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12/3/2024

# Artificial Intelligence Tools for Work Management and Inspection Automation



# AI to Automate Work Management Tasks

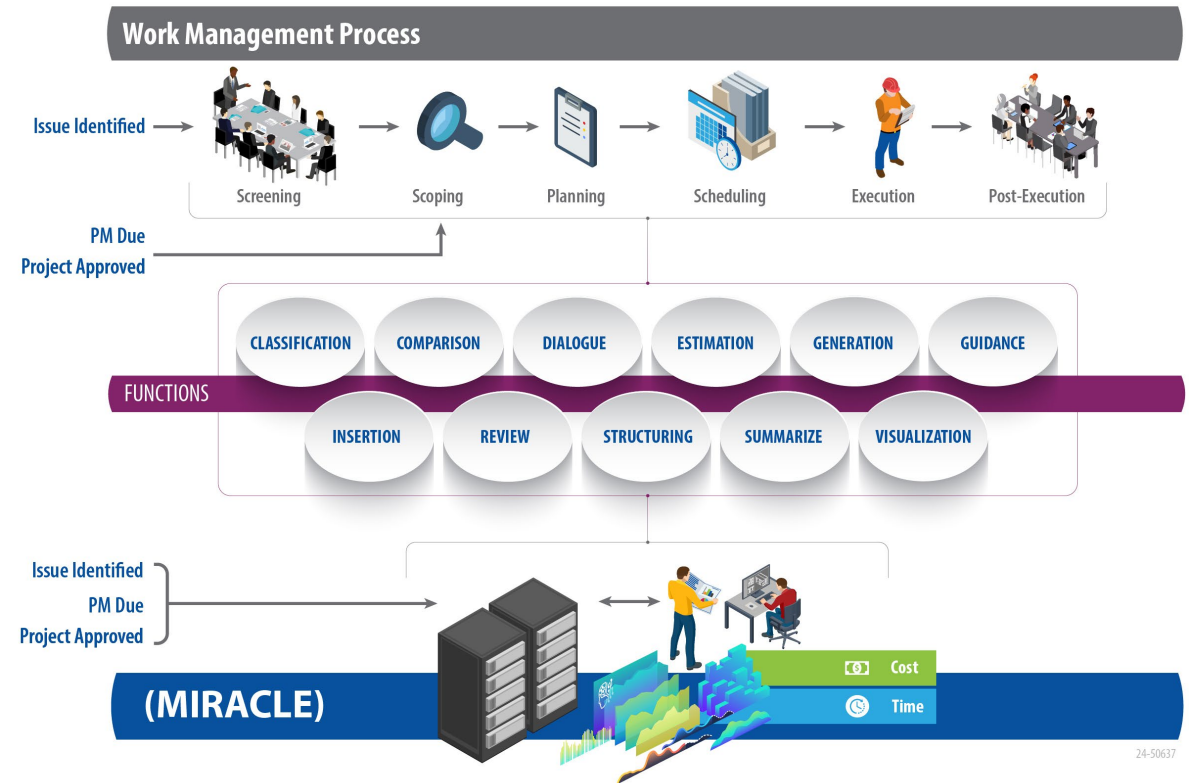
AI methods and tools to **automate decisions or actions** taken by the various organizations staff involve **all the phases of the work management process**.

The work management process is labor intensive, involving multiple phases and plant organizations. Routine tasks can incur significant expenses, often costing tens of thousands of dollars individually. Thousands of work packages are executed every year in a single nuclear power plant.

- The work management process was broken into specific steps performed by staff. AI automation methods for tasks were identified. Some tasks were demonstrated using AI.

## How the process works:

- Categorize all type of decisions into main functions of AI tools
- Develop AI methods and tools to automate each function
- Map each decision and action to the functions
- Assign the AI methods and tools to each decision and action
- Identify and overcome technological challenges.



# Example AI Use in Work Management

AI Function: Comparison

Key Question: Did this condition occur before?

*New Condition: There was a steam leak coming from a check valve near the reactor core isolation cooling system. This leak caused damage to piping and resulted in a boric acid spill. There may need to be revisions to technical specifications.*

*Previous Condition 1: During the walkdown, dry white boron was observed. This is not reportable, and operability is maintained. The presence of dry white boric acid suggests an inactive leak with minimal or no corrosion. There is reasonable assurance that the leak did not affect the flow of the available emergency core cooling system. Operability remains intact.*

*Previous Condition 2 : Half of the high bay lights in [Room] are out, leaving one end particularly dark. Please replace the faulty lights.*

Comparison Results

Condition 1	Condition 2	MiniLM Cosine Similarity (%)
New Condition	Previous Condition 1	29.0
New Condition	Previous Condition 2	-2.6

