

# INSTITUTIONAL RADIOACTIVE WASTE MANAGEMENT IN THE NUCLEAR RESEARCH INSTITUTE REZ PLC

Kovařík P., Svoboda K., Podlaha J.

*Ústav jaderného výzkumu Řež a.s.,*



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Nuclear research institute Rez, plc. (mentioned below as NRI) has had a dominant position in the area of the nuclear research and development in the Czech Republic, the Central and the Eastern Europe. Naturally, the radioactive waste management is an integral part of the nuclear industry, research and development. For that reason, there is Centre of the radioactive waste management (mentioned below as Centre) in the NRI. This Centre is engaged in the radioactive waste treatment, decontamination, characterisation, decommissioning and other relevant activities.

This paper describes the system of, technology for, and other information about institutional radioactive waste management in the NRI.

## A) INTRODUCTION

The NRI is a leading institution in the area of nuclear R&D in the Czech Republic. The NRI has had a dominant position in the nuclear programme, since it was established in 1955 as a state-owned research organization, and it has developed to its current status. In December 1992, the NRI has been transformed into a joint-stock company.

The NRI's activity encompasses nuclear physics, chemistry, nuclear power, experiments at the research reactor, and many other topics. In the past decades, the main issues addressed in the NRI were concentrated on the research, development and services provided to the nuclear power plants operating the WWER reactors, the development of chemical technologies for a fuel cycle and an irradiation services for industrial sector, agriculture, food processing and medicine.

Currently, the research activities are mainly targeted to assist the State Office for Nuclear Safety (SÚJB) – the national nuclear safety regulating body, Czech power plant operator (ČEZ a.s.) and nuclear facilities contractors. Significant attention is also paid to the use of nuclear technology outside the nuclear power sector, providing a wide range of services to industry, medicine and the preparation of radiopharmaceuticals.

NRI operates two research nuclear reactors and another facilities such as a hot cell facility, research laboratories, technology for radioactive waste (RAW) management, <sup>60</sup>Co irradiators, an electron accelerator, etc.

## B) CENTRE OF RAW MANAGEMENT

The Centre is an integral part of the system of management of institutional RAW (RAW from research, industry and hospitals) in the Czech Republic. The Centre ensures the management of the major part of institutional RAW produced in the Czech Republic, providing complex services, i.e. the taking-over of RAW, characterization, storage, treatment and conditioning into a form allowing the disposal into the repository for RAW. The technology for RAW management was subjected to an extensive modernization at the end of last century, 80s and beginning of 90s. After 2000, the NRI became practically exclusive processor of the institutional type of RAW.

The Centre operates the evaporation facility for processing of liquid RAW, the Fragmentation and decontamination facility, the pressure compactor for compacting of solid RAW, and the cementation facility. The Centre also provides the storage of the spent fuel (mentioned below as SF) from the research nuclear reactor (LVR-15) operation.

The research and development laboratories form the integral parts of the Centre. Laboratory of RAW characterization performs the radiological characterization of RAW and develops new procedures for this activity. The Laboratory is equipped with the gamma scanner for nondestructive characterization of the radiological composition of 200 l drums with the conditioned RAW and the radiography instrument. The Laboratory is a member of the European Network for Checking Quality of Radioactive Waste Packages.

The Laboratory of decontamination is focused on the research of the contamination processes and the development of decontamination methods for the needs of Centre, as well as that of another institutions. R&D on decontamination has been carried out in the NRI since its foundation, first – on laboratory equipment decontamination, later on – on decontamination of A-1 decommissioned equipment. The laboratory also serves as a supporting R&D base for newly installed modern decontamination technologies.

**Figure 1) Typical institutional RAW**



## **C) FACILITIES FOR RAW MANAGEMENT**

The Centre is equipped with facilities necessary for providing complex services in the field of RAW management, decontamination and SF management.

### **1. High-level waste store**

The High-level waste store serves for storage of RAW and SF from the LVR-15 research nuclear reactor operation. The facility was built in 1981 – 1988. Subsequently, modifications were made to meet SÚJB requirements. The facility construction was completed in 1995. Its trial operation started in 1995 and since 1997 the facility has been in permanent operation.

The store is constructed as a hall. The lower part of the hall is made of reinforced concrete monolith to the height of 5.65 m, and the upper part is constructed as a prefabricated hall.

There are 2 pools for storage of IRT-2M spent fuel, and boxes for storage of high-level radioactive waste. The total capacity of the store is 1410 m<sup>3</sup>.

## 2. Fragmentation and decontamination facility

The Fragmentation and decontamination facility is designed for the safe processing of solid RAW. After its acceptance, RAW is separated according to its composition and contamination, and then the operations of fragmentation and decontamination follow. The effort is focused on minimizing the amount of material needed to be disposed and the production of secondary wastes needed to be treated. The goal is maximum unrestricted release of decontaminated materials. The facility consists of 4 parts:

- 1) Manipulation area – serves for manipulation with contaminated objects before processing.
- 2) Dismantling box – serves for basic characterization and dismantling.
- 3) Fragmentation box – serves for fragmentation of contaminated objects.
- 4) Decontamination box – serves for decontamination of fragmented parts.

