Applicability of AREVA Learning From Experience to Sellafield Post-Operation Clean Out and Decommissioning Programmes

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Agenda

- ***Context, AREVA and Sellafield POCO Programmes***

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  - ***Post Operations Clean-Out (POCO)***
  - ***Marcoule SPF POCO experience vs. Sellafield HALES POCO programme***
- ***Applicability of AREVA Learning From Experience to Sellafield Post-Operation Clean Out and Decommissioning Programmes***

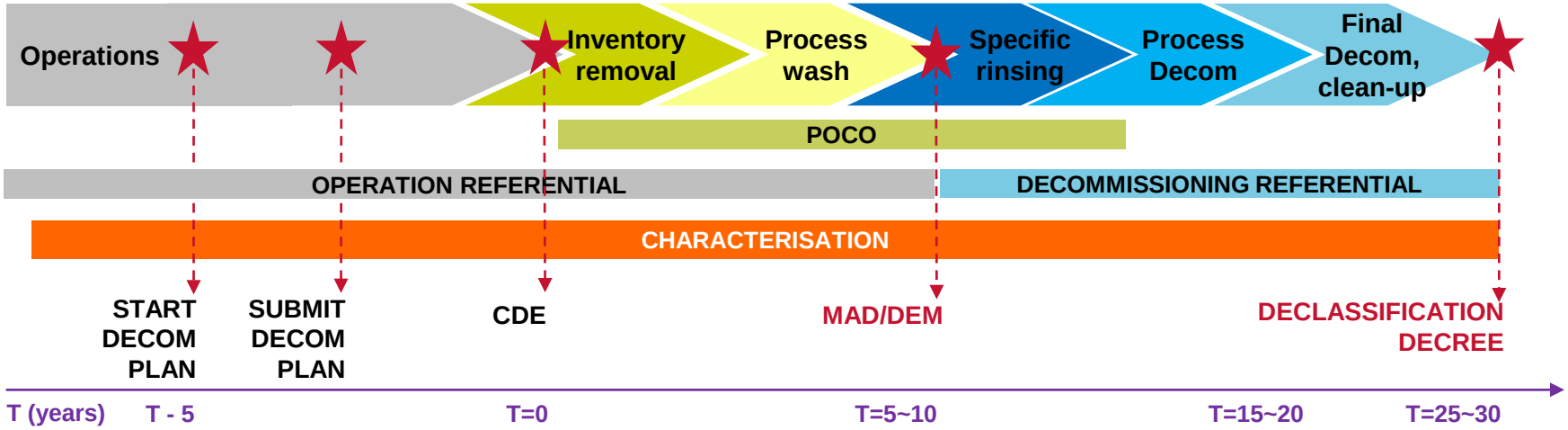
Context

- **Sellafield Ltd and AREVA operate, prepare for decommissioning and decommission very unique nuclear fuel commercial recycling facilities**
  - **For AREVA: the CEA's UP1 on the Marcoule site, and UP2-400, UP2-800 and UP3 on the La Hague site**
  - **For Sellafield Ltd: Magnox reprocessing and THORP**
- **All recycling plants differ in their design and operation history**
  - **Transferability of Learning From Experience (LFE), best practices and decommissioning tools and techniques, repeatability of tasks may appear at first less applicable to decommissioning recycling plants than a fleet of reactors**
- **Regulatory, economic and social drivers differ from France to the UK**

Post Operations Clean-Out (POCO)

- **In France, UP1 and UP2-400 have already been shut-down and are under decommissioning**
- **Sellafield Thorp and Magnox reprocessing are to shut-down in 2018 and 2020**

