Development of a Systematic Approach to Post-Operation Clean Out at Sellafield

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ABSTRACT

Post Operational Clean Out (POCO) relates to the activities undertaken directly after commercial operations cease to remove residual activity and facilitate decommissioning of a nuclear facility. Historically the transition of Sellafield facilities has proved sub-optimal resulting in loss of critical plant knowledge, additional cost and protracted delivery timelines.

The move from reprocessing in Magnox and Thorp to POCO is a significant transition facing the site, with a large number of diverse facilities scheduled to cease operations over the next 15 years. In order to ensure that the facilities are dealt with in a consistent manner, that supports both Site and Nuclear Decommissioning Authority (NDA) strategies, the POCO programme has been established across the Sellafield Operations Division.

Primary aims of the POCO programme are:

- *Risk and Hazard Reduction*
- *Enabling redeployment of resource and capability*
- *Lifecycle cost reduction*
- *Enhanced Reputation*

Transition preparations will cover process, organisation, technology and information. Knowledge is a key output of POCO: the creation of records of the plant configuration and status to enable and support the safe and effective eventual decommissioning of the plant. The consistent approach that has been developed will:

- *Ensure the smooth transition from operations into POCO, and then into surveillance and maintenance.*
- *Maximise the potential of facilities to support other site activities prior to POCO.*
- *Optimise the facility schedules within the overall POCO programme, to ensure timely decoupling.*
- *Define and manage the resource demands and capabilities prior to and during POCO.*
- *Provide a baseline configuration for each facility at the end of the POCO phase.*
- *Encourage and enable knowledge management to ensure that subsequent decommissioning activities are informed and supported.*
- *Look for opportunities to progress housekeeping and co-processing activities so as to reduce inventory and make best use of existing waste routes during operations.*
- *Seek and use learning from experience (LFE) from internal and external facilities and from other organisations that have already gone through POCO.*

Post Operational Clean Out at Sellafield

POCO relates to the activities undertaken directly after commercial operations cease. It is a systematic displacement of radioactive and non-radioactive liquors and solids. The primary aims of POCO are to reduce risk and hazard from the plant and, in doing so, to minimise the radiological and chemotoxic challenge to future decommissioning activities so as to facilitate decommissioning and demolition of the facility.

