EXPERIENCE OF DECOMMISSIONING OF TRANSPORT FLASKS

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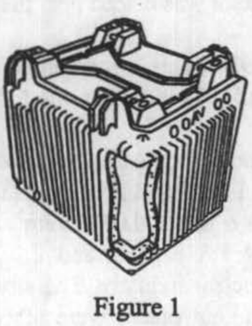
SUMMARY

With a fleet of 4000 transport flasks and associated materials, COGEMA is involved with EDF and other foreign customers (Japan, Germany) in the transportation of nuclear materials (fissile and spent fuel, plutonium, uranyl nitrate, vitrified and low-activity level residues). Providing this service since the start of civil nuclear activity, we are currently faced with solving the industrial problem created by decommissioning of such materials. An original process was implemented by MMT for decommissioning baskets made of mixed stainless steel and aluminium structure that was used for transporting spent fuels from Pressurized Water Reactors. Other methods were used for decommissioning obsolete trailers, tanks and flasks.

The purpose of this paper is to present the technical solutions taking into account the nuclear safety and security constraints and the industrial choices made for optimizing economic aspects.

DECOMMISSIONING OF SHIPPING FLASKS

The UNGG type spent fuels from graphite-gas nuclear power plants were transported in IU06 shipping flasks (Figure 1). The biological barrier of these flasks, manufactured in the mid-sixties, was formed by molten lead in the wall spacing of a compartment lined whose interior was lined with stainless steel plating and the exterior with painted carbon steel plating (Figure 1). The cover was made up of a stainless steel envelope filled with lead. Evolution of regulations and the drawbacks resulting from external paint aging were the reasons why these flasks were decommissioned.



Number	: 2
Total weight	: 55,000 kg
Weight of lead	: 40,000 kg
Dimensions	: 1812 x 2338 mm
height	: 2850 mm

Figure 1

The adherence of the lead inside the steel structure was made possible by embedding the fins welded to the walls in the lead, when the latter is poured in the inter-wall space. One of the difficulties for decommissioning consisted in separating these two materials.

The process, consisting in cutting the panels with plasma torch or with thermic lance, gave in to the benefit of the process which consisted in melting the lead, its recovery then cutting the remaining framework with plasma torch. In this respect, an oven ① was constructed with 40 cm thick walls and a removable cover made of refractory material (Siporex). The chimney ② of the oven was equipped with a system for controlling exhaust gases (Figure 2).

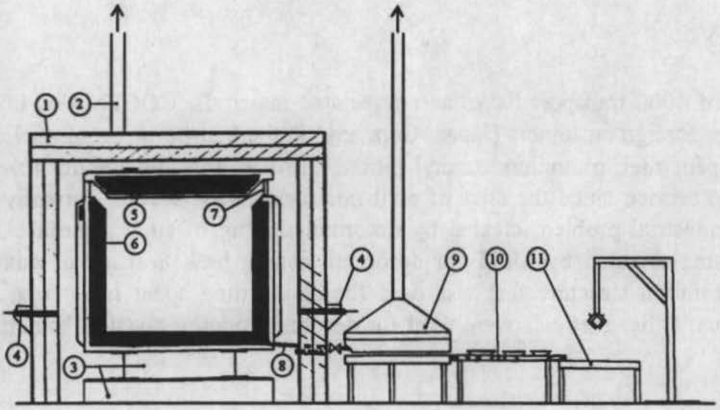


Figure 2

Placed at the center of the oven and raised on two IPN beams ③, the shipping flask was heated by five propane gas burners ④ with a nominal flow of 10 kg/h. A pipe ⑦ connected the flask ⑥ to the cover ⑤ that was drilled up to its lead wall. The flask was drilled at its base and fitted with a pipe ⑧ for draining lead. Venting tubes were fitted to the flask and the cover, in their top section. Two thermocouples located in a thimble on the flask and cover were designed to record the temperature. The molten lead was poured into ingot moulds fed by a horizontal rotating table ⑨. A roller table ⑩ ensured evacuation of the ingot moulds towards the unmoulding of the pig ingots and their loading on palettes ⑪. Above the horizontal rotating table, a forced convection chimney evacuated the air towards the exterior. For these operations, the procedures and safety instructions were displayed in the working premises. The personnel was medically monitored. A CO-CO_2 detector was placed near the oven.