AREVA shared its experience with Sellafield to input POCO preparation



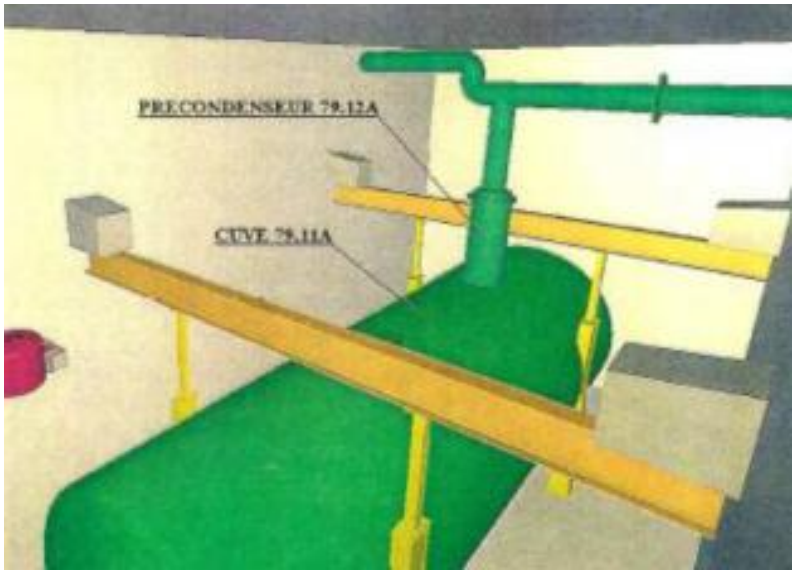
CDE = « Cessation Définitive d'Exploitation » = notification of end of operation (start of POCO, preparation of shutdown)

MAD/DEM = « Mise à l'Arrêt Définitif / DEMantèlement » = Decree of final shutdown (start of decommissioning)

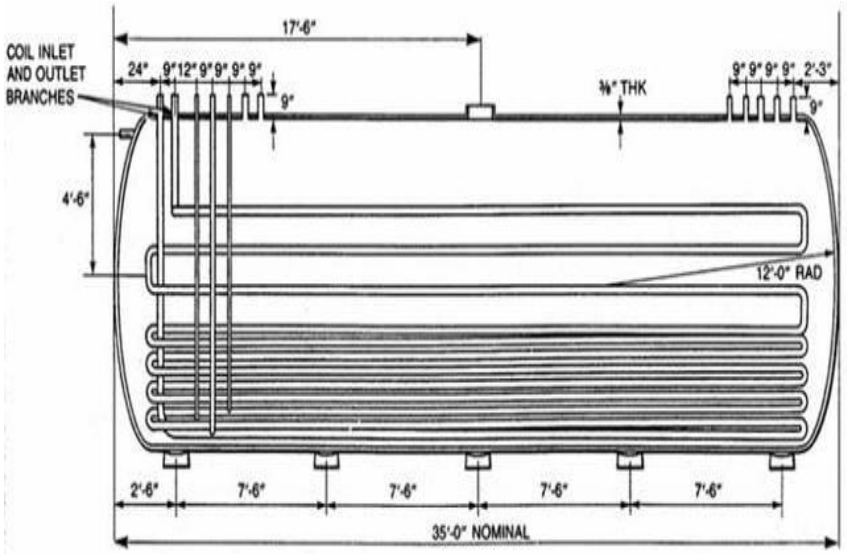
Marcoule SPF POCO experience vs. Sellafield HALES POCO programme

- **AREVA and Sellafield share comparable technical challenges:**
  - **Marcoule UP1 reprocessing plant is very similar to Magnox reprocessing**
  - **Marcoule SPF facility ('Fission Product Storage') is comparable to Sellafield HALES facility (High Activity Liquid Evaporation and Storage)**

Marcoule SPF2 tank



Sellafield HALES Oldside High Active liquor Storage Tank



Agenda

- ***Context, AREVA and Sellafield POCO Programmes***

- ***Applicability of AREVA Learning From Experience to Sellafield Post-Operation Clean Out and Decommissioning Programmes***
  - ***Extensive characterization***
  - ***POCO end-state definition***
  - ***Waste driven strategy***
  - ***Specific safety issues***
  - ***Competencies, resources and knowledge management***
  - ***Major change in culture***
  - ***Conclusion***

Extensive characterization (1/2)

- **The performance of a POCO programme is heavily dependent on the depth of knowledge of the initial condition of the plant, and subsequent evolution through rinsing operations**
- **Appropriate characterization plan is necessary and feasible**
- **Techniques are proven and transferable**

