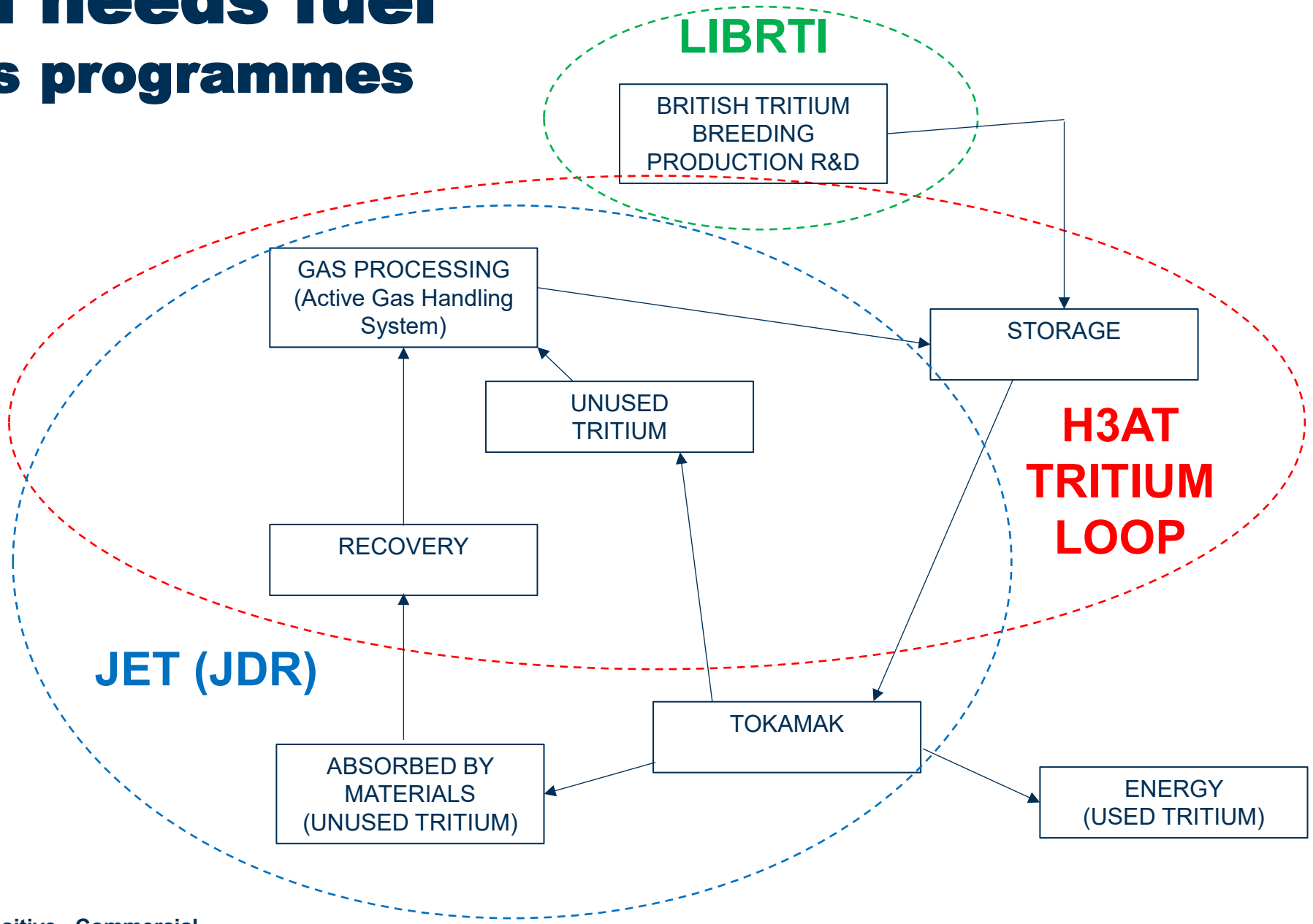
UK Atomic Energy Authority

UKAEA

JET Decommissioning and Repurposing: Overview

2026

Fusion needs fuel
UKAEA's programmes



Official - Sensitive - Commercial

Hazards inside JET

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There are a number of significant hazards within the JET tokamak which made the use of Remove Handling necessary for decommissioning.

TRITIUM

- Significant hazard due to the mobility of this radioactive gas, and its ability to permeate through protective suits and even skin.

