERNIZATION

Brad Conner, STPNOC

OVERVIEW AND OBJECTIVES

- Overview:
  - Improve the training effectiveness as a Work Reduction Opportunity by developing video-enhanced micro-modules and on-demand tutorial videos.
- Objectives
  - Enhance the efficiency of training to free up valuable class time for hands-on practice.
  - Improve learner engagement and proficiency.
  - A modernized approach opens the door to future readiness, including more interactive, adaptive and personalized training experiences for a multi-generational workforce.

THE MODERN LEARNER

Key Points:

- The growing digital landscape
- Traditional training methods fall short
- A demand in accessibility, interactivity and high-quality multimedia experiences
- Visuals (plus audio):
  - Static Slides vs Interactive Video

MODERNIZATION METHODOLOGIES & TECHNOLOGIES

Techniques Used:

- Conversion of PowerPoint content into dynamic multimedia content featuring overlay graphics, multiple camera angles, and synchronized audio commentary
- Implementation of behavioral questions and interactive elements to foster deep learning

Emerging Technologies:

- Exploration of gamification, virtual reality (VR), and augmented reality (AR) to further enhance engagement and personalization in training
- Use AI chatbots in training courses, allowing additional questions to be answered quickly while maintaining learner momentum

IMPLEMENTATION APPROACH & PRODUCTION PROCESS

Planning & Preparation:

- Storyboarding sessions identifying critical operational steps and key learning areas
- Detailed scheduling for content capture in both lab and field settings

Production & Editing:

- Use of commercial editing software to create polished multimedia CBT modules and on-demand videos
- Incorporation of interactive elements and real-time review sessions to refine the final products

Deployment:

- Integration into the plant’s Learning Management System (LMS) and intranet for ongoing access and review

KEY RESULTS & WORKLOAD REDUCTION METRICS

Quantitative Achievements:

- Training time reduced by an 8:1 ratio
- Significant reduction in instructor and learner hours (verified by business case analysis)

Qualitative Benefits:

- Improved learner confidence and engagement as demonstrated in survey results
- Enhanced retention of critical skills through realistic and interactive training modules

BUSINESS CASE & ECONOMIC BENEFITS

Investment Overview:

- Modest upfront investments compared to long-term savings in instructor and learner hours
- Detailed business case analysis showing potential net present value improvements

Scalability:

- Approach is scalable both within a single plant and across the nuclear industry
- Standardized design enables sharing of CBT materials across sites and fleets

FUTURE DIRECTIONS

Future Enhancements:

- Expansion into broader initial classes and technical training topics
- Continued exploration of advanced technologies (VR, AR, gamification, AI) for personalized learning
- Integration of on-demand videos into work packages and field activities

CONCLUSION

Core Takeaways:

- Modernized training dramatically increases efficiency, reduces workload, and enhances learner engagement
- Successful integration of multimedia CBT and on-demand videos paves the way for industry-wide adoption

Matt Brunner - Manager
Equipment Reliability

4/30/2025

Use of Artificial Intelligence in Improving Equipment Strategies

Xcel Energy

Problem Statement

Some preventive maintenance (PM) tasks for equipment important to safe and reliable NPP operation are not performed with the right scope, frequency, or acceptance criteria.

This is a contributor to unplanned equipment failures and unplanned maintenance.

What is ATOM?

- Joint collaboration between Xcel Energy and Idaho National Lab (INL)