# Example AI Use in Work Management

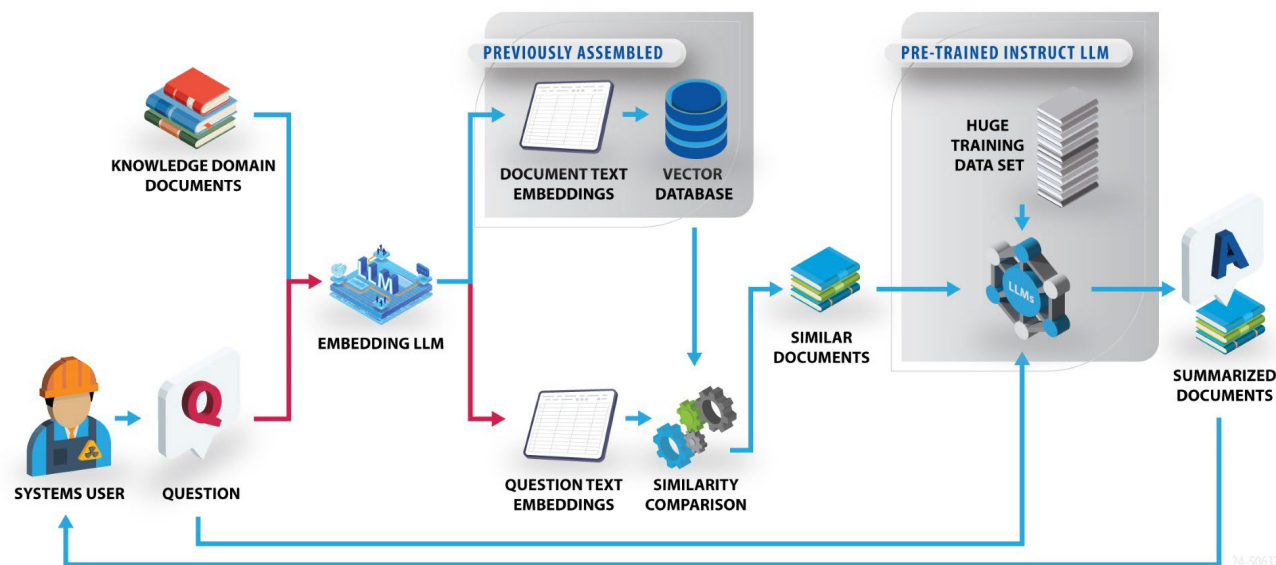
AI Function: Generation

Knowledge need: Explain the risk of arc chuting during breakers inspections

Prompt: *“What is the risk of arc chutes when conducting breakers inspections?”*

Response: *“Based on the provided document, the risk of arc chutes during breaker inspections is related to the potential exposure to asbestos when handling and removing the arc chutes. Asbestos is a known health hazard and should be handled in accordance with established safety protocols and regulations. Therefore, personnel should follow the procedures outlined in the document to minimize the risk of exposure.”*

The Retrieval-Augmented Generation (RAG) process.



# AI in Inspections

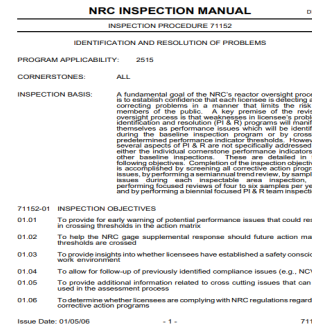
AI methods and tools are used to analyze plant data and generate results that **demonstrate compliance with inspection procedures requirements in an automated and comprehensive manner.**

Plants expend significant resources performing compliance-assurance activities, including inspections.

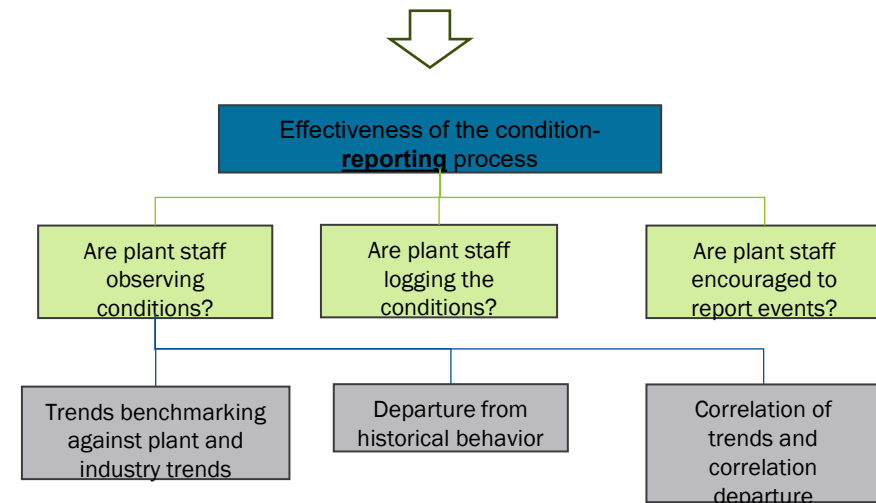
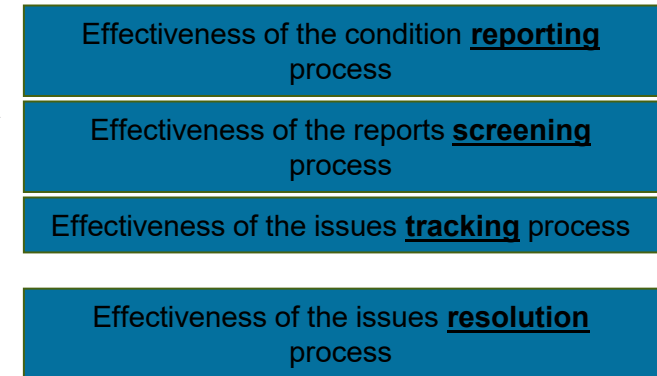
- Much effort is expended by nuclear power plant personnel to prepare and complete these inspections and ensure the safe operation of the plant.
- Most of the staff effort involves evaluating plant data and comparing it against the inspection procedure requirements. AI can automate those evaluations.

