AT-1 Pilot Dismantling Project

Dismantling operations and main results

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1. Introduction

The dose rate in the shielded cells ranges from a few 10^{-2} Gy to 1 Gy and forbids any direct access work in cells 903, 904 or limits the working time in cells 902, 905, 908 and 909; it can impose shielded protection to work.

Cells 903, 904 and 905 are completely blind (without windows or manipulators) and it was necessary to design a special equipment to perform remotely the dismantling of these cells.

In the second part of the process, after fission products segregation, the cells and the glove boxes devoted to the uranium and plutonium treatment are only contaminated by alpha emitters. They are composed of usual glove boxes and large concrete cells with a front plastic panel. The ports located on this panel do not give access to all the equipment and the dismantling of such cells necessitates to cut out the front panel for direct access.

The main dismantling steps are as follows:

1. dismantling of unshielded alpha cells and glove boxes of the fourth cycle of the process (separation, concentration and recovery);
2. dismantling of accessible hot cells (necessary for the installation of the ATENA machine): cell 911, filtration cell;
3. dismantling with the ATENA machine of the three main shielded blind cells;
4. dismantling of various storage cells (liquid waste stored in cell 907, fission products in cells 908, 909 and in the extension building);
5. general cleansing of the building.

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2. Dismantling of high activity cells with the ATENA machine

The following operations have been supported by the CEC in the frame of its 1989-1993 "Research Programme on the decommissioning of nuclear installations":

B1: Remote operated dismantling of equipments from the highly contaminated cell 903 (used for dissolution) and from cells 904 and 905 (used for extractions);

B2: Measurement of the radioactivity and packaging of the waste arising from B1;

B3: Dismantling of tanks for the storage fission products;

B4: Generation of specific data;

B5: Remote dismantling of a reinforced concrete wall between cells 903 and 904;

B6: Semi-automatic decontamination and contamination measurements of concrete walls and floors.

2.1. Description of the ATENA dismantling machine

The ATENA machine was designed for remote dismantling of the AT-l high level cells based on the PLKDE machine used to dismantle ELAN II B. It includes a carrier and an electrically actuated telemanipulator.

The carrier includes a containment housing, a transfer carriage and a support arm with provisions for vertical motion and an articulated portion supporting the telemanipulation.

The carrier arm and its telemanipulator can be introduced in cell 904 and in cell 905 through the openings of the new biological shielding which is designed to support the ATENA machine and covering cells 904 and 905. Leak tightness is ensured by an obturator device set up at the selected work station.

2.2. Preparation of the dismantling of hot cells with the ATENA machine

Before the dismantling operation of high activity cells and the setting up of the ATENA machine, it was necessary to:

Dismantle some shielded cells as filtration and cell 911;

Dismantle a glove box or cell 906, to have place for building a workshop which was designed for conditioning operations of solid waste;

Replace biological shielding that covered cells 904 and 905 by other, especially designed to support ATENA machine and including openings for access to high activity cells 904 and 905;

Build a maintenance cell for the ATENA machine and its MA 23 manipulator;

Install a twin beam carriage beneath the new biological shielding, for removing operations of solid waste materials.

2.3. Dismantling of hot cells 905, 904 and 903

From January 1990 till to February 1993, the ATENA machine (with a manipulator MA 23) was used for the next dismantling operations:

Dismantling of cell 905 (January, February 1990).

The first cutting phase in cell 905 was carried out with hydraulic shears. The weight of this equipment (18 kg) was too important compared with the possibility of the MA 23 M. A circular saw of only 7 kg was used afterwards. Its better manoeuvrability especially through the cells openings difficult to access and to cut irregular pieces settled its choice.

Dismantling of cell 904 (March - August 1990).

This operation was carried out with a circular saw.

Tele-operated cutting of a concrete wall after testing operation (September 1990 - March 1991).

In order to allow the introduction of the poly-articulated arm of ATENA in cell 903, it was necessary to make an opening in the wall between cell 903 and cell 904: the opening dimensions were 1.2 m by 4.5 m.

Near this partition wall the radiation level was so high that there was no direct intervention possible especially when the protection disappeared with the demolition of the wall. The technique used by the selected equipment was to cut the concrete with a diamond disc saw. The driving of the disc, by lateral rollers, resulted in a minimal diameter (35 cm for a 20 cm thick cut).

The minimal dimensions and weight of the tool enabled its direct mounting on the ATENA machine without MA 23. The cooling of the disc through nitrogen liquid avoided the generation of liquid waste. The realisation phase saw the cutting of two vertical furrows of 5 m each and was continued with the cutting of horizontal furrows, producing blocks removable by the twin beam carriage installed in cells 904 and 905.

Hatches were installed with the MA 23 as well as the slings necessary for removing the concrete pieces. Dismantling of cell 903 (March - May 1991). This operation was carried out in the same conditions as in cell 904.

