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STORAGE OF LOW-LEVEL RADIOACTIVE WASTE AND REGULATORY CONTROL OF SEALED SOURCES IN FINLAND

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Introduction

Regulatory control of radioactive sources in Finland is based on national radiation safety legislation, considering internationally recognised recommendations on radiation safety. The legislation has been evolving ever since the very first Radiation Act of 1957. The latest major revision of the Act, also paying attention to the ICRP 1990 recommendations, took effect in 1992.

Finland became a Member of the European Union in 1995 and since then the legislation has evolved under the EURATOM framework. The latest step of this development was the implementation of the HASS Directive (1) into national legislation by December 31, 2005. At the same time, also the IAEA Code of Conduct Import/Export Guidance was considered.

In addition to the above, certain other new provisions taking effect from the beginning of 2006 were introduced to the Radiation Act. One of the most important was that STUK was defined as the responsible party for operating the national long-term storage for small user low-level waste. This was an outcome of thorough considerations including other possible solutions which, however, finally all failed to the fact that the overall volume of small user waste in Finland is so minor that setting up such operations on a commercial basis is practically impossible.

Within STUK, the regulatory functions and activities related to handling and storage of radioactive waste are strictly separated from each other by organisational arrangements. All regulatory functions, including preparation of regulations, authorisation, inspection and enforcement, are assigned to the Radiation Practices Regulation Department, whereas the activities on handling and storage of waste is the task of the Department of Research and Environmental Surveillance. In addition, the internal description of duties at STUK defines the Radiation Practice Regulation Department responsible for the regulatory control of the use of radiation in other departments at STUK in a manner consistent to any licensee with similar activities.

Regulation of low-level radioactive waste

The waste produced by nuclear power plants is subject to the Nuclear Energy Act. The waste arising from the use of radiation, i.e. non-nuclear radioactive waste, is regulated by the Radiation Act, its subsequent legislation (Radiation Decree) and the regulatory guides (ST-guides issued by STUK under the authorisation provided by the Act). These main two categories can be divided into sub-groups according to the final destination of the waste as shown in figure 1. This paper is concentrated on the non-nuclear low-level radioactive waste.

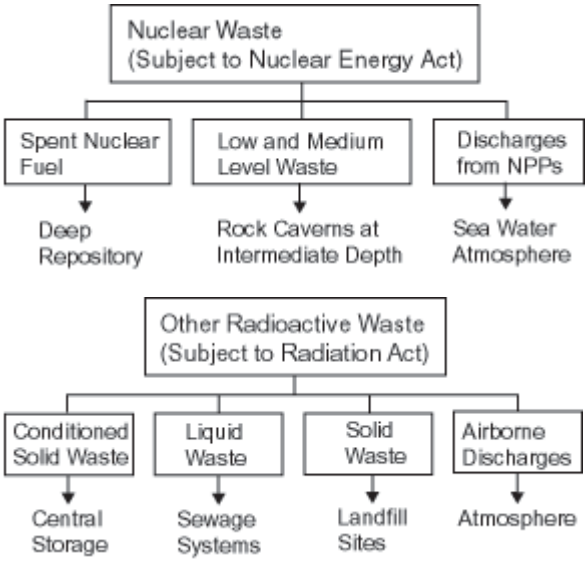

Figure 1. Classification of radioactive waste for disposal purposes

As defined in the Radiation Act, radioactive sources that have no use and must be rendered harmless owing to their radioactivity are radioactive waste. The licensee is required to take all the measures needed to render harmless radioactive wastes arising from its operations. Should the licensee not meet the requirements, or if the origin of the waste is unknown, the State has a secondary obligation to render the radioactive waste harmless. The expression rendering radioactive waste harmless shall refer to any measure needed to treat, isolate or dispose of the waste, or to restrict its use so that it does not endanger human health or the environment.

For small user waste from medical use, research and industry, activity limits for disposal in landfill or sewage system are provided in the Guide ST 6.2. According to the guide liquid waste can be disposed of into a sewage system and solid waste can be delivered to a landfill site or an incineration plant if the activities are below the nuclide-specific limits based on the Annual Limit on Intake values. The upper level of radioactivity for a sealed source eligible to be treated as solid waste and within these activity limits is 100 kBq. Sealed sources with higher radionuclide content and other radioactive waste exceeding the limits have to be delivered to a facility authorised by STUK for long-term storage or disposal.

