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## CHALLENGE: Post Operational Clean Out

The Game Changers Innovation Programme is hosting a challenge-led event on Wednesday 16<sup>th</sup> May 2018, at the Technology and Innovation Centre, Glasgow.

The aim of the event is to present and describe the Post Operational Clean Out (POCO) challenges Sellafield face as they prepare for decommissioning.

POCO is the process that takes place when a nuclear plant has reached the end of its operating life.

The aim of POCO is to reduce the risk and hazard in a facility by removing the nuclear inventory and lower the lifetime costs of the redundant plants.

There are a minimum 87 facilities due to undergo POCO over the next 40 years at the Sellafield site.

Attendance at the event will help you understand how you can access funding to deliver innovative technologies, processes and characterisation techniques which could enable game-changing improvements over current POCO practices at Sellafield.



Simplified cross-section of typical cell.

## Sellafield site overview

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Sellafield is a nuclear fuel reprocessing site on the west coast of Cumbria. It covers 6 square kilometres and is home to more than 200 nuclear facilities.

Nuclear operations on the site commenced in the 1940s, reflecting the full range of activities undertaken by the UK civil nuclear industry.

For most of its existence, the main business focus of Sellafield has been reprocessing, but over the next two years reprocessing activities at the site will come to an end.

The focus of operations at Sellafield will then shift to a Post Operational Clean Out (POCO) phase before decommissioning can begin.

## Introducing POCO

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POCO (Post Operational Clean Out) is the process that takes place when a nuclear plant has reached the end of its operating life.

The aim of POCO is to reduce the risk and hazard in a facility by removing the nuclear inventory and reduce the lifetime costs of the redundant plants. In simple terms, it gets the plant as radiologically clean as it can be, which reduces the risk and hazard and, in turn, makes the plant cheaper to care for.

It is estimated that the cost benefit of POCO could be a saving of £1.8bn across the life span of three key reprocessing facilities at Sellafield. A minimum of 87 facilities are due to undergo POCO over the next 40 years.

## Current practice

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Current POCO practice is focused on carefully sequenced washout of the plants using water or simple acids, employing existing process equipment and techniques.

Successful POCO requires the mobilisation of materials which:

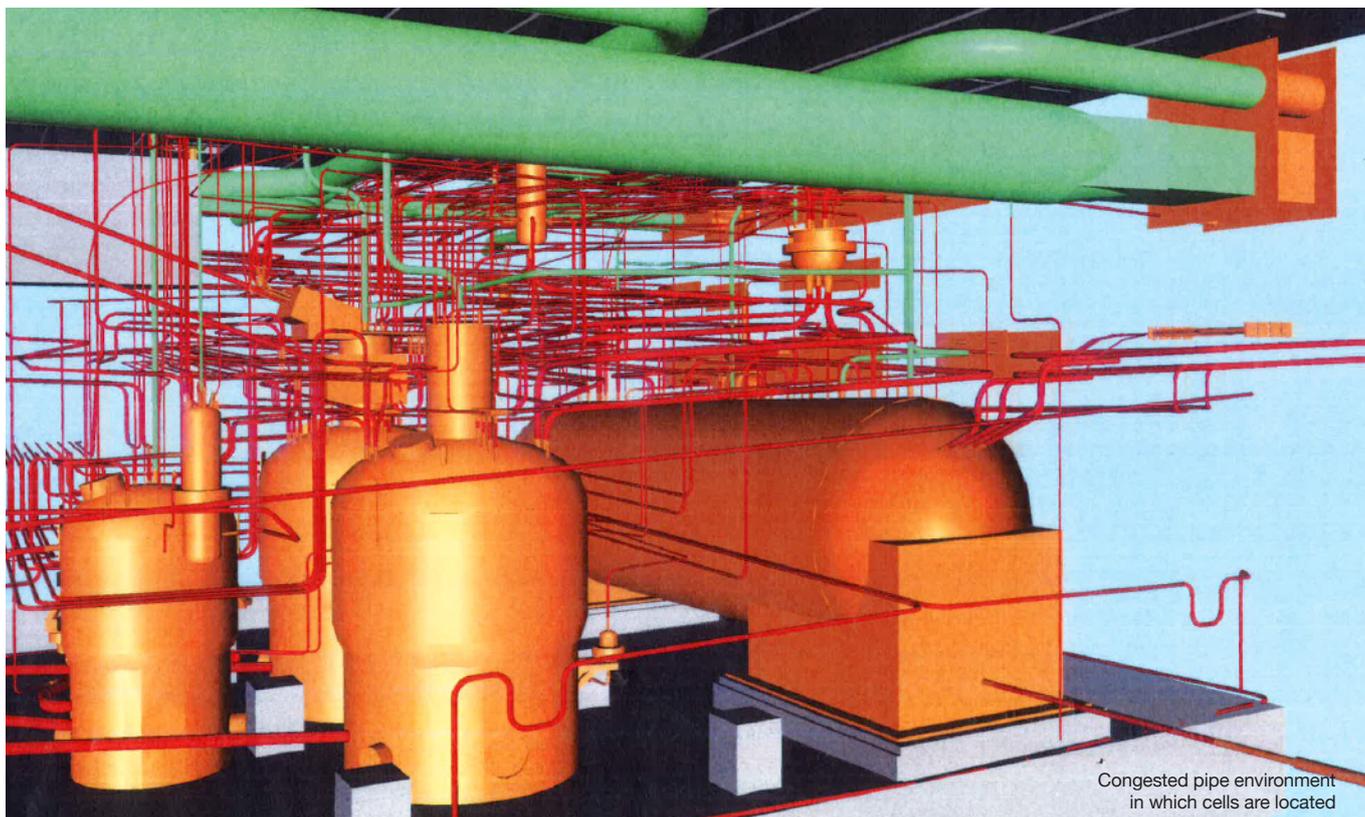
- Are highly radioactive and chemotoxic;
- May be either solids and deposits, or a combination of both;
- Have become adhered or attached to vessel walls, process equipment and pipes;
- Have become engrained within metal cell walls;
- Are remaining solvents within process systems.



