

# Development of a Decommissioning Knowledge Management Tool at EPRI

IAEA Technical Meeting on Knowledge Management  
for Decommissioning



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# ABOUT US

Founded in 1972, EPRI is the world's preeminent independent, non-profit energy research and development organization, with offices around the world. EPRI's trusted experts collaborate with more than 450 companies in 45 countries, driving innovation to ensure the public has clean, safe, reliable, affordable, and equitable access to electricity across the globe. Together, we are shaping the future of energy.

The Decommissioning Knowledge Management tool development at EPRI is being lead through a collaboration between two programs:

- Remediation and Decommissioning Technology Program
- Data-Driven Decision-Making Program

# 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;
- **Strong international engagement**, at IAEA, OECD-NEA, European Commission and others, to structure and drive KM through **taxonomies** and **ontologies**, now supplemented with advance language processing capabilities.
- Synergizing and complementing EPRI developments in the area of **smart information retrieval systems** and **information processing through advanced machine learning modules**.



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





# EPRI Remediation and Decommissioning Technology Program

- Building on more than **30 years of documented experience**, EPRI's research provides structured and practical guidance, plans, and strategies for executing an effective decommissioning program



**Facilitates technology transfer**  
between nuclear plant owners  
and industry experts



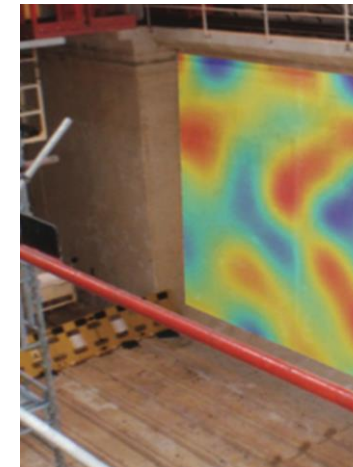
**Compiles best practices**  
from past and ongoing  
decommissioning projects



**Demonstrates technologies**  
that offer efficiency or  
safety improvements



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



D:EEP Application and visualization output

*Quick-Link to EPRI  
Decommissioning  
Sourcebook:*



# Data-Driven Decision Making (3DM)



Leverage data science for the Nuclear Power industry

Launch & support activities across the Nuclear Sector



General application areas

- Insights:* learning from the past
- Prognostics:* anticipating the future
- Automation:* increasing reliability
- Optimization:* increasing efficiency