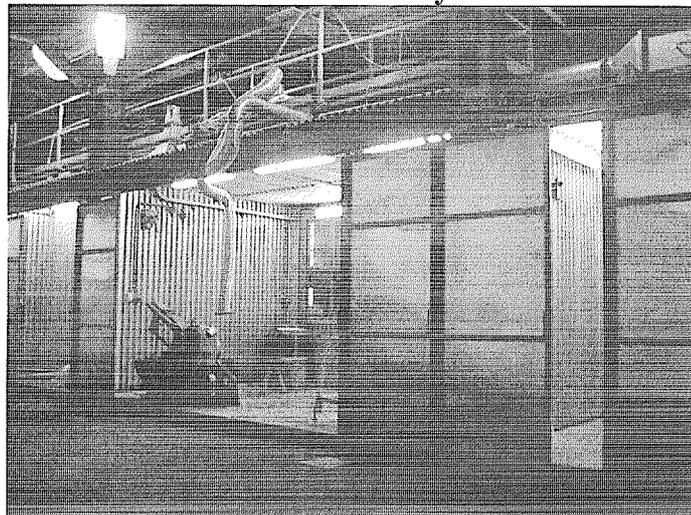
All boxes are equipped with adjustable closing doors and removable roof. The overhead cranes and forklift truck serve for manipulation. The facility is equipped with a ventilation system; the fragmentation box and the manipulation area are equipped with additional local ventilation system. The facility is equipped with the system for drainage of spent decontamination solutions.

The list of methods used for fragmentation and decontamination is provided in Table I.

**Table I. List of methods used for fragmentation and decontamination**

Fragmentation	Decontamination
Power hydraulic shears	Vacuuming (vacuum cleaner with HEPA filter)
Mechanical saw	High-pressure water jet
Abrasive cutting wheel	Chemical decontamination
Oxy acetylene cutting	Foam decontamination
Plasma arc cutting	Ultrasonic decontamination in a special bath
In-situ mechanical milling	Dry ice blasting

**Figure 2) Fragmentation and decontamination facility**

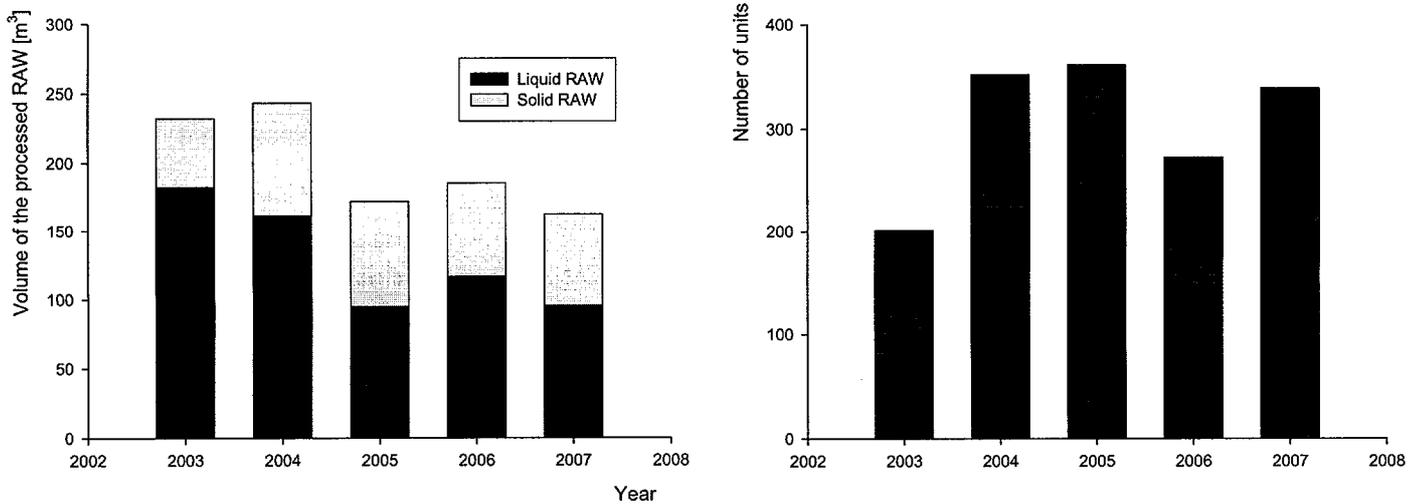


### 3. Another equipment for RAW processing

The evaporation unit is used for treatment of aqueous liquid RAW. The decontamination factor is about  $10^3$  and the condensate can be discharged into the environment after measurements. The concentrate is cemented into 200 l drums by means of a batch-type cementation unit. The processing of compactable solid RAW consists of in-drum, low pressure compaction (into 100 l drums) and embedding of the 100 l drum within a 200 l drum with concrete.

### D) STATISTICAL EVALUATION OF THE CENTRE ACTIVITY

**Figure 3) Amount of processed RAW in the Centre within the years 2003 – 2007 (left) and number of units with conditioned RAW transported to national repository within the years 2003 – 2007 (right).**



### D) CONCLUSION

The radioactive waste management has to be safe, transparent, and environmental friendly as much as possible. The Centre of the radioactive waste management tries everyday to change these courageous words into the reality.