

Waste Generated in a Hotlab

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a General View

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ABSTRACT

The hot laboratory at PSI generates a variety of different waste streams. A short overview about the wastes generated there and their handling and conditioning is presented. The close collaboration is of special importance between the waste producer (i.e. the Hotlab) and the waste treatment unit.

1. Introduction

The Paul Scherrer Institute (PSI) is the largest national research centre in Switzerland. Its multidisciplinary research is dedicated to natural science and technology, i.e. solid state physics and materials sciences, life sciences, elementary particle physics, nuclear and non-nuclear energy research and energy-related ecology. PSI is the centre of a national and international collaboration with universities, industry and other research centres. PSI's priorities lie in the development and operation of complex research installations which are beyond the possibilities of single university departments.

PSI operates facilities dedicated to research in nuclear fields and uses nuclear methods in materials and life sciences.

The hot laboratory at PSI is dedicated to PIE experiments in cooperation with Swiss nuclear power plants and it runs a fuel analysis programs. In addition it supports research projects of other PSI units with respect to highly activated and α -containing components. The PSI hot laboratory provides services for Swiss costumers from non-power producing activities too.

These inevitably produce radioactive wastes which have to be treated, stored and eventually disposed of. In contrast to other waste producers waste from the hot laboratory typically contains α -emitters in varying concentrations as well as fission products. In close cooperation with the Dismantling and Waste Treatment Section at PSI these wastes have to be conditioned for interim storage and final disposal.

2. Legal Basis

Basic principles are laid down in the Radiation Protection Act and the Radiation Protection Ordinance. The Radiation Protection Act demands to minimize radioactive waste and states that radioactive waste has to be disposed of inside the country. The waste producer is responsible for the cost. The Radiation Protection Ordinance demands in addition a book keeping of waste. It regulates the option of decay storage and demands the collection of radioactive waste by the PSI. The responsible authorities are listed and the Federal Nuclear Safety Inspectorate (ENSI) is defined as authority for nuclear installations.

In addition, the Nuclear Energy Act defines waste treatment installations as nuclear installations and states that waste after being collected by PSI is subject to this law. The Nuclear Energy Ordinance demands that conditioning of radioactive waste needs an approval by the responsible authority (ENSI).

ENSI organizes its tasks in guidelines. Among others there are two guidelines of special importance, one describing the demands for conditioning of radioactive waste (named B05) and the other organizing the storage of radioactive waste with special emphasis on interim storage. One important issue is that radioactive waste has to be solidified preferably in cement/concrete. Pressure strength of this matrix has to be well above 10 MPa and the leaching rate has to stay below an experience value. Waste has to be described in detail in a specification with respect to its material and nuclide composition, production procedure and construction of the waste package. The final waste package has to fulfil the international transportation rules (ADR) and shall also fulfil the demands of an interim storage and the final disposal.

This specification is the basis to apply at the final disposer (NAGRA) for a certificate for final disposal. Based on that certificate and the specification the ENSI approves the production procedure. After having received this approval waste packages are allowed to be produced.

To comply with above described procedure the Dismantling and Waste Management Section at PSI runs a quality assurance system according to ISO/IEC 17020 and EN/ISO 9001.

3. The Hotlab Waste Procedure

Radioactive waste in the PSI Hotlab is generated as a result of general fuel related activities as post irradiation investigations (PIE), fuel development programs, special investigation using the Hotlab equipment (f.i. MEGAPIE) and operational waste as burnable and compactable waste, bulky goods and aqueous waste. Figure 1 presents a view into a hot cell with an installation to solidify aqueous waste containing conc. HNO_3 . Fuel containing waste is checked in the Hotlab by a segmented gamma-scanner and the nuclide vector is calculated based on the Cs-137 value.

Pu-containing waste is surveyed and its amount controlled by the IAEA.

