COGEMA EXPERIENCE ON RETRIEVING AND AUTOMATICALLY REMOTE CUTTING LARGE METALLIC STRUCTURES USING SPECIAL SAW DURING NUCLEAR DECOMMISSIONING OPERATIONS.

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ABSTRACT

Used spent fuel baskets have been stored in the La Hague North-West concrete-lined pits until decommissioning.
In 1998, COGEMA decided to retrieve, cut and condition these spent fuel baskets.
This paper describes the experience gained, since the start up of this operation in 1999, discusses resulting dosimetry and waste produced, during retrieving and remotely cutting of LL activity large metallic structures.
This process result in significantly lower exposures to workers in the D and D operations.
In addition the work was carried out in an environmentally safe manner with reasonable financial costs.

INTRODUCTION

The current correct procedure, for nuclear installations, is to ensure on-line packaging of the waste.
In 1988, 140 spent fuel baskets of low level radioactive material could not be packaged on line due to the lack of available technology at this period and the time required to carry out the investments. It was therefore decided to hold back their dismantling and to store them in a safe way in concrete-lined pits situated to the North-West of the La Hague reprocessing plant. As early as 1998, the predominant worry was to minimise, as rationally as possible, equivalent doses absorbed by the staff what would be allocated the task of dismantling spent fuel baskets, so COGEMA designed and manufactured a prototype saw able to automatically cut such contaminated and spent fuel baskets or voluminous metallic structures without dispersing radioactive particles into the environment. This account relates the experience acquired from the end of 1999 to the present day at the La Hague reprocessing plant in the conduct of such operations. One of the objectives of this kind of work is dismantling contaminated spent fuel baskets using one of this prototype robot saw, in complete protection for the environment, and as a substitute for intervention agents, within the given time-scale and at radiological and financially acceptable costs.

WORK PERFORMED

The different spent fuel baskets (approximately 5 m^3 each) are stored vertically in several concrete-lined pits in the north-west area of the site (Figure 1). The overall volume of the spent fuel baskets to dismantle represents about 700 m^3 of metallic structures in stainless steel.

Individual weight varies according to the type of basket from between 900 kg and 1100 kg. Each basket is covered with several layers of PVC envelopes ensuring tightness. 200 packages requiring dismantling constituted essentially of old filter units without carbon steel filtration media have been deposited in the same conditions in one of the pits (Figure 5). The total volume of the packages represents 1000 m^3. From a mobile intervention workshop situated on the pits and designed and fitted out to avoid any dispersion of radioactive particles into the environment, the different phases of the work were as follows:

0. collection/extraction of the basket or filter unit cases from the bunker
1. tipping the basket into a horizontal position in the workshop
2. automatic sawing of the different segments of the basket
3. reduction of volume by compacting the former segments from the basket
4. packaging the compacted elements
5. loading into metal containers of the various packages before shipment and treatment by the subsidiary for fusion (Figure 4).

At the same time, the watertight protective PVC envelopes are cut up and placed in 120 liters metal drums. Work collecting the baskets is carried out gradually from place to place by moving the mobile intervention workshop in 3-meter steps. Dismantling operations for the various metallic packages began in November 1999 and will be finished by the end of 2001.

PROCESSES IMPLEMENTED

In the previous chapter, we have seen the method used to carry out the work. The working procedure and methods used can be resumed as follows (Figures 2-3):

0 – the intervention workshop is positioned above the pit containing the spent fuel baskets to be collected

1 – once the lifting head or the tipper is in place, and using a 6-T rolling crane, the basket is lifted into the mobile workshop

2 – using the lifting beam and the mobile crane, the basket is placed in a horizontal position and then onto the conveyor belt leading to the band-saw

3 – removal/packing of the PVC envelopes is carried out

4 – using a control panel from the interior of a soundproof cabin, the operator advances the basket and controls automatic sawing operations into segments according to the pre-determined cutting diagram

5 – the different segments of the basket are transferred to the press and compacted

6 – compacted products are transferred to the packaging unit and, once identified, weighed, and the dose output measured, are placed in metal containers (2.8 m^3) before shipping and fusion treatment.

