EXPERIENCE IN THE UPGRADING OF RADIOACTIVE WASTE DISPOSAL FACILITY «EKORES»

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The national Belarus radioactive waste disposal facility "Ekores", designed for radioactive waste from nuclear applications in industry, medicine and research was started in 1964. It is a typical RADON-type facility, located in the neighbourhood of Minsk (2 mln. people) which is the only one in this country. Currently 12 -20 tons of waste and over 6 000 various types spent sources annually come to the "Ekores" for being disposed of. Total activity of the waste in vaults is evaluated as 352,8 TBq. Approximately 150,000 spent sources disposed of in the vaults and in the wells have total activity about 1327 TBq.

In 1997 the Government initiated the project for the facility reconstruction in order to upgrade radiological safety of the site by creating adequate safety conditions for managing and storage of the waste. The reconstruction project developed by Belarus specialists was reviewed by experts of the IAEA. This covers modernising technologies for new coming wastes and also that the wastes currently disposed in the pits are retrieved, sorted and treated in the same way as new coming wastes.

1. OUTLINE OF EXISTING "EKORES" FACILITY

First Generation Radioactive Waste Storage Facility

This historic waste storage facility was originally commissioned in 1964 and comprised 2 concrete lined trenches, up to 4 meters deep. A variety of solid radioactive waste (including sealed sources containing short-lived and long-lived radionuclides) was placed in these trenches. The solid waste was not segregated in the different waste types or conditioned.

The trenches were filled with waste between 1964 and 1977. In 1977 the trenches were closed. Concrete slabs were placed on top of the trenches and these were covered by a layer of bitumen and by a mounded layer of soil. Today the mounds over the trenches can be seen with local vegetation growing on them.

Second Generation Radioactive Waste Storage Facility

In the late 1970's a second waste storage facility was constructed and put into operation. This comprised 2 below surface, reinforced concrete vaults. Each vault was covered by a lightly constructed building to provide environmental protection and acceptable working conditions to operate the facility throughout the year. Each vault has a storage capacity of 830 m^3 and is divided into 8 cells. In addition, at one end of each vault there are a pair of so-called «wells»for spent source storage.

Each of the cells is covered by a concrete slab. When a storage cell is considered to be full, free space at the top of the cell is to be filled with sand and a concrete grout. The properties of the cement used to cover the waste are not known, therefore it is difficult to predict its behavior after it was added to the storage cell.

One of the concrete vault storages is full to capacity. The concrete slabs over the storage cells have been covered with a layer of asphalt, thus preventing further access to the cells. The currently used storage vault is around 45% full.

It should be noted that in 1989, irradiated fuel from the nearby research reactor was placed in one of the cells in this storage vault. This comprises around 2kg of ' U in 10 purpose-built stainless steel containers. These containers are sealed, however, the surface dose rate is between 5.4 and 36 mSv/hr.

Disposal of Sealed Spent Source

The wells for spent source disposal are located approximately 3m from the edge of the solid waste pit. They are loaded through an S-shape tube, 108 mm in diameter. One of the wells is assigned for gamma, betta source storage, another for neutron sources and a third for cobalt sources. The fourth well was blocked accidentally a number of years ago and has subsequently not been used.

Until 1995, disposal of waste at the 'Ekores' facility was conducted without any waste segregation and processing. Now wastes containing ^{239}Pu, ^{241}Am, ^{226}Ra are stored separately in special containers.

Record-Keeping

As for record-keeping the special note-books have the following data for a batch of incoming waste:

•type of waste (material or spent source),

•radionuclides

•original activity

•weight

In 1999 all the available data were entered into a computer-based data management system implemented at the Ekores. In this system each waste batch is programmed to have the following characteristics:

•waste item No

•date of receive

•owner, last user of the source

•description and special hazards

•radionuclides

•original activity/date

•disposal/storage location

The accounting system contributed very much to evaluation of a potential danger from the Ekores repositories. The assessments made by the specialists of the Institute of Radioekological Problems, show that within the sanitary-protection area the concentrations of the radioisotopes C-14, Cl-36,Co-60,H-3,Pu-239,Ra-226,Sr-90,U-235 may exceed their permissible values for drinking water. It has been concluded that in it's present condition Ekores can be considered as a source of a potential hazard for public and the environment. At the same time the facility has almost been drained of its capacity.

To improve the situation a project for the Ekores facility reconstruction has been launched.