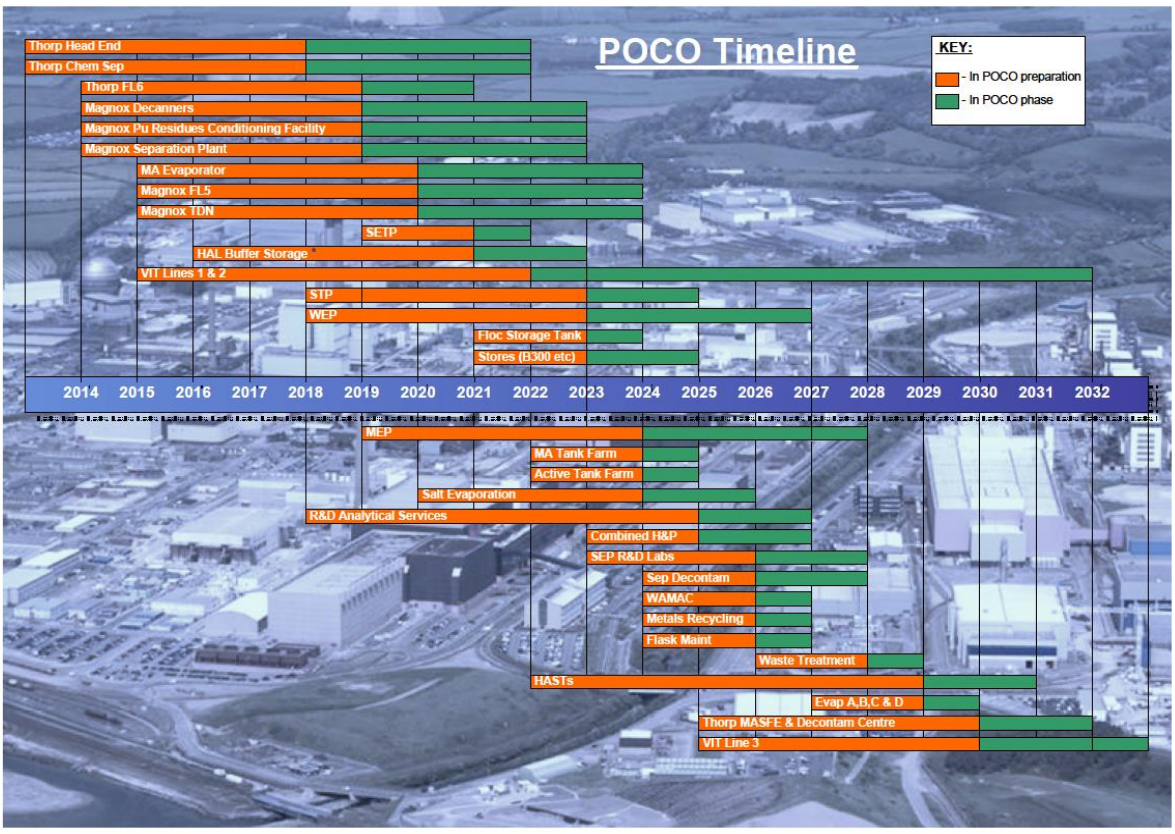
POCO achievement is about successful transition. The transition from reprocessing to POCO in the Magnox and Thorp facilities is a significant transition facing the site, with a large number of diverse facilities scheduled to cease operations over the next 15 years. Historically, the transition of Sellafield facilities has been sub-optimal. The POCO Programme team has been established to ensure that successful transitions are consistently achieved across the Sellafield Operations Division, in a manner consistent with both Site and Nuclear Decommissioning Authority (NDA) strategies. The primary aims of the POCO programme are wider than just reduction of risk and hazard from the plants. They also include:

- Redeployment of resource and capability
- Lifecycle cost reduction
- Enhanced reputation

Hence POCO will aim to:

- Remove as much of the radioactive inventory as possible from the plant.
- Remove chemical and other potential environmental hazards from the plant.
- Leave the plant in a safe, quiescent, and well-understood configuration suitable for eventual decommissioning.
- Define the sequence of "decoupling" of site facilities and taking them into POCO.
- Reduce resource requirements for maintaining the plant during surveillance and maintenance.

Figure 1. Sellafield Operations Division Provisional Timeline



Vision for Implementation of POCO

It is assumed that POCO will be carried out by the incumbent plant operators using the existing plant safety case. In that way it makes best use of experienced plant personnel, installed plant, processes and equipment, and downstream waste facilities. Some plant modifications may be required to support POCO operations.

During the POCO planning phase, in the final years of normal plant operations, a number of key activities should take place. They include:

- Seek and use learning from experience (LFE) from internal and external facilities and from other organisations that have already gone through POCO
- Look for opportunities to progress housekeeping and co-processing activities so as to reduce inventory and make best use of existing waste routes during operation
- Characterise the plant to understand the radiological and chemotoxic challenge and the as-built status of the plant, so as to inform the POCO tasks, technology development and waste routes.

During POCO, the same supporting facilities and activities will be required as during the commercial operations that preceded. Levels of support will differ, sometimes increasing. Support includes core utilities, infrastructure, effluent plants, asset maintenance programmes, analytical services, laundry and protective equipment services, transport, security and safeguards, and training facilities.

At the end of POCO the key output is the creation of records of the plant configuration and status, and how that status was achieved, to enable and support the safe and effective eventual decommissioning of the plant.

POCO will be considered a success when:

- Each facility's POCO delivery has been completed and the target state for transition to Decommissioning has been achieved.
- The Plant Safety Case and associated Engineering Schedules reflect the reduction of hazardous inventory.
- Plant condition, status and configuration is robustly documented.
- Knowledge management activities (plant history, information and people) have been completed.
- Personnel have been identified and trained for facility dismantling tasks, new missions or new facilities.
- All wastes from POCO activities have been removed, or approved waste routes for disposal are in place.
- Regulators and stakeholders support the position that post-operational status for each facility enables safe and effective transition to the decommissioning phase.
- Any systems not required for decommissioning are deactivated.