National long-term storage

Since 1973 it has been possible to deliver low-level disused sealed sources to STUK against a waste management fee. The interim storage facility was until 1997 situated at a closely guarded site in Helsinki. The nuclear power plant company Teollisuuden Voima (TVO) has leased to the State a cavern in the LILW disposal facility in Olkiluoto for interim storage of non-nuclear radioactive waste. Since 1997 STUK maintains this national storage facility at the Olkiluoto nuclear power plant site for solid non-nuclear radioactive low-level waste awaiting the final disposal. The facility is adjacent to the intermediate and low-level nuclear waste repository at the Olkiluoto site forming a separate part of the Olkiluoto repository. This part has been reconstructed for housing low-level waste and leased to the State. The agreement between the nuclear power plant company TVO and the State also includes the final disposal, the details of which are to be specified later. It has so far been agreed that the total volume of waste, when packed for final disposal, cannot exceed 100 m^3.

Sealed disused and orphan sources are collected to the Radiation Hygiene laboratory in the Department of Research and Environmental Surveillance at STUK for further transport to the interim storage in Olkiluoto. To keep the volume and weight suitable for storage, most of the small user waste delivered to STUK is repacked before transfer to the interim storage. Figure 2 shows a waste drum and a transport container ready for transport to Olkiluoto. The aim is not to store unnecessarily heavy shielding nor increase the volume. At the interim storage the waste packages are loaded into 5m^3 concrete containers. The maximum weight is 5 tons per container.

Figure 2. Two types of transport containers.

The inventory in the end of 2004 showed that there was 47.7 m^3 and 24,7 TBq of waste in the interim storage for state-owned waste in Olkiluoto and 0.5 m^3 and 0.05 TBq in the storage room at STUK, respectively. The mean volume of waste received per year is estimated to be 1 m^3. In 2004, 59 batches comprising 160 packages of waste were delivered to STUK's premises in Helsinki. Table 1 gives an overview of radioactive small user waste received for interim storage in 2001 - 2003.

The annual fee for holding a licence depends on the number of sources the licensee possesses and therefore there is some financial incentive to transfer the disused sources back to the provider (and thereof to the manufacturer) or to the central storage managed by the State. In 2002, STUK initiated a campaign to encourage the licensees to assess the actual future needs for the stored sources and required to transfer all sources for which no future use was foreseen. As a result, over 200 sources were transferred to the national long-term storage or back to the provider or manufacturer.

Table 1. Small user low-level waste delivered to the interim storage of STUK 2001-2003.

Radionuclide	Activity (GBq) or mass (kg)		
	2001	**2002**	**2003**
H-3	355	148	4,0
Co-60	6,7	31,7	4,2
Ni-63	3,2	0,33	3,0
Kr-85	112	351	79
Sr-90			0,4
Cs-137	114	679	220
Pm-147	12	61	14
Ra-226	0,7	0,01	0,3
U-238	5 kg	160 kg	10 kg
Am-241	161	84,5	68
Cm-244			29
Pu-238		258	1,0

Regulatory control of sources

All practices with radioactive sources are subject to prior authorisation which is granted by STUK on written application. General conditions for granting a licence are laid down in the Radiation Act and the licensing procedure is prescribed in more detail in the Radiation Decree. The applicant shall provide STUK various information, depending on the nature and extent of the practice. These include:

- a description of the user's organisation defining responsibilities related to radiation protection and safety as well as competences of the involved personnel,
- places where radioactive sources are utilised,
- protective and safety systems to be used,
- systems for monitoring radiation exposure,
- plans for rendering harmless disused sources and other radioactive waste,
- any other information concerning arrangements ensuring radiation safety.

For practices involving high activity sealed sources, more stringent requirements in accordance with the HASS directive (1) entered into force from the beginning of 2006. These include the requirement to provide a financial security for the safe management of the source. This requirement is applied to sources whose activity is greater than 100 times the activity level prescribed in the HASS Directive and the half-life is greater than 150 days.

The name of the radiation safety officer responsible for the safe use of radiation shall be included in the description of the organisation. The officer shall have undergone radiation safety training, including a qualifying examination acceptable to STUK.

All premises where radioactive sources are utilised are inspected by STUK regularly, every 1–5 years, depending on the type and extent of the practice. The main objective of an inspection is to validate that radioactive sources are used safely and in accordance with the legislation and conditions set in the licence. Among other verifications, the inspector shall locate and identify every sealed source. Any discrepancies found in the licensing information concerning placing of sources, new sources and sources taken out of use, are recorded for amending the licence correspondingly.

