RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

HUNGARY

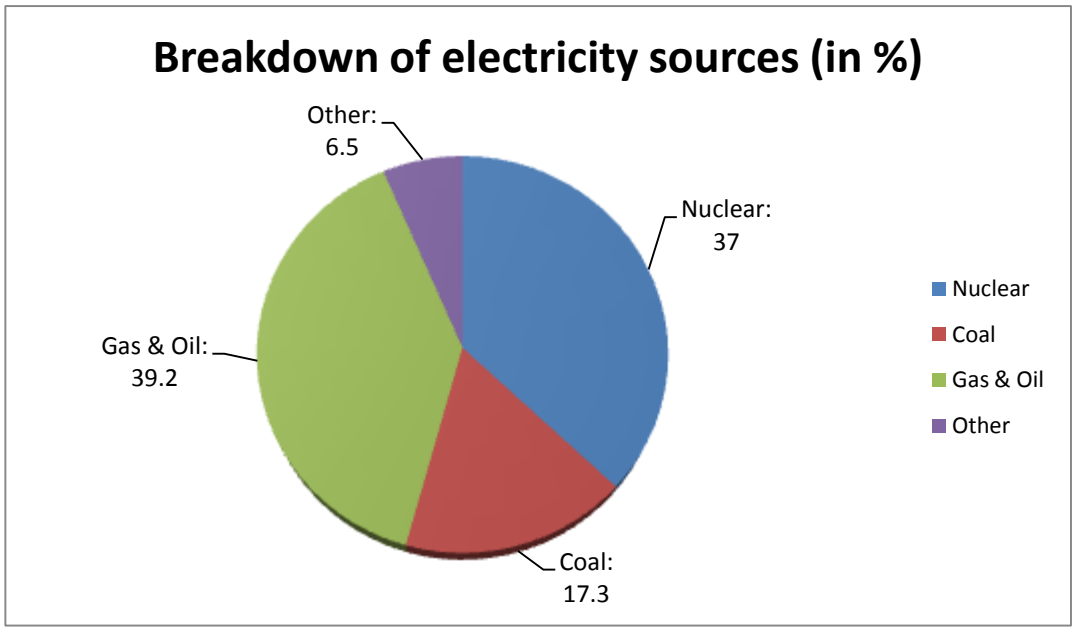
NATIONAL NUCLEAR ENERGY CONTEXT

Commercial utilisation of nuclear power in Hungary started in 1983 and by 1987 there were 4 nuclear power units connected to the electricity grid. All four nuclear power units are of the VVER 440/213 reactor type and are located at the Paks Nuclear Power Plant (NPP).

In 2008 they generated 14.8 TWh of electricity, about 37% of the total electricity generated in that year in Hungary.

As of 2009, a total of 1959 fuel assemblies (and 30 damaged fuel assemblies) were in the spent fuel ponds in the nuclear power plant, and 5587 fuel assemblies were stored in the Interim Spent Fuel Storage Facility.

By the end of 2008 the Interim Spent Fuel Storage Facility consisted of 16 vaults (each for 450 fuel assemblies) and further four vaults were in the phase of construction. Future expansion of the facility could increase the capacity to 33 vaults.



Source: Hungarian Power Companies Ltd. 2008

SOURCES, TYPES AND QUANTITIES OF WASTE

Waste classification and sources

Most of the radioactive waste in Hungary is generated by operation of the Paks NPP, with much smaller quantities are generated by other (rather institutional, non-NPP) users of radioactive isotopes.

The following classification scheme is based on Appendix 2 in the Decree 47/2003 (VIII. 8.) of the Minister of Health on certain issues of interim storage and final disposal of radioactive wastes, and on certain radiohygiene issues of naturally occurring radioactive materials concentrated during industrial activity.

General classification of radioactive waste:

1. Radioactive waste is classified as being low and intermediate level where the waste's heat production during disposal and storage are negligible.

a) Low- and intermediate-level radioactive waste (ILW) is short-lived where the half-life of the radionuclides is 30 years or less. Short-lived ILW contains long-lived alpha emitter radionuclides only in limited concentration (this concentration is 4 000 Bq/g in the case of collecting packaging, and 400 Bq/g on average for the whole quantity of waste).
b) Low- and intermediate-level radioactive waste is long-lived where the half-life of the radionuclides and/or the concentration of the alpha emitter radionuclides exceeds the limits for short-lived radioactive waste.

2. High-level radioactive waste is waste where the heat production is so significant (above 2 kW/m^3) that it has to be considered during the design and operation of storage and disposal options.
3. Within the above classifications the authority can prescribe more detailed classifications for low, intermediate and high level radioactive wastes.

