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JET Decommissioning and Repurposing: Overview

2026

Characters in the JDR Story

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A Brief History of Fusion Decommissioning

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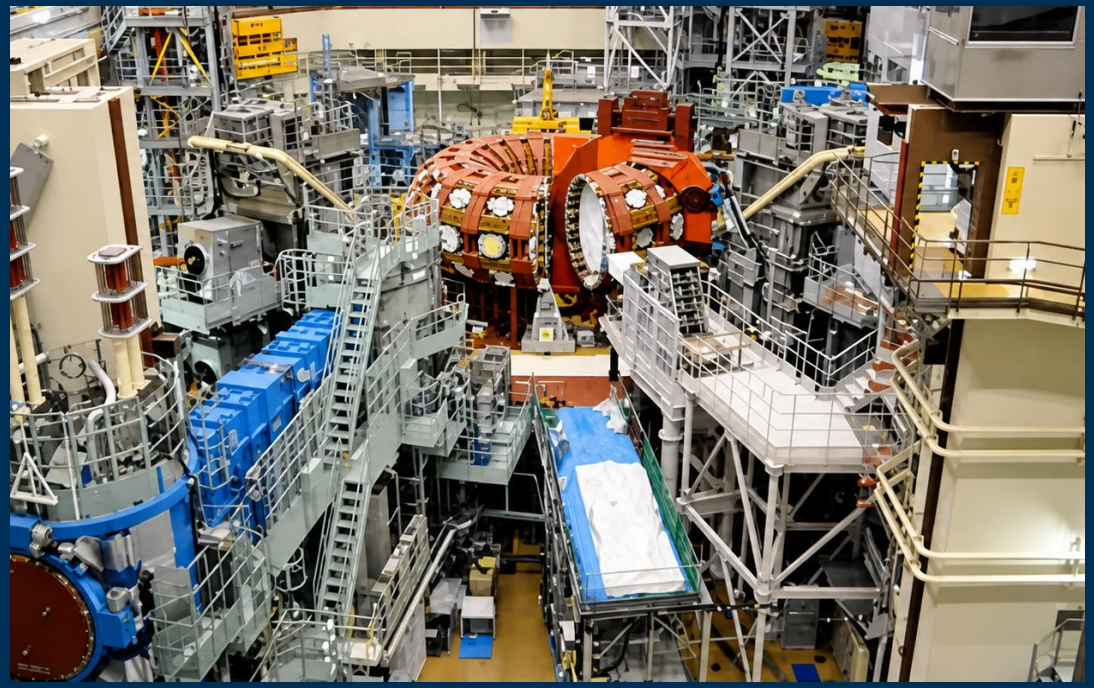
(JT-60) Japanese National Institute for Quantum Science and Technology

