PRESENTATION OF THE ERFB BITUMENIZED WASTE DRUM RETRIEVAL FACILITY

G. CAUQUIL, JP MISTRAL, R. THEMINES
Compagnie Générale des Matières Nucléaires
BP 76 170 - 30206 Bagnols sur Cèze Cedex, FRANCE

D. FULLERINGER,
Groupement d'Intérêts Economiques CODEM
Paniscoule - BP 4 - 30201 Bagnols sur Cèze Cedex, FRANCE

S. HAUSS
Groupement Momentané d'Entreprises Solidaires SGN–TECHNICATOME–EDF
BP 144 - 30204 Bagnols sur Cèze Cedex, FRANCE

ABSTRACT

The bitumenized waste drum facility (ERFB) is built on the Marcoule site and is intended to handle the historic bitumenized waste of the site, that were conditioned in metallic drums. The purpose of the facility is to retrieve the drums stored in pits, condition them in stainless steel overpacks and produce packages ready to be shipped to the multipurpose interim storage (EIP) facility.
The ERBF includes a mobile frame structure capable to shift from one pit to another. It is used to recover drums and characterizes them (weight, radiological properties, etc…) and to repack them according to their state. The first operation results are provided.

INTRODUCTION

During its service life, the UP1 reprocessing plant in Marcoule, France, generated liquid waste that has been conditioned in bitumenized encapsulate drums in the liquid effluent treatment facility. Six thousand of these drums have been stored in half-buried pits located in the north area of the site.

Cleanup operations at Marcoule include retrieval, conditioning and transfer of the drums to a storage facility that complies with current safety standards. The first step in the program was to build the multipurpose interim storage facility (EIP) to receive the drums. The second step was to build the bitumenized waste drum retrieval facility (ERFB).

The ERFB facility was built specifically to retrieve approximately 6,000 bitumenized waste drums stored in 35 pits located in the north area of the solid waste conditioning facility on the Marcoule site. The waste drums were produced between 1966 and 1978. The facility can cover an entire pit in order to retrieve all its contents, and remove, treat and individually condition the stored bitumenized drums, which are subsequently transferred to the EIP facility.

The salient feature of the ERFB facility is its modular design as a complete mobile, motor-driven unit. Its main functions are to:
- retrieve the bitumenized waste drums stored in the pits,
- treat and condition the drums in stainless steel overpacks,
- insert the waste packages into casks for shipment to the EIP facility.

The bitumenized waste drums are made of carbon steel, have a unit capacity of around 220 liters of radioactive materials and may be contaminated. Some are in reasonably good condition, while others have been subjected to significant deformation and require special conditioning due to their non-standard dimensions.

The facility is operated remotely due to the contamination and radiation exposure hazards. It complies with current safety standards, including:
- containment systems with specially designed ventilation and HEPA (High Efficiency Particulate Air) filters to treat discharges prior to release into the atmosphere,
- restoration of radiological shielding following removal of the cover slabs over the storage pits.

Its design makes provision for possible degradation of the drums, in particular significant deformations.

Initially, a stationary frame structure was installed around the pit to be emptied, but was replaced in August 2001 by a mobile frame structure to optimize ERFB displacement time. The purpose of the structure is to provide additional radiological shielding around the facility. At the top, it is fitted with an adjustable-height seal that mates with the underside of the mobile structure to provide static containment.

The facility is mobile so it can move from pit to pit and position itself over the drums during retrieval operations (the ERFB moves roughly a hundred times when retrieving the contents of a pit). Retrieval operations are conducted on a pit-by-pit basis after transfer of the frame structure around each new pit to be emptied.

In the case of standard-dimension drums, which exhibit only slight deformation and are compatible with overpacking, the facility performs the following functions:
- one-by-one retrieval of drums,
- visual inspection,
- drum weighing,
- removal of the supernatant water, dust and rubble visible at the top of the drums,
- elimination of any bitumen overflow,
- measurement of the drum radiation dose rate,
- drum insertion into an overpack, and fastening and contamination monitoring of the overpack cover,
- installation of radiological shielding into the overpack and removal of the entire package.