Treatment rate is about one basket dismantled per day. The band-saw, specially developed to cut spent fuel baskets or filter units, is able to automatically cut complex metallic structures of 1.1 m x 1.1 m in section and lengths exceeding 5 meters (Figure 3). The time required to cut a basket segment 1 x 1 m in stainless steel varies between 8 and 10 minutes.
Figure 6 shows a band-saw in action cutting a segment of a spent fuel basket.

WASTE PRODUCTION

The waste resulting from this work, is mainly contaminated by beta-gamma emitters.
A dose rate measurement is taken on the radiating waste. The presence of beta-gamma emitters in the waste is not strictly speaking a constraint as regards acceptance criteria for LLW surface disposal in France. A check simply has to be made to make sure that the packages do not have a doses rate above 2 mSv on contact. The beta-gamma emitter activity is calculated using a transfer function.
The check on the alpha emitter contamination is based on the alpha/beta-gamma activity ratio determined on the basis of the analysis of representative samples. Procedures established for dismantling operations meet one of the objectives aimed at the La Hague reprocessing plant as regards reduction in the volume of waste.
Automatic cutting of the baskets to be dismantled, associated with compacted packaging have led to an average reduction of volume by 2.7. The types of packages generated are as follows: 120-liters metal drums for the basket's PVC envelops and the installation's maintenance and intervention operator's overalls – cubic, metallic containers (2.8 m^3) for the metallic baskets or filter units intended for treatment by the fusion subsidiary.
Production of waste generated by dismantling 93 spent fuel baskets is given as an example in Figure 7. One may note that the same operations carried out manually by operators generated 1.7 times more waste.

RADIOLOGICAL EXPOSURE

The doses integrated by the people working directly are given on the La Hague site in man.milliSievert for all the operations carried out at the North-West area of the La Hague center.
The COGEMA Radiation Protection Department (SPR) deal daily with the doses integrated by the workers, thus limiting the dose integrated by the workers to the maximun value defined as an objective on La Hague site (10 mSv over a 12 months period).
The dosimeter report is 17.6 man.mSv. ; this corresponds to dismantling operations on 93 baskets by 8 permanent, intervention agents. Figure 8 gives us an indication of the doses integrated for the same work carried out manually by intervention agents.

FEEDBACK

Despite the satisfactory development of these works, many tricky situations have been encountered. They are mainly:
- the difficulty of grasping the first basket in the pit – managing radioactive packages,
- adjustment difficulties at the beginning of the procedures and techniques brought to bear.

The scheduling of the operations and the care applied to their preparation allowed us to adapt rapidly to the conditions encountered. The revised and adapted procedures and techniques applied in response to unforeseeable situations have also allowed the elaboration of quality metallic waste in conformity with the treatment criteria of the fusion subsidiary. This feedback has also allowed us to progress normally in the execution of these tasks and this work whilst also favouring two fundamental aspects, which are: the lowest radiological exposure possible for the personnel (the ALARA principle), and the total absence of any impact on the environment.

CONCLUSION

COGEMA has carried out dismantling operations (collection, automatic cutting, volume reduction, packaging) of spent fuel baskets, provisionally stored in the pits of the north-west area of the la Hague center, complete security as regards the environment, within the time schedule indicated, and at radiological and financially acceptable costs.
COGEMA is studying the possibilities of using these techniques for other similar operations. Because of the quantity of operational technical data recorded during the working period (2 years), COGEMA has acquired real experience in the domain of such dismantling operations which it would like to share.