## How the process works:

1. Convert inspection procedure to data-based decisions
2. Develop AI methods and tools to make the data-driven decisions
3. Apply the AI methods and tools to plant data and generate compliance insight
4. Evaluate the insights and make conclusions.

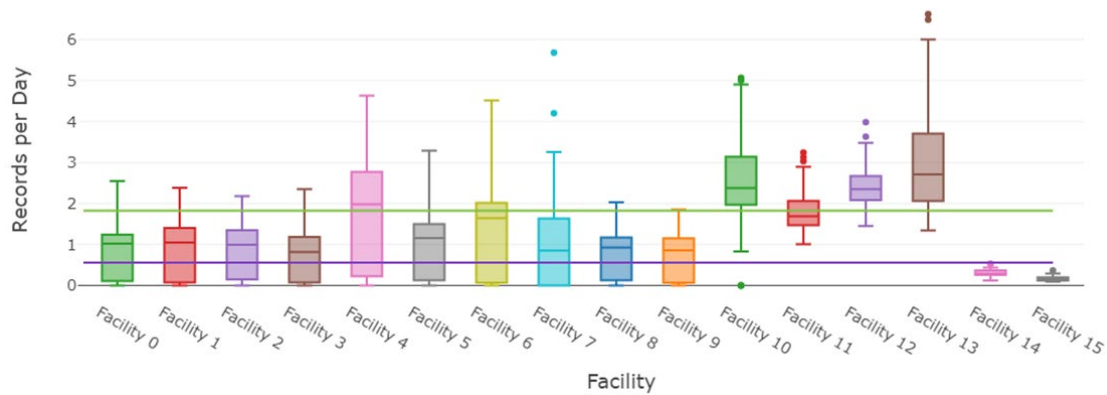


15 pages



# Example AI Use in Inspections

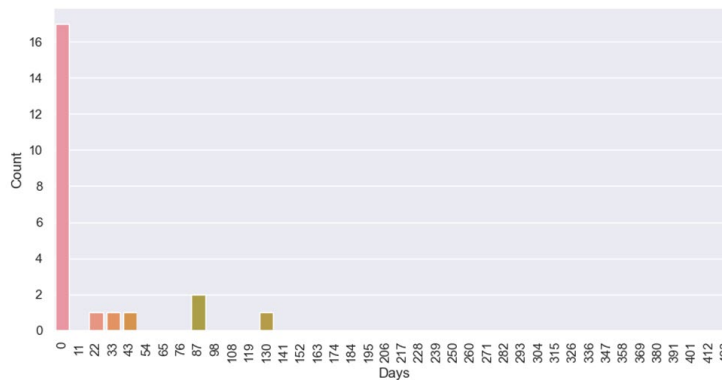
Example of “Reporting” Evaluation



Example of “Screening” Evaluation

		Machine Prediction	
		CAQ	NCAQ
Human Prediction	CAQ	478	199
	NCAQ	23	1245

Example of “Resolution” Evaluation



# Day 2 - Session 4 – Innovation and Data Analytics

Wednesday, December 4, 2024  
 1:30pm – 3:45pm (EST)

Time (EST)	Topic	Speaker - Organization
1:30 - 1:35	Introduction	Jake Farber, INL
1:35 - 2:00	Advanced Remote Monitoring	Jamie Dugan, Vistra Corp.
2:00 - 2:25	Continuous Online Monitoring for Process Anomaly Detection and Predictive Maintenance	Jake Farber and Vivek Agarwal, INL, on behalf of Xcel Energy and PSEG
2:25 - 2:50	Artificial Intelligence (AI) in Work Management	Pat Murray, EQRPI, Inc.
2:50 - 3:15	Insights on using AI for Inspections	Chris Esser, Xcel Energy
3:15 - 3:45	General Q&A and Session Wrap Up	Vivek Agarwal, INL
3:45	Session Adjourned	





# Sustaining National Nuclear Assets

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