PROCESSING OF LLW ARISING FROM DISMANTLING ACTIVITIES IN A REPROCESSING FACILITY

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ABSTRACT

The Eurochemic reprocessing facility, at the Mol-Dessel site in Belgium, was in active operation from July 1966 until January 1975. In total, about 210 Mg of various types of irradiated nuclear fuels were processed. After the shut-down the plant has been partially decontaminated in view of recommissioning. When the recommissioning option was abandoned, the decision was taken in 1986 to dismantle the plant. A 2 years study resulted in the start of a pilot project: the dismantling of two smaller buildings, previously used for storage of uranyl nitrate and used solvent. The minimisation of radioactive waste generation was also one of the major goals of this project.

The report deals with the different steps in the minimisation of radioactive waste generation during the dismantling activities. First, an estimation of the amounts of radioactive waste, expected to be generated, was made. In a second step the actual waste production during dismantling operations was minimised and compared with the estimations. Finally, a large part of the primary radioactive dismantling waste has been completely decontaminated, resulting in much lower amounts of nuclear waste generated.

SCOPE

The Eurochemic reprocessing facility, at the Mol-Dessel site in Belgium, was constructed in the early sixties (1960-1966). It went in active operation in July 1966. About 180 Mg of low enriched uranium fuels have been reprocessed. Among these fuels 115 Mg were oxide fuels; the remaining quantity consisted of various kinds of test reactor fuels. Additionally, 30.5 Mg of high enriched uranium fuels have been reprocessed. The plant was shut down in January 1975. The shut-down was immediately followed by an extensive rinsing of the reprocessing installations, aiming at the recovery of the remaining fissile material in order to close the material balance. Afterwards, a remote decontamination was performed with so-called soft chemicals, e.g. nitric acid, sodium hydroxide, sodium tartrate, sodium citrate (1). A second decontamination phase consisted of direct interventions in the cells, including the dismantling of plugged lines and obsolete equipment. As a result, the radiation level in the cells could be decreased to an average working level of 200 microSv. The plant remained in these stand-by conditions for about 6 years, in view of recommissioning the plant.

However, the recommissioning option was abandoned later and in 1986 the decision was taken to dismantle the plant. After a 2 years study, a pilot dismantling project was started (2). The aims were to demonstrate dismantling techniques, to train personnel for dismantling works and to verify the estimations made in the study. The pilot project consisted of the dismantling of two smaller storage buildings for uranyl nitrate and for used solvents. In this pilot project, the minimisation of radioactive waste production was one of the main goals. The waste minimisation consisted of three important steps:

- estimation of the amounts of various types of radioactive waste produced;
- minimisation of radioactive waste production duringdismantling operations;
- complete decontamination of a part of the radioactive waste.

This report describes the experience acquired during the execution of this sequence of steps.

WASTE GENERATION AND ESTIMATIONS OF AMOUNTS

The dismantling of reprocessing installations and the decontamination of their cells or buildings generates three main types of radioactive waste :

- the metal waste from the dismantling activities of the chemical processing installations;
- the concrete waste from the decontamination or demolition activities;
- the secondary waste produced during both abovementioned activities.

The estimation of the active metal waste production was mainly based on the total metal inventories of the two storage buildings. These inventories are rather accurate for larger pieces of equipment like vessels, because most of the relevant data are still available. However, the determination of the amounts of pipework and smaller equipment require a somewhat rougher estimation.

The active concrete waste production was partially based on the estimated thicknesses of the contaminated concrete layers to be removed, which were taken different for floors, walls and ceilings. For this part, the waste estimation is mainly based on the history of the cell or buildings, i.e. the products treated, possible accidents,... Another part of the concrete waste was supposed to be generated during demolition works, which were necessary to get easier access to the buildings and/or cells. This concrete waste generation is based on the construction design of the buildings.

The secondary radioactive waste is generated during the intervention activities in the contaminated area's. It mainly consists of burnable solid waste and low active liquid waste.

Since the reprocessing plant still has its own liquid effluent treatment installation for effluents from other waste treatment and conditioning installations, the amount of secondary liquid waste is negligible compared to the total production in the whole plant. The burnable solid waste mainly consists of protective clothing for the personnel and other intervention materials. Before filling into waste drums it is precompacted. Estimations of this type of waste were based on experience from the past.

Table 1 shows the estimations for waste generation, which resulted from these considerations.

ACTUAL DISMANTLING WASTE PRODUCTION

The total amounts of metal waste generated during the dismantling of the installations in the two storage buildings are respectively shown in Fig. 1 and Fig. 2. Compared to the estimated values, both are somewhat higher : 20.3 vs. 18.2 Mg and 26.7 vs. 21.1 Mg or about 10 % and 25 % higher. These differences are partially due to inaccurate estimations. However, in the case of the building 6B, large metal construction parts have been removed during decontamination operations, in order to simplify them.