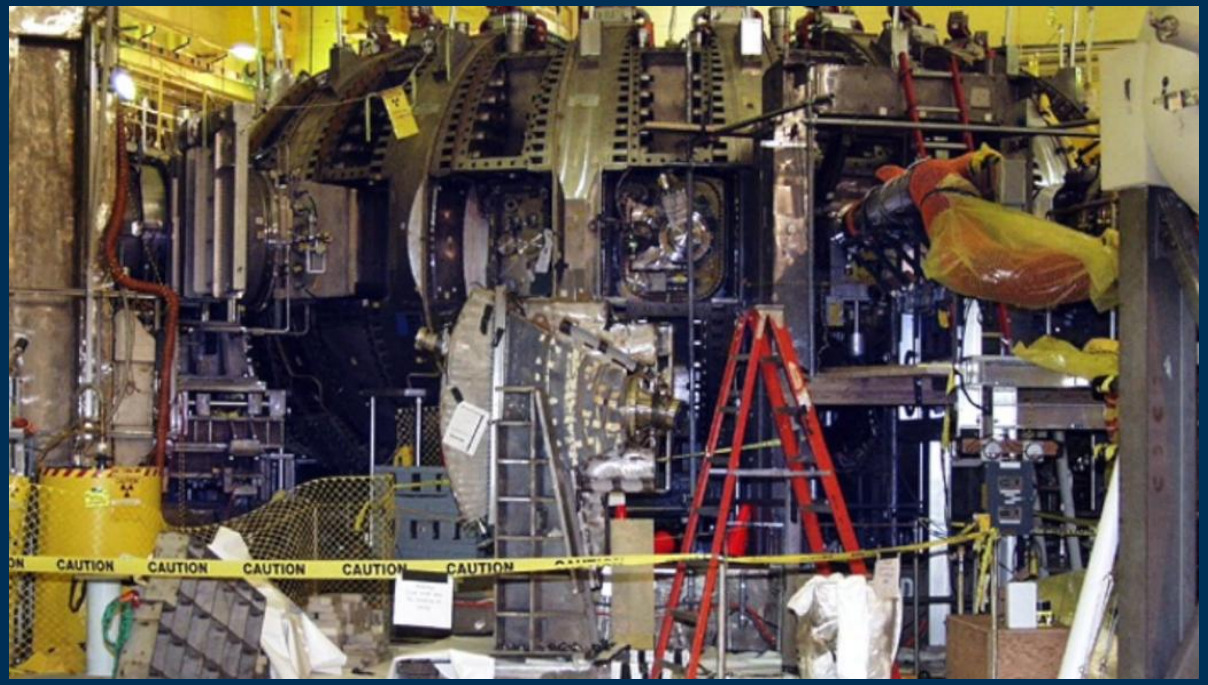


8-year operational life D-D (10mSv/h & 10,000 Bq/cm2 T-density on VV surface). Co60 main source of activation)

Storage facilities built in advance for large components (3,650t inc VV, TFC, PFC) and for tritium contaminated components (~200t in vacuum)

1st stage involved removal of contaminated inner wall tiles, EVD 250t crane limit, requiring VV size reduction

(TFTR) Princeton Plasma Physics Lab



Operational 1982-97 (D-T 1993-97). Initial decom for VV, Coils, Test Cell & Basement, but Tritium systems deferred until 2019

POCO included use of Helium Glow Discharge Cleaning, Pulse Discharge Cleaning, Vessel heating & pump / purges with air

Carbon tiles removed (diamond wire cut lines), VV filled with concrete (encapsulation, waste burial), negative pressure exhaust pumps analyse tritium content (vent to stack)

Reference Class Forecasting (case studies)

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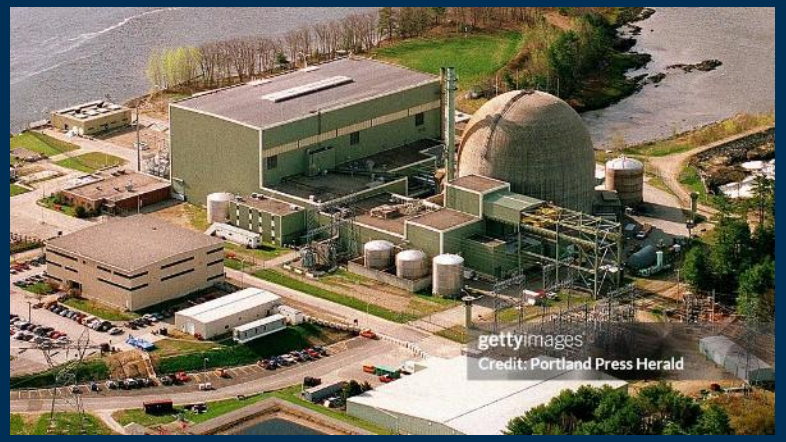
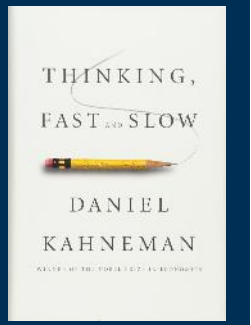


