

## Nuclear

### Client

United Kingdom Atomic Energy Authority (UKAEA)

### Location

Cumbria, United Kingdom

## Windscale Decommissioning

### Project Description

Situated in Cumbria, the 35-acre Windscale site is located within the larger Sellafield complex, which is currently operated by Sellafield Ltd. UKAEA working in alliance with CH2M HILL, continues to manage site operations. The nuclear liabilities at Windscale are owned by the Nuclear Decommissioning Authority (NDA), a government body which has strategic responsibility for the clean-up of the UK's twenty civil nuclear sites.


The Windscale Pile 1 is a graphite moderated, air-cooled, horizontal, natural uranium fuelled reactor. In October 1957, during a graphite annealing operation, the core temperature unexpectedly increased – resulting in a large fuel fire. After the accident, its sister plant, Pile 2, was shut down. The two facilities were later isolated and sealed, and put on a monitoring and surveillance regime during the development of dismantling plans.

For years the intrusive inspection of the fire damaged region of Pile 1, estimated to contain 15 tonnes of fuel, was precluded based on concerns that the remaining fuel could reignite or a nuclear reaction could be initiated. These very pessimistic assumptions had substantial influence on early plans for dismantling. Proposed dismantling options called for complex remote systems accessing the core through small penetrations in the bioshield in an atmosphere made fully inert. The technical, financial, and regulatory hurdles of these options were found to be too substantial to overcome.

The decommissioning of the Windscale Pile 1 reactor – fifty years after the 1957 fire – is considered one of the most technically challenging decommissioning projects in the UK, if not globally. In 2004 the UKAEA and CH2M HILL formed an alliance that has developed a technically robust and detailed plan to decommission the reactors using a top down approach that employs an array of light weight, carbon fibre, high payload robotic arms to remove the damaged fuel, graphite core, activated metals, and concrete.

In June of 2006, the United Kingdom Health and Safety Directorate (UK HSD) approved a new Pile 1 safety case that more accurately evaluated the safety risks. Adoption of the new safety case enabled intrusive inspections of the fire damaged region and a decommissioning strategy that employs a top down approach for the core and bioshield assess and removal the damaged fuel in air using 'conventional' techniques.

The UKAEA and CH2M HILL team prepared a new and innovative decommissioning Safety Environment Overview Report (SEOR) in tandem with the new Pile 1 operational safety case. The Windscale Piles Decommissioning SEOR presents a detailed technical description of the new top down decommissioning approach. Unlike previous nuclear safety



documents in the UK, the Windscale Decommissioning SEOR includes a broad range of photographs, graphical illustrations, and “Virtual” computer animations. It provides a unique and detailed overview of the decommissioning strategy and technical approach. The electronic document was provided to a wide set of stakeholders, regulators and local community leaders in late 2006 and was positively received. The SEOR received a 2007 UKAEA Innovation Award.

To further validate the technical strength of the Pile 1 decommissioning strategy, a full scale prototype test and display facility located in Moresby Park was built to house a mock-up of the reactor core, simulated damaged fuel, and waste processing equipment. The facility allowed the NDA, NII, EA, local and international media, governmental officials, school children and others to see first hand the equipment. This facility also showcases the progress being made in developing a credible plan to decommission the piles. The test facility was fully operational by late September 2007.

Work is currently underway to prepare the Piles facility for full scale decommissioning. Facility modifications are required to provide space for decommissioning equipment and support the waste conditioning, assay, and a buffer store. One of the most significant site preparation activities involves the removal of the Pile 1 air inlet duct, which was contaminated by fire water during the accident. A new reactor core ventilation system is being designed and will be installed. This system will be used to maintain negative differential pressure within the core once access through the pile cap bioshield is established. Other site preparation activities include characterization of the activated bioshield concrete, video inspections and sampling of the core and damaged fuel channels, and radiological surveys of the core.

The UKAEA and CH2M HILL team has made significant progress since 2005 on developing a robust and technically defensible decommissioning strategy for the Windscale Pile reactors. The net effect is the accelerated schedule for decommissioning the Windscale Pile reactors, which has been reduced from the previously estimated 30 to 45 years to between 10 and 20 years. The cost estimates for the project have also been reduced from £560 million for Pile 1 fuel removal alone, to £490 million for the achievement of a brownfield endpoint for both Pile 1 and Pile 2.

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