BERYLLIUM

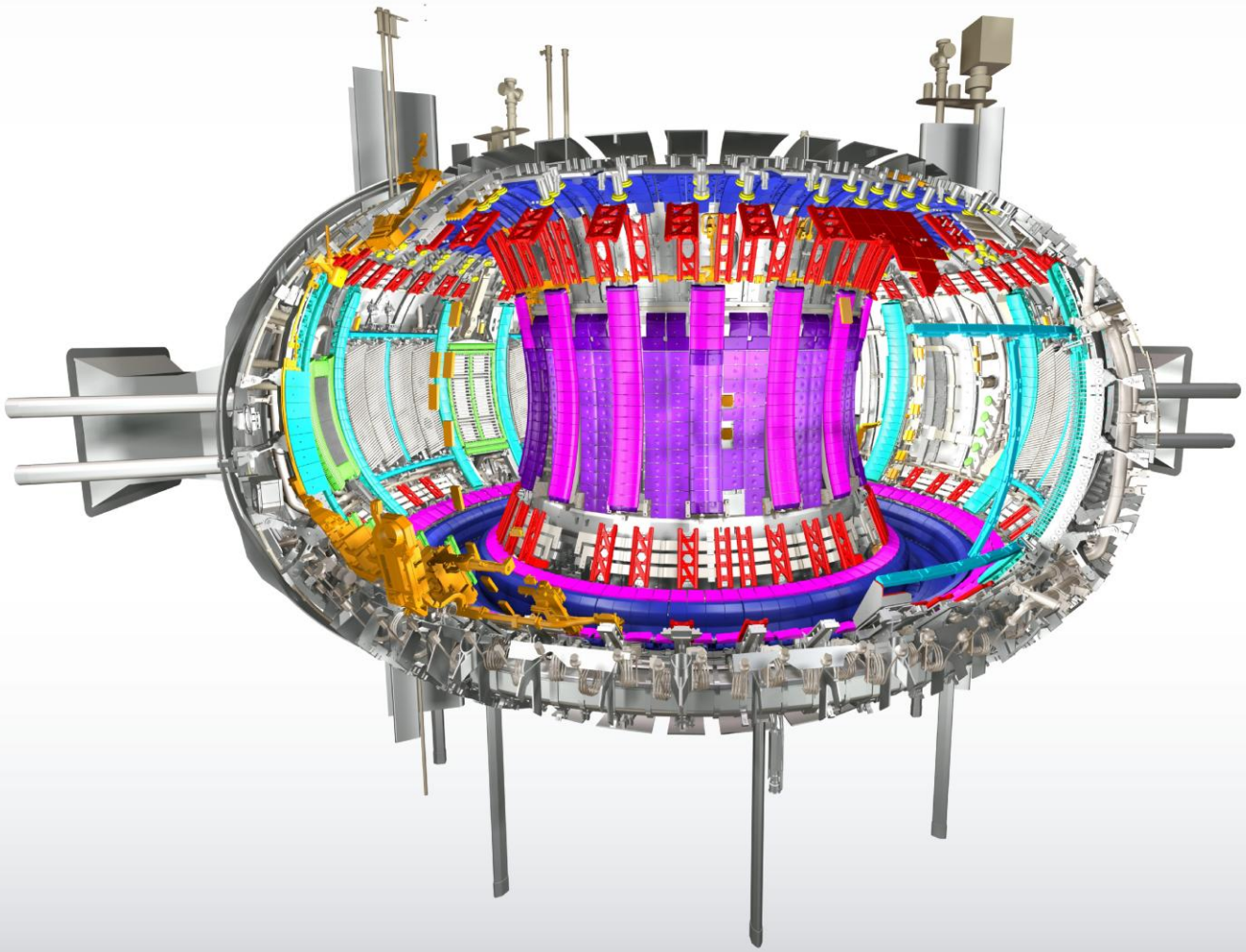
- Loose beryllium dust is a toxic material and is harmful when inhaled. It is generated during plasma operations and moved around the tokamak coating tiles and components.

GAMMA RADIATION

- The components exposed to fusion neutrons emit harmful gamma rays which are only shielded effectively by thick metals or concrete.

REMOTE HANDLING

- Using remote handling equipment within JET separates people from these hazardous materials.
- The use of remote handling will not be optional in future tokamaks at power-generation scale - JET is proving concepts and generating invaluable experience in tokamak maintenance and decommissioning.