Decommissioning operations

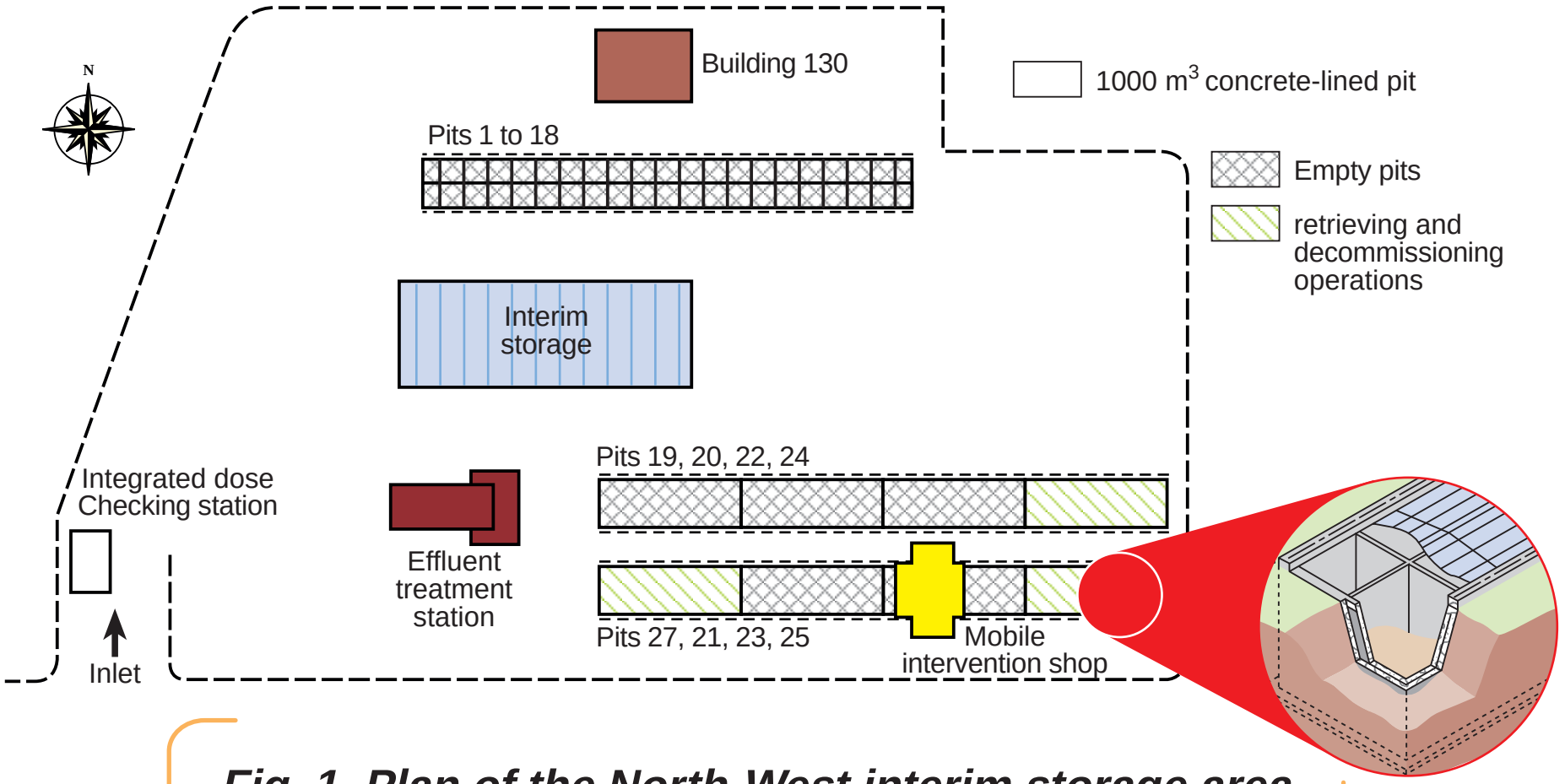

Fig. 1. Plan of the North-West interim storage area

Decommissioning operations