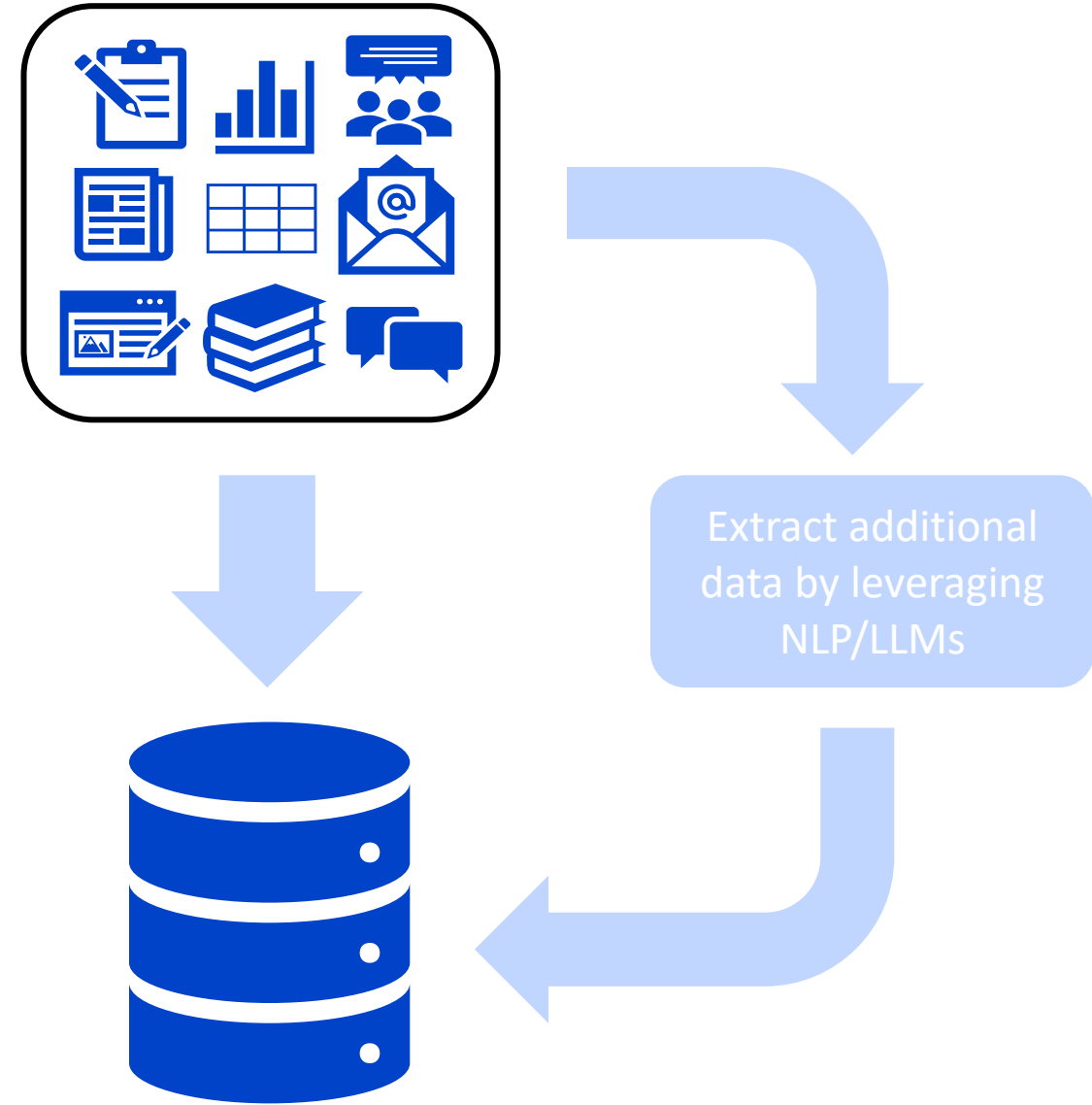
More details on [3DM program page](#)



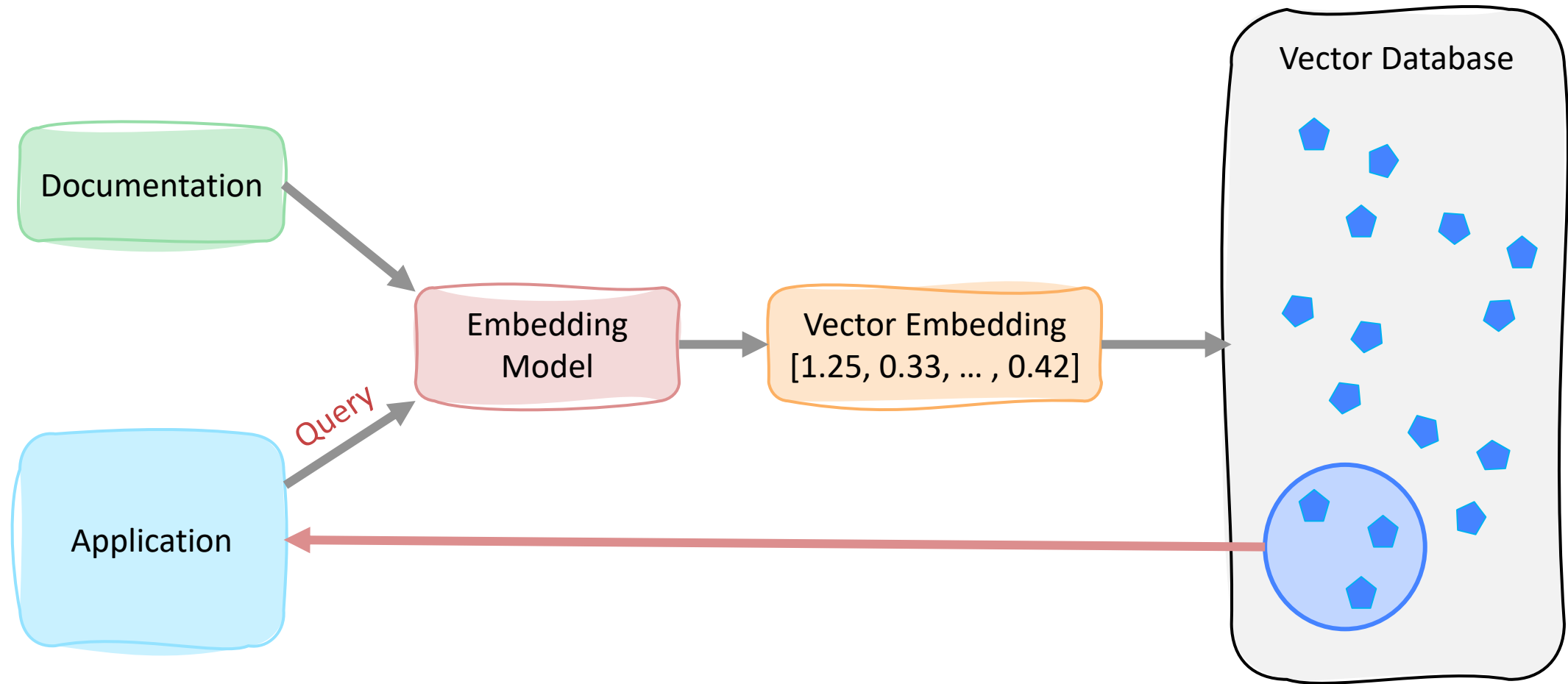
Applying Data Science in the Nuclear Power Industry