Waste inventory

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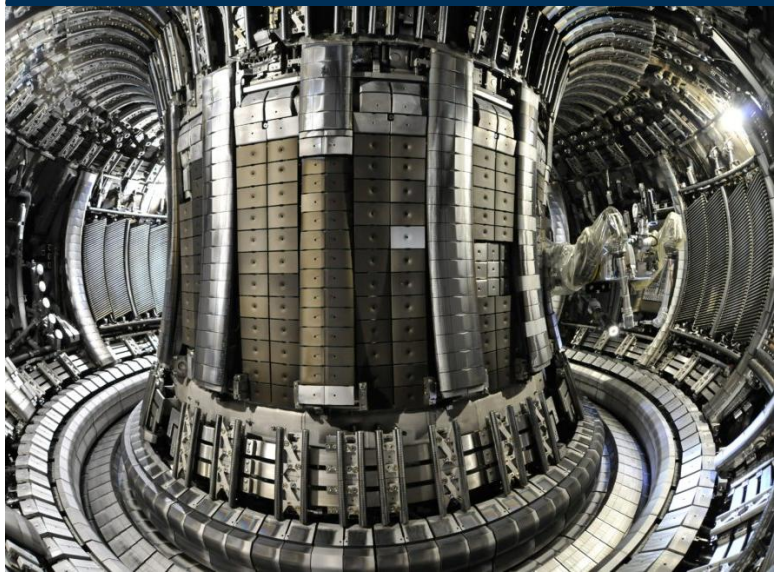
Hard waste



- ILW: ~235t
- LA-LLW/LLW: ~7,000 to 10,000t
- OSR: ~100,000t (Depends on end-state)

Soft waste

- Soft waste: 2,000 to 3,000t

Tritiated water

- Depends on torus ventilation
- Depends on detritiation activities

Waste classifications & considerations for fusion

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Hard & soft waste

Disposal facilities

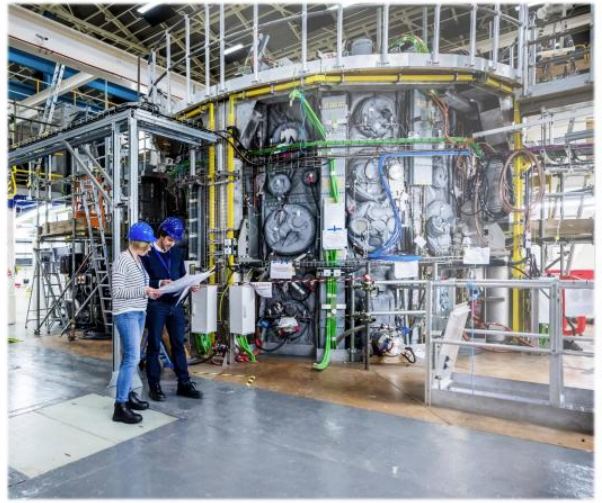
Tritiated water

Development of regulation

Department for Business, Energy & Industrial Strategy

Towards Fusion Energy

The UK Government's proposals for a regulatory framework for fusion energy



Closing date: 24 December 2021

October 2021

Progress
Research and Development

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Building evidence for Intermediate Level Waste processing challenges in tranche 3

Analysis of samples removed from JET:

- Detritiation and tritium off-gassing measurements
- Gamma spectrometry
- Full radwaste analyses

Material	Ave. efficiency
Inconel	78%
Stainless steel	70%
Beryllium*	81%
Tungsten*	97%

