MARCOULE UP1 REPROCESSING PLANT FIRST STEPS TOWARDS DECOMMISSIONING

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ABSTRACT

The UP1 reprocessing plant in Marcoule started in 1958. After reprocessing, 18,200 tons of fuel, the plant has been shut down at the end of 1997 and entered in the decommissioning phase.

This operation will be completed in three phases :

1. advanced rinsing and removal of as much nuclear material as possible (MAD)
2. historical waste retrieval and conditionning (RCD)
3. decommissioning and dismantling (DEM).

The total operation is supposed to take more than 30 years.

So far, the first phase is being implemented according to the schedule :

- in the head end (mechanical part, i.e fuel reception and decladding), the rinsing are almost over, the sludges have been removed and the mechanical equipments are being dismantled
- in the chemical part, the rinsing performed by a succession of acid and basic solutions have reached targets earlier than expected
- the vitrification cell has been revamped and cleaned and is now ready to restart to treat the rinsing solutions.

In parallel, the operation of the second phase (waste retrieval and conditionning) are being started. A detailed planification of this operation has been made to avoid bottlenecks.

After a strategically survey, it was decided to retrieve (from pits) at first 6000 historical bitumen drums produced between 1968 and 1972 the storage conditions of which are estimated to be less satisfactory than present standards. This bitumen productions resulted from the effluent treatment of the plant.

A mobile retrieval installation is being built and will be ready to operate at the end of 1999. This installation will recondition the drums (most of them showing signs of corrosion) and control them before sending them to the interim storage. The first operation is a pilot operation on 450 drums.

A new modular interim storage has already been built to receive these drums and all the waste to be retrieved that cannot be evacuated to surface disposal.

This paper describes the results obtained for the rinsing operations, the retrieval operation and gives perspective for the future.

INTRODUCTION

In 1952, the French Atomic Energy Commission (CEA) selected Marcoule as the development center for nuclear activities associated with national defense requirements. Marcoule, located in Southern France, has evolved considerably since its inception, and a wide variety of players has been involved through the years.

The UP1 reprocessing plant commenced operation in 1958, recovering re-usable nuclear materials from irradiated fuels (uranium and plutonium). In 1962, the CEA commissionned an active pilot facility for reprocessing irradiated fuel, which ultimately led to the application of reprocessing in the UP1 plant at Marcoule, followed by the UP2 plant at La Hague.

Civilian operations of the UP1 plant began in 1965 with the reprocessing of nuclear fuel from French and foreign (Vandellos) GCR reactors. COGEMA was created in 1976 and then assumed control of UP1 operations in 1976. At the time, the Marcoule facility included both COGEMA and CEA facilities. The first French vitrification facility (AVM) was added to the UP1 plant in 1978, applying a process developed in the Piver pilot plant in the late 1960s.

The UP1 plant's reprocessing capacity was boosted in 1983 by the commissioning of a facility for decladding GCR fuels (MAR 400). The plant's liquid effluents treatment station (STEL) was revamped from 1986 to 1990, and the solid waste conditioning facility (CDS) followed suit in 1989.

COGEMA terminated operations at UP1 in late 1997 and went into final shutdown in 1998 after 40 years of continuous and successful operation and 18,200 tons of reprocessed nuclear fuel. During those 40 years, UP1 was operated for the CEA, Electricite de France (EDF), and various utilities.

COGEMA, the CEA, and EDF ultimately set up an Economic Interest Group, named CODEM, to manage all the operations following the shutdown of the plant. This group decides, finances, and supervises the three phases of the operation:

- advanced rinsing and removal of nuclear material (MAD)
- historical waste retrieval and conditioning (RCD)
- dismantling and decommissioning (DEM)

In addition, COGEMA was selected as the industrial operator and as such, is responsible for all operations in terms of safety.