Immediate Decontamination
Maine Yankee PWR, Wiscasset

Peripheral buildings (nuclear)
Oak Ridge National Laboratory

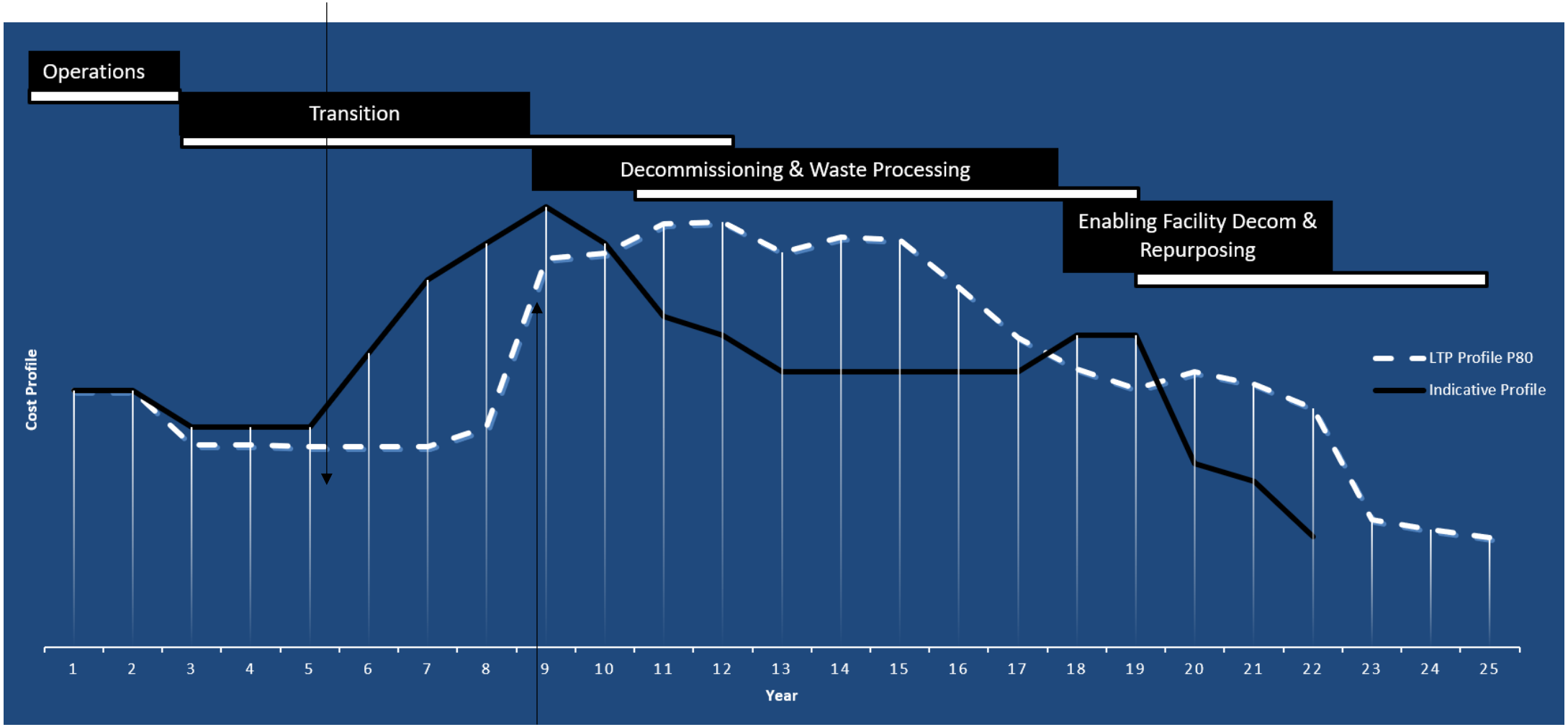
Refurbishment (Detritiation)
Savannah River Heavy Water Moderator

Immediate Decontamination
Big Rock Point, Lake Michigan



Decommissioning profile (generic)

JDR. Shutdown & POCO. De-plant & demolition of auxiliary buildings. Utilities & maintenance costs. JET transition (site-wide support)



Building & asset condition. Legacy waste processing facilities. Legacy waste arisings. Upfront investment (new facilities & enabling capability). Deferring decisions adds long-term cost.

JET Decom (original concept)

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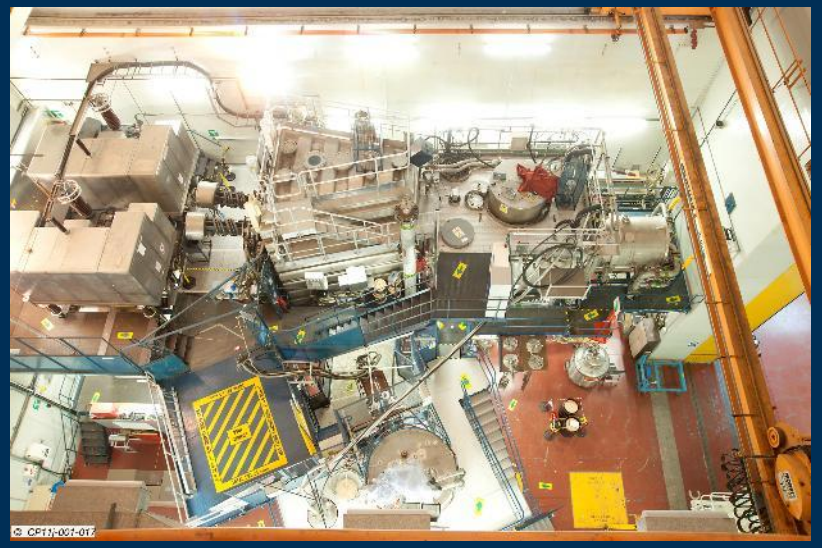
Octants (separation)

