ADVANCED WASTE HANDLING TECHNOLOGY DEVELOPED FOR COGEMA'S SPENT FUEL REPROCESSING PLANT AT LA HAGUE

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ABSTRACT

As part of the studies for the solid LLW and MLW processing facilities at the AD2 installation in the UP3 plant at La Hague, SGN developed novel waste handling technology for intensive industrial use by Cogema.

The new technologies have been applied in two different units:

- An automatic transfer system that uses waste package coordinates, addresses them to overhead handling facilities and ensures deposit of the packages even when receiving containers are offset from their theoretical position. These packages are standard canisters containing reprocessing waste not intended for compacting.
- A flexible drum supply system operating from a storage of drums containing compactable waste routed to a supercompactor.

The flexible drum supply system uses a selection algorithm. Flexibility is provided thanks to the inter-changeability of selection criteria.

INTRODUCTION

The AD2 facility of the new spent nuclear fuel reprocessing plant commissioned at La Hague in 1989 processes and packages dry solid waste. The waste packages are separated according to their activity levels and stored at temporary onsite facilities. (Fig. 1)

The AD2 facility handles all dry solid technological waste from controlled areas of the new reprocessing plant. It also: characterizes the resulting waste packages (contents, mass, alpha, beta and gamma activity, dose equivalent rate) and checks for surface contamination; transfers the packages to temporary onsite storage facilities; store and administers mobile handling casks and carriers.

The AD2 facility conforms to the general design principles established for the new reprocessing plant. These principles provide for maximum safety and high availability under optimum operating conditions (including reduced dose rates for plant workers) at acceptable cost.

Novel methods are employed to unload and process waste under shielded conditions without loss of confinement (except for drummed waste during compacting whose confinement is maintained at the level of the compaction cell). This simplifies maintenance design and permits hands-on servicing of much equipment. It also reduces the radiological hazards for operating personnel.

Almost fully automated, the facility is operated from a central control room. The only main functions not automated are reception of waste and removal of processed waste packages. These are conditioned in fibre reinforced concrete containers according to a special design welcomed by the French Safety Authorities and the French Radioactive Waste Management Agency (Andra). They are manufactured by Sogefibre™, a subsidiary of SGN.

The AD2 facility comprises four buildings:

- Building A receives and processes solid waste to be compacted;
- Building B receives and processes more active radiation-emitting solid waste to be conditioned directly without compaction;
- Building C is a storage building for mobile handling casks and carriers;
- Building D houses the control room and changing rooms.

The total under-roof area is about 12,200 m^2 for a volume of about 180,000 m^3. The ventilation rate is about 250,000 Nm^3/hour.

WASTE HANDLING PARTICULARS

Transfer System Addressing

The relative positioning of the reprocessing waste canisters and the final receiving containers precludes the use of handling facilities that employ fixed position coordinates.

Consequently, an automatic position recalculation system was developed to transfer the canisters to their final storage position in the containers automatically, i.e. without requiring visual monitoring by closed-circuit television. It mainly consists of a plug on which are fitted:

- two TV cameras mounted vertically above the theoretical target point,
- a lighting system designed to enhance contrast,