# Decom KM

- The goal is to help subject matter experts in the Decommissioning program find relevant information fast
- Challenges:
  - Information spread over various formats
  - Evaluation of search results and optimization of database parameters
  - Working with the legal team to make sure we are in compliance and that our data are protected

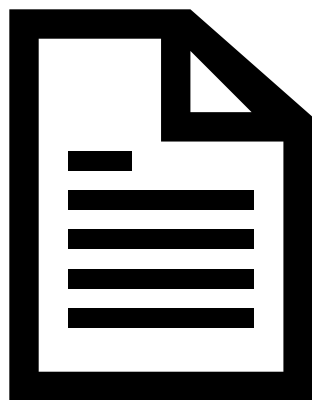


# Approach

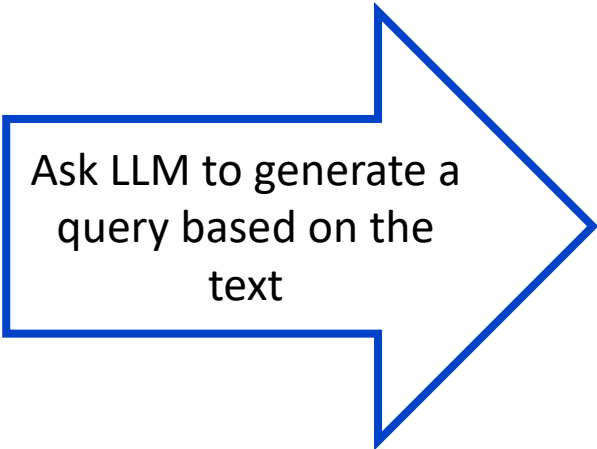


## Standard Semantic Retrieval Approach

# Synthesis of Queries



Chunk of text



Also evaluate information retrieval based only on the text chunk and its source

Synthesized Query	Relevant Text Chunk	Text Source

The corpus can then be used for:

- Evaluations of how well the information is retrieved based on different parameters (i.e. chunk size, embedding model used, different reranking algorithms). This uses the form of queries that are expected to be input by the user.
- Finetuning of the embedding model with domain-specific language
- However, does not consider multiple relevant documents



# Evaluation of Synthesized Queries

- Synthesized queries need to be reviewed by the SME's
  - Hallucination concerns
- However, synthesis speeds up the whole process