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- **Initial state**
  - **Define and update a robust configuration management baseline as a general backbone for POCO and D&D programmes**
  - **Conduct extensive inspections, not only on primary equipment (vessels, deposits), but on all potentially needed equipment with focus on tanks, pipes, transfer equipment, etc.**
  - **Inspect, test and adapt nuclear ventilation if needed**
- **Radiological characterization**
  - **The less characterisation there is, the more monitoring and the more constraints there will be**
  - **Radiological measurements can be performed in high radiation area (>200Gy/h) and in complex cells with a large amount of active equipment and pipes. If needed, new ports can be created.**
  - **It is very efficient to set up an integrated team for the characterisation programme delivery, both realization of measurements (and sampling) and interpretation of results,**

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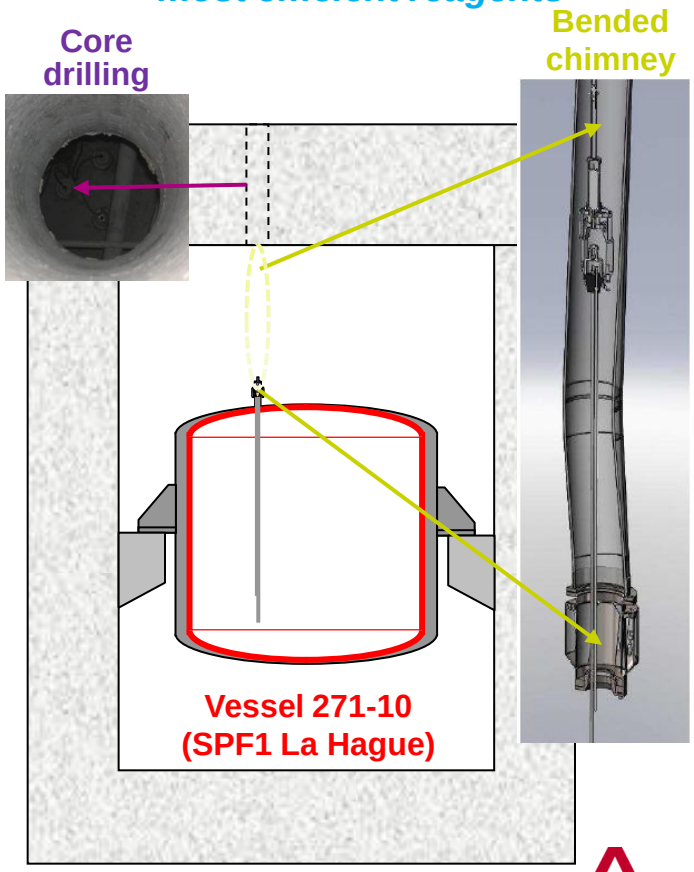
Extensive characterization (2/2)

- **Physical sampling**
  - **Physical sampling is needed to test the candidate reagents on "real" deposits, whose behaviours differ from simulants, to define the appropriate treatment sequence and underpin safety case preparation**
  - **Deposit sampling can be done in high radiation area (>200Gy/h)**

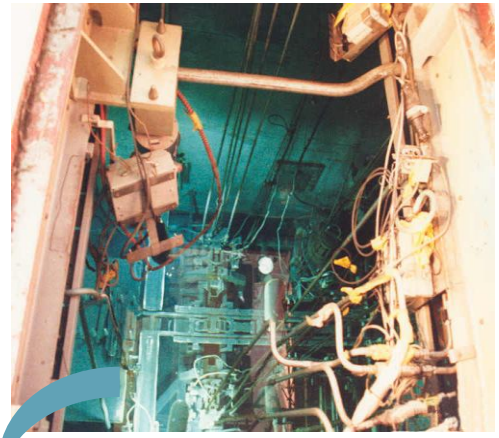
- **POCO follow-up**
  - **Monitoring the rinsing sequences is important to follow the efficiency of the different reagents, and answer to safety requirements (e.g. criticality)**

Sampling of deposits in a La Hague Fission Product tank to select the most efficient reagents



POCO end-state definition

- Various transition points (interim states) can be identified throughout the course of a decommissioning programme
- France and UK strategies differ
- AREVA rationale for immediate decommissioning encourages “enhanced POCO”:
  - To significantly decrease the radioactivity within process equipment maximizing the potential for contact or distance dismantling, and reduce the overall cost of waste
  - At a reasonable cost as it uses existing equipment and waste routes
- In the UK, the Nuclear Decommissioning Authority strategy calls for a delayed decommissioning
  - POCO is followed by a surveillance and maintenance period
  - POCO end-state is a major transition point