Fig. 3 shows the the comparison between estimations and real concrete waste generations. Here again the difference for building 6A is about 10 %, while for building 6B an overestimation of about 25% had been made. The reason was that the contamination degree of and thus the

TABLE I

Waste Generation Estimations

	6A	6B	6A/B
Metal waste (Mg)	18.2	21.1	39.3
Concrete waste (Mg)	26.0	58.8	84.5
Secondary waste (m^3)			13.3

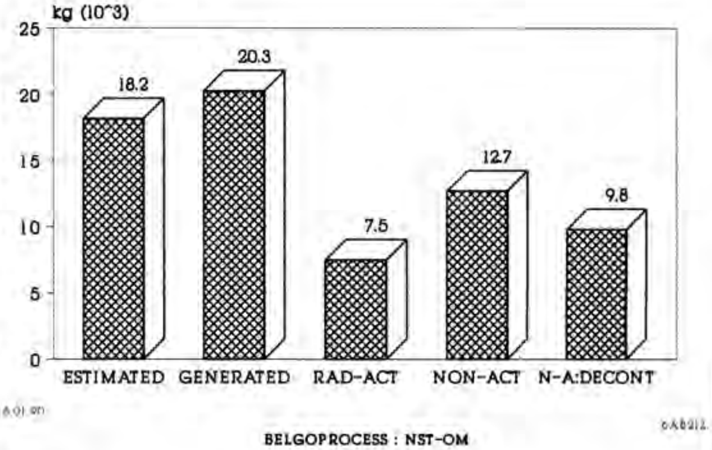

Fig. 1. Dismantling of Blg. 6A Metal Waste Generation.

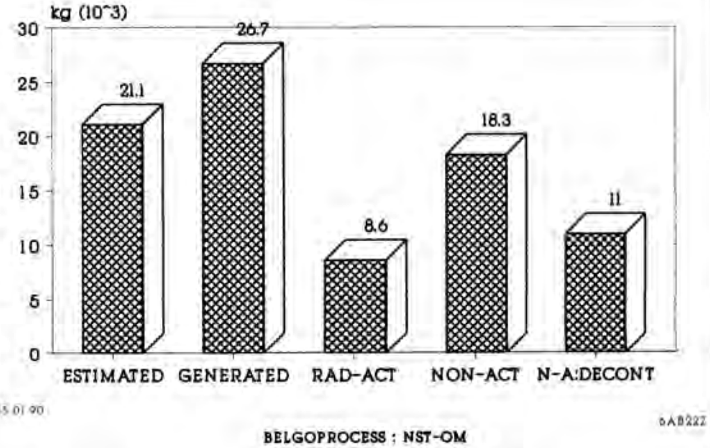

Fig. 2. Dismantling of Blg. 6B Metal Waste Generation.

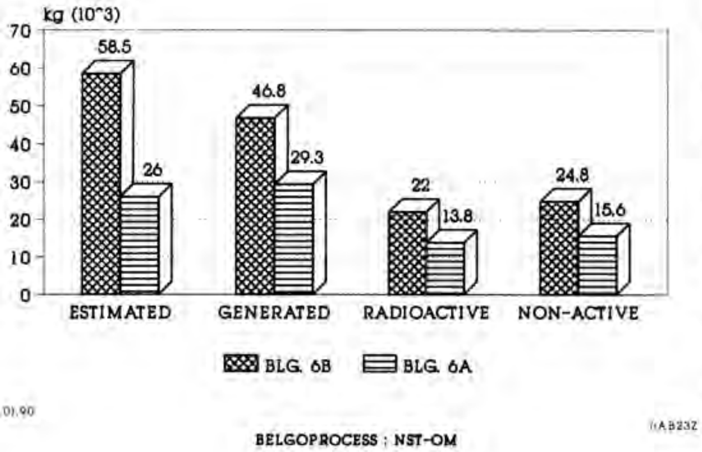

Fig. 3. Dismantling of Blg. 6A/B Concrete Waste Generation.

thickness of the layers to be removed from the different concrete surfaces had been overestimated.

Concerning the burnable secondary waste production, a considerable underestimation had been made : 17.1 m^3 generated vs. 13.3 m^3 estimated. A reasonable explanation herefore, at least partially, is the fact that all the work had been carried out by new, inexperienced operators. Table II summarizes the comparison between waste estimations and waste generations.

DECONTAMINATION OF ACTIVE DISMANTLING WASTE

Also shown in Figs. 1-3 is the fact that not all of the waste generated is radioactive waste. From the metal waste, only about 30 % is active : respectively 7.5 of 20.3 Mg and 8.6 of 26.7 Mg. Furthermore, a large part of the inactive waste has been obtained by decontamination of active waste, respectively 9.8 Mg and 11.0 Mg. Decontamination was performed chemically both by rinsing with nitric acid and sodium hydroxide solutions and by treatment with HF-containing pastes. Decontamination is especially feasible

TABLE II
Waste estimations vs. waste generation

	6A	6B	6A/B
Metal: * estimated	18.2	21.1	39.3
(Mg)* generated	20.3	26.7	47.0
Concrete: * estimated	26.0	58.5	84.5
(Mg)* generated	29.3	46.8	76.1
Burnable: * estimated			13.3

with larger vessels, but it has to be mentioned that also the history of the vessel is an important factor in the feasibility.

Figure 3 again shows that more than 50 % of the concrete waste was also non-active waste. This could be obtained by carefully performing the decontamination operations. Decontamination of wall surfaces before removing large blocks for making new entrances also contributed to this favorable figure of 50 %. These concrete decontamination works have been carried out mechanically, e.g. by scabbling or pneumatic drilling. For both metal and concrete decontamination, the remaining contamination levels were lower than 0.4 Bq/cm^2 for beta-gamma and lower than 0.04 bq/cm^2 for alpha emitters.

CONCLUSIONS

The production of dismantling waste is generally somewhat underestimated, with an average of about 10%. However, taking into account that this concerned a pilot project, this figure can be considered as reasonable.

The dismantling practice learned that, by carefully working, the amount of radioactive waste generated can be reduced to a large extent.

Moreover, by applying the proper decontamination techniques for both metal and concrete, the amounts of inactive dismantling waste can even be further increased.

REFERENCES

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