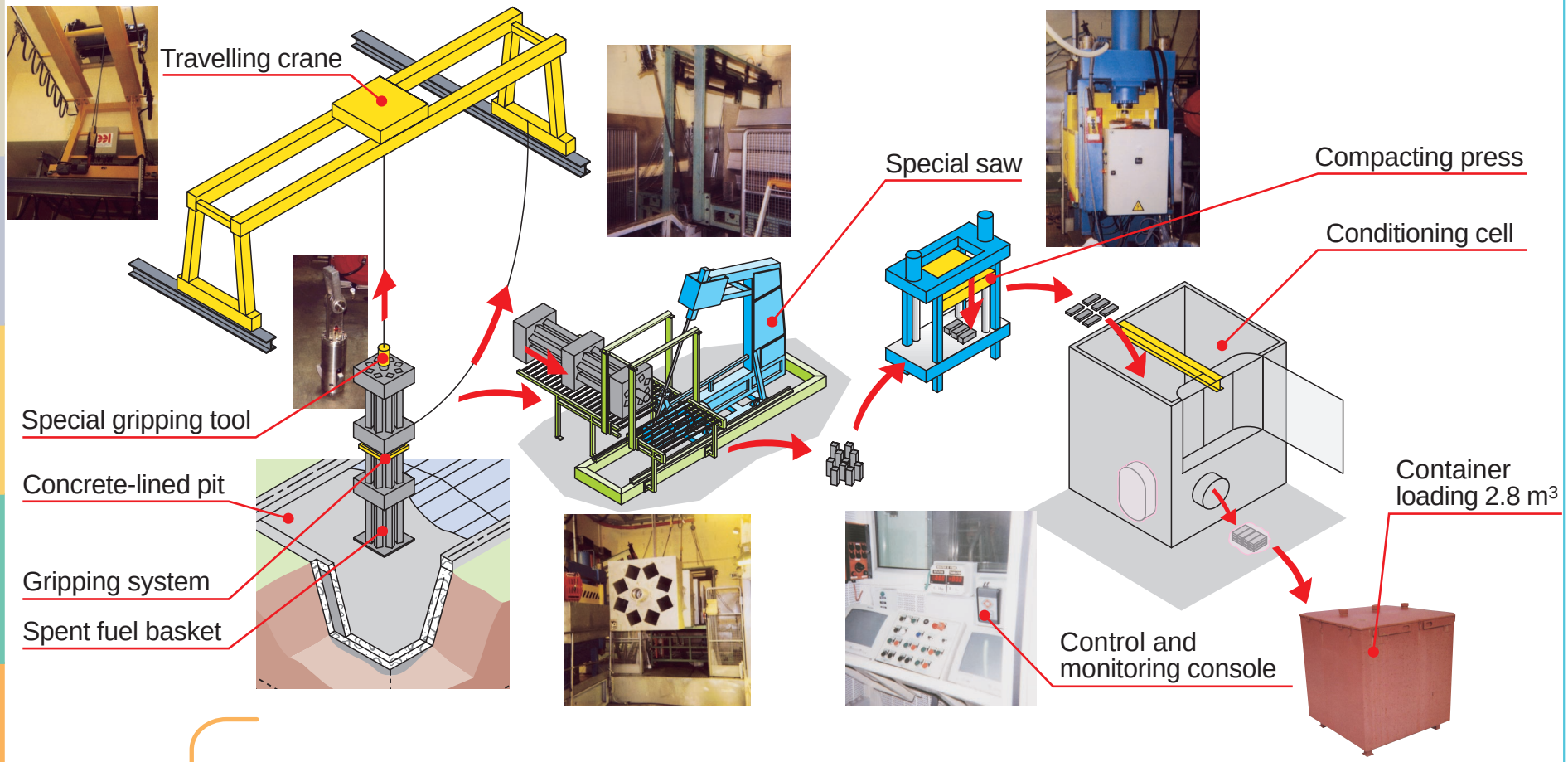

Fig. 2. Processes implemented

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Decommissioning operations

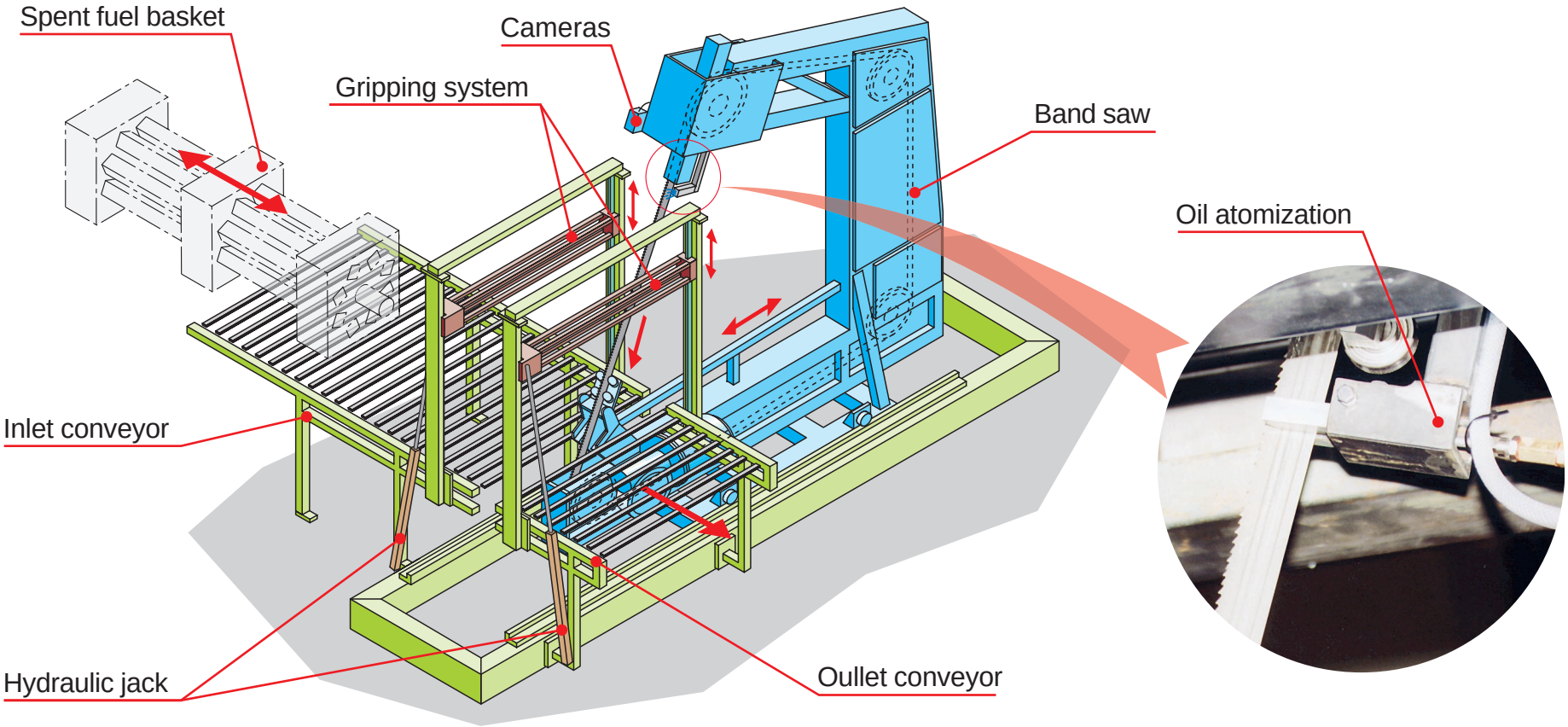

