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Unlocking historical nuclear knowledge through artificial-intelligence-enabled searching



UKNNL holds around 100 million files dating back to the 1940s, and a new artificial intelligence (AI) enabled search platform now finds what teams need at least 10× faster than before, surfacing past research that is directly shaping cutting-edge programmes of the future.

Challenge

The UK's nuclear sector holds one of the world's largest and most complex technical archives. UKNNL alone stores around 100 million electronic files, some originating from as long ago as the 1940s.

Conventional search methods make it difficult and time-consuming to locate specific information, especially as many original researchers are no longer available to provide context.

This creates risks of duplicated work, programme delays and loss of valuable expertise. As the UK develops next-generation reactors and fuel-cycle technologies, rapid access to historical knowledge is critical.

Solution

To support the streamline searching of historical nuclear knowledge, a UKNNL team identified, tested and proved an AI-enabled natural language search platform and deployed this on its secure networks to index and interpret millions of scientific documents.

Deployment of the tool at this scale, with the support of the Office for Nuclear Regulation, represents the first of its kind both in the nuclear sector and internationally. It enables:

- search speeds at least 10× faster than manual methods
- more comprehensive and relevant search results
- discovery of previously overlooked or inaccessible content
- improved cross-sector collaboration
- enhanced information security through identification of legacy data

AI-enabled searching is now actively supporting research and development, programme design and technical decision-making across UKNNL and partner organisations.

Using knowledge to support growth: Developing the UK civil nuclear library

As part of UKNNL's commitment to unlocking the full value of its knowledge assets, the organisation has established a comprehensive Knowledge Asset Management Strategy. This strategy sets out how UKNNL will identify, protect and maximise the impact of its extensive historical and contemporary knowledge base.

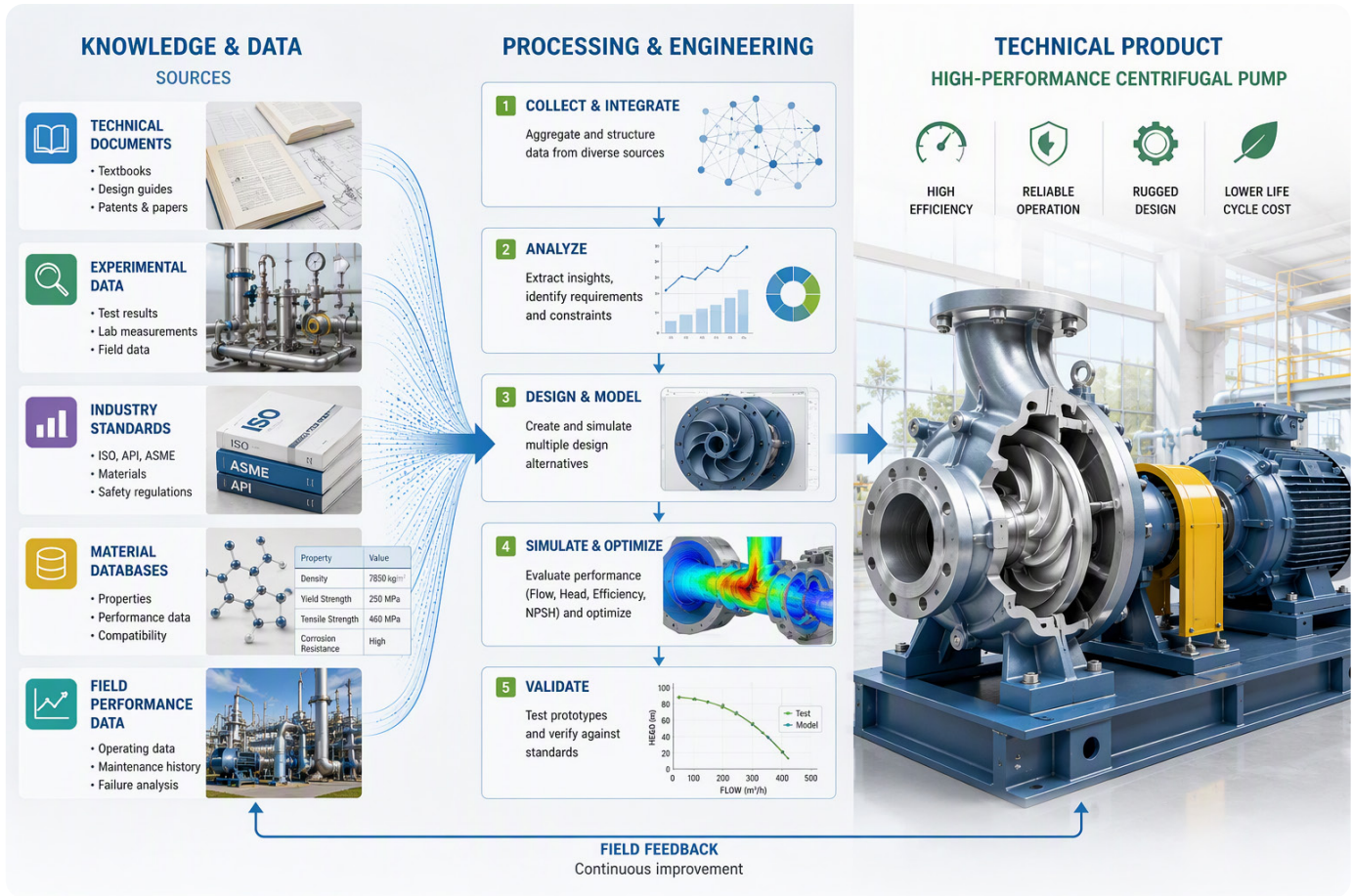
Working closely with industry-leading experts, and supported by advanced AI-enabled search tools, UKNNL is developing structured libraries of information that can be shared with partners to accelerate the deployment of advanced nuclear technologies.