Two IU06 shipping flasks were decommissioned in 1986. This operation took place in a single run: 15 h for temperature rise - temperature step at 550°/600° - pouring for 12 hours.

The radiation dose absorbed by personnel was insignificant. After decontaminating the interior and sand blasting the exterior, the contamination level fixed for each of the flasks was 2.21 Bq/cm^2 and 4.1 Bq/cm^2 in βγ and the level fixed for α was < 0.07 Bq/cm^2. After melting the lead, these contamination levels were respectively 1.8 Bq/cm^2 and 2.9 Bq/cm^2. The 80,000 kg of lead thus recovered were re-used in the nuclear industry. The structures of the two shipping flasks were cut with plasma torch and the cut pieces were placed in storage containers.

DECOMMISSIONING OF TRAILERS AND TANKS

The decommissioning methods used in this case take advantage of the radioelement spectrum announced by the Marcoule nuclear center and recognized by ANDRA (National Agency for Radioactive Waste Management), the French low-activity level waste storage center.

These trailers were in use since the end of the sixties for evacuating spent fuel from gas-graphite nuclear power plants (Chinon and Saint-Laurent-des-Eaux) and are no longer in activity since the start of the nineties.

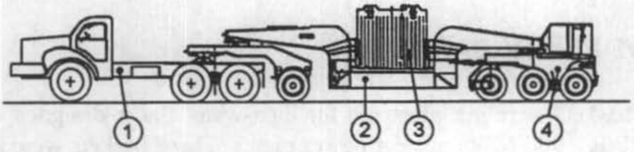


Figure 3

Number : 3
Length : 19.000 m
Height : 3.205 m
Width : 2.495 m
Weight : 78,500 kg
Materials : carbon steel
stainless steel
Flask : IU09 and IU17

Since tractor ① and rear directional wheelset ④ are not contaminated, only chassis ② carrying flasks ③ is decommissioned. Contamination measurements revealed a notable level to contact in the central section of trailer ②: $\beta\gamma = 60$ Bq/cm^2, $\alpha = 0$ Bq/cm^2. Thus:

- the uncontaminated section of the trailer is sand blasted for being returned as waste for public use,
- the contaminated section of the trailer is cut into pieces. The cut pieces are placed in type 8S cubic containers with a volume of 1.5 m^3 and dispatched to the ANDRA waste storage center. These operations were easily carried out since the radioelement spectrum measured on the trailer complied with the spectrum announced by the Marcoule nuclear center. The low contamination level does not require washing or decontamination.

These tanks, in use since the late 1960s for transporting uranyl nitrate or other nuclear fluids, are no longer in activity since the early 1990s.

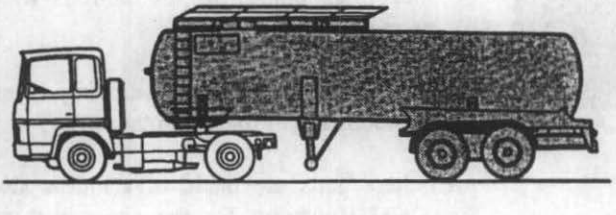


Figure 4

Number : 2
Capacity : 11,780 litres
Weight : 10,180 kg
Materials : carbon steel
stainless steel
lead, glass wool

Since the utilization background of the tank is uncertain, its interior was rinsed and the spectrum analyzed by performing internal wipe tests by smearing: Mn54, Co58, Co60, Ag110, Sb124 and 125, Cs134 and 137, Th234, U235.

The permissible contamination level being: $\beta\gamma = 30$ Bq/cm^2, $\alpha = 1.5$ Bq/cm^2.

- the tractor has been preserved as it is uncontaminated,
- the tank was cut into pieces and conditioned in three type 8S cubic containers with a volume of 1.5 m^3, a total weight of 11,400 kg and an equivalent dose rate of less than 5 μSv/h.

DECOMMISSIONING OF FLASK BASKETS

In the early 1980s, six LK123 baskets were manufactured for light-water flasks designed to ship spent fuel from the EDF PWR - 900 MWe nuclear power plants. These baskets were in use for ten years and have been subjected to a respective number of maintenance operations. The neutronic poison consisted of boron graphite confined in envelopes formed of stainless steel welded plates with a low thickness, secured to the basket frame. The damage to these envelopes led us to replace these baskets and store them in DV75 type containers. It was due to the cost of immobilization of these containers that we decided to study decommissioning of the baskets.