2. OUTLINE OF STRATEGY FOR EKORES FACILITY RECONSTRUCTION

The reconstruction conception is that **all** the wastes at the Ekores facility are identified, packaged and labelled to be sure that the waste storage conditions meet safety requirements. This also gives more flexible possibility to relocate the waste to a new disposal repository after it is constructed (the plan is over 20 years).

The first task of Ekores reconstruction is to implement the advanced technology for waste managing. This is being realised within the framework of IAEA Technical Co-operation Projects BYE/004/02 over the period 1997 - 2000. The first reconstruction stage covers also expanding the capacity of Ekores site.

The radioactive waste management strategy which follows from this project is shown as a scheme in the Figure 1. Three new buildings are planed to be constructed: waste sorting, treatment and packaging building A, new spent source storage building B, new drum storage building C. A site drainage system, decontamination centre, new laundry, laboratory and administrative block are included into the project to be realised in 2000-2003.

The proposed waste management strategy is applied to waste arisings over the next 20 years. It splits the wastes into three categories: liquid radioactive waste, solid radioactive waste and spent sources.

Liquid Radioactive Waste

There are no current stocks of liquid radioactive wastes (LRW) at "Ekores". Small amounts of very low level LRW which are produced from the present laundry and decontamination centre are sampled and discharged under current authorisation.

Future LRW is expected to arise from five separate sources. These are:

- from waste producers outside the "Ekores" site;
- from the new laundry to be constructed at the "Ekores" site;
- from the new decontamination centre to be constructed at the "Ekores" site;
- from the new drainage facilities to be constructed at the "Ekores" site;
- from waste retrieval and sorting operations at the "Ekores" site.

The left-hand side of the Figure 1 shows the proposed route for LRW from external waste producers. Wastes will be transferred to new building **A**, sampled, conditioned to pH7 (if required) then treated with a biological agent prior in order to remove surface-active agents (soaps). These wastes will then be physically mixed with cement and allowed to set in a 200 litre drum. The 200 litre drum containing cemented LRW will then be moved to new building **C** for storage.

LRW produced by the new laundry will be consigned to a holding tank where the LRW will be sampled. Depending on the sample results, the LRW will then be either discharged under authorisation as very low level LRW, or will be consigned to new building **A** to be treated as described above. It is assumed that LRW from the other sources will be treated in the same way as the above mentioned two.

Solid Radioactive Waste

Future SRW requiring treatment and storage at the site will arise from two sources: new coming wastes and SRW which will arise from waste retrieval operations. It is proposed to sort all SRW into two separate streams : compactible SRW and non-compactible SRW.

Compactible wastes will be placed into mild steel 200 litre drums, and each drum compacted, capped with grout and consigned for storage in the new building C.

Non-compactible wastes will be placed into a 200 litre drum during sorting then directly grouted in place and consigned for storage.

SRW stored in the current pits are to be retrieved and sorted as it is adopted for new coming SRW.

As for fissile material which is known to be present in the pits, it is proposed that retrieval operations remove the intact containers and transport them to an approved fissile material storage facility. It is expected to obtain the services of international (IAEA) experts to make safety assessment and to develop a detailed plan for appropriate management of this kind waste.

The packages of treated SRW will be temporarily placed in approved storage until the pit is empty. The surface of the pit should then be decontaminated, monitored and then subjected to a structural survey. If the pit is assessed to be suitable for continued use, then it should be modified to the same standard as new building **C**. On completion of modifications, the pit should be used for storage of the drums of cemented SRW.

It is considered that once SRW is recovered from the more modern pits, there will then be a requirement to undertake a similar exercise with the pits, closed in 1977, as this will have been shown to be the best practice.

Spent Sources

There are now no plans to remove the spent sources currently stored at the S-shaped wells at the «Ekores» facility. In August of this year the IAEA expert team mission under above mentioned Technical Cooperation project (BYE/004/02) was carried out to assess the situation with the existing wells, in particular those containing long lived and radon-emitting sources. The recommendation of mission team was to condition sources in the wells into metal matrices directly in the underground reservoirs, using Russian technology. The technology was developed by Russian Association «RADON» in the mid of 80-s and since then has been used in a number of facilities of the former Soviet Union [1]. Special mobile equipment was constructed for the purpose of conditioning «in situ». It is considered that the technology should be implemented at the Ekores in order to ensure safe conditions for spent sealed sources in well type repositories.

The strategy for new coming sources is to separate sources into different types, then to store them within ***a retrievable*** source storages.

Sources with half-lives less than approximately 30 years, which include mainly Co-60, Cs-137 and Sr-90/Y-90 are planed to be disposed of within wells of a similar design to the existing ones, using the Russian technological scheme (low melting metallic matrices). However the design of new wells provides for collapsing their upper parts in a way that a retrieval of underground reservoir (which will be in a form of an entire metal block) could be easily realized. Completely filled reservoir is intended to have weight about 2.2 ton, so standard crane mechanism could be used for retrieval.