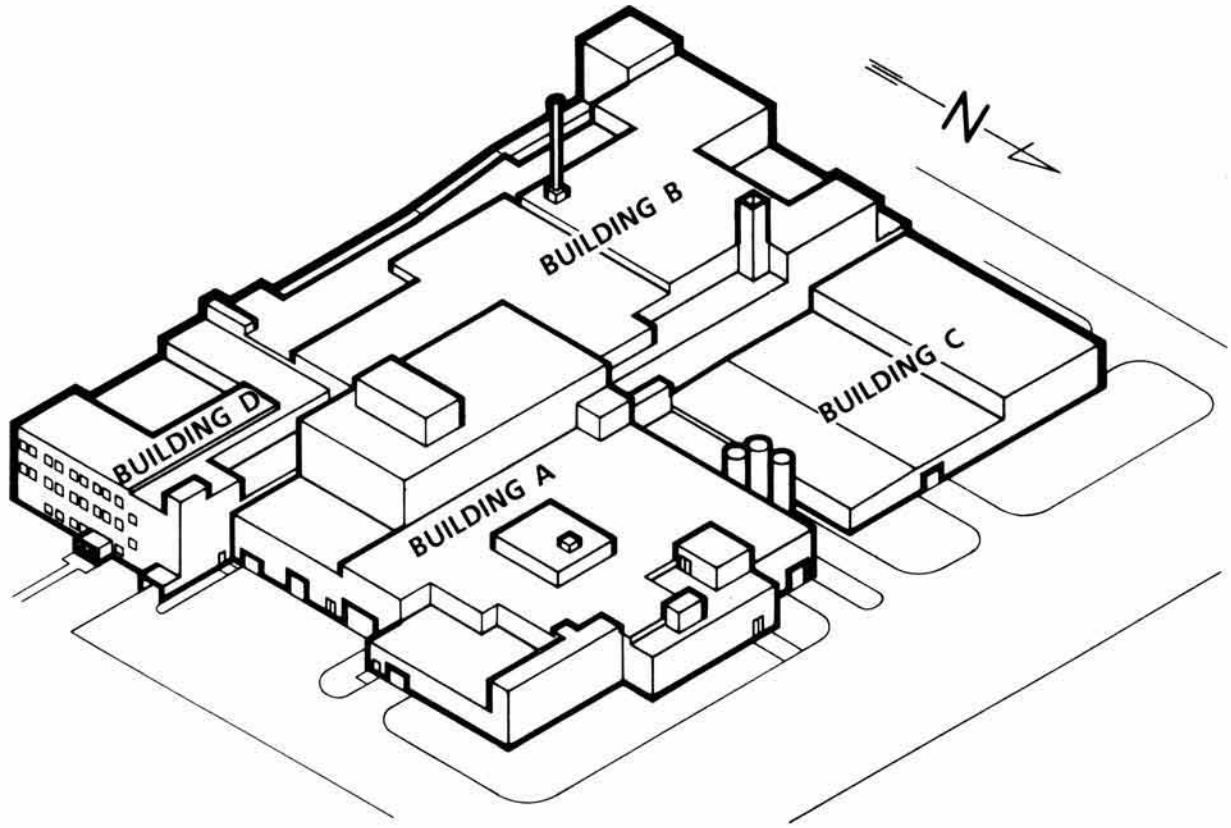

Fig. 1. Layout of the AD2 workshop.

- an image digitizer with a contour extraction system,
- a transfer system addressing computer and communication links between the computer and the automatic controller actuating the handling devices.

The system can ensure positioning to within 1 mm. It is shown schematically in Figs. 2 and 3.

System Description

The system comprises the following equipment:

a. On the roof of the process cell
- a plug in the cell roof over the target point with
  - two TV cameras each aimed to cover 2/3 of the target area
  - four individually adjustable spot-lights for illuminating the target area, each providing a lighting intensity of 100 lux.

These equipments are installed horizontally in the cold area. Images are reflected by stainless steel mirrors, which enables use of equipment that is not radiation hardened.

b. Inside the cell are five studs for resetting the system. They have the following functions:
- two studs per camera,
- one stud in the range of the two cameras for synchronization.

c. In an electrical equipment room
- 12 V power supply for the cameras,
- 220 V switch and intensity variator for spotlights,
- GIXI™ VX200 control system (processor, memory device, image board, 16 inputs, 32 outputs),
- RS232 converter/current loop programmable controller serial interface,
- a control console.

System Specifications

- TV cameras with 75 mm lenses, 8.30 m optical path,
- image 512 x 512 pixels (1 pixel = 1.86 mm X; 1.26 Y),
- enter position accuracy 0.5 pixel (0.9 mm X; 0.6 Y).