Development of the Systematic Approach to POCO

In recognition of the forthcoming 15 year rolling programme of POCO that will take place at Sellafield, starting with POCO of the Thermal Oxide Reprocessing Plant (THORP) in 2018, the POCO Programme was set up in September 2013. Its mission is to 'Establish the site standards for POCO preparation to enable Sellafield Ltd to realise the full benefits by successfully preparing our people and plants for transition to the new site missions'.

POCO preparation is in several tranches, which interface with key Sellafield strategies. The tranches cover information, process, organisation, and technology.

Information

Knowledge management (KM) strategies need to be developed for facilities that are coming to the end of their operational life. The strategies need to recognise that one of the main customers of an effective knowledge management process will be the future workforce that undertakes decommissioning. There is also a significant requirement for information to support POCO planning. Key steps in the knowledge management process are:

Knowledge transfer. In order to promote and enhance the identification and retention of critical knowledge required to support the POCO and decommissioning phases, a process of capture and transfer of people's experience and learning is being developed at the facility level.

Learning from Experience. An effective and robust learning from experience (LFE) process is being developed to support the POCO programme by identifying opportunities where valuable LFE from ongoing activities and experiences in internal and external facilities and organisations can be recorded. This LFE can be made accessible for future users, whilst also demonstrating an LFE culture where opportunities are identified and LFE is actively used to support decision making processes. Benchmarking activities have already taken place with a number of facilities in the UK and France.

Plant Configuration. Before POCO starts there is a need to understand the plant configuration and status to support the planning of POCO tasks. Following on from POCO, there is a need to create and retain good quality records of plant operations, POCO operations, plant configuration, facility characterisation and operational experience so that knowledge will be retained in an accesible format for the future decommissioning activities. This is especially important since the Sellafield strategic model suggests that once facilities have entered into their decommissioning phase there will be a period, maybe decades, of surveillance and maintenance (S&M) before final decommissioning.

Management of this knowledge will require consideration of, and significant investment in information, repositories and archives, etc (tools); individual knowledge, experience and skills (people) and information management systems (processes). To guarantee successful implementation of a POCO KM strategy, governance is required to encourage a strong KM culture within the facilities. This will require trained resources to be part of an organisation that will implement and coordinate the POCO KM processes across all facilities in line with the POCO delivery and future decommissioning schedules.

Process

Several overarching strategies have been prepared that set out the principles that will guide POCO preparation at Sellafield. They include:

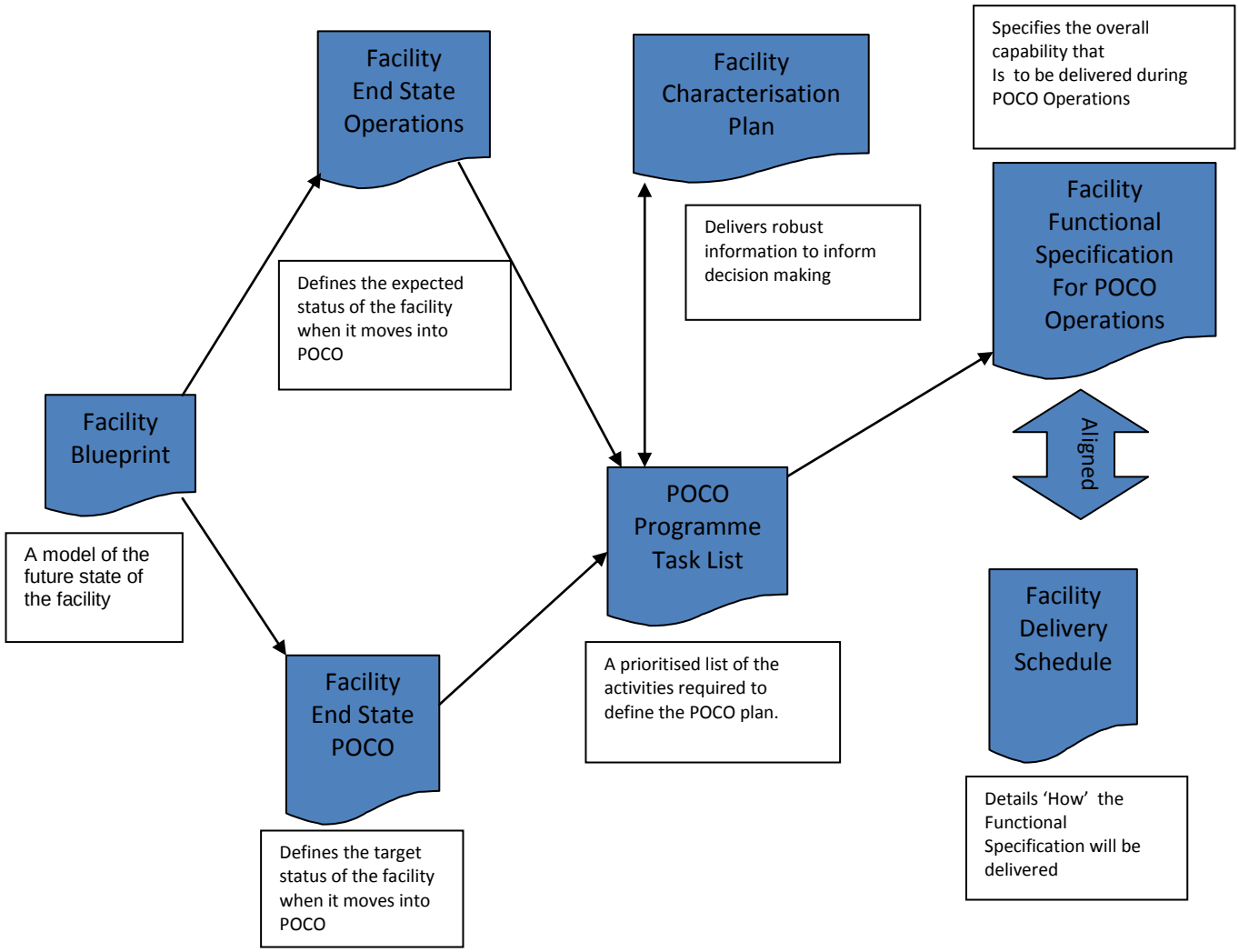
- Waste Management Strategy- to outline the waste-led approach to be taken in POCO planning and the principles for managing solid and liquid waste arisings during POCO operations.
- Safety Case Strategy- to outline how safety cases will be managed as plants transition through POCO and into decommissioning. Seeking to maintain a safe operating envelope whilst ensuring flexibility and aiming for an overall reduction in the safety case burden as the hazard reduces.
- Characterisation Strategy- to set out the approach to be taken in identifying and delivering POCO characterisation requirements throughout POCO planning and implementation.
- Asset Management Strategy- to define how asset management and asset investment decisions will be managed as facilities transition into and through POCO, ensuring that full lifecycle of assets and facilities is considered.

The process of preparing for POCO for an individual facility has been divided into a number of stages, each with associated outputs. They are summarised in Figure 2. The stages are:

- Facility Blueprint. This describes a model of the future state of the facility, how it will be organised, what operations will be undertaken, what the working practices will be, what technology and information is required to support it, etc.
- Facility End State Operations. This defines the expected status of the facility when commercial operations finish and it moves into POCO. It defines the activities to be carried out during POCO preparations and POCO Operations.
- Facility End State POCO. This defines the target end state for POCO operations. It represents the state that is considered to present the best compromise of risk and hazard reduction, minimised lifecycle cost, and decommissioning start point, taking into account constraints of time, funding resources, etc. Used in conjunction with the 'Facility End State Operations' document it bounds the scale of the POCO task.
- POCO Programme Task List. This is a resource loaded and prioritised list of the activities required to deliver the Facility Blueprint, i.e. the tasks necessary to underpin the end state documents and all the activities needed to transition between them. It will be used to plan and monitor delivery of these tasks. Delivery of the tasks will be undertaken by the facilities and their supporting functions, e.g. technical, operations support, engineering, and safety case.
- Facility Characterisation Plan. Many of the plant unknowns will require characterisation to define them. This will detail the activities needed to deliver robust information on the nature and contamination levels of buildings, systems, components and waste, thus informing end state decisions about decontamination, waste disposal, dose impacts, etc.
- Facility Functional Specification. This specifies the overall capability that is required to be delivered during POCO Operations. As such it is key to managing the POCO scope and its governance. It serves as a key form of communication for agreement between the facility management and its stakeholders.

