

Fuel Handling, Waste Management and Decommissioning

COMMISSIONING AND IN-SERVICE SUPPORT



With over 40 years experience in the operation of two land-based research reactors, Rolls-Royce has developed comprehensive fuel handling, radioactive waste management and decommissioning capabilities across the fuel life cycle.

The continued operation and upgrade of the research reactors has allowed Rolls-Royce to develop a vast knowledge and range of expertise for safe and efficient fuel handling, waste management and decommissioning activities through life.

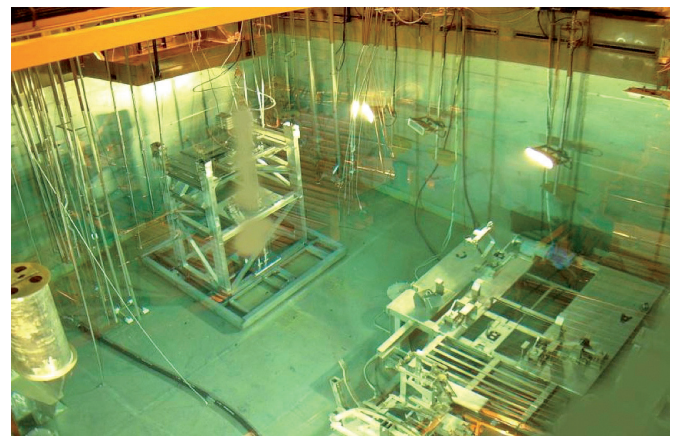
Fuel handling

Long term operation and maintenance style contracts have required Rolls-Royce to complete five iterations of the core loading process and four iterations of the refuelling and defuelling process at the Rolls-Royce Vulcan site, along with a well exercised plant boronation procedure, for chemical depression of radioactivity and post boronation flushing procedure for refuelling.

Currently, Rolls-Royce operates and maintains two fuel storage ponds on behalf of the UK MOD. During the life of the two ponds, Rolls-Royce has undertaken a variety of fuel handling activities, including; flask

transfer operations and post irradiation examinations (PIE). PIE operations have included a number of novel techniques to remotely handle, cut, examine and measure the fuel assemblies. Rolls-Royce has developed and implemented a number of technologically advanced techniques to ensure the safe and effective performance of such tasks.

For transportation of radioactive materials between licensed sites, Rolls-Royce also has a team dedicated to the design, safety justification and licensing of fuel handling and transportation equipment in accordance with all UK and EU nuclear transportation legislation.



A Rolls-Royce designed and operated fuel storage pond

Waste management

Decommissioned PWR decontamination process

Following the shut down of the original PWR reactor prototype, in 1984, Rolls-Royce was tasked with the responsibility for the defuelling and decontamination of the decommissioned plant. Rolls-Royce engineers designed a prototype process utilising MODIX decontamination principles and programmes. The prototype multi-oxidative decontamination with Ion Exchange Clean-up was successfully completed 7 months after plant shut down. Since then, Rolls-Royce has successfully applied the process in an operational environment during submarine refits for the Royal Navy.

In-Service PWR decontamination process

The MODIX decontamination process could not be utilised prior to core defuel due to the corrosive effects on some of the PWR component materials. Therefore, Rolls-Royce engineers designed, built and commissioned a bespoke decontamination and waste treatment facility (DWTf) designed to decontaminate spent fuel during the refuelling process.

On successful completion of the DWTf at Vulcan, Rolls-Royce supported the D154, decontamination and waste treatment facility, commissioned at Devonport for the defuel and waste management of the Royal Navy's nuclear reactor fleet.

Decommissioning

Rolls-Royce has been working closely with the NDA at the Dounreay site where novel decommissioning techniques are being pioneered. Rolls-Royce is involved at every stage of decommissioning the original PWR research reactor.

Supporting Capabilities

- Fuel flask transfer (In-Pond)
- Post irradiation examination (PIE)
- Fuelling mock-up operation rigs – simulation and training
- Fuel handling equipment design, manufacture and licensing
- Nuclear transport container design, manufacture and licensing
- Radioactive waste disposal
- Radioactive waste retrieval
- Safety case authorship and justifications



Experience/references

Fuel handling

With the completion of in-service core testing Rolls-Royce began an extensive refuel update and revalidation (RUR) of the full PWR plant. The programme covered four key areas: the defuel of the first prototype core; in service inspection of the reactor plant; installation of the prototype long life core; updated safety cases to justify the plant and operations with the new core.

This project saw Rolls-Royce achieve the first application of nuclear authorisation and the first of the modern standard safety cases of the time in the UK.

Clearance of the reactor fuel from the DSMP fuel storage pond is an example of the extensive experience Rolls-Royce has amassed in the field of fuel handling.

Successful iterations of the defuelling process involved:

- Removal from the reactor
- Transport to the fuel storage ponds
- Removal from the ponds
- Insertion into the used fuel handling flasks
- Onward off site transport to Sellafield.

Post irradiation examination (PIE)

The Post Irradiation Examination (PIE) of a number of PWR cores have all been completed through a series of destructive and non destructive testing and data analysis.

Rolls-Royce has established a wealth of skills, experience and technical capability of In-Pond PIE and are currently researching the trial of In-Cell PIE techniques used by the US. This would further utilise the established nuclear grade construction capabilities in the local supply chain.