2.4. Dismantling of the workshop cell and maintenance cell

A special treatment cell for conditioning the waste arising from high activity cells was built at the northern side of cell 905 (at the initial place of the cell 906), it was called *workshop cell*.

It was made of concrete wall and stainless steel modular panels coming from the AT-1 worksite. The location of this workshop cell allowed communication with cell 905 through removable slabs.

Two articulated beams allowed to reach out all parts of the workshop cell. In the cell, the tele-operation tools included two M 8 manipulators and the RD 500 manipulator.

In breakdown situation, a MA 23 M manipulator could take the place of the RD 500. Tooling in the workshop cell included hydraulic shears kept in position on a work plan, and a circular saw hanging above the work plan.

In cell 904 or 905, waste was put in a bin, then removed with the twin beam carriage to cell 905. The bin is then lifted by the 15 KN hoist of the workshop cell and tipped in the remote manipulators area.

A selection is carried out according to the irradiation level of each waste.

Waste was cut again if necessary and put in a vinyl bag in an iron drum (120 litres).

When the drum was full, it was removed through the waste exit and transported to the measuring station. Then the drum was introduced in a special iron container for definitive storage by ANDRA (Agence Nationale pour la gestion des Déchets RadioActifs).

2.5. Conditioning the waste arising from high activity cell

After the conditioning waste operation was achieved, the workshop cell was decontaminated and the iron panels dismantled for a possible reuse during other decommissioning operations.

Note: the maintenance cell will soon be dismantled (order in progress).

2.6. Cleaning of the walls of high activity cells (cells 903, 904, 905)

After dismantling operations, the walls of high activity cells 903, 904 and 905 are contaminated. So it was necessary to cleanse the wall surfaces.

The target values for this decontamination operation were 0,7 Bq/cm^2 and 3,4 Bq/cm^2 re-objectivise.

Experience gained in decontaminating the extension building and tests in cell 905 has led the UDIN to favours shot blasting for the cleansing of high activity cells and probably for the cleansing of the whole building.

Concrete is removed with a depth of 4 mm and shot is recycled in order to limit the amount of solid waste. Before cleansing operations the irradiation dose rate in cells (after dismantling operations) are as follows:

- cell 905: 0.05 mGy/h;
- cell 904: 0.2 - 2 mGy/h;
- cell 903: 10 - 20 mGy/h.

These last conditions don't allow direct access work in the cells. To realise cleansing of walls in semi-remote conditions, a light carrier has been studied and ordered; it can support either the shot blasting head, or the "mosaic" detector which has been studied by UDIN/EAP. After a testing period with the shot blasting machine in the "Extension Building" at ATI, the cleansing of cell 905 has started (April 1994). Another carrier (or heavy carrier) which can break concrete has been ordered; it will be used when contamination reaches an important depth (contamination by liquid).

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3. Dismantling operations by direct access work

3.1. Dismantling of cells 901, 902

In these cells, fuel pins were received and cut.

Dismantling operations of mechanical equipment of the cell have been achieved by direct access work in spite of high irradiation level.

Note: the main results don't take into account the dismantling of stainless steel covering of walls and floor; this work is in progress.

3.2. Dismantling of fission products storage cells (Programme B3 of CEC contract)

- Cell 920 (extension building storage)

  The tanks of cell 920 had been installed to increase the initial storage capacity of fission product solutions.

  In 1986, the cell pipes were dismantled and the connections plugged by welding. Inside remained two 30 m^3 tanks with their internal process and cooling pipes.

  Although this cell has never been set into operation, it was by incident contaminated during AT-1 operation.

  Dismantling of the tanks and the recovery pan were realised with plasma torch cutting. Then decontamination with electro-polishing was carried out.

  In total 80 % of the metal sheets could have been decommissioned.

- Cells 908 – 909

  The purpose of these cells was to store fission products solutions coming from the first extraction cycle (located in cell 904).

  In both cells, there was a 15 m^3 tank with a horizontal axis (diameter 2 100 and length 1 800 mm) and its associated pipes.

  During shutdown operations, the fission products solutions were removed from the tanks to the UP2 facility. The tanks were strongly rinsed and then emptied.

  Irradiation measurements carried out showed ambient dose rates of 0.25 mGy/h with hot points up to 100 mGy/h.

  Dismantling operations were carried out by linear shaped explosive charges and completed with a traditional cutting.

  Each tank was cut in six steps totalizing 7 shootings with 1 500 g of explosive.

3.3. Other main dismantling operations by direct access of workers

Some dismantling operations present a very low irradiation level but an important contamination level, enabling direct access work.

To avoid a dispersion of contamination in environment and to protect workers, modular workshops have been developed. They were built with stainless steel panels of standard dimensions.

The panels smooth surfaces are easy to clean and decontaminate, so that they can be reused.

Modular workshops have been used for the dismantling operations as follows:

- Cell 906 (x cells and gloves boxes).
- Cell 952 for extraction of U and Pu.
- Cell 911 which contained transfer pipes and demisters.
- Cell 907_{bis} for reprocessing of spent solvent.