The recovery and transfer of waste during current baseline POCO methods involves ejection (steam) pumping and systems under vacuum.

**Characterisation is critical to understanding if POCO targets have been met but this is challenging at Sellafield as many plants were not intentionally designed to support post-operational sampling or characterisation.**

It is essential that containment is maintained.



## The opportunity for innovative solutions

Sellafield are looking for innovative technologies, processes and characterisation techniques which could deliver game-changing improvements over the current baseline POCO methodology.

This would entail the development of alternative approaches to effectively remove and reduce hazardous material within the process equipment and associated cells.

To support Sellafield's principles, the following need to be considered;

- the potential for cost savings gained by eliminating over-engineered packages;
- improved efficiencies through reduced complexity of deployment.

Sellafield would like to explore:

ACCESS	CHARACTERISING	CLEANING	TRANSFERRING
Alternative cell and vessel access.	Deployment of innovative technologies for visual, physical and radiological characterisation.	The use of new reagents to aid dissolution of insoluble materials and deposits contained in tanks.	The use of retrieval and disposal tools and techniques.
Remote handling and navigation techniques.	Material identification – solids (which may be loose or adhered), solvents and engrained activity.	Alternative techniques to mobilise solids, solvents, adhered and engrained material.	In-situ storage and grouting applications.
Reduction of human intervention.	The location and assessment of radiation dose i.e. 'hot spots'.		Shielding and containment technologies.

## Considerations

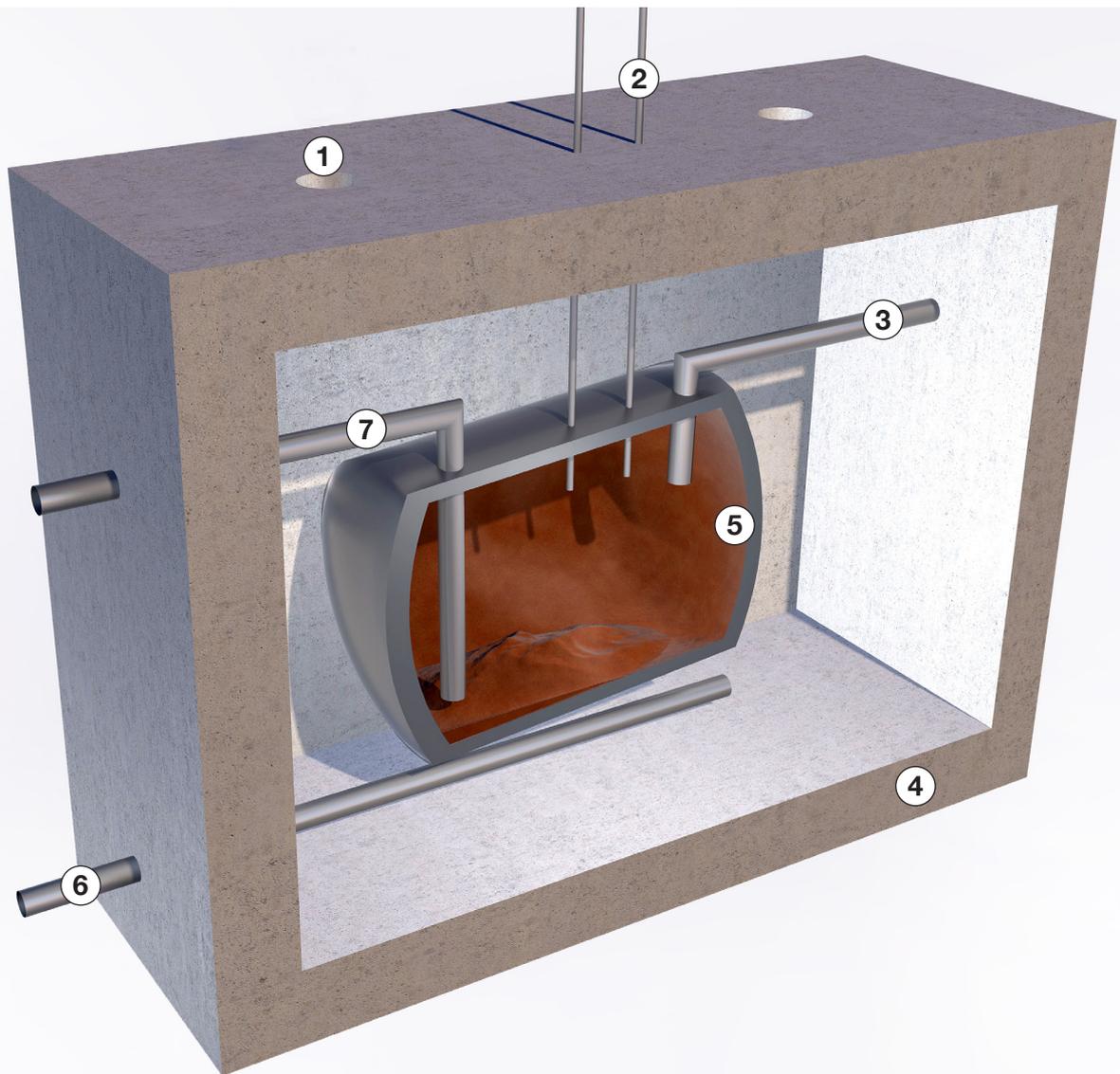
The following considerations need to be made when developing potential solutions:

<b>Activity</b>	Active residue remains within vessels and pipes (typically in the range of 1Sv/hr – 40 Sv/hr although 1000 Sv/hr is possible for highly active waste streams). Dose rates mean that only remote handling is possible.	
<b>Poor Access</b>	Access is restricted to the process vessels which are located within shielded cells constructed from 1.5m thick concrete (see diagram). No man access is possible and there is no visibility to the inside of vessels. Access to the vessels must be through existing ports which are typically 70mm in diameter. Vessels are typically 10mm thick stainless steel. Navigation to the associated process vessels and pipework within the cells is through congested environments.	
<b>Contamination</b>	Containment must be maintained during POCO and whilst transferring wastes.	
<b>Power Supplies</b>	There are no power supplies within the cell environment so all equipment to be used during POCO must be powered externally to the cell or independently.	
<b>Variable Packages</b>	POCO needs to be carried out on many different cells, vessel designs, shapes, sizes and storage configurations which are currently in use at Sellafield.	

Sellafield are seeking new technologies and techniques which can be deployed within 1 - 5 years. All proposed methods will be subject to appropriate reviews, Sellafield Design and Safety Case assessments.

The images below are examples of the congested dark environment in which pipework and vessels are located.





Simplified cross-section of typical cell.

	Item	Description	Material	Dimensions
1	Inspection ports	Removal of concrete shield plugs to enable inspection access	Concrete	approx. 155mm diameter
2	Pneumercator lines	Used to measure liquor levels via pressure differential (several)	Stainless steel	approx. 20mm diameter
3	Process lines	Used to transfer liquor into vessel	Stainless steel	
4	Cell outer casing	The vessel and pipework are located inside a shielded cell	Reinforced concrete	1.5m thickness, approx. 10m x 8m x 10m (H, W, D)
5	Process vessel	Vessel or tank used to store, mix or react liquors/slurries	Stainless steel	approx 19mm thick
6	Neutron tube	Sealed tube to allow instrumentation be inserted in close proximity to the vessel from outside of the cell	Stainless steel	approx 70mm diameter
7	Ejector leg	Used to remove liquor from vessel via air or steam driven ejection	Stainless steel	approx 70mm diameter

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## What next?

The Game Changers Innovation Programme, supported by Sellafield Ltd and in association with Subsea UK, are hosting a challenge-led event on at the Technology and Innovation Centre, University of Strathclyde, Glasgow, on Wednesday 16<sup>th</sup> May, 2018.

If you're an individual, an SME or large organisation with new ideas or innovations which can be applied to address the Sellafield POCO challenges please join us.

Attendance at the event is free and you can register your place at [innovation-in-poco.eventbrite.co.uk](http://innovation-in-poco.eventbrite.co.uk)

Proof of Concept funding is available through the Game Changers Innovation Programme for new technologies which may aid Sellafield in their decommissioning mission and which demonstrate commercial potential for the innovator.

Visit [www.gamechangers.technology](http://www.gamechangers.technology) to find out more about the Game Changers Innovation Programme, the application process and to download or complete an application form.

You can also request an application form by emailing us at [apply@gamechangers.technology](mailto:apply@gamechangers.technology)



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