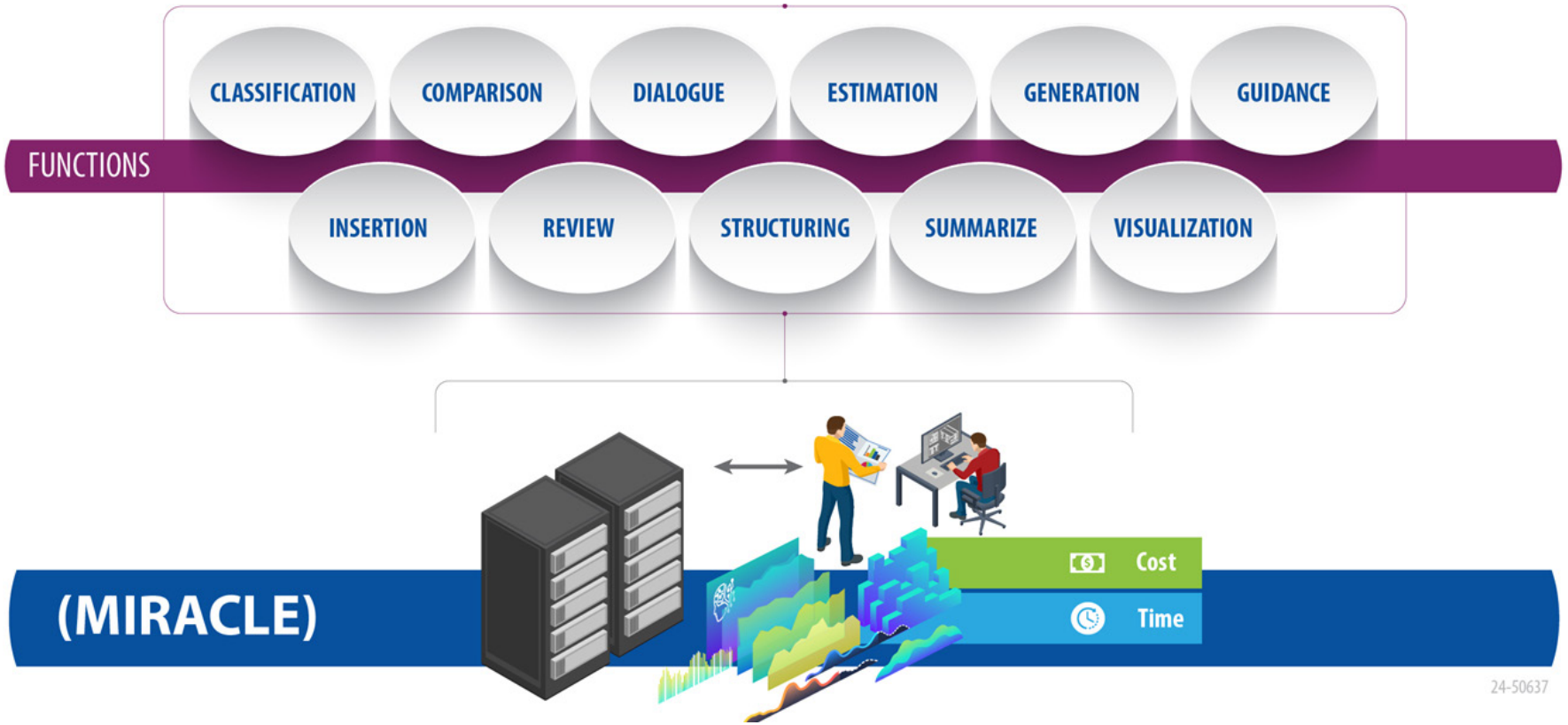
- Enhancement of Maintenance Strategies using Artificial Intelligence (MIRACLE)
  - Improved Preventive Maintenance Scope and Frequency

  - Deployment of Informed Predictive Maintenance and Condition Based Monitoring

Goals of the ATOM Project

- Improved plant equipment reliability
- Improved prioritization, availability, and deployment of NPP resources on critical and important maintenance activities
- Provide the framework for future development and deployment of INL's AI tool (MIRACLE) in other NPP applications

What is MIRACLE?



CAP Screening → Tech specs analysis → Availability and reliability prediction → Work management automation → Inspections automation → Performance improvement

Methodology

Optimize the equipment reliability strategy at nuclear power plants using the INL MIRACLE model.

- Integrate generic, manufacturing, plant-specific, and industry data to inform and improve the equipment reliability strategy.

- Advance the development, training, and user interface of INL's MIRACLE toolset for deployment in NPP applications.