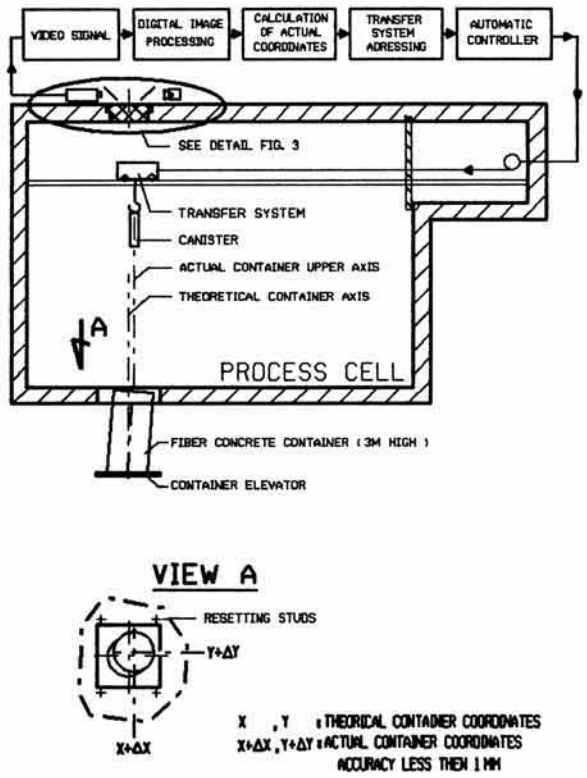

Fig. 2. Transfer system addressing.

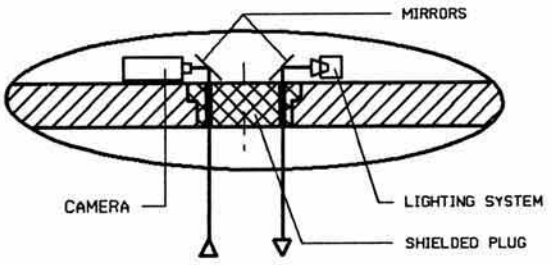

Fig. 3. Transfer system addressing.

Data Transmission

The contour extraction system is generally operated by the programmable controllers. The main data exchanged are:

- coordinates of container center,
- coordinates of canister deposit.

Supercompactor Drum Supply System

The handling of drums for compaction is fully automatic and includes completely automated unloading of collection trailers.

The drums are stored in eight level systems of racks. The racks are loaded by an electronically controlled addressable storage unit. Management of the storage unit is independent of the arrival sequence.

Before the drums are stored, their alpha and beta/gamma activity is measured as they progress through the measurement and weighing stations (See Figs. 4 and 5).

The algorithms used to select drums to be compacted and the associated waste tracking system are also used to supply the compaction press according to different selection criteria. These criteria may include:

- order of arrival,
- minimizing storage system travel,
- drum weight (to optimize filling of packing drums),
- drum activity (so final drum contained activity can be adjusted).

Other criteria may also be combined with the above. Examples are:

- limiting residence time in the storage facility,
- criteria specific to special operations,
- selective overrides by the operator.

At any time in the process the computer can report:

- if a rack is occupied or empty,
- if occupied
  - drum identification and file characteristics,
  - drum weight,
  - drum activity.

This handling line is part of the system used to handle waste drums to be compacted.

The system ensures credible characterization of the final waste packages. It enables:

- entering the shipping lists of each incoming drum identified by a bar code,
- supplementing information on the shipping lists with results of the nuclear measurements performed in the AD2 facility (gamma spectrometry or passive neutron measurement),
- handling each drum using stacker cranes and compactor feed conveyors, and storing the drum coordinates,
- providing with each outgoing container
  - the pellets of compacted drums with the contents of their shipping lists and their radiological inventory resulting from the nuclear measurements,
  - the container dose rate,