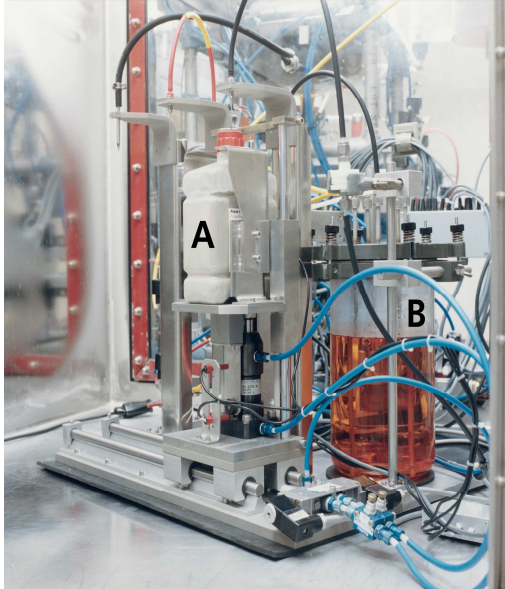


Fig.1 Solidification, of aqueous waste containing conc. HNO_3
A: special cement
B: waste solution

According to its properties, the waste is sorted by the waste producer (Hotlab) and declared on coloured cards containing the relevant information. The colour code reflects the nuclear and chemical properties of the waste. Fig 2 shows examples. The declared and packed waste is stored in the Hotlab facility until it is handed over to the Dismantling and Waste Management Section of PSI. There, the waste is conditioned and stored in the federal interim storage facility at PSI.

Fig 2 The Hotlab waste declaration cards

4. Waste Treatment facility

As part of the Dismantling and Waste Management Section at PSI a Waste Treatment Facility is operated (1). There the waste can be sorted according to the declaration of the waste producer. Burnable waste is separated and prepared for the incineration at nearby plasma furnace run by ZWILAG (the interim storage facility of the Swiss nuclear power plants). Homogeneously miscible waste is solidified with cement. Irregular waste is embedded in concrete using 200-l-drums or 20-t-concrete containers. Compactable waste is pressed by a 120-t press to be conditioned in 200-l-drums. There is also the possibility to decontaminate waste with respect to its free release. This is an important measure to reduce the volume of radioactive waste. Figure 3 gives an impression about the dismantling of bulky goods from the Hotlab.



Fig. 3 The metallography box from the Hotlab to be dismantled

Radioactive waste prepared in the Hotlab according to table 1 is delivered to the Waste Treatment Facility either as raw waste or as preconditioned waste to be finally conditioned.

Waste stream	Characteristics	Path	Colour Code
Burnable	< 30 kBq Pu-isotopes < 30 μ Sv/h, halogens to be separated in transparent waste packs	Incineration	blue
Compactable	< 30 μ Sv/h, dose rate < 2 mSv/h	120 t press	orange
contains Pu (2)	dose rate < 50 mSv/h in 20-l-drums	compacted	yellow: non irradiated, orange: irradiated
PIE	50 mSv/h < dose rate collected in hotcells	compacted in steel cans, stored in concrete containers	gray
Aqueous (3)	HNO ₃ -containing, Pu-isotopes, Am-241, fission products	solidified in special concrete	pink
Special Waste	Unique research programs	dedicated treatment	

Table 1 Overview about the Hotlab waste streams

5. Interim Storage

After hardening of the cement matrix and the final closure of the waste package the overall weight is determined and the dose rates as well as the spectra of gamma-emitters are measured. The guaranteed values given by the specification are finally checked. The data are transferred to the waste data base (4) and the waste package will be stored in the Federal Interim Storage Facility (BZL, Fig. 4) awaiting a future final repository.



Fig. 4 View into the Federal Interim Storage Facility

6. Final Remark

The Hotlab at PSI generates different waste streams from research, development and services. Very often, the wastes bear a combination of chemical hazards and radiotoxicity. These wastes are sorted according to an established system. They are conditioned in a close cooperation between waste producers and waste managers with different interests concerning their goals. Whereas the researchers are interested in rather short term scientific results rather than waste description, the waste managers have to guarantee a long term safety of their waste products.

7. Literature

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