Chris Esser - Principal Performance Analyst

4/30/2025

Use of Artificial Intelligence in Internal Audits

Xcel Energy

Agenda

- Background
- Example of Old Method vs AI Informed Method – CAQ Classification
- Next Steps

Background

Requirements	Old Approach	New Approach
• NRC Problem Identification & Resolution Inspection - Biannual • Station's **perform** Self Assessment **(**aka **Internal Audit)** prior to the inspection, leveraging the NRC's inspection procedure	• **~10 people for one week** to perform assessment (400 hours) • **Assessment Checklist** contains **tasks** that **mimic** NRC **inspection manual** plus other **excellence objectives** • Small, random sample sizes to 'assess'	• Leverage AI to look at **entire dataset** and flag **issues** for **follow up** • Use analytics to answer programmatic health • Piloted in **February 2024** • Performed in **February 2025**

CAP Facts

~10,000 Condition Reports (CR) per Inspection period
Includes Conditions Not Adverse to Quality (NCAQ)

Use of INL's PI&R Inspection Toolset – CR Priority

PI&R Objective: Assess the licensee's ability to evaluate and prioritize issues entered into the PI&R program

Old Method

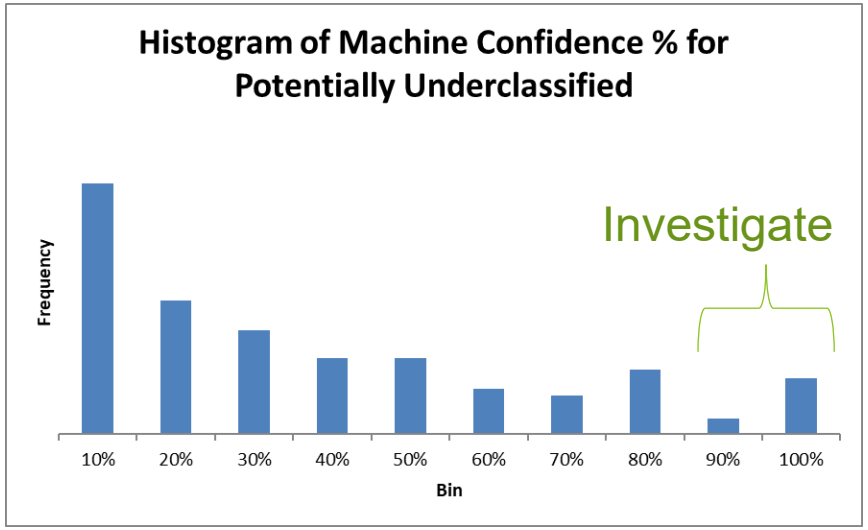
- Review 20 CRs for proper classification of significance… out of ~10,000 in the inspection period… ~75% are NCAQ
- Rarely does our random sampling find an issue

New Method

- Send Data to INL
- INL train CAQ Classifier model on data *PRIOR* to inspection period
- Apply model predicator to *ENTIRE* inspection period dataset
- Filter on potentially under classified CRs
  - Machine Predicts CAQ vs Current is NCAQ
- Sort by highest Machine Confidence %
- Team Member investigate

Condition Adverse to Quality (CAQ) AI Classifier Results

		Machine Prediction	
		CAQ	NCAQ
Human Prediction	CAQ	16%	7%
	NCAQ	3%	74%



- Found a few issues but were still corrected
  - Found more ‘false positives,’ even for high percent confidence
- Opportunity to further refine the AI models
  - "FYI or Additional Information" CRs regarding a previous CAQ
  - New information within a CR that may conflict with original

Next Steps

- Continue to refine AI Classification models to minimize false positives and refine selection process
  - Looked at the same number of CRs as the old method but our ‘success rate’ in finding issues was greatly improved
- Formalize Process and Approach for Repeatability
- Explore new AI use cases.

Same Level of Effort, Better Outcome

Sustaining National Nuclear Assets

lwrs.inl.gov