ADVANCED RINSING AND REMOVAL OF NUCLEAR MATERIAL

MAD activities, the primary objective of which is to thoroughly rinse and remove as much nuclear material as possible, began after the UP1 plant ceased reprocessing irradiated fuel in December of 1997.

The process employed for this effort is as follows :

- The material is rinsed, similar to the rinsings performed during operation..
- The material is then rinsed with acid, caustic soda, and water.
- Additional rinsing with more aggressive reagents is performed in localized areas.

All MAD activities in all production workshops should be completed in 2001. It is expected that by the end of this effort, the radiological status of the plant will be low enough to reduce the constraints imposed by surveillance and the level of waste radioactivity present, and accommodate the dismantling effort. RCD activities are currently starting in the UP1 plant, and the level of radioactivity present is already lower than anticipated.

HISTORICAL WASTE RETRIEVAL AND CONDITIONING

The Marcoule site pioneered the vitrification of high-level waste (HLW). The industrial facility has produced nearly 3,000 containers (400 kg) of vitrified fission products since its startup in 1978.

However, most of the other process wastes, as well as the technological wastes from operations, have been stored on-site in silos or pits withoutconditioning. At the time of their disposition, the plant lacked well defined options for final disposal.

The following are representative of the type of non-conditioned waste stored in the silos that require conditioning or reconditioning if there are signs of corrosion:

- metallic mechanical parts resulting from operations
- metallic magnesium from cladding
- fragments and fine particles from the graphite moderator
- bitumen drums (from liquid effluents treatment)
- sludges, resins, and fine particles
- alpha waste drums.

After this operation has been completed, non-surface waste will be sent to interim storage on-site in the form of glass containers or in 400-liter drums and all surface wastes, excepting very low-level wastes, will be conditioned and shipped to the Centre de l'Aube for surface disposal in three possible forms :

- 200-liter stainless steel drums for those wastes with low alpha activity (less than 185 MBq per ton)
- 4-m^3 metallic boxes for larger waste materials with low alpha activity
- 5-m^3 cubic fiber concrete container (CBFK) for intermediate alpha activity waste (below 3.7 GBq per ton)

The vitrification facility has been revamped and will be maintained as long as necessary to vitrify the HLW resulting from rinsing.

Medium level waste (long lived) will be stored on-site awaiting a government decision, expected in 2006, regarding its future disposal. In the meantime, 400-liter stainless steel drums have been chosen as the most suitable package for conditioning, based on the following criteria :

- it is a common and standard package
- it is easy to handle and transport (size and weight)
- it is resistant to corrosion in a controlled environment, with a good mechanical resistance.
- it does not impose any unnecessary volume, as thick concrete containers may do.

Low-level plastic wastes (below 20,000 Bq/g beta) will be incinerated in the CENTRACO facility adjacent to the Marcoule plant, as well as the low-level steel wastes due to be melted in the same facility as ingots for disposal or drums to be recycled as ingots.

Very low-level waste is to be stored on-site in 10-ft-long ISO containers awaiting an available disposition site or recycling paths that will be established for them.

The retrieval operation will last approximately 20 years, from 2000 to 2020, and the total package production is significant (it includes the production of waste from MAD) :

- 50,000 surface drums (200-liter drums)
- 18,000 containers (4-m^3 or 5-m^3 containers)
- 47,000 non-surface drums (400-liter drums)

Retrieval requires a great deal of planning for the following reasons :

- available personnel are limited for construction, operation, and documentation.. Documentation will be particularly important as each retrieval and conditioning operation requires its own conceptual study, preliminary and detailed design, safety analysis report, and license application. existing conditioning facilities have a given capacity, and waste streams will need to be gradually adjusted to accommodate it
- capacity of conditioning facilities yet to be built must be kept reasonably low to minimize investment
- transportation capacities are limited and construction of buffer interim storage for surface waste should be avoided for cost reasons
- laboratory resources are limited and characterizations must be performed on a staggered schedule.

