



AI in Action: Applied Research Projects for the Nuclear Sector at EPRI

Select Use Cases



Agnieszka Czeszumska, PhD
Senior Technical Leader
EPRI Europe DAC

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The EPRI logo is displayed in white, bold, sans-serif capital letters on a dark blue background. The background of the slide features a grayscale image of a construction worker in a hard hat, a blue world map, and a city skyline at night.

EPRI

How to build trust through global collaboration

“

*Advancing safe, reliable, affordable, and clean energy for society through **global collaboration**, science and technology innovation, and applied research*

Together...Shaping the Future of Energy®

If AI is the answer, what is the question?

Use case definition



Appropriate AI technology choice

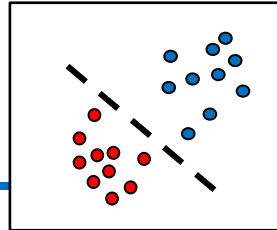
Qualification/Benchmarking

It's an iterative process

Select projects at EPRI



Discriminative AI



Use case:

Nondestructive Evaluation (NDE)

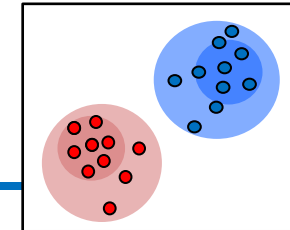
Technology: Computer Vision

Projects:

- Concrete Defect Detection Tool for aerial drones
- AI-assisted Ultrasonic Testing



Generative AI



Use Cases: Document generation, Knowledge Management

Technologies: LLMs and Knowledge Graphs

Projects:

- TroubleBot: Troubleshooting Chatbot
- Oral History
- Decommissioning KM



Projects using non-generative AI

Concrete Defect Detection

Key contact: tseuaciuc-osorio@epri.com

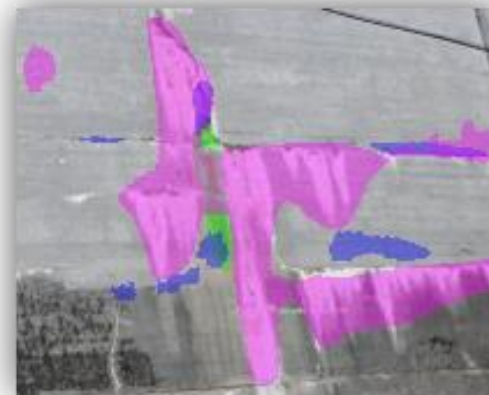
Upload Images

Set Thresholds

Create Dataset

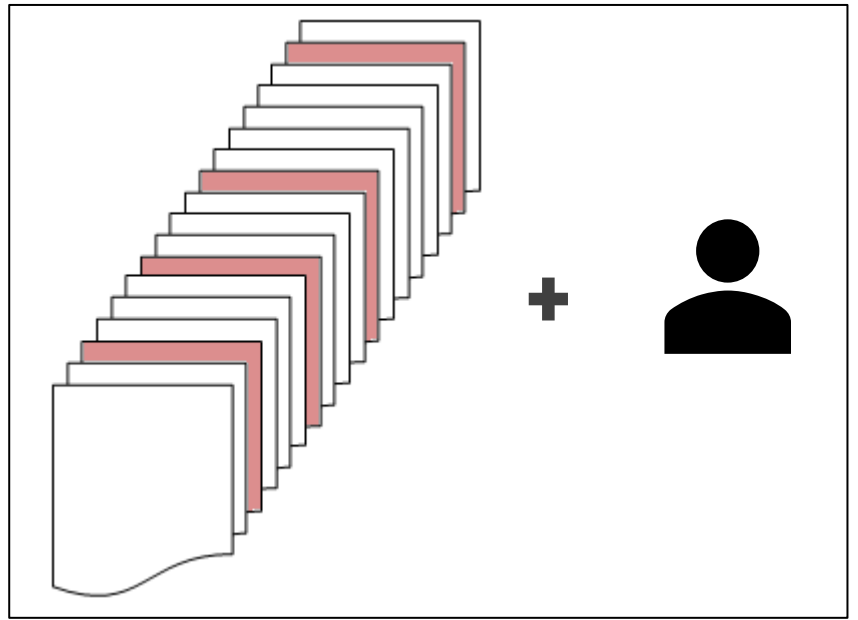
Evaluate

View Results

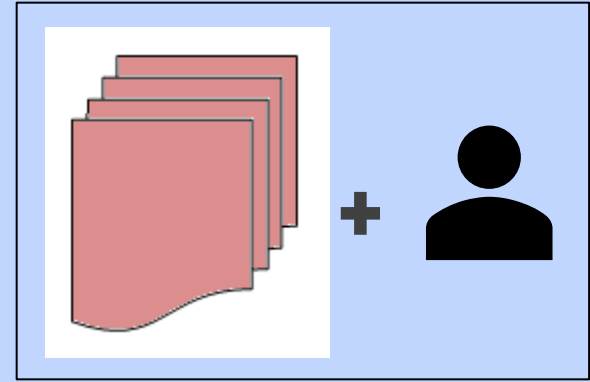


AI-assisted Ultrasonic Testing (UT) NDE Inspections

- Current Inspection
 - Examiners distribute their energy across a high volume of (mostly benign) data

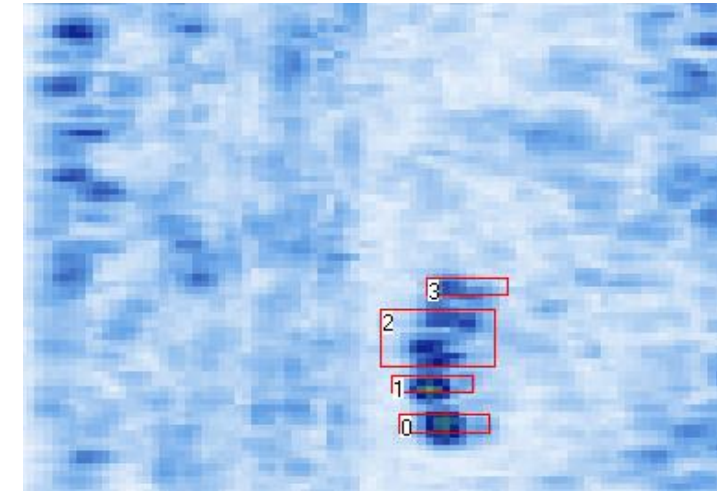
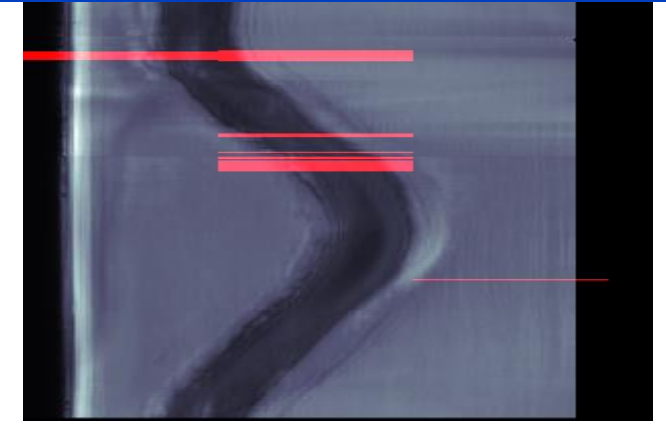
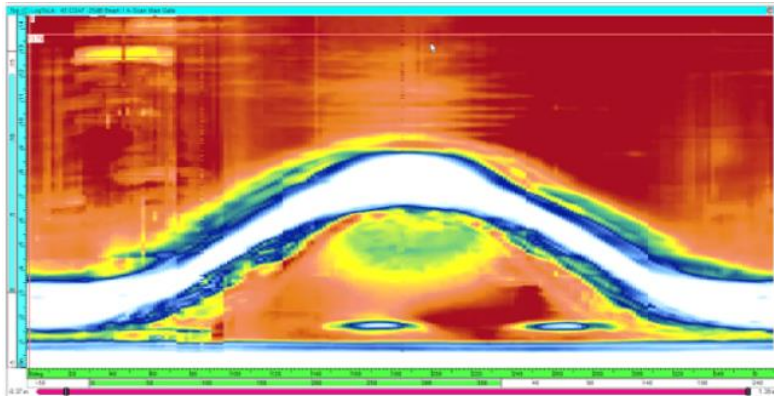


- AI Assisted Inspection
 - Examiners focus their energy on the regions that require more careful review



Deployment

Key contact: tseuaciuc-osorio@epri.com



1

UT data is saved in ML Box through local connection

2

Box automatically detects and processes UT data...