In the case of drums with excessive deformation (exhibiting non-standard dimensions or incompatible with design criteria), which cannot be inserted into standard overpacks, the facility performs the following functions:
- one-by-one retrieval of drums,
- dimensional inspection,
- drum weighing,
- removal of water,
- measurement of the radiation dose rate,
- insertion into a special container (non-standard dimension overpack or interim storage box),
- installation of appropriate radiological shielding,
- removal of the entire package.

Weighing more than 100 metric tons, the mobile facility is a metal structure that supports the cells required to retrieve the drums and control operations. It consists of welded modules and access stairways. The unit is bolt-assembled, which enables transfer to another row of pits.

Electrical, instrumentation and control connections between the modules can be quickly disengaged using connectors mounted on boxes or positioned in the cable trays.

The mobile unit rests on tracks with rails laid on each site of the pits concerned.

Ten motor-driven wheels are used to move the unit from one pit to another. They include one geared motor, two driving gears and one roller. Eight guide wheels and 11 idle wheels support the unit on the track. The mobile unit is fitted with a shock absorber system consisting of jointed spring washers placed between the frame structure and the bogies to offset geometric defects of the rails.

All functions are performed from seven cells (see Figures 1 and 2)

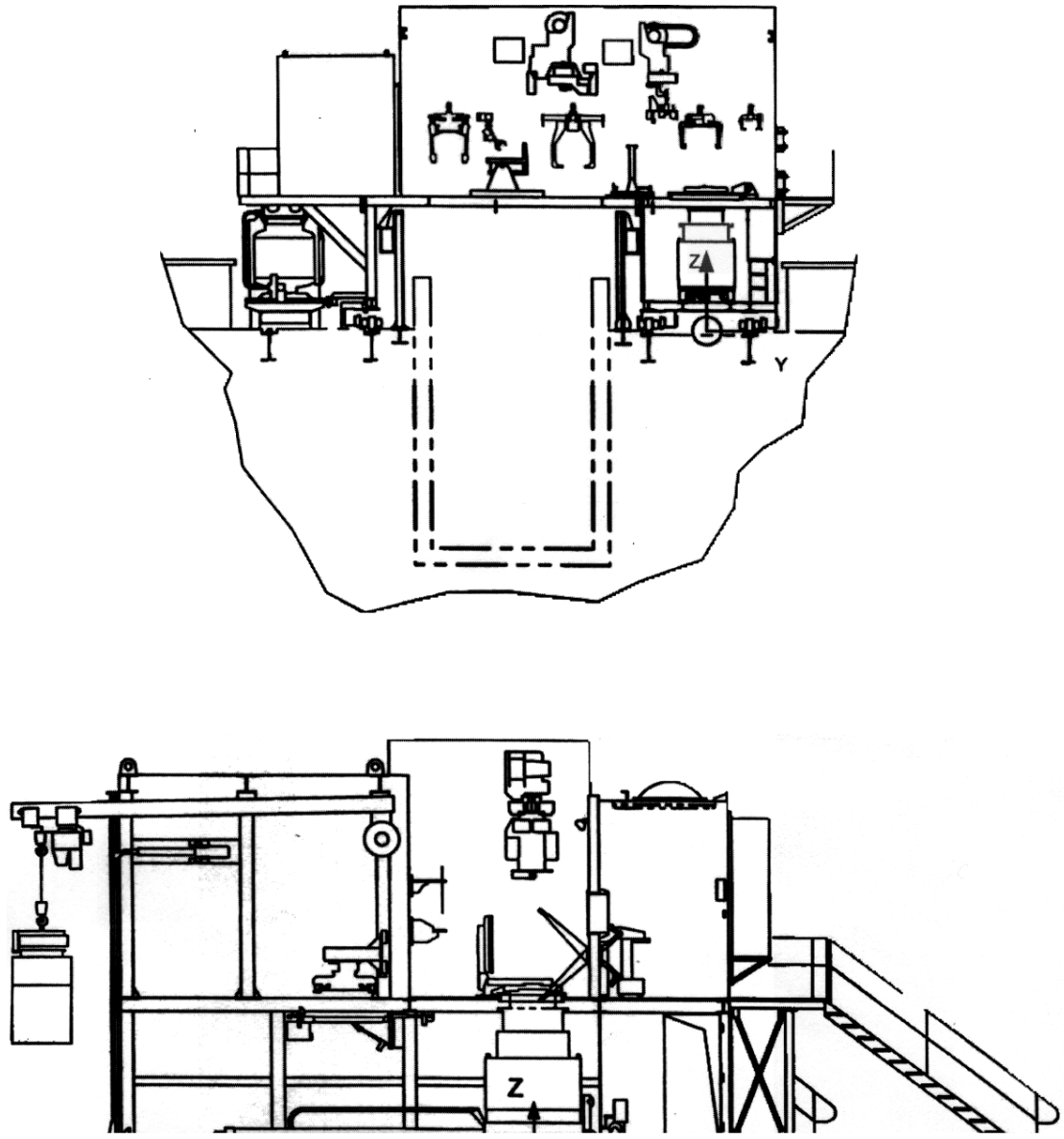

Fig. 1 : CHARACTERISTICS OF THE INSTALLATION

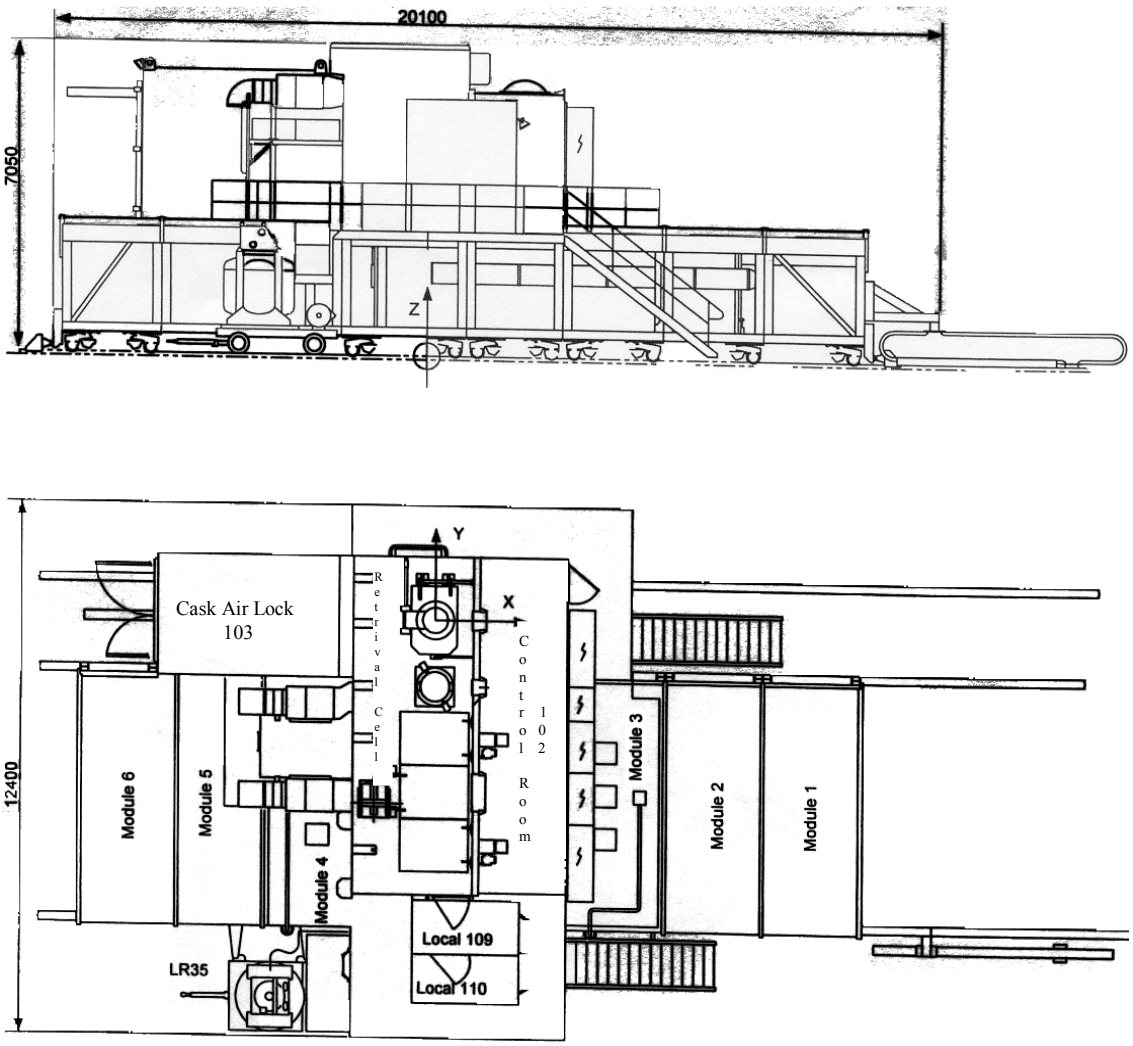

Fig. 2: CHARACTERISTICS OF THE INSTALLATION (cont.)