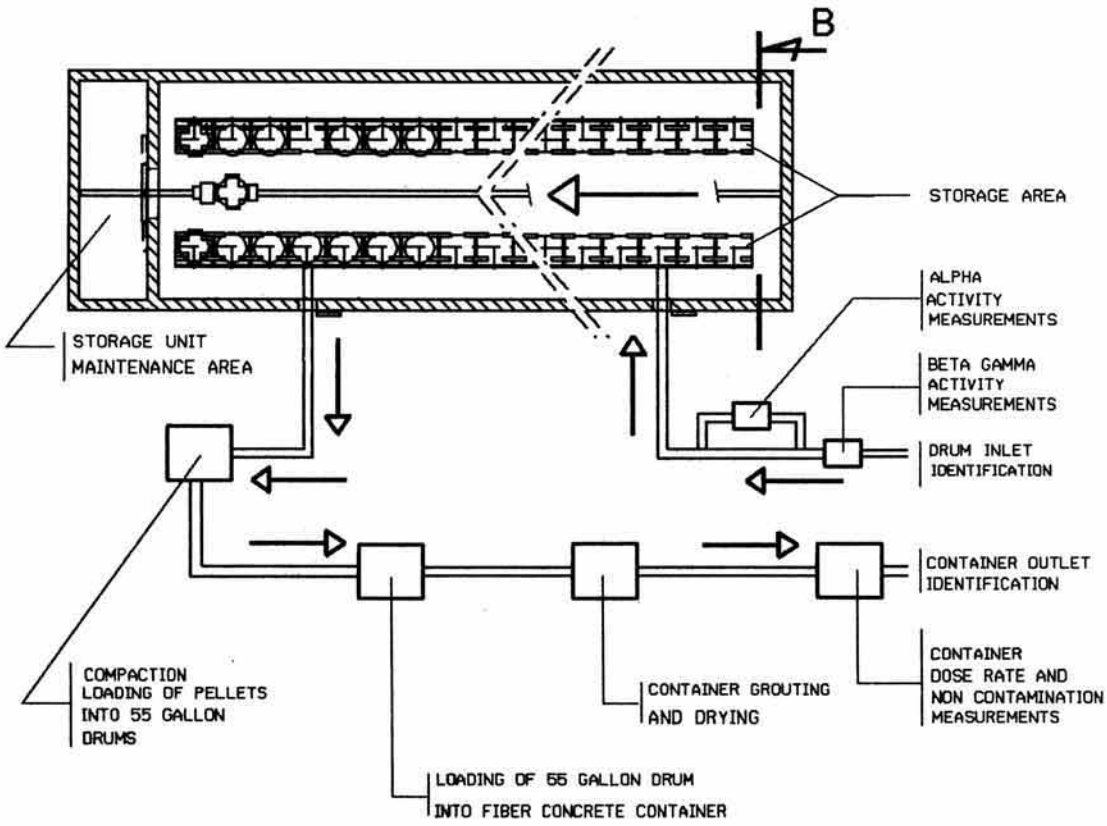

Fig. 4. Compactable waste routing scheme.

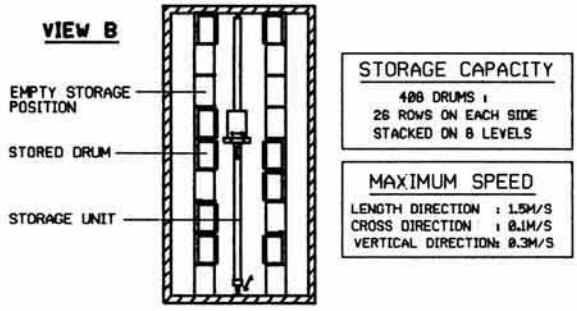

Fig. 5. Storage area cross section.

- the results of the contamination check performed before departure from the facility for the storage area.

CONCLUSION

The AD2 facility described in this paper is an application of a fully integrated maintenance concept implemented for waste management in a large industrial complex of nuclear facilities. This achievement has benefitted from the fact that the waste management facility was designed at the same time as the production facilities.

These advanced waste handling technologies play a decisive part in the general waste tracking system in operation between the waste generator and the final disposal contractor. They also enhance the reliability of the waste management Quality Assurance Program.

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