Fig. 3. Schematic view of sawing equipment

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Decommissioning operations

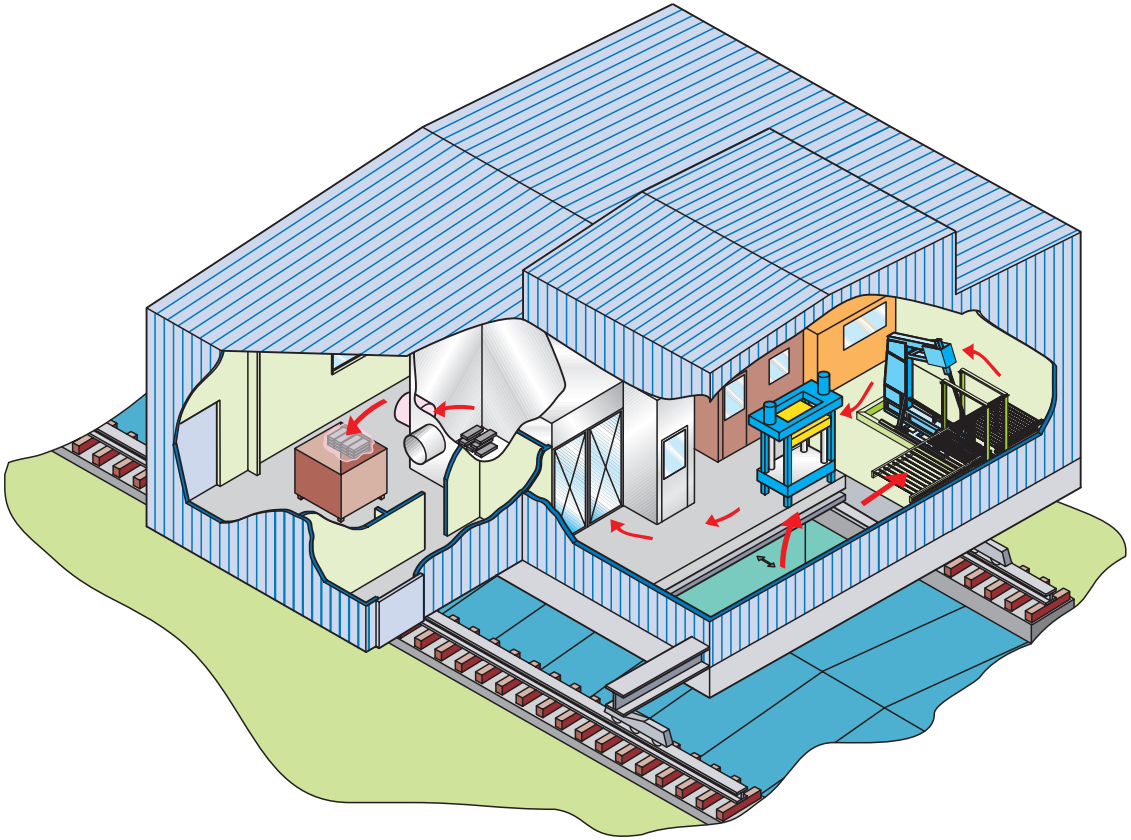