OPERATION

Organization

The ERFB facility is operated by two four-person shifts managed by a supervisor. A health physics officer is assigned to the facility to perform periodic radiological inspections required for the transport operations.

Results

Operation of the ERFB facility started with a pilot phase on January 21, 2000. This phase, which was scheduled to last one year, concerned the retrieval of bitumenized waste drums stored in pits 154 and 147. The purpose was to :

- gain experience,
- validate operating assumptions,
- define potential areas of improvement to optimize the facility,
- secure permission to continue operation.

The contents of three pits had been retrieved by July 19, 2001.

During the 216 days of actual operation, 736 bitumenized waste drums were retrieved, treated and conditioned. Four of these drums, which had non-standard dimensions, were conditioned in stainless steel overpacks and stored in an adjoining pit, pending development of a treatment process.

A total of 192 conditioned drums were transferred to the multipurpose interim storage facility.

The dimensions of 19 drums were adjusted to comply with specifications using a remote-operated pneumatic chisel.

In order to refine knowledge of the chemical and radiochemical properties of the encapsulated material, 40 samples of bitumenized waste were taken.

In all, 4,570 liters of water were recovered from the surface of the bitumenized waste drums. The presence of this water is due to storage conditions in the pits because the cover slabs do not ensure total leaktightness and water inleakage has been observed during inclement weather conditions.