Basement under construction (GDF)

J1C Hot Cell (decay storage area)



150t crane c1981 (state of the art)

Direction from DESNZ

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Discharge the UK's liability for JET decommissioning in a cost-effective manner, using innovative cost saving methods, and reducing nuclear hazard. Minimise waste streams and maximise tritium recovery.

Develop, implement and prove new technologies to position the UK for future international markets.

Repurpose JET facilities for UK science and innovation *where there is a clear case to do so* Enable the growth of the fusion cluster by regenerating land released from JET

Retain and build on key UK skills base gained through hosting and operating JET, including within the supply chain.

DESNZ (the Department) and HMT (the Treasury) have approved tranche 2 funding

23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41	40/41
Tranche 1			Tranche 2				Tranche 3				Tranche 4				Tranche 5			

JDR's freedom to innovate

Breaking the decommissioning cycle

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CULTURE
Culture of innovation, risk taking, and collaboration

SECURITY
Lower security site enabling visitors without the same level of clearance as nuclear site

SCALE
Industrial scale facility, but small enough to enable first use of new technology without undue financial burden

SEVERITY OF HAZARD
Relatively low hazard environment, increasing ability to prove out new technologies

STATUTORY COMPLIANCE
Regulated by Environment Agency and Health & Safety Executive, with fewer constraints and mutual approach to developing regulation

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Decomm and Repurposing

JDR's

4-axis approach

OUTSIDE IN

- Releasing JET's estate for development
- Liberating assets for repurposing, recycling, sale or disposal
- Reducing liability within the programme

INSIDE OUT

- Sample Retrieval
- Removing tiles, components,vessel furniture
- Practical demonstrations of Remote Handling capabilities

COSTS: RECURRING AND TRANSITION

- Recurring costs: electricity, insurance, etc
- Transition costs: keeping JET systems functioning, staffing, etc

PROVING CONCEPTS

- Intelligent machines
- Detritiation and Tritium science

JDR “eating the elephant”

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23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38	38/39	39/40	40/41	40/41
Tranche 1			Tranche 2				Tranche 3				Tranche 4				Tranche 5			

