Wastes from Research Activities

Overview

A wide range of research activities have been undertaken in the UK over the last 70 years, which have led to the production of radioactive wastes. Research activities have benefited the nuclear, defence, medical and industrial sectors.

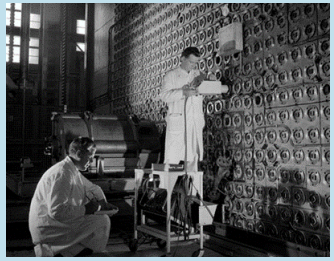
Research into commercial nuclear fission

In the early days of the nuclear industry in the 1940s until the 1980s, there was a large Government funded research programme into nuclear fission reactor technology.

Many different reactor designs and fuel types were investigated. That research programme led to the successful development of the early Magnox reactors and the later AGR that have been built and operated commercially in the UK.

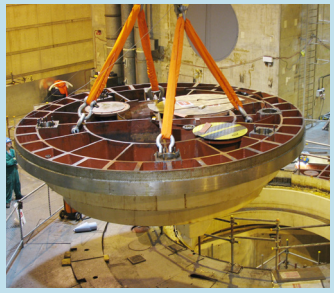
Experimental Fission Reactors

During the research programme, 19 test and prototype fission reactors, both large and small, were operated at the research sites of Harwell, Winfrith, Windscale and Dounreay. The experimental research reactors that remain in the UK in various stages of decommissioning include:



British Experimental Pile 0 – was built at Harwell in the1940's and operated from 1948 to 1968. The air-cooled graphite moderated reactor was made from interlocking graphite blocks

Material Test Reactors (MTR) – DIDO and Pluto at Harwell and the Dounreay MTR are essentially of the same design with an aluminium tank which contained the heavy water moderator and coolant surrounded by a graphite reflector



Steam Generating Heavy Water Reactor (SGHWR) – began operating at Winfrith in 1967, and was intended to combine the features of the CANDU reactor and Pressurised Water Reactors. The core consisted of a bank of metal pressure tubes (zirconium alloy) which passed through vertical tubes in an aluminium tank of heavy water moderator allowing the designers to do without the pressure vessel that normally contained the reactor's core

Overview of the Production and Management of Radioactive Waste in the UK

Dragon Reactor - was the first power reactor built at Winfrith in 1964. It was the first demonstration high-temperature gas-cooled reactor (HTGR) and operated until 1976. The graphite core and reflector are surrounded by the concrete bioshield

Dounreay Fast Reactor (DFR) – operated from 1959 to 1977, was a loop-type Fast Breeder Reactor cooled by primary and secondary liquid sodium/potassium NaK circuits, with 24 primary coolant loops made of stainless steel

Prototype Fast Reactor (PFR) – the larger PFR was a pool-type fast breeder reactor that operated until 1994

The decommissioning of these reactors will generate large volumes all waste categories that will require planning/preparation, treatment, packaging, storage and disposal.

These experimental reactors were supported by an array of laboratories and facilities for material testing, and for fuel manufacture, analysis and reprocessing.

These experimental reactors and associated facilities have now all shut down and are being decommissioned, or have already been decommissioned.

Research into Nuclear Fusion

In the UK, research into nuclear fusion is being conducted at the Joint European Torus (JET) facility at Culham, which is currently the largest facility of its kind in the world. JET will continue to operate until 2022, when it is due to close. Plans are in place to replace JET with STEP (Spheroidal Tokamak Electricity Production). STEP will be a much larger fusion reactor.

A fusion reactor does not use conventional nuclear fuel. Instead energy is generated through the fusion of radioactive hydrogen isotopes (deuterium and tritium).

Radioactive wastes produced during operation and future decommissioning of JET are activated with neutrons and will be contaminated by tritium.

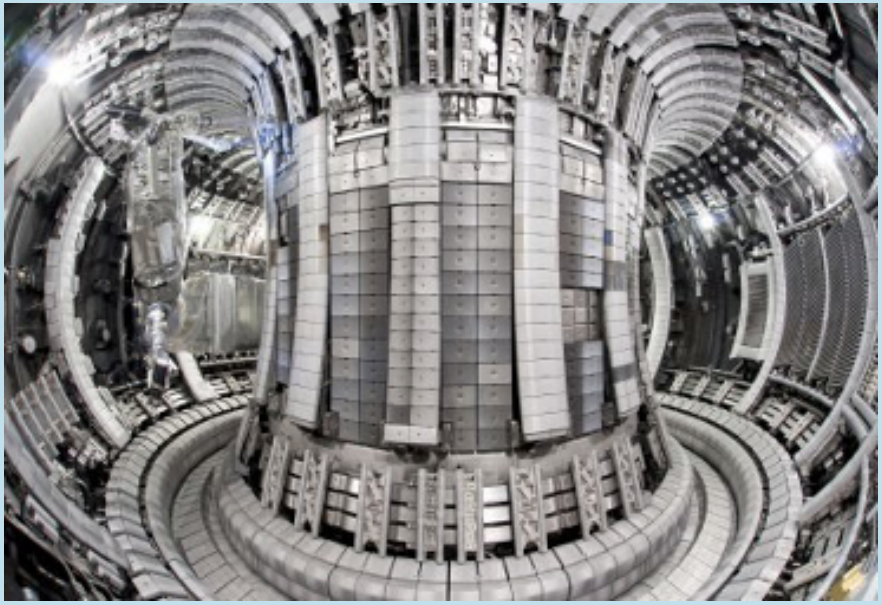


Image: The inside of the JET fusion facility. Source: www.ccfe.ac.uk/images.aspx

Other Civilian Nuclear Research

Academic and industrial research and development work takes place in many universities and research establishments across the UK.

The scope of research is very wide, and includes work to address challenges across the nuclear, industrial and medical sectors. Examples include research into new radiotherapy treatments and work to test novel techniques for encapsulating liquid radioactive wastes.

Radioactive Wastes Produced by Research Activities

Although the design and operation of the research reactors is different to the conventional power stations the wastes generated through their operation and decommissioning are very similar and dominated by activated steels, aluminium and graphite. They will be managed in the same way as wastes from conventional power stations.

A wide range of different radioactive wastes are produced from other research activities, although the quantity of waste generated by these activities is relatively small and the small volume of these wastes presents a challenge for their management.