Sources with very long half-lives, much greater than 30 years consist mainly of "smoke detector" type sources, containing Pu-239, Am-241, both can be handled without beta/gamma shielding. Current sources of this type are temporarily stored at the "Ekores" site above ground, awaiting the construction of new facilities. The reconstruction project proposes to construct special store facilities for these sources.

References

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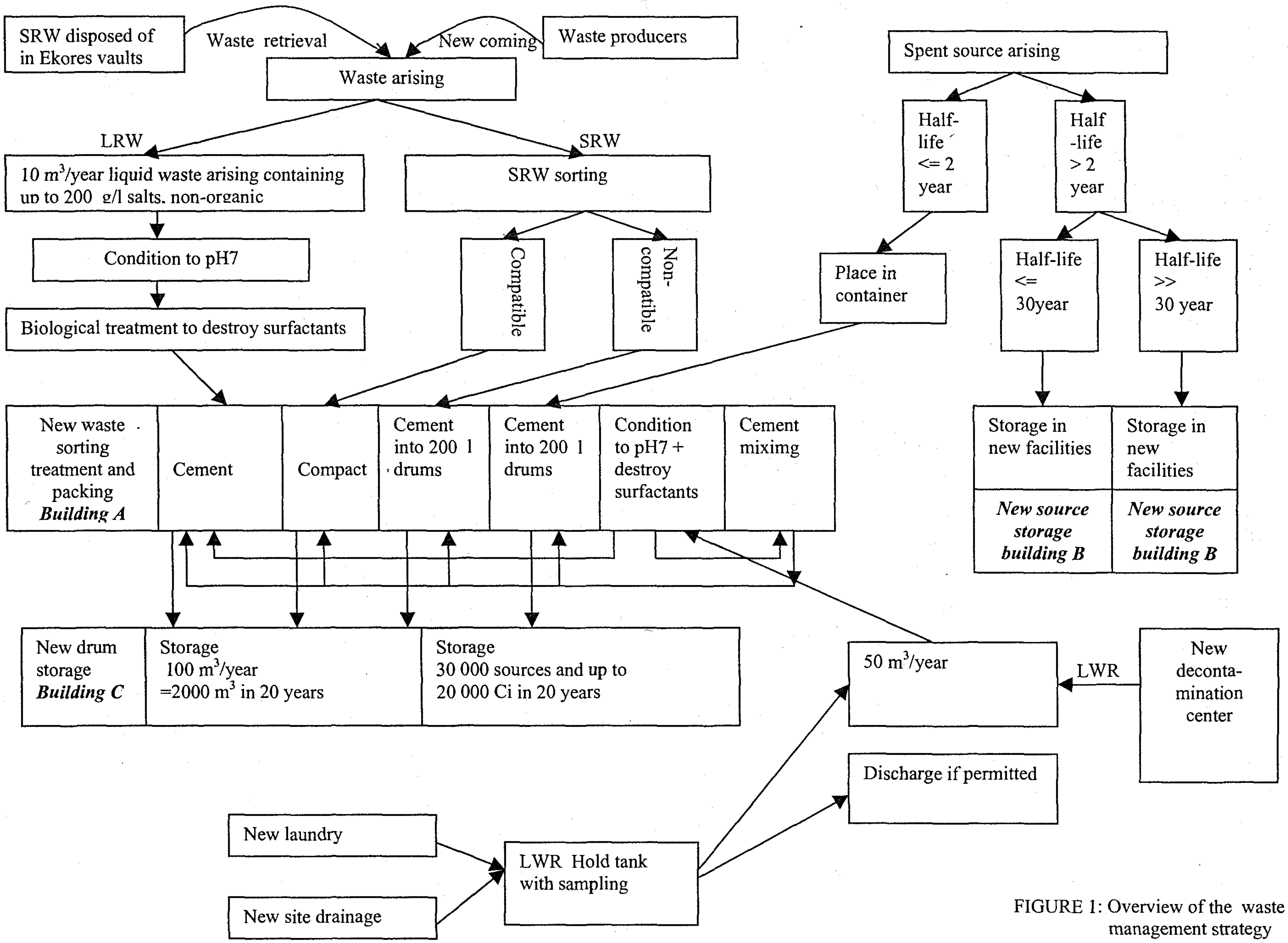

FIGURE 1: Overview of the waste management strategy