The drums were retrieved from the first pit at an average rate of 2.6 per day. This rate increased to 5.3 per day for the third pit, which enabled treating up to 37 drums a week.

Two pit changes and one row change were made during this period.

Table I details the operations performed during the 18-month period.

Table I. Operations performed during the 18-month period.

Operation	Period
Retrieval from pit 154	Jan. 21-June 19, 2000
Cleanup of the pit and facility	June 20-July 5, 2000
ERFB move to pit 147	July 6-July 25, 2000
Reconditioning and requalification	July 26-Aug. 7, 2000
Retrieval from pit 147	Aug. 8-Oct. 31, 2000
Cleanup of the pit and facility	Nov. 1-Nov. 10, 2000
Drafting of a lessons-learned report, civil engineering work for new row, facility move to pit 167, facility reconditioning and requalification	Nov. 11, 2000-March 26, 2001
Permission to continue operation	April 27, 2001
Retrieval from pit 167	May 2-July 19, 2001
Cleanup of the pit and facility	July 20-Aug. 27, 2001

Drum Tracking

The traceability of each removed drum is ensured by the use of a traveler sheet containing the following information:

- Date of retrieval,
- Reference number of the storage pit,
- Drum identification,
- X-Y-Z coordinate position in the pit,
- Volume of water removed,
- Weight of the bitumenized waste drum,
- Contact radiation dose rate,
- Gamma activity,
- Reference number of the stainless steel overpack used for drum conditioning,
- Date of transfer to the multipurpose interim storage facility (EIP),
- Drum position in the EIP facility.

PRODUCTION DISTRIBUTION

Weight Monitoring

Each bitumenized waste drum is weighed in the retrieval cell immediately after removal from the pit. It is also weighed after drainage of any water it may contain.