The LK123 baskets basically consist of (Figure 5):

Figure 5

- a base plate,
- five independent modules, fixed by tie-rods, relatively positioned during assembly by 16 columns running into the corresponding bores,
- a cover plate,
- four tie-rods blocked in rotation at the level of the base plate,
- four rings pinned to the tie-rods by a permanent link,
- four shoes for positioning and immobilizing the basket in the cavity.

All these parts are made of stainless steel Z2 CN18-10 except for the shoes that are made of aluminium alloys AS7G and AG3.

The decommissioning constraints relate to:

- the permanent link of the rings on the tie-rods,
- a contact dose rate of 53 mGy/h, with a spectrum having PWR nuclear power plant pool water characteristics (Co58, Co60, Mn54, Zn65),
- seizing of the basket components between themselves at the columns,
- tie-rods made of a single block,
- positioning shoes mounted on springs and therefore mobile and difficult to grasp with an automatic system.

The tools developed (Figure 6) and the process retained enable the problems encountered to be solved industrially:

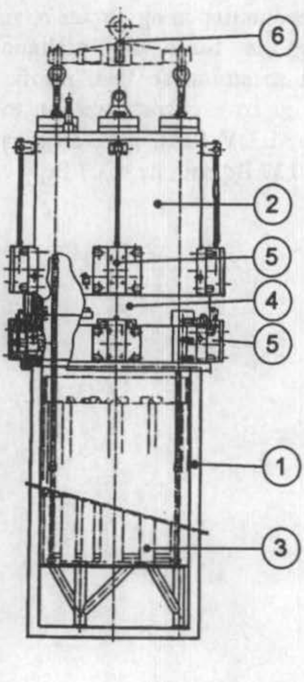


Figure 6

- dose rate limited by the use of a cap ② made of heavy-gauged steel,
- separation of basket components ③ by raiser block ④/cap ② assembly and their blocking and clearing system by means of hydraulic jacks ⑤.

The process retained is mainly aimed at optimizing cost, security and safety aspects:

- basket decontaminated by pressurized hot water,
- decommissioning operations performed in a cell (room dedicated for working on contaminated material),
- basket ③ to be decommissioned placed in a DV75 container ① filled with water in order to reduce the dose rate,
- manual sawing of the lifting rings,
- uncoupling of basket components through cap ② and raising and lowering of basket by means of crane ⑥,
- uncoupling of seized components of the basket by means of raiser ④ and cap ② assembly,
- placing of basket components in ANDRA approved nuclear waste containers type CBF.K.

Up to now, MMT has decommissioned two baskets by implementing the procedure described above. Decommissioning of a 4000 kg basket with a volume of 4 m^3 and having dose rate peaks of 53 mGy/h, required production of five CBF.K containers with a maximum contact dose rate of 0.90 mGy/h, taking up a total volume of 25 m^3 for a cumulated weight of 36,000 kg. For this operation, the dose rate received by the operators was ten times below the limit required by the standards (2 mSv for all operators). The cost of such a decommissioning operation, with the containers ready to be shipped, corresponds to the purchase of a new DV75 type storage container and a loss in availability of the workshop due to a loss in flexibility linked to unavailability of DV75 storage containers.

PURSUANCE OF DECOMMISSIONING OPERATIONS

The decisions for decommissioning contaminated materials are mainly motivated by economic and nuclear safety aspects that form part of our activity. We have just presented a process that has been specially developed for decommissioning baskets. In the same way, MMT has undertaken studies for decommissioning a fleet of 219 flasks (tank, caisson, flasks for fissile materials, laboratory products and miscellaneous residues) representing a total weight of 250 tons. The choice in the type of decommissioning process (use of flask as storage container, compacting, cutting out) as well as the decommissioning circuit retained (internal operation, on COGEMA site, sub-contracting) is based on preliminary characterization of the flasks, the contamination level and spectrum, so that, insofar as possible, the existing resources and processes are used. Up to now, characterization to be performed for 15 CC01 flasks, 3 CC02 flasks, 27 GS flasks, 1 DV flask, gave an internal contamination corresponding to transportation standards ($\alpha < 0.37$ Bq/cm^2, $\beta\gamma < 3.7$ Bq/).

SESSION 7.3

Thermal Analysis