Thermal treatment innovation

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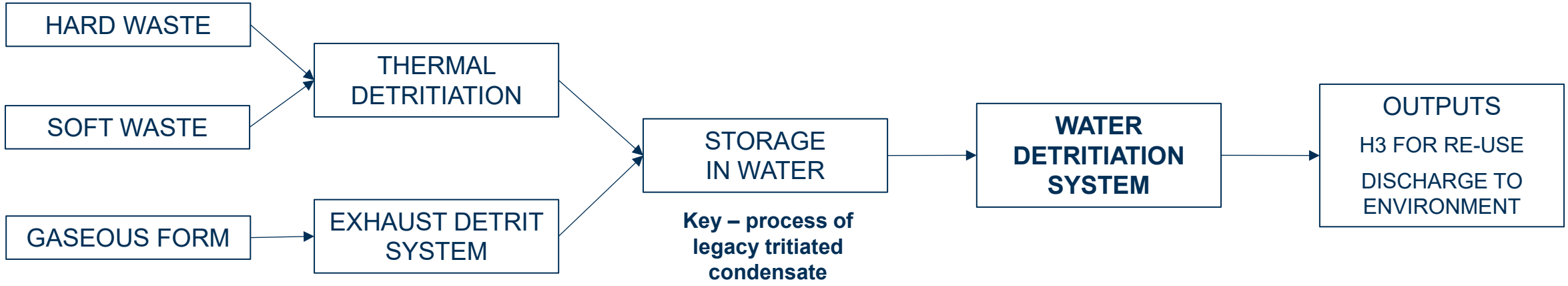
Water Detritiation System (WDS) in the waste treatment process

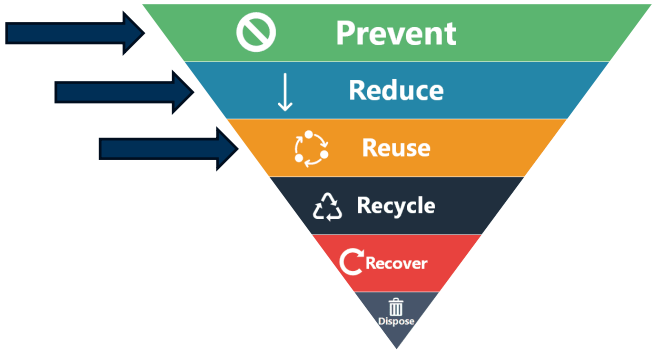


- All tritiated waste leads to water
- Underpins the Alternative Strategy
- Avoids waste by converting HTO into water for disposal and tritium for fuel

Requirement

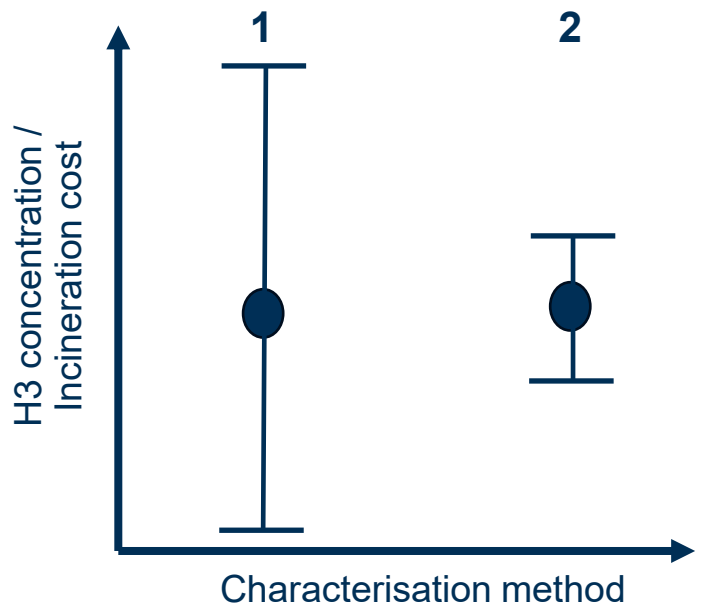
non-discretionary

Waste Hierarchy

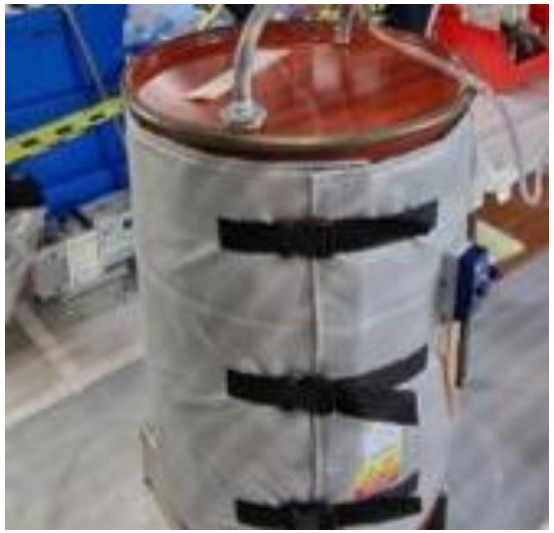


Soft waste detritiation

Exploring Cost Benefit Ratio for changing our Soft Waste Characterisation process