The bitumenized waste removed from the three pits weighed 194 metric tons, representing an average weight per drum of 264 kg.

During the operation period, the bitumenized waste weight per drum ranged between 100 and 305 kg.

The water volume eliminated from drums during draining operations totaled 4,570 liters. After coarse filtration, this water was transferred by gravity into a 2 m^3-capacity vessel. Samples were then taken

and the water was routed to the liquid effluent treatment facility (STEL). The average volume of water removed per drum was 6.5 liters.

Radiological Supervision

After water draining and weighing operations, each drum is placed in a stainless steel handling basket. The basket is in turn positioned on a revolving platform.

Radioactivity is measured on the rotating drum for five minutes. This measurement is used to determine the radiation dose rate in contact with the drum, and the radioactivity it contains.

Radiation Dose Rate

The average radiation dose rate of the drums removed from the three pits was 3.7 mGy/h. The maximum was 41.5 mGy/h.

Radioactivity

The total radioactivity removed from the three pits was 21,500 GBq.

Monitoring

During the 18 months of operation, contamination and radiation exposure was monitored on a periodic or continuous basis for the operators, the cells and the environment.

Contamination Testing

After fastening of the overpack cover, contamination of the outer surfaces is checked by a smear test using an articulated arm fitted with removable swabs.

The atmosphere in the retrieval cell is monitored continuously with an atmospheric sampling unit.

A weekly smear test program is used to check contamination in the cells and on the underside of the facility in contact with the atmosphere in the pit.

The atmosphere in the retrieval cell is renewed by removing air at the pit level. This air is cleaned with a HEPA filter prior to discharge into the atmosphere. Air discharges are monitored continuously by filtration and offline measurements.

During the 18 months of operation, the following results were reported:
- No overpack contamination was detected,
- No significant atmospheric contamination was detected inside the retrieval cell,
- No surface contamination was detected outside the retrieval cell,
- Radioactivity of atmospheric discharges was below 94 kBq,
- No body contamination was detected for personnel.

Dosimetry

The operators are provided with personal dosimeters to monitor radiation exposure.

The control room is equipped with a gamma chamber that indicates radioactivity instantaneously.

FLi dosimeters are installed in the environment near the ERFB facility.

Measurements may be performed periodically or on request with portable radiation meters.

During the 18 months of operation, the following results were reported:
- No radioactivity above 10 μGy/h was detected in the control room, indicating that the facility's biological shielding has been properly designed,
- With the pit full, a monthly radiation dose of 10.2 mSv was recorded in contact with the south-east deck of the facility,
- No significant radioactivity increase was recorded by the area dosimeters.

Table II shows the integrated radiation dose for operators during each phase.

Table II. Integrated radiation dose for operators

Operation (mSv)	7.3
Maintenance (mSv)	0.9
Radiation protection (mSv)	2.7
Pit cleanup (mSv)	2.8
Facility moving (mSv)	2.2
Total (mSv)	**15.9**

The average integrated dose per drum is 22 μSv. The dose decreased from 32 μSv during retrieval operations from the first pit to 15 μSv at the end of retrieval operations from the third pit.

Sampling

A device specially developed for the ERFB facility was used to take 40 bitumenized waste samples from 40 drums whose identification was visible. The samples were processed and analyzed by the Marcoule laboratory in order to refine knowledge of the chemical and radioactive properties of the bitumenized waste drums.

The sampling and measurement program has provided additional information which will be required in the final waste characterization phase, in particular concerning toxic chemicals, chelating agents and ratios such as the radioactivity of measurable radionuclides divided by that o difficult-to-measure radionuclides. The program is continuing with 5 to 10 samples taken for each storage pit. Initial results show good agreement with past production records and design code predictions.

CONCLUSIONS

After a pilot phase of operation on the first two drum storage pits, which required several technical and organizational adjustments, the ERFB facility is now in service. It is being used to remove bitumenized waste drums from the pits at the specified nominal rate without any adverse environmental impact.

The integrated radiation doses for operators are below the maximum expected levels and the facility is scheduled to continue operating until 2006.