

## **Dismantling of the 904 Cell at the HAO/Sud Facility - 13466**

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### **ABSTRACT**

La Hague facility, in France, is the spent fuel recycling plant wherein a part of the fuel coming from some of the French, German, Belgian, Swiss, Dutch and Japanese nuclear reactors is reprocessed before being recycled in order to separate certain radioactive elements.

The facility has been successively handled by the CEA (1962-1978), Cogema (1978-2006), and AREVA NC (since 2006).

La Hague facility is composed of 3 production units:

The UP2-400 production unit started to be operated in 1966 for the reprocessing of UNGG metal fuel. In 1976, following the dropout of the graphite-gas technology by EDF, an HAO workshop to reprocess the fuel from the light water reactors is affiliated and then stopped in 2003.

- UP2-400 is partially stopped in 2002 and then definitely the 1st of January 2004 and is being dismantled
- UP2-800, with the same capacity than UP3, started to be operated in 1994 and is still in operation.

And UP3

- UP3 was implemented in 1990 with an annual reprocessing capacity of 800 tons of fuel and is still in operation

The combined licensed capacity of UP2-800 and UP3 is 1,700 tons of used fuel.

### **INTRODUCTION**

The dismantling process is a quite long and complicated step which can take several years to be carried out. Most of the time, this process involves the implementation of many technologies dedicated to decontamination or also cutting operations.

Those complex operations require at the same time different types of expertise, the use of several technologies and to take into consideration the context and particularly:

- The accessibility to cells,
- The dimensions and the thickness of the equipments and pipes,
- The type and the level of contamination and irradiation,
- The policy regarding waste production and management,
- The operational dosimetry of workers,
- The risk management and the safety requirements,
- The cost.

This paper summarize the demonstration made by AREVA in order to conduct this 9 year long dismantling project successfully (2011-2020) from the preliminary studies to the completion of the operations.

## **CONTEXT**

The 904 cell and its support cells are located in the HAO/Sud facility of the AREVA La Hague establishment. This facility belongs to the UP2-400 facility. This cell use to managed the slitting and the dissolution of fuel elements coming from the HAO/Nord facility (facility for the inpool warehousing of fuel elements before reprocessing) and the clarification of the dissolution solution prior to the transfer to the HA/DE facility (facility for the extraction of fission products)

The specificity of this cell comes from its high radiological activity and its configuration. The presence of fuel elements during the operations in this cell has made it a high radiological activity cell and doesn't allow the human intervention on the equipments to be dismantled. The 904 cell is 21 meters high, 10 meters wide and 3.5 meters deep. The 904 cell is composed of two principal levels:

- A “Mechanical” level that was used for the implementation of fuel elements extracted from the warehousing pool and for the slitting. This level can be seen from outside thanks to portholes.
- A “Chemical” level that was used for the chemical dissolution of sheared fuel elements. This level can't be seen from outside the cell and involves that the dismantling workers work “blind”.

Almost 50 tons of equipments (vessels, tanks, etc.) and 25 kilometers of pipes are stored in the cell and most of it in the “Chemical” level. Equipments can be 4 meters long and weigh 5 tons.



In this environment, draft design studies have been led following several tools and technologies:

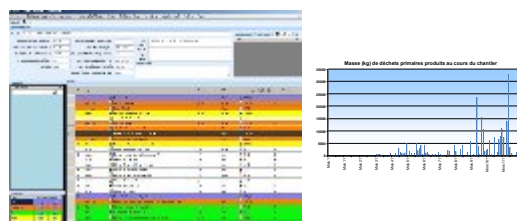
- The use of planning tools and the project sequencing in order to optimize and to chose the dismantling scenarios : OCAPI
- The implementation of standardized value analysis methodologies and Design to Cost.
- Studies on effective means to ensure the remote dismantling: implementation of a remote dismantling installation specially designed for the 904 cell.

## OVERVIEW OF THE DRAFT DESIGN STUDIES

In this context, AREVA developed 4 dismantling scenarios. A tool which combines the calculating capacity of a spreadsheet and the power of a planner. The designed automations enable simultaneous management of all the parameters related to the intervention such as length, number of interveners, dosimetry management, costs, waste management, planning, human resources and material flows management.

OCAPI (an AREVA tool) was the tool that enabled the comparison between all the scenarios in order to shortlist the best compromise regarding all the project parameters.

For information, OCAPI is employed on all projects using value analysis adapted whatever its customers (CEA, EDF, ...).



OCAPI has contributed to optimize the scenario thanks to its ability to deal with and to interact between the selection parameters such as:

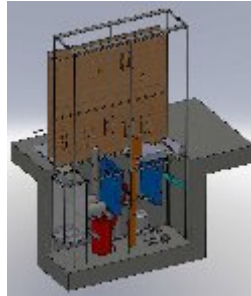
- The planning,
- The cost,
- The wastes,
- The on site co-activity

Once the scenario is accepted, the draft design studies were oriented on the technical and economical optimization. The cost-efficiency of such a project lies in the ability to carry out analysis of the dismantling technical solutions thanks to value engineering and Design To Cost methods. The principle is to announce the need as a function, to quantify and to describe it according to value criteria specifically set up for the project (cost, waste, delay, dosimetry, safety/security and risks). To illustrate, consider two examples:

- Of robotics designed in the context of the UP3 workshop operation in the 904 cell dismantling shipyard. The suggestion was to gather the know-how and the AREVA's expertise on the RX130 robot (brand Staubli) in the context of the 904 cell dismantling project.

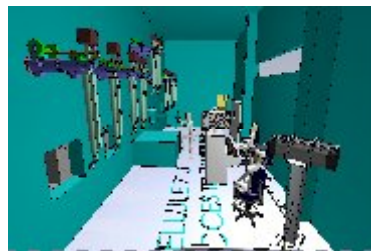


- Of test building and modelling allowing the reliability of the dismantling scenario. The suggestion was to benefit for free from the HEF facility enabling the 1:1 scale modelling of the 904 cell in order to test the dismantling installation before the implementation in the radiological zone. A similar approach of tripartite protocol has been implemented enabling all the parties to benefit from it.



Such analysis have made possible to reduce the project cost by using AREVA's internal resources in order to make the dismantling scenario more reliable.

The chosen scenario is based on a remote intervention by the conception of a dismantling installation dedicated to the 904 cell thanks to telerobotic tools (which can tolerate the high level of contamination and irradiation) remotely controlled from a control room.



This installation is composed of:

- 3 new handling cranes installed on the existing rail track and two slewing cranes in order to maintain and handle the dismantled equipments and to hang two robots (RX130 and CONDOR II) that will disunite those elements thanks to portable electrical tools.
- A volume reduction workstation over-centred on the 904 cell's depth, located at the "Mechanical" level in order to enable a direct sight of the operation through the portholes of the cell. The aim of this volume reduction workstation is to reduce the equipments (vessels, tanks,...) thanks to an high capacity alternative saw and to clean it up via mechanical and chemical clean-up technologies (vacuum cleaning for mechanical clean-up, and dry ice for cryogenic clean-up), in order to be compliant with waste escape routes regarding the contamination and irradiation level.
- A control room to control the 3 overhead cranes, 2 robots and the volume reduction workstation saw. This driving position is located at the same level than the portholes.

These draft design studies are the working basis for the future studies.

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