J5 36KV

J51

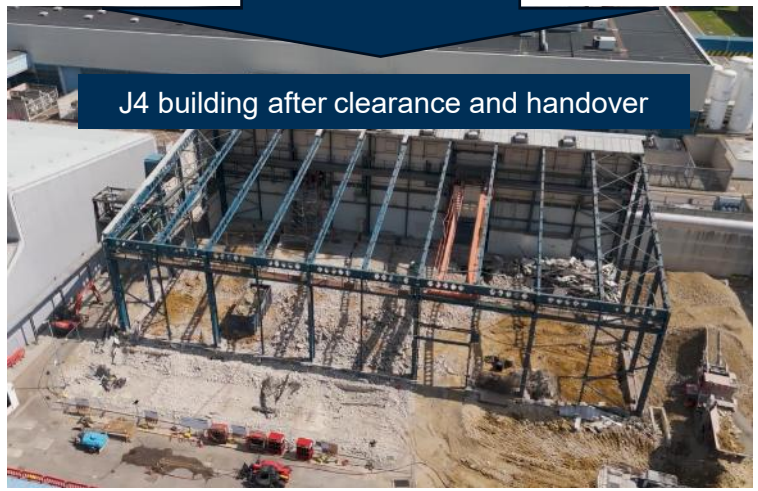
J3&31

IVD PREP

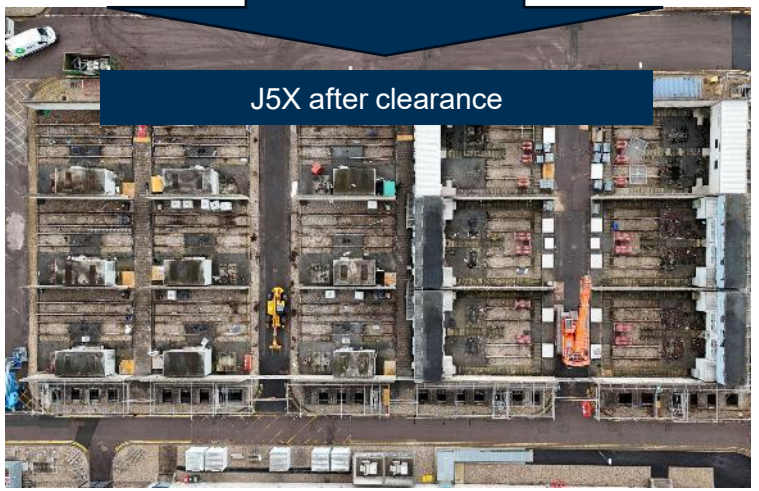
WASTE PREP

Progress
JET Estate

J4's power diodes before clearance


J4 building after clearance and handover

J5X transformers before clearance


J5X after clearance

J7-22 portacabins before clearance

J7-22 after clearance

Progress
Research and Development

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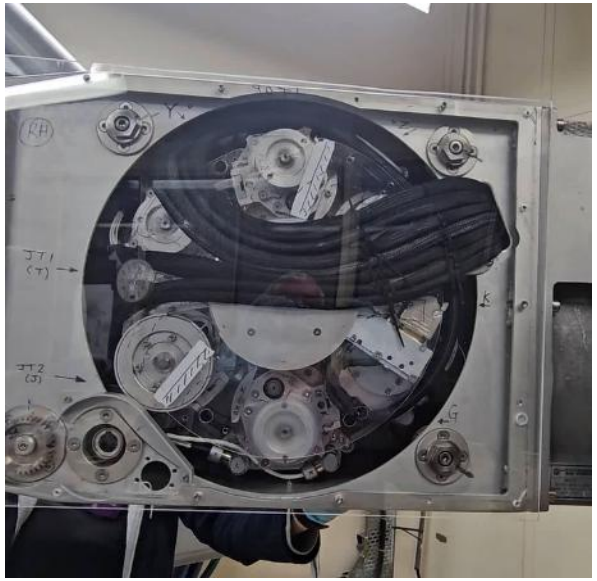
Remote Handling



Demonstrating capability:

- Sample Retrieval Campaign
- Laser Induced Breakdown Spectroscopy (with EUROfusion)

Practical in-vessel experience for Remote Handling team

Upgrades in progress for In-Vessel Decom phase 1

Waste Characterisation

Analysis of samples removed from JET:

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

Building evidence for Intermediate Level Waste processing challenges in tranche 3

Asset repurposing: Aspiration vs Reality

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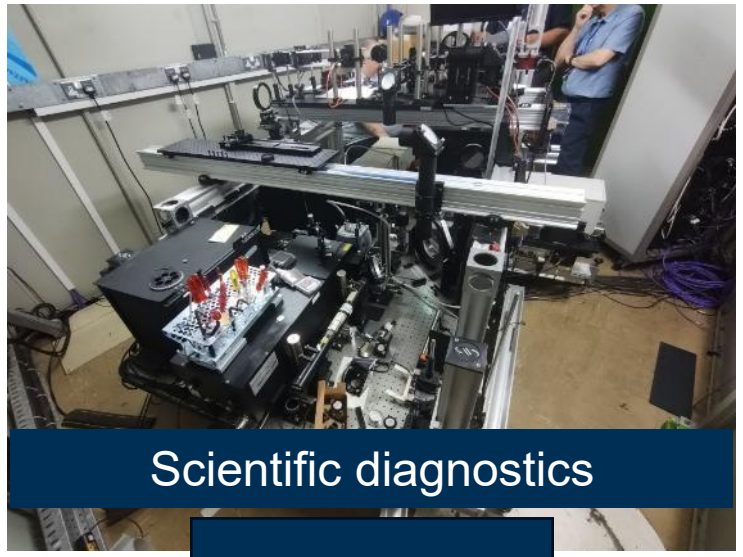
Power diodes

Aspiration

To be removed from JET and repurposed at MAST Upgrade during engineering upgrades

Reality

Power diode stacks transferred to MAST Upgrade within budget and schedule



Scientific diagnostics

Aspiration

To be removed from JET and transported to other fusion experiments

Reality

Completed for 11 assets, but high up-front costs for planning and execution = deferral

Flywheel generators

Aspiration

To be refurbished and repurposed as part of national grid stabilisation

Reality

Unfeasible due to prohibitive refurbishment costs and geographical location

The six strategic questions

Fully decommission JET or partially decommission then care & maintain?