3

... and generates output for review

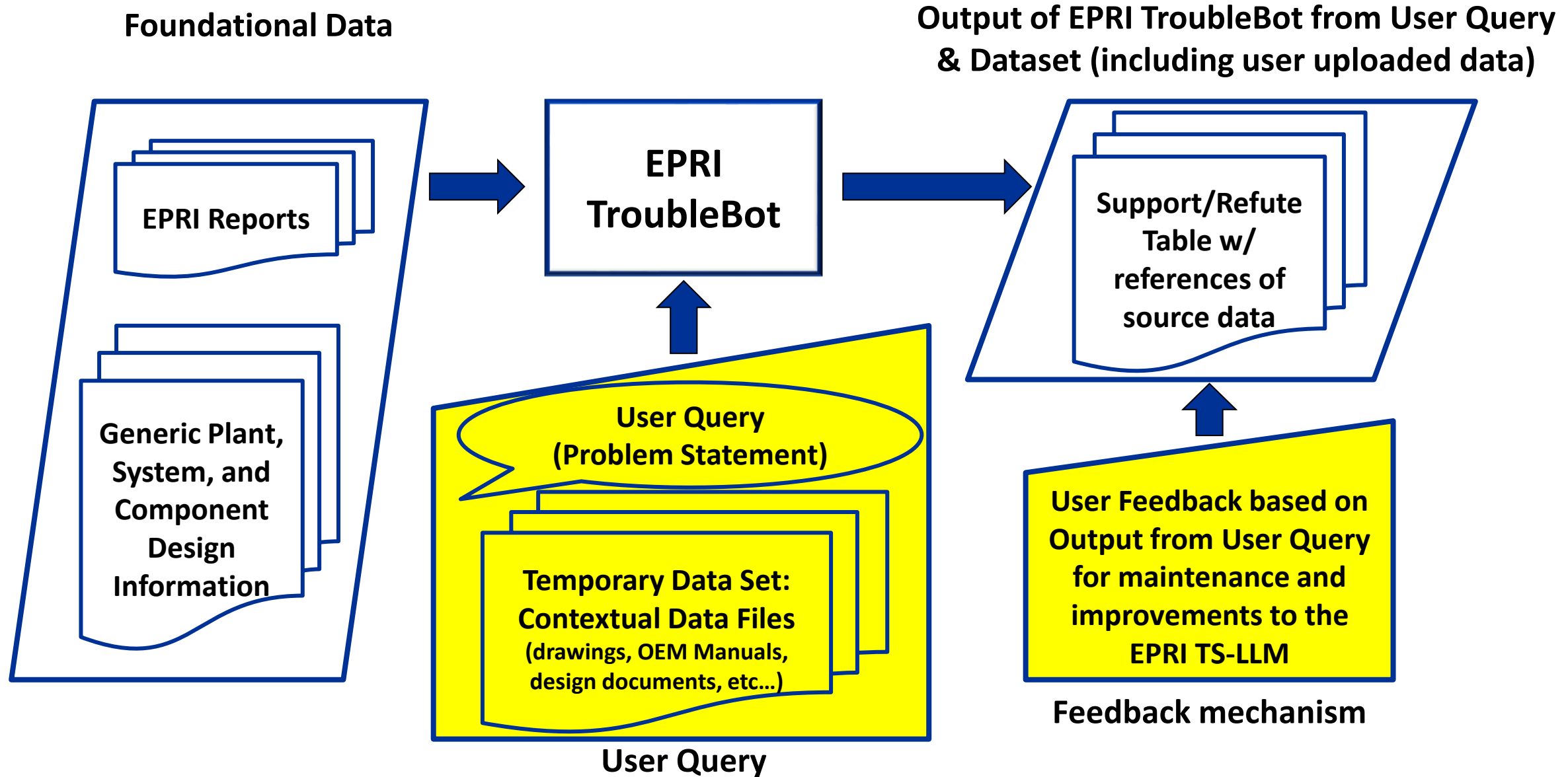
All data remains local; no SW needed



Projects using Generative AI

EPRI LLM-for-Troubleshooting (TroubleBot)

Key contact: mhinman@epri.com



Now in Beta – accessible to EPRI members

Chat

User can upload documents as well

pump is smoking

The following details were extracted from your question:

Component/System: Pump

Symptom: Smoking

Effect of Symptom: Potential malfunction/failure of the pump, possible fire hazard, and likely interruption of fluid transfer.

If any of the above details are incorrect, please refine your question and try again.