- Facility Delivery Schedule. This details how the capabilities described in the Functional Specification will be delivered. POCO task delivery is owned, planned by, and achieved by the workforce and teams associated with each operations facility.

Figure 2: Key POCO Preparation Deliverables



The Sellafield site is a highly-integrated network of operational, service, and waste-handling plants and facilities. Very few operational units at Sellafield are stand-alone. As plants move from scheduled operations into POCO, the nature and quantity of wastes and effluents reaching downstream plants and facilities will change. Thus, when planning POCO at Sellafield, it is necessary to take an overall consideration of the capability and capacity of transfer systems and of waste management systems and plants. Therefore, the sequence of taking plants from operations into POCO - and of de-coupling of plants, facilities and transfer systems - is considered part of the POCO planning process with the goal of optimisation.

In considering "optimisation" of POCO, there are many factors which are relevant including: rate of risk & hazard reduction; waste management capabilities; resource availability; and asset condition. A further key factor is cost and funding, where funding available in any given year and overall lifecycle costs are of significant importance.

Organisation

Target organisation models are being developed with matching resource plans. These will inform both the facility plans and the Site Capability Plan. Ongoing support will be required by the facilities through and after POCO from most existing facilities and capabilities. This will include such skills as Engineering & Technical, Disciplined Operations & Maintenance, Integrated Works Management, EHS&Q, Training, Design, Projects Asset Management, etc. However, it is likely that POCO will result in a reduced facility workforce therefore the resource plan will focus on skill matching to other site activities and will identify training needs for any skill gaps that are identified. There will be opportunities around the site for a wide range of skill types in ongoing operations, high hazard retrievals, broadfront decommissioning, and commissioning and operations of new build plants on Site. Initial engagement with Human Resources and workforce representatives has taken place. A Stakeholder Engagement Plan is in place that outlines a phased and cascaded approach for delivering continuous engagement throughout the POCO planning and delivery periods.

Regulatory interface

As facilities are prepared for their transition into POCO there will be a number of regulatory interface points, including Nuclear Site Licence requirements, discharge permit requirements, safeguards and Euratom Treaty Article 37 requirements. These involve interfacing with a number of UK and European organisations, including the Office for Nuclear Regulation, the Environment Agency, DGEner and Euratom.

Routine regulatory engagement has already started and, where possible, strategies are already being developed and shared that seek to optimise the levels of input from all parties without any compromise to the safety or quality of what is achieved.

Conclusion

The Sellafield POCO Programme has been established to deliver a common and consistent approach to Post-Operation Clean Out at Sellafield as the site enters a sustained period of transition. The programme has set the strategy and high level tactics to help ensure successful transitions are consistently achieved across Operations Division. The programme also aims to enable coordination and optimisation of the sequence of POCO across the various facilities at Sellafield so as to ensure best use of the waste management capacities and capabilities, and best use of the knowledge and capability vested in the Sellafield workforce.

POCO task delivery is owned, planned, and achieved by the workforce and teams associated with each operations facility. Those teams have the experience, the knowledge and the capability.

Getting POCO "right" at Sellafield offers significant potential benefits:

- Reduced risk and hazard
- Reduced lifetime cost
- Enables redeployment of resources to other activities on site.
- Enhanced reputation

Failure to carry out POCO and failure to retain fit-for-purpose knowledge will result in increased future cost and consequence.