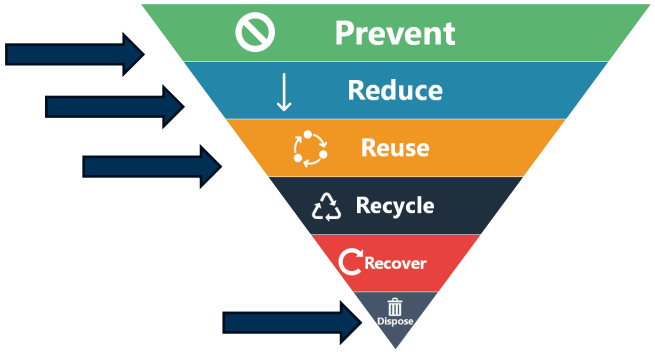
1. Conservative approach in sampling (~0.1% of total waste sampled) leads to uncertainty and drives incineration cost up
2. Goal is to characterise waste package from 100% of waste. This reduces uncertainty and therefore incineration cost



Requirement

Discretionary

Waste Hierarchy



Hard waste detritiation R&D

Continuing research and development to better understand costs and benefits of end-to-end processing

Material	Ave. efficiency
Inconel	78%
Stainless steel	70%
Beryllium*	81%
Tungsten*	97%

*Awaiting final results

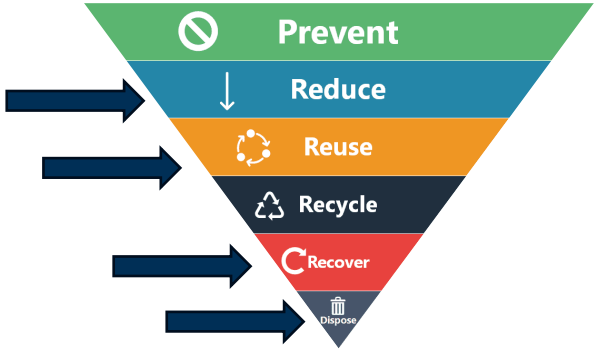
To establish a robust detritiation strategy, JDR needs:

- To establish technical feasibilities
- To optimise operational parameters
- A comprehensive VfM assessment of disposal options

Requirement

Discretionary

Waste Hierarchy



Laser Induced Breakdown Spectroscopy

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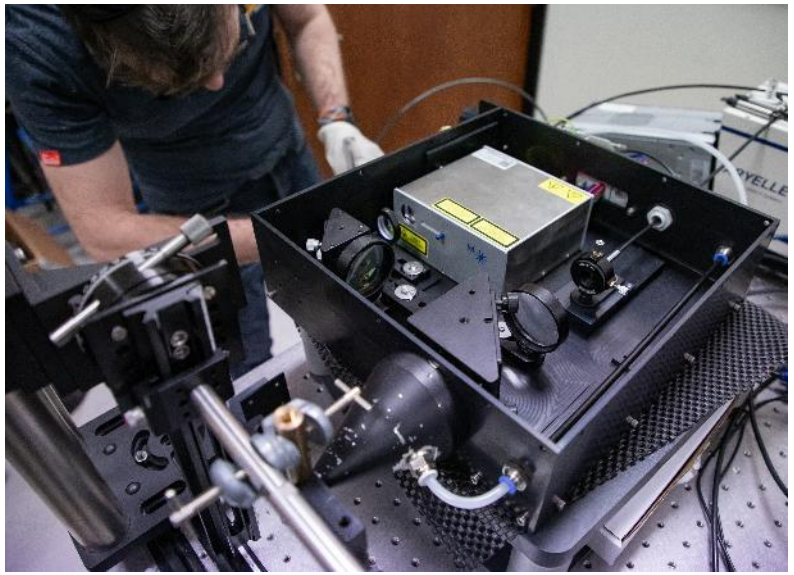