DEFINITION OF PRIORITIES

Although the interim waste storage sites have not leaked any radioactivity to the environment, several of them do not meet current accepted safety standards. A multi-risk analysis has been performed to prioritize waste retrieval activities. For this analysis, an assessment of each silo and pit was performed, which yielded the following as potential internal and external causes of environmental contamination :

- fire hazard
- thermal release
- waste handling risk
- flooding
- adverse weather conditions
- seismic events

Evaluation of the consequences on a scale ranging from zero to four has been conducted. The product of « total probable causes » and « amount of consequences » results in a number. The higher numbers are selected as the first priorities for retrieval. This approach can be applied to any safety analysis of the same type.

PRESENT ACTIONS

Interim storage :

Waste due to be stored in surface disposal is shipped to the disposal sites as it is produced. High-level and medium-level wastes are to be stored on-site awaiting future disposition. An increase in the amount of interim storage for vitrified waste is currently being evaluated.

An individual interim storage (polyvalent interim storage) facility for the standardized 400-liter-drum waste packages of medium-level waste has been built and started receiving waste in late 1999. This facility, which includes a building for the reception and unloading of waste packages and two cells for storage, is modular and will require 14 additional cells to accommodate the total volume of waste to be stored. The lifetime of this facility is expected to be at least 50 years. The 400-liter drums are transported on-site in shell-type casks that can be opened, allowing for the waste package to be removed and transported to a shuttle. Transfer and unloading are automated functions.

Bitumen drums :

Based on the multi-risk analysis that was performed, the northwestern zone of pits where 6,000 bitumen drums, produced between 1966 and 1978, are stored has been selected as the first site to be retrieved. A mobile facility on rails was designed and built for a pilot operation to be conducted in late 1999. The use of such a mobile facility allows for :

- radiological protection and the containment to be maintained after removing the pit cover
- ventilation and air filtration
- retrieval, identification, and control of the waste (surface contamination and dose rate)
- removal of condensed water from drums, if necessary
- reconditioning of the drums (several are corroded) into 400-liter standard drums ready for storage at the interim storage facility
- installation of the drum in the tranport cask.

Waste Characterization :

Once the wastes have been placed in storage, adequate characterization is performed to meet the current needs, which are as follows :

- selection of disposal routes or interim storage based on specifications
- performance of thorough safety analyses for the various operations
- provision to the disposal agency (ANDRA) of requested information concerning the safety analyses and radiological balances of the diposal sites

Most of the wastes were inadequately characterized and priorities must be established for their conditioning and disposal.

The first action is to characterize solid, fine particles, including sludges, resins, and graphite moderator pieces. This characterization program relies heavily on gamma and alpha spectrometry and plasma analysis to ensure that representative samples are taken from media that are not necessarily homogeneous. If homogeneity is not proven, further sampling is performed until a reliable result is obtained. Aliquots, such as major beta, plutonium, DCO, anions, carbon, sulfur, and long-lived beta nuclides, iodine and technetium, are used for destructive examination in a laboratory setting. Other long-lived beta nuclides, Pd^{107}, Ag^{108}, Cl^{36}, known as 'difficult to analyse', are used for analysis. On other types of waste, and more specifically on bitumen drums, significant research is performed to gather and analyze all relevant historical documents providing details that corroborate the parameters of the drums and when the drums were produced.

CONCLUSIONS

Prior to decommissioning the UP1 plant at Marcoule, measures must be taken to integrate human and technical resources, identify the waste types present in the facility and the appropriate disposal or storage method, and increase the current amount of interim storage available. Rinsing of the waste materials is currently being performed and is expected to be completed by 2002. Results have been better than expected. The retrieval operation of bitumen drums has also been launched as well as characterization of historical wastes.

Despite the large size of the project, the future decommissioning of the UP1 plant is not unknown territory for COGEMA. Its 40 years of experience in plant operation and maintenance make COGEMA the ideal choice for decommissioning and ultimate shutdown of the facility.

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