Marcoule MAR400 decladding ponds

Waste driven strategy

- **Waste represents about a third of the total cost of a decommissioning programme**
  - **To manage the lifetime cost of the decommissioning programme, the wastes and their costs should be part of the scenario definition**

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- **Specifically applied to POCO, the waste strategy aims at:**
  - **Retrieving isolated wastes with classical or special techniques to use waste routes while they are available**
    - The least expensive (per Bq) and most stable final conditioning mode is vitrification
  - **Treating contaminated material and equipment to use cheaper waste routes, by means of rinsing and decontamination operations**
    - Using existing equipment and effluents routes (few modifications needed compared to standard in situ decontamination), and
    - With minimal dosimetry to operators

Specific safety issues

- **Once the facility is operated outside of its reference case, the risks and associated safety cases are very different**
- **The approach to safety case is part of the scenario development**
  - **It is important to maximize how much POCO can be done under the commercial operations safety case**
    - E.g. initial rinsing with process reagents, removal of contaminated parts
  - **Specific reagents, particularly for targeted rinsing, can require changes to the safety case**
    - E.g. risk of release of radioactive materials
  - **Criticality risk is to be monitored and managed during POCO**
    - E.g. deposits with unexpected content can be solubilized or moved

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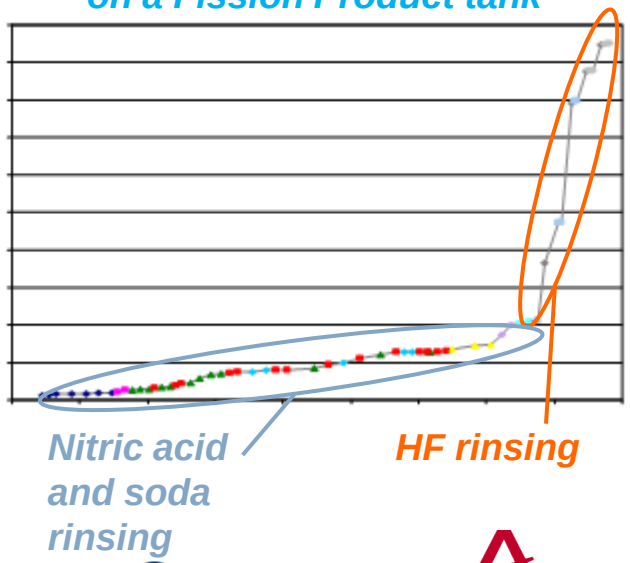
Pu extracted by rinsing operations on a Fission Product tank



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Competencies, resources and knowledge management

- **The facility configuration baseline needs to record plant operations, POCO operations, plant configuration, facility characterisation and operational experience throughout the decommissioning programme**
  - **It is even more necessary for Sellafield since the delayed decommissioning – and the necessary surveillance and maintenance period – will put an added pressure to knowledge management: the operators will not be decommissioning the facility**

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Major change in culture

- **The commercial operations environment is characterized by**
  - **Stable operational state, with minimum uncertainties,**
  - **Stable work force, and**
  - **Top-down management culture**
- **When shutting down the facility and switching to decommissioning, there's a strong need**
  - **To focus on new and continuously changing references (even the structures of the buildings are to be demolished), dealing with the unexpected (e.g.: history of operations, orphan wastes, etc.), requiring brand new skills, and**
  - **To ensure implementation of an explicit performance improvement and change management programme as early as possible within the programme**

AREVA LFE applicable to Sellafield

Conclusion: key takeaways

1. An extensive characterization plan (with physical and radiological surveys and active sampling) is feasible and essential to underpin the final POCO / decommissioning scenario
2. End-state definition has a strong impact on POCO and Decommissioning scenarios
3. A waste-driven strategy is essential for the overall programme cost and schedule management
4. Safety issues associated with POCO and decommissioning programmes are different from the commercial operations environment
5. Securing specific competencies, resources and knowledge management of the facility is a key to success
6. Transition from operations to decommissioning requires a major change in culture