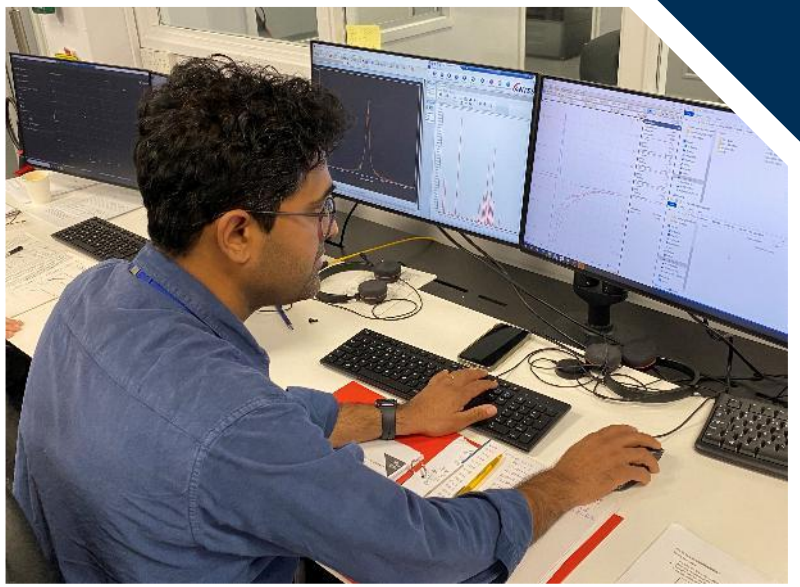

Demonstration of first in-vessel LIBS with remote handling on a D-T exposed fusion device

Provides semi-quantitative D retention result and D/(D+H) ratio via in-vessel LIBS

Achieves 0.07 at & detection limit for J isotopes in tungsten using LIBS

Successfully detects Be, Mo, C, W and Ti spectra for erosion and deposition study

Read more

Roadmap to fusion power

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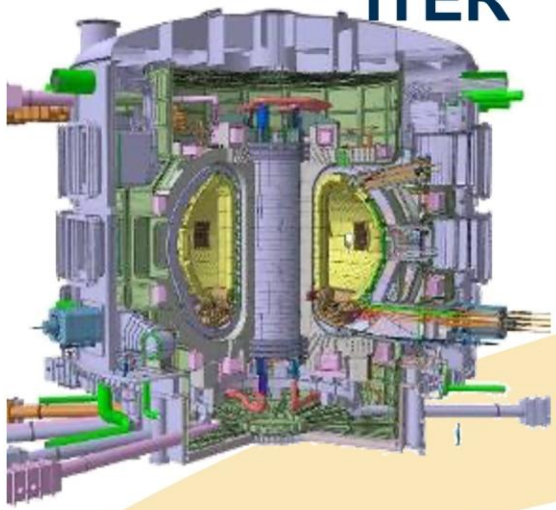

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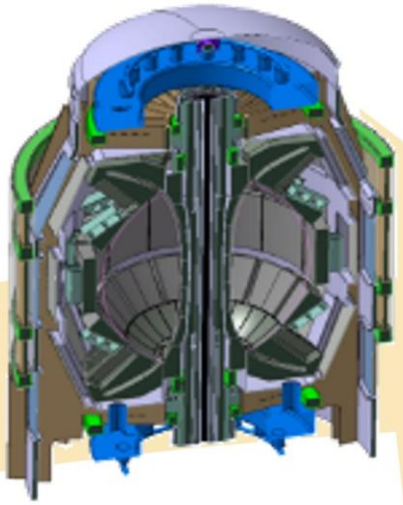
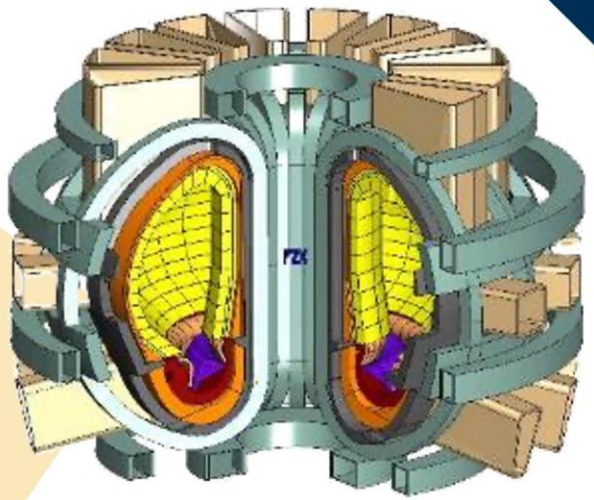