Fig. 4. Mobile intervention shop

Decommissioning operations

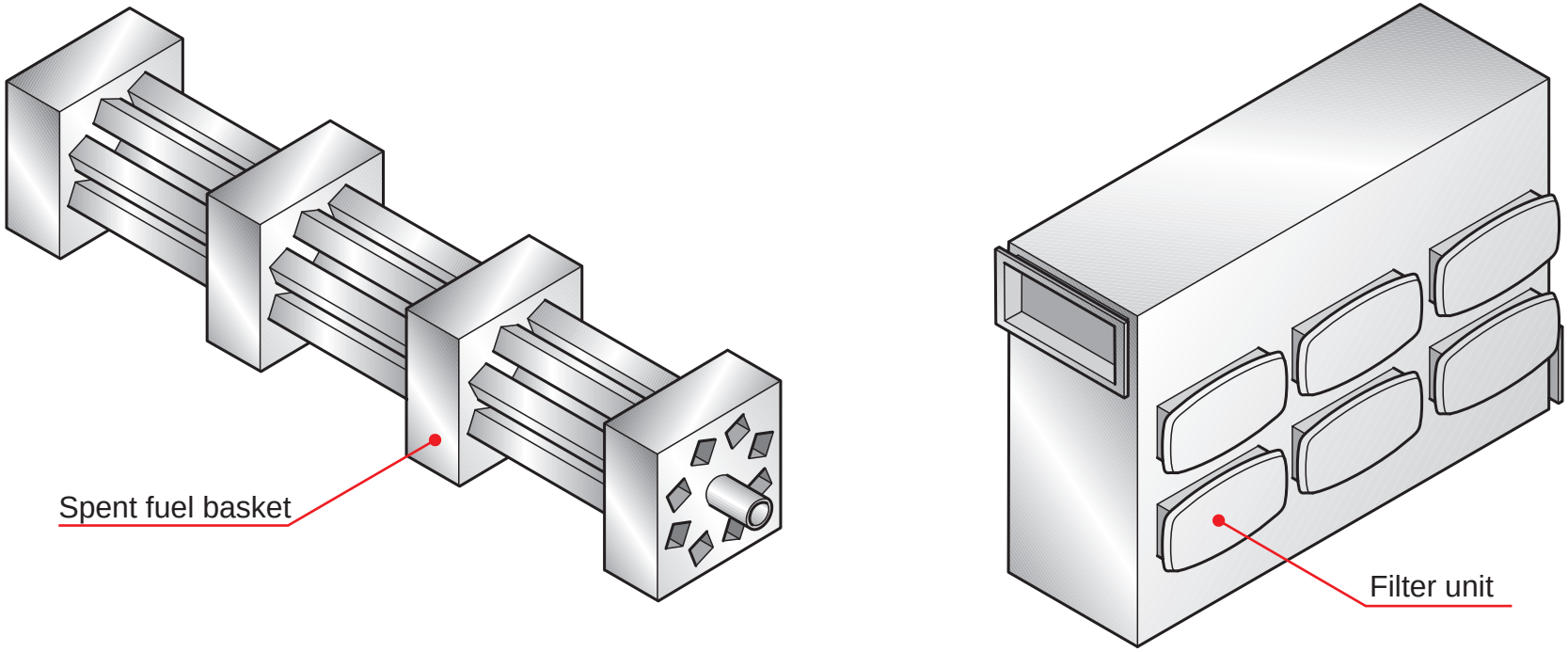
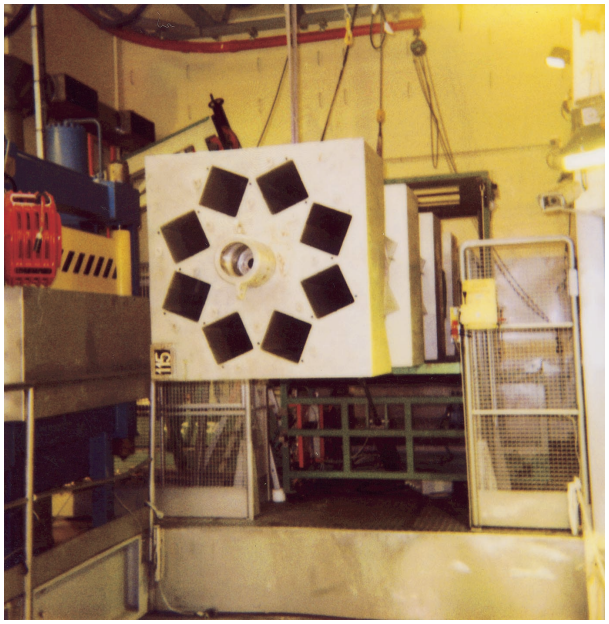