Licensing information is stored in a database maintained by STUK, including also source-specific information on all sealed radioactive sources in the licensee's possession. Source-specific information is updated continuously according to licensees' notifications and observations made during inspections. Statistics on the licenses, uses, devices and sources, disused sources, as well as imports and exports, are published regularly in Annual STUK Reports on Radiation Practices.

Orphan sources

The cornerstone for maintaining radioactive sources under control in Finland is that that all practices involving sources are subject to authorisation and all licensing information, including information on each individual source, are entered into a register which is continuously updated based on applications and notifications received from the licensees. The correctness of the data is being continuously validated by regular inspections at the places of use as well as other means, such as the comparison of information received from various sources (especially suppliers). The licensing system has been in operation since 1957 but the source-specific information was inserted into the database only since the beginning of 1980's. Therefore, the likelihood of having lost control over sources was much higher some twenty years ago or earlier than today.

The Finnish Customs and the metal recycling industry intensified significantly the radiation monitoring of scrap metal after the Chernobyl accident and due to a rapid increase in import of scrap metals from the former Eastern bloc countries in the early 1990's. Fixed monitors for vehicles and railway traffic have been installed to all major crossing points at the Finnish - Russian border and at Helsinki harbour. Other crossing points have hand-held monitors at their disposal. All important users of scrap metal have installed fixed monitors at the gates of their installations.

In addition, STUK has provided information to scrap yards on how to identify an orphan source and the procedures if one is suspected to have been found. STUK co-operates with the Customs and the metal industry in questions such as measurement arrangements and training of personnel. STUK also provides expert help in cases where exceptional radiation is detected.

So far, in the order of ten sealed radioactive sources have been found among scrap metal. In most cases the origin of the source was unclear; either it originated from some other country or it was an old source probably used over twenty years ago. The number of lost registered sources (i.e. sources registered after the early 1980's), is very little; only a few exceptional cases. Orphan sources whose owner cannot be identified are delivered to the long-term storage in Olkiluoto.

Conclusions

The cornerstone for maintaining radioactive sources under control in Finland is that all practices involving sources are subject to authorisation and all licensing information, including information on each individual source, are entered into a register which is continuously updated based on applications and notifications received from the licensees.

Experiences during the past twenty years have shown that source-specific records of sources combined with regular inspections at the places of use have prevented efficiently losing control over sealed radioactive sources.

The current capacity in the interim storage for State owned waste is not adequate for all used sealed sources and other small user waste which are currently kept in the possession of the licensees. Thus, expansion of the storage capacity and other options for taking care of the small user waste is under consideration.

References

1. Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources. OJ, L-346, 2003.
2. Code of conduct on the safety and security of radioactive sources. IAEA/CODEOC/2004, IAEA 2004.
3. Code of conduct on the safety and security of radioactive sources: Guidance on the Import and Export of Radioactive Sources.
4. Radiation Act (592/1991) and its amendments, Statutes of Finland. Available in English at: http://www.stuk.fi/saannosto/19910592e.html
5. Radiation Decree (1512/1991) and its amendments, Statutes of Finland. Available in English at: http://www.stuk.fi/saannosto/19911512e.html
6. Guide ST 6.2 Radioactive Wastes and Discharges. STUK,1999.
7. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. 2nd Finnish National Report as referred to in Article 32 of the Convention. STUK-B-YTO 243. STUK, Helsinki 2005.
8. Rantanen E (ed.). Radiation Practices. Annual Report 2004. STUK-B-STO 59. STUK, Helsinki 2005. (html)
9. International Basic Safety Standards for Protection against IonizingRadiation and for the Safety of Radiation Sources. Safety Series No.115. Vienna: International Atomic Energy Agency, 1996.
10. International Commission on Radiological Protection. The Handling, Storage, Use and Disposal of Unsealed Radionuclide Sources in Hospitals and Medical Research Establishments. ICRP Publication 25, Oxford: Pergamon Press, 1976.
11. Principles and Methods for Establishing Concentrations and Quantities(Exemption Values) Below which Reporting is not required in the European Directive. Doc. XI-028/93, Commission of the European Communities.
12. Principles for the Exemption of Radiation Sources and Practices from Regulatory Control. Safety Series No. 89. Vienna: International Atomic Energy Agency, 1988.