STEP



DEMO

JET

MAST Upgrade

Work being undertaken within JDR – research, processes, technologies, techniques – and collaboration between departments – fuel cycle, materials, robotics, etc – will impact the design and development of future fusion machines and powerplants

Roadmap to fusion power

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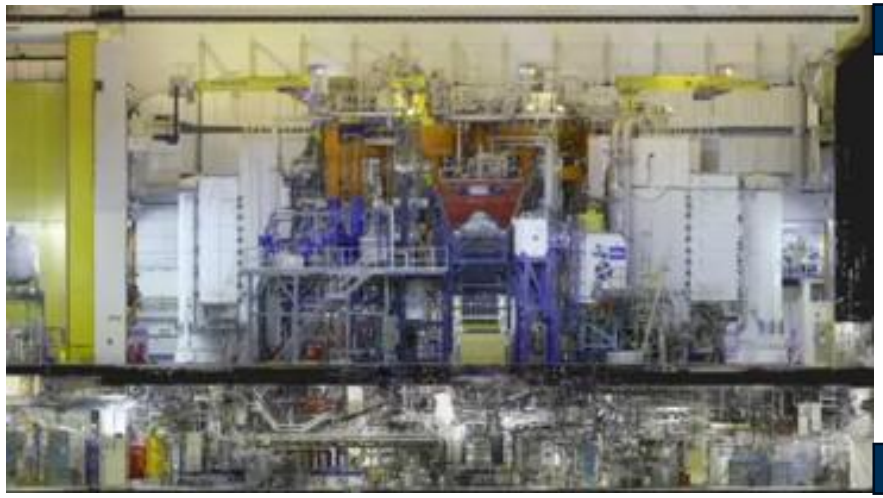
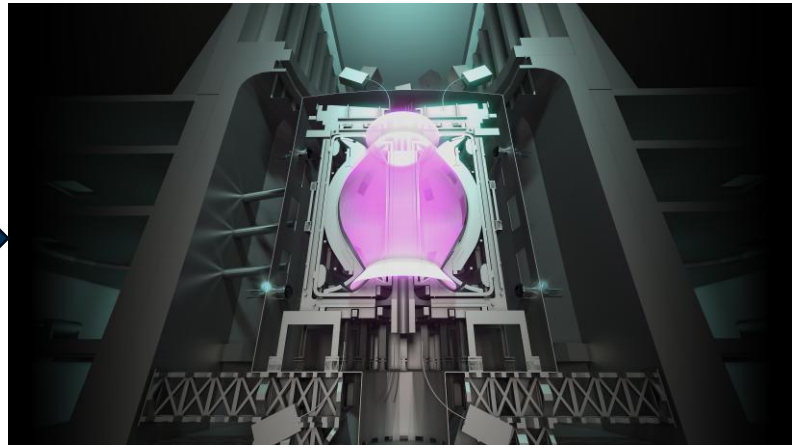
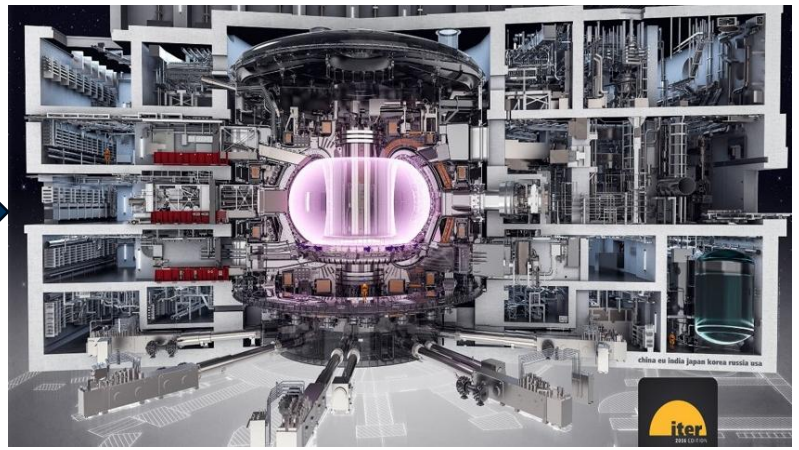
Work being undertaken within JDR – research, processes, technologies, techniques – and collaboration between departments – fuel cycle, materials, robotics, etc – will impact the design and development of future fusion machines and powerplants



Commercial powerplants, e.g. STEP Fusion



Ongoing R&D, e.g. ITER, DEMO