We have already assembled a curated catalogue of more than 50 topic areas, spanning the entire nuclear fuel cycle. This provides a clear framework for communicating, accessing and exploiting knowledge assets across the sector and forms an essential building block for the emerging UK civil nuclear library.

“AI-enabled searching has transformed our ability to understand and exploit our wealth of knowledge assets.”



Luke O'Brien
Fellow, UKNNL



AI-POWERED DIGITAL LIBRARY

Intelligent search. Trusted knowledge.

NATURAL LANGUAGE SEARCH AI UNDERSTANDING & CONTEXT SEMANTIC SEARCH ACROSS CONTENT RELEVANT RESULTS YOU CAN TRUST

What are the main causes of pump cavitation and how can it be prevented?

Ask AI

LIBRARY

All Collections

Technical Papers	12,842
Standards	3,215
Manuals & Guides	8,730
Research Reports	6,114
Case Studies	2,457
Datasets	1,886
Patents	4,321

FILTERS

Document Type	▼
Industry	▼
Date Published	▼
Author / Organization	▼

AI SEARCH RESULTS

28 results

Most Relevant

AI SUMMARY

Cavitation in pumps is primarily caused by insufficient Net Positive Suction Head (NPSH), high fluid temperature, restricted suction flow, or excessive system losses. It can be prevented by ensuring adequate NPSH, optimizing system design, reducing fluid temperature, and maintaining proper pump operation and maintenance.

View sources (28)

TECHNICAL PAPER

Cavitation in Centrifugal Pumps: Causes, Effects and Prevention

...Cavitation occurs when local pressure drops below the vapor pressure... The main causes include low NPSH, high temperature, and excessive losses...

Smith, J. • Journal of Fluids Engineering • 2021

98%

Relevance



ISO 9906:2012 Rotodynamic Pumps — Hydraulic Performance Acceptance Tests

...This standard specifies the acceptance tests for rotodynamic pumps including recommendations to avoid cavitation during operation...

International Organization for Standardization • 2012

95%

Relevance



Pump Operation and Maintenance Guide

...To prevent cavitation: ensure adequate NPSH, minimize suction losses, control liquid temperature, and regularly inspect impeller and seals...