Fig. 5. Equipment cut using the special saw

Decommissioning operations



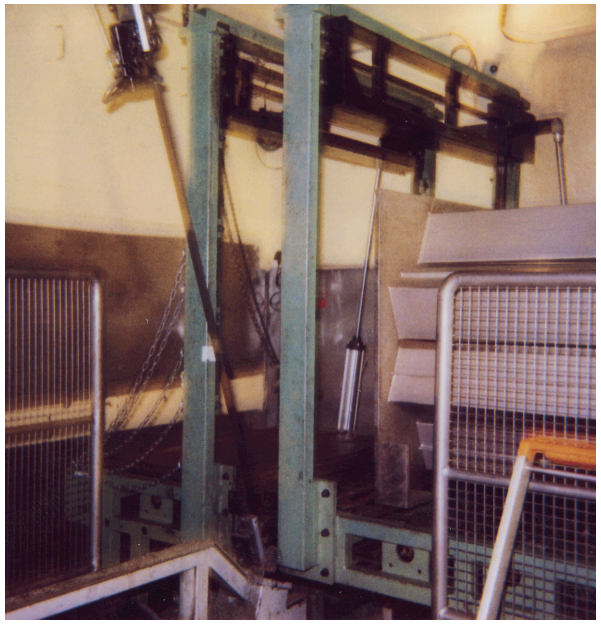


Fig. 6. Special saw in operation

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Decommissioning operations

Spent fuel baskets decommissioning	Operations with special saw	Manual operations - estimate
Number of 120-liter drums	265	750
Number of metal melting containers	70	120
SLLW packed for melting* (m^3)	196	336

SLLW - Solid Low-Level Waste
*** in CENTRACO facility (SOCODEI)**

Fig. 7. Waste production

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Decommissioning operations

External exposure (8 agents)

Spent fuel baskets decommissioning	Operations with special saw	Manual operations - estimate
Total integrated doses man.mSv	17.6	50

average integrated doses for each basket : 0.2 man.mSv

Fig. 8. Radiological balance

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