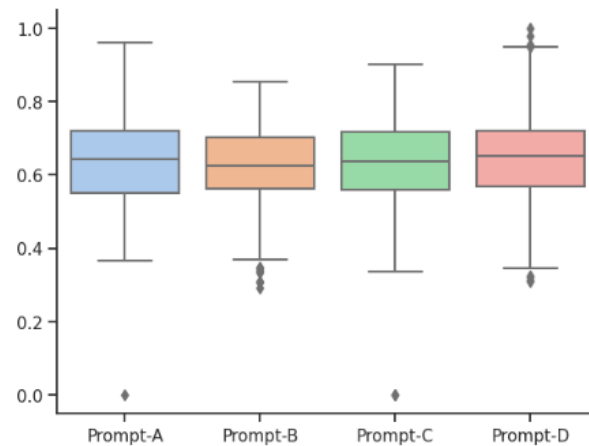


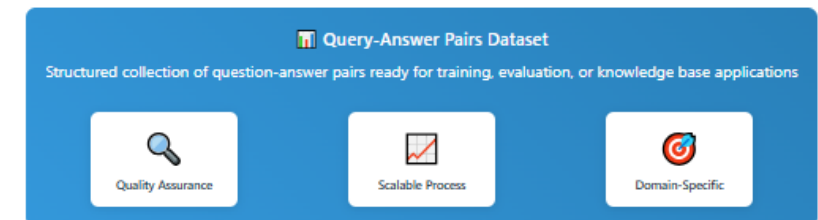
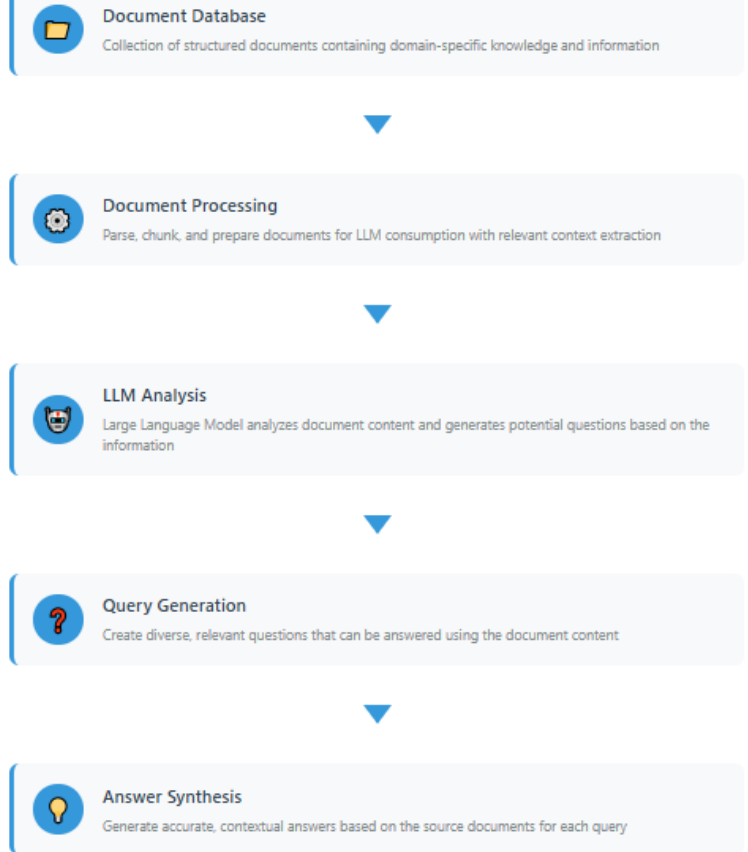
Figure 6: Score distribution across different prompts

← Evaluation of questions generated with Llama 70B  
[from Amyeen et al, 2023]

<https://arxiv.org/abs/2310.18867>  
Under [CC license](#) with no changes

## Query-Answer Pair Synthesis with LLM

\*Created with Claude AI



# Streamlit User Interface (restricted access)

EPRI

ELECTRIC POWER  
RESEARCH INSTITUTE

Search Tool

User Feedback

Nuclear Decommissioning Search Tool

Enter your search query:

Basic considerations for decommissioning

Top Results

	id	score	text_preview	source	page
0	5	0.4699	Unless both parties make a sincere effort to meet their responsibilities the Commission to assure that all facts are presented, and the public to assure that...	data/WMP_DATA/01-United%20States%20Atomic%20Energy%20Waste%20Managen	2
1	27	0.4465	One important subject involves management of the large volume of plutonium contaminated waste just noted. Looking to the future, burying millions of cubic feet of...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	3
2	17	0.4004	Atomic Energy Commission. The first involves the assessment of the environmental effects of utilizing plutonium fuel in light-water reactors; the second is an environmental...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	1
3	23	0.3949	I would like to give you my point of view on what some of these answers might be. Present...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	2
4	25	0.391	One important subject involves management of the large volume of plutonium contaminated waste just noted. Looking to the future, burying millions of cubic feet of...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	3
5	29	0.39	One important subject involves management of the large volume of plutonium contaminated waste just noted. Looking to the future, burying millions of cubic feet of...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	3
6	14	0.3803	Types of Wastes There are six types of wastes to be discussed: government-generated high-level wastes (highlevel wastes are those wastes with characteristics that prohibit...	data/WMP_DATA/02-The%20Hidden%20Commitment%20to%20Nuclear%20Wastes	2
7	11	0.3778	Types of Wastes There are six types of wastes to be discussed: government-generated high-level wastes (highlevel wastes are those wastes with characteristics that prohibit...	data/WMP_DATA/02-The%20Hidden%20Commitment%20to%20Nuclear%20Wastes	2
8	8	0.3633	INTRODUCTION To meet its energy requirements, the United States is committing an increasingly significant portion of its resources...	data/WMP_DATA/02-The%20Hidden%20Commitment%20to%20Nuclear%20Wastes	1
9	20	0.3617	I would like to give you my point of view on what some of these answers might be. Present...	data/WMP_DATA/03-Waste%20Management%20_%20Licensing%20and%20Criteria	2

Select a result to view details:

data/WMP\_DATA/01-United%20States%20Atomic%20Energy%20Waste%20Management%20Programs%20and%20Objectives.pdf

Relevant Text

Unless both parties make a sincere effort to meet their responsibilities the Commission to assure that all facts are presented, and the public to assure that it has considered and understands the facts the gap of misunderstanding and misconception can never be bridged, and a true public analysis of the relationship of public benefit to public risk in the use of nuclear fission to help meet our serious energy problems is not possible. As an example, may I cite the oft repeated idea, put forward by those who have generally not bothered to analyze all the known facts, that until we have completely developed, proven, and placed in operation the methods for the ultimate disposal as proposed to retrievable storage of radioactive waste, we should halt all actions which generate such waste. The facts are that the only requirement for safe waste management is to assure that the waste is isolated from man's biological environment for as long as its radioactivity is at a level where it could harm man or the environment. Such isolation can be accomplished, theoretically, in any one of three ways. It can be placed in man-made multiple barrier containment which can be continuously monitored and repaired to ensure against escape. It can be placed in geologic formations, which are outside of man's biological environment, in a way which will ensure that it cannot migrate into that environment before it has radioactively decayed to innocuous levels. Or it can be removed from the total earth environment by transportation to outer space. We have made studies and evaluations of all three approaches and have analyzed the current state of technology for each. This analysis shows that we do not today have all the technology needed to ensure that the extraterrestrial approach can be used safely and economically. The development of the basic space technology which would allow us to consider this approach would encompass a very extensive and expensive effort which cannot be justified for the sole purpose of radioactive disposal and which must be based on other national objectives.

Provide your feedback for this result:

General Feedback

Name

Share your feedback

Type here...

Rate your overall experience

135

Submit General Feedback

- Simple **Top Results** tabled to display relevant document matches with relevance score.
- **Preview** of source snippets prior to opening full file.
- **User Feedback** (work in progress) per respective document hit for model finetuning based on preliminary vectorstore.

# Consideration for improvement...

- Filtering methods of the WM database
- Q&A evaluation dataset: best to use only SME input, but would like to improve the process of synthesis to increase the volume
- Document scraping and ingestion pipeline – quality checks, ingestion methods are evolving, metadata considerations
- Embedding model and vector DB choice, search methods, etc..
- On-prem vs. enterprise cloud tools

# Collaboration with the Oral History Project

- New joint project between Nuclear and Generation sectors at EPRI
- The goal is to develop a scalable application that enables power plant workers to record their experiences and insights via voice, which are then transcribed, anonymized, and processed using large language models (LLMs). The processed content would then be stored in a searchable knowledge base, making it accessible to current and future employees for training, troubleshooting, and decision-making.

**Focusing on capturing context and nuance**

# Acknowledgments

- **Crosscutting international exchanges** with SMEs at IAEA, EC-JRC, OECD-NEA, LANL and international research entities (UM, FIU, University of Rome)
- Strong **internal EPRI collaboration**:
  - Support and funding by **EPRI Technology Innovation Program**
  - Strong collaboration between **EPRI Fuels&Chemistry** and **EPRI Engineering Department** directorates:
    - EPRI Program 41.09.02: Remediation and Decommissioning Technology
    - EPRI Program 41.13.02: Data-Driven Decision Making



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