Contact: Matt Hinman
mhinman@epri.com

Points to references (document and page number, pulls text)

Support/Refute Table can be downloaded as .CSV

#	Problem Statement	Failure Mode	Validation Task	Reference Document Number	Document Title
1	pump is smoking	Overloading of the motor causing overheating and smoke emission due to excessive	Check motor current draw against nameplate rating using an ammeter.	1009670	Facilities Maintenance Guide
2	pump is smoking	Bearing failure due to lack of lubrication causing friction, heat, and subsequent smok	Perform oil analysis to check for metal particles and lubricant degradation.	1009670	Facilities Maintenance Guide
3	pump is smoking	Short circuit within the motor windings causing overheating and smoke due to insula	Perform a megger test to check insulation resistance of the windings.	1009670	Facilities Maintenance Guide
4	pump is smoking	Seal failure allowing lubricant leakage onto hot surfaces, causing smoke.	Visually inspect pump seals for leaks and damage.	1009670	Facilities Maintenance Guide
5	pump is smoking	Vibration causing loosening of electrical connections and arcing.	Check tightness of all electrical connections and inspect for vibration damage.	1009670	Facilities Maintenance Guide
6	pump is smoking	Electrical connection failure (loose or corroded) causing arcing and smoke.	Inspect all electrical connections for tightness and corrosion.	1009670	Facilities Maintenance Guide
7	pump is smoking	Contaminated oil causing increased friction and heat in bearings.	Perform oil analysis to check for contaminants.	3002009219	Comparative Study of Major Asset Ma
8	pump is smoking	Misalignment between the motor and pump causing increased friction and heat.	Perform laser alignment check of the motor and pump.	3002009219	Comparative Study of Major Asset Ma
9	pump is smoking	Excessive thrust load on the motor bearings causing overheating and smoke.	Check for proper thrust bearing operation and alignment.	3002009219	Comparative Study of Major Asset Ma
10	pump is smoking	Pump cavitation leading to impeller damage and increased friction, generating heat	Inspect pump for cavitation damage (pitting) and verify adequate NPSH.	1022187	Plant Susceptibility Screening for Ero

Input problem statement here

TroubleBot

Feedback

Refresh



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800.313.3774 or 650.855.2121

EPRI 3420 Hillview Avenue, Palo Alto, California 94304

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Oral History for Plant Experience

Key contact: lboche@epri.com

Phone app/audio recording device

The recordings are automatically transcribed and anonymized

Text is entered into database (Knowledge Graph)

Other users can query the database based on assets, incidents, and plant types

Knowledge Retention

Decommissioning Knowledge Management

Key contact: dacampbell@epri.com

Motivation:

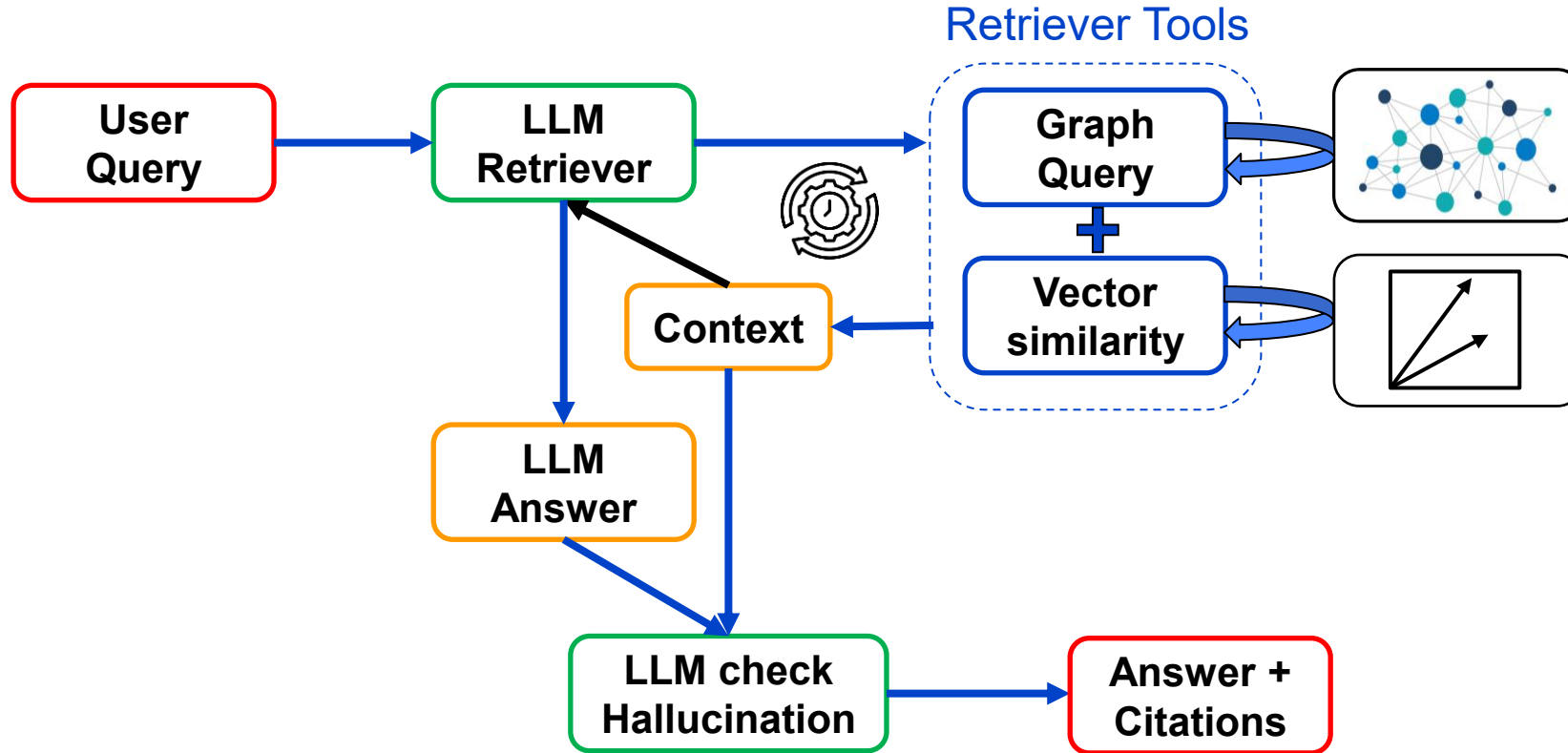
- Building on more than **30 years of EPRI unstructured decommissioning information**, with the aim of providing guidance, plans, and strategies for executing an effective, efficient and safe NPP decommissioning program
- **International collaboration** to exchange lessons learned and approaches with IAEA, OECD-NEA, European Commission and others – core group member of “Application of Semantic Information Technologies in Nuclear Decommissioning” consultancy at IAEA



EPRI Connecticut Yankee Decommissioning Experience Report ([1013511](#))



Graph RAG approach (RAG + Knowledge Graph)



Proof of concept scheduled to be completed by Q3

Initial testing on expert-curated dataset: 80% of questions were answered correctly or partially correctly

Richer context from KG can add essential information

Nuclear Industry LLM Pilot Project

Advancing Secure, Federated AI for the Nuclear Sector



All Images Produced by Copilot

Project Vision & Objectives



Secure Platform

Develop a secure, federated AI platform tailored for the nuclear industry



Enhanced Operations

Enhance knowledge retrieval, decision support, and safety compliance



IP Protection

Demonstrate data sharing with IP protection and regulatory compliance



Collaboration

Foster collaboration across utilities, members, and vendors

Nuclear Industry Virtual Assistant (NIVA)



Image: AI-generated

A secure, federated AI platform advancing knowledge retrieval, decision support, and safety compliance across the nuclear sector through industry-wide collaboration.



Knowledge Assistant - Led by NEI

Instant access to nuclear industry documentation, procedures, and technical resources



Operational Experience - Led by INPO

Search and analyze OE across IRIS, INPO, EPRI, and NEI documents



Troubleshooting - Led by EPRI

AI-assisted problem diagnosis and resolution using industry expertise

Project Milestones and Participants



Upcoming Milestones

- 1** — Q1 2026
Knowledge Assistant with EPRI documents, OE Module, Troubleshooting Module & Security Implementation
- 2** — Q1/Q2 2026
Documentation, Training & Pilot Wrap-Up
- 3** — Q2 2026
Project Completion & Full System Deployment

Completed Milestones

- 1** — Q3 2025
Requirements Gathering
- 2** — Q3 2025
Technical Alignment Workshop
- 3** — Q3 2025
Portal MVP Delivery

Participating Organizations

Leadership

- INPO (Sponsor, Technical Contributor)
- EPRI (Project Management, Technical Contributor)
- NEI (Technical Contributor)
- Constellation (Technical Contributor)
- Atomic Canyon (Developer)

Oversight Committee

- Constellation
- PG&E
- Southern
- OPG
- NextEra

NIVA Demo



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