Actively repurpose J1 assets or defer to main deplant phase?

How much Intermediate Level Waste to detritiate versus decay store?

Detritiate Intermediate Level Waste in-situ or ex-situ??

Build new waste facilities, or repurpose existing buildings for packing & consignment?

Demolish or repurpose J1 & J25 at the end of JET decommissioning?

Decom Considerations for Design / Op / Decom

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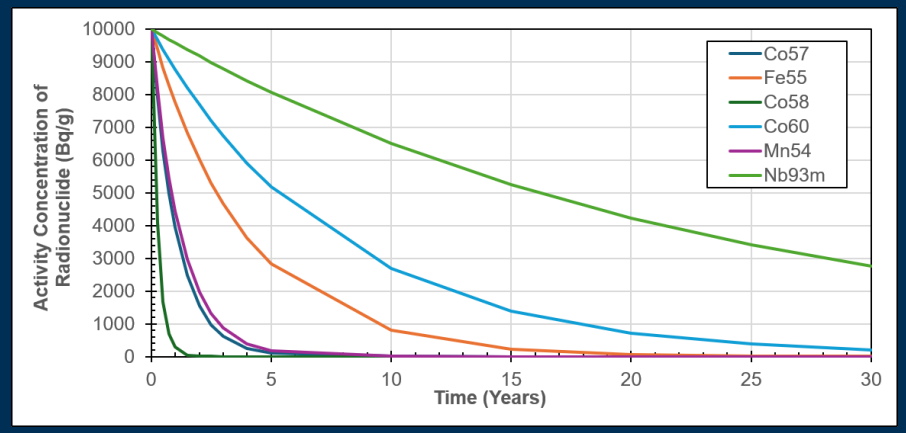

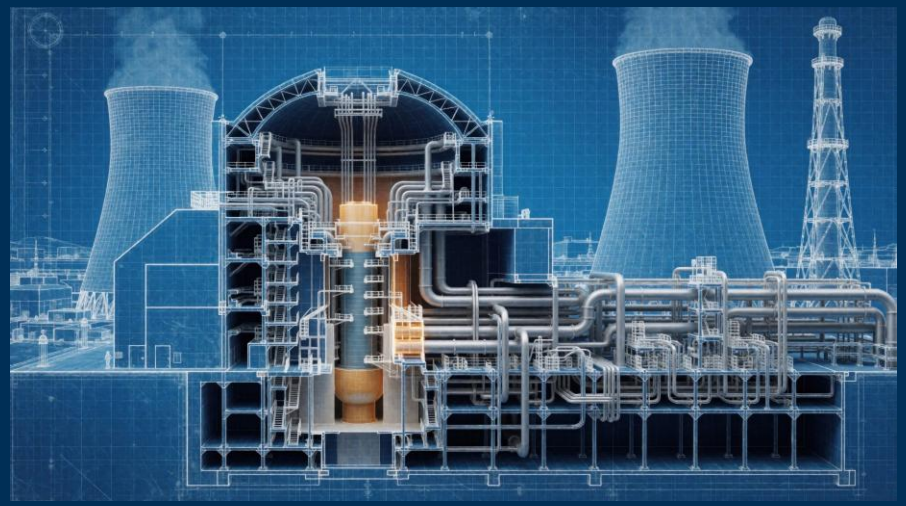

Science

- Activation - relatively short half-life (<30 years) for some products e.g. Co-57, Co-58, Co-60, Fe-55, Fe-59, Mn-54, but some long-lived radionuclides e.g. C-14, Nb-94, Mo isotopes. Defer?
- Contamination (Total tritium retention & off-gassing rate). Detritiate or Decay store?
- Chemical / Material hazards (Beryllium, Tungsten, Asbestos, SF6, etc). Reduce? Recycle?

Real-world considerations

- Modularity, Op inertia, New builds & Transition
- Total Cost Ownership (TCO). Building & Asset Maintenance, Utilities, Mid-Life Upgrade (MLU), Life Extension.
- Stress-testing the Lifetime Plan (LTP).