Stakeholder briefing note: Cutting holes in the Pile Fuel Cladding Silo

Introduction

With an expected start of work in late February/early March 2017, the Pile Fuel Cladding Silo Programme at Sellafield will begin making the very first large penetrations into this “locked vault” facility which has stored legacy nuclear waste for more than 65 years.

This technically-challenging work – one of the most significant moments in Sellafield’s high hazard reduction history – is a key step to beginning the twenty-first century removal of waste which was first deposited in the facility when George VI was still on the throne.

While cutting six holes in the side of an ageing nuclear silo presents a slight increase in near-term risk, the work is essential to the longer term mission of overall risk and hazard reduction, and is being managed within strict safety envelopes and management tolerances to protect the site and wider community.

What is the Pile Fuel Cladding Silo?

The Pile Fuel Cladding Silo (PFCS) was commissioned with its associated plant and equipment in the early 1950s for use as a dry Intermediate Level Waste (ILW) storage facility for waste resulting from the de-canning operations of pile fuel and later Magnox. When tipping operations ceased in the 1960s the silo was left as a waste store under a regime of care and maintenance, with the concrete structure continuing to provide containment and bulk shielding for the waste.

Today, the PFCS Programme is driving for the earliest possible start of retrieval operations, in order to reduce the risk associated with this ageing facility. To achieve this vision, the programme is providing a capability to access the silo, to remove the waste, and to containerise, transport and safely store it, prior to final disposal.

What is PFCS Hole Cutting?

In order to gain access to the waste within the silo’s walls, Sellafield Ltd, working together with Bechtel Cavendish Nuclear Solutions (BCNS) and the subcontractor Babcock Marine Technology (BMT), will cut a sort-of rectangular shaped hole at the top of each of the facility’s six compartments.

The project has designed, manufactured and commissioned a rig capable of safely cutting the hole whilst maintaining containment, known as the Retrievals Access Penetration (RAP) rig. The section of the wall that is cut away in a single piece (known as the monolith) will be withdrawn into a
containment bag, and removed from the RAP rig. The silo containment door (already installed on all compartments) will be lowered over the aperture and closed.

These giant steel doors will provide radiological shielding and maintain the inert argon atmosphere inside the silo until waste retrievals begin (currently scheduled for 2020, with opportunities to accelerate to 2019).

The RAP rig consists of three major structures – the undercarriage (39 tonnes), the operating area frame (12 tonnes), and the monolith removal frame (36 tonnes). Together, this equipment – measuring around 14 metres in length – weighs in excess of 90 tonnes (the equivalent of 7 double decker buses). It has been installed 14.8m up on the specially-built concrete retrievals superstructure next to the silo rather than on the silo itself. Reinforced beams have been installed to strengthen the silo so it can safely support the extra weight from the six silo doors and maintain its structural integrity during cutting work.

Why is this the right solution?

Sellafield has carefully considered this approach, and the alternatives – such as penetrating the silo from the roof or the bottom. However, cutting the holes into the top side of the silo is demonstrably safer and more practical than other options. Trial work demonstrations up at Rosyth in Scotland have provided significant confidence in the technology.

In tandem with the hole cutting, it is necessary to remove the six deflector plates positioned at the top of the silo. These metal structures, each roughly the size of a small car, ensured that waste tipped into the top of the facility would deflect onto both sides of the silo, avoiding a built-up pile in the middle. The deflector plates would have been in the way of the retrievals equipment extended into the building through the hole we are now cutting. We have now successfully cut up and removed two of the six deflector plates (in compartments 5 and 6) using remote water jet cutting techniques.

The radiological risk in the hole cutting operation has been assessed as low. However it will be the first ever engineered cutting of the silo containment structure since it was built and is irreversible.

How is the work being checked, monitored and regulated?

We have worked closely with our nuclear regulators to ensure this operation is safe and to make the risk As Low As Reasonably Practicable (ALARP) in all aspects while using the Best Available Techniques (BAT). There has been a truly constructive, aligned approach between Sellafield Ltd, Government, the Nuclear Decommissioning Authority and our main regulators in the Office for Nuclear Regulation and the Environment Agency in driving forward the early retrievals mission from the silo. Specialist inspectors have witnessed and approved the cutting trials in Rosyth and there are a series of ‘hold points’ throughout the operation to make the necessary safety checks before progressing.
What are the risks and how are they being managed?

We will be making irreversible alterations to the structure of the building and have therefore assessed the risk of the silo wall being weakened by this procedure. We have carried out reinforcement and strengthening work to ensure the silo walls will still safely contain the waste.

There is also the potential for some water to enter the silo during dust suppression and equipment cooling, which could potentially lead to hydrogen being generated. We will be monitoring this closely and have already demonstrated successful hydrogen controls during water jet cutting work.

Operators carrying out the work will be wearing full protective clothing and breathing apparatus to protect against potential chemotoxic hazards from the silo’s inert argon gas. The training and walkthroughs at the Rosyth facility can also give us confidence that they can carry out the operations safely, securely and human factors have been considered and managed thoroughly.

Will there be any change in emergency planning arrangements while it’s happening?

The risk for this operation has been assessed as low and there will be no change to our normal day-to-day running of the site and no need for our standard emergency planning arrangements to change. Sellafield is a hazardous nuclear site with well-drilled procedures to deal with any release of radioactivity.

It is important to underline that the project has been preparing for this landmark operation for a number of years. The RAP rig has been rigorously tested on the full scale replica test rig at Rosyth, and all aspects of its operation have been successfully demonstrated to our regulators and other stakeholders. Operators have benefited from a significant programme of training and trial work.

Like many aspects of the PFCS Retrievals Project, the RAP operation has been considerably simplified from original plans. The new RAP approach is quicker, simpler and ultimately safer than the alternatives considered earlier in the programme’s lifetime.

What’s next?

Cutting the six holes is the final major enabling activity for the Early Retrievals Project, and provides the essential access for the waste retrievals equipment. We anticipate all six hole cutting operations will be completed this summer, at which point the project will continue to prepare for the installation of retrievals equipment and tooling for the start of operations from compartment 5.

Early Retrieval operations are currently scheduled to begin in 2020, with further acceleration efforts underway to bring this timeframe forward. This is significantly ahead of the agreed site schedule and reflects the effort of the team to simplify and de-risk the approach, whilst using commercially available off-the-shelf technology wherever possible. The current anticipated completion of retrievals is 2027, but this date will become much clearer once we have started the retrievals process and can fully understand the challenges and opportunities to accelerate.
How the RAP Rig works – as seen at the Rosyth test facility

- Monolith Removal Frame Arm
- Local Indicator Panel
- Catchment Canopy
- CCTV Scaffolding
- Coupon Support Frame
- Undercarriage & North South Rails
- Main Control Panel (Door)
- Hyva Crane
- North South Movement Hydraulic Power Pack
- North South Tug
- RAP Entrance Change Room
- East West Movement System
- Effluent/Slurry Drain Line