Global Pumps Inc. • 2020

93%

Relevance

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DOCUMENT DETAILS

TECHNICAL PAPER

Cavitation in Centrifugal Pumps: Causes, Effects and Prevention

Smith, J.
Journal of Fluids Engineering, Vol. 143, 2021

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OVERVIEW

KEY POINTS

REFERENCED BY (24)

Abstract

This paper investigates the causes and effects of cavitation in centrifugal pumps and presents practical methods for prevention. Experimental and numerical results are provided.

Key Topics

Cavitation NPSH Centrifugal Pumps Suction Pressure Pump Design

Highlighted in document

...Cavitation is mainly caused by insufficient NPSH, high fluid temperature, restricted suction flow, and excessive system losses... Page 3

...To prevent cavitation, ensure adequate NPSH, optimize suction piping, reduce fluid temperature, and maintain proper operation... Page 7

...Design improvements such as inducer addition and impeller trim can also help mitigate cavitation effects... Page 11

Thermodynamic modelling support: Streamlining research into next-generation fuels

Crucial work is under way at UKNNL's Preston Laboratory to convert high-assay low-enriched uranium (HALEU) from its gaseous form into chemically stable compounds that can be used to make fuel for the next generation of advanced nuclear reactors.

Using the AI search engine, the team uncovered a kinetic study conducted in 1962 that was not publicly available elsewhere.

This document confirmed the predicted product and provided insights which directly shaped the design and statistical analysis of upcoming experiments, strengthening confidence in the approach. Without using the AI search engine, reproducing the equivalent data in the paper would have required months, or even years, of additional work to progress the project.

The use of AI on the HALEU project shows just how these tools can support the efficiency and effectiveness of the teams working to build a nuclear future.

“The discovery of this paper through the use of AI searches has been extremely useful to validate and support the use of thermodynamic modelling for this project. It gave our team a real confidence boost in our results and methods to look at novel systems moving forward.”



Sophie Cooper
Chemical Modeller,
UKNNL

Digital technology in action: Capturing knowledge about advanced modular reactors

To support cross-sector collaboration in the development of advanced modular reactors (AMR), it is essential to be able to leverage the UK's AMR knowledge base.

Funded by the UK Department for Energy Security and Net Zero (DESNZ) and delivered by UKNNL alongside Arup, AMR Knowledge Capture Programme digitised and

indexed this knowledge to improve its accessibility.

More than 7,000 paper documents were scanned, indexed and integrated into a searchable SharePoint platform using AI-generated metadata and natural language processing.

This work prevents the loss of critical historical knowledge

and supports faster, more cost-effective AMR development.

DESNZ confirmed that the project laid a strong foundation for improving accessibility of historical nuclear information, helping to position the UK as a leader in next-generation nuclear technology development.

“AI-driven search is transforming how nuclear knowledge is accessed and used. Through the UK's AMR Knowledge Capture project, we have shown how complex legacy information can be analysed and made accessible beyond conventional methods, unlocking new insights, reducing rework and accelerating cost-effective innovation across the sector. It also enhances collaboration by enabling knowledge to be more readily shared and applied.”



Department for
Energy Security
& Net Zero

What the future holds

UKNNL is continuing to expand and refine its knowledge assets, working towards the development of a comprehensive UK civil nuclear library.

AI-enabled search will play a central and increasing role in helping to improve technical decision-making and reduce duplication of effort.

It will also be invaluable in supporting national programmes and training the future nuclear workforce, all of which can only serve to strengthen the UK's position in advanced nuclear technologies.

UKNNL has developed a **Knowledge Asset Management Strategy** to identify, protect and maximise the value of its knowledge assets.

By combining domain expertise with **AI-enabled search**, UKNNL is creating libraries of information that can be used with partners to **accelerate advanced nuclear technology deployment**.

A catalogue of **50+ topic areas**, covering the full nuclear fuel cycle, supports ongoing communication and the effective use of **UKNNL's knowledge base**.

100
million
files



all areas
of nuclear
fuel cycle

8 decades of
knowledge
50+ topic
areas