Classification for low- and intermediate-level radioactive waste:

1. The classification of the radioactive waste into low-and intermediate-level classes shall be performed based on the activity-concentration (AC) and exemption activity-concentration (EAC) of the radioisotope contained in it. For low-level wastes the activity concentration is between 1 EAC and 10^3 EAC.
2. If the radioactive waste contains more radioisotopes, then the classification shall take into account all radioisotopes. In that case for low level wastes the sum of the AC/EAC values for all the radioisotopes shall be under 10^3.

Quantities of radioactive waste and spent nuclear fuel

Inventory and rate of generation of HLW from NPP operation

HLW is generated primarily by the Paks NPP, and only in relatively small quantities. At present, there is no decision on the back-end of the fuel cycle so the final form of HLW (spent fuel or the highly active residue arising from reprocessing) is not known. Spent fuel is stored for the time being in spent fuel ponds in the reactor buildings and in the Interim Spent Fuel Storage Facility. The rate of generation of HLW from routine operations is 3-5 m^3/year, which will result in a total of about 130 m^3 by the end of NPP operation. The amount of HLW from decommissioning of the Paks NPP is currently estimated to be about 410 m^3.(CZI????)

Inventory and rate of generation of LLW/ILW from NPP operation

The amount of solid LLW/ILW produced at the Paks NPP is now estimated at 170 m^3/year, after compaction. The rate of generation of liquid radioactive waste is about 270 m^3/year in total for the four reactor units. The total volume of LILW generated during the operation of Paks NPP will be about 22 000 m^3. This amount does not consider the effect of the planned 20 year life time extension.

The disposal capacity required for LLW/ILW from the decommissioning of the Paks NPP has

recently been estimated to be about 17 000 m^3.

Rate of generation of LLW/ILW from small sources

About 20-30 m^3 of LLW/ILW, and 1000 - 3000 spent sealed radiation sources arise annually from small non-NPP sources outside the nuclear power industry. Most of these radioactive wastes, including the spent sealed sources, are generated in medical, industrial and research applications. The two most widely used radionuclides are ^{60}Co and ^{92}Ir. They are used in medical and industrial radiography and give rise to significant inventories of activity.

RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES

Waste management policies

Interim storage of spent fuel takes place in the 16 storage modules of the Interim Spent Fuel Storage Facility in Paks, in the vicinity of Paks NPP. The storage is assured for 50 years and the capacity of the facility has been and is going to be extended as necessary.

The management of liquid and solid LLW and ILW is carried out by the operator of Paks NPP. This includes collection, processing, packaging, qualification and storage of these wastes on the NPP site. The Public Agency for Radioactive Waste Management (PURAM) is responsible for the transportation and disposal of these wastes.

The National Radioactive Waste Repository has been constructed for the disposal of LLW and ILW of Paks NPP. The commissioning of the surface facilities was licensed in October 2008, and buffer (predisposal) storage of drums containing solid waste of Paks NPP started. By 2011, the first two disposal chambers are planned to be put into operation.

PURAM is also responsible for preparing the Paks NPP for decommissioning and for performing all related activities after plant shutdown, including dismantling, waste disposal and site restoration. These activities (similarly to the above mentioned tasks of PURAM) are financed by the Central Nuclear Financial Fund as prescribed by relevant regulations.

Programmes and projects

Disposal of HLW

Preparations for disposal of high-level and long-lived radioactive wastes started in 1995. The programme outlined long-term concepts but, during 1996-98, it focused mainly on in-situ site

investigations of the Boda Claystone Formation, at 1100 m depth. At that time the area under investigation was accessible from a former uranium mine. The final report of these investigations raised no question about the suitability of the Boda Claystone Formation for disposal of HLW and, consequently, a recommendation was made for construction of an underground research laboratory and for further research. Later, however, the uranium mine was closed for economic reasons, and the investigations continued in 2003 from the surface.

At present, the decision on the back-end of the fuel cycle is in preparation, and the whole HLW programme needs to be reconsidered. As the Interim Spent Fuel Storage Facility provides for 50-year storage of the spent fuel from the NPP, it is not urgent yet to take these decisions.

Disposal of LLW/ILW from the Paks NPP

Currently, the solid and liquid LLW/ILW wastes arising from operation of the nuclear power plant are processed and stored temporarily at the plant.

In 1996, a proposal was made for a further search for a new geological disposal site for the LLW/ILW from Paks NPP. This was based on geological investigations and on safety and economic studies, and it proposed exploration of mined cavities, 200-250 m below surface, in granite on the territory of Bátaapáti. Following this, in 2001, a research project for site characterisation and confirmation was defined. On-site investigations using boreholes, trenches and wells have taken place on the basis of a geological exploration plan approved by the competent authority, and a start has been made on preparation of an environmental impact study and an integrated safety assessment.

The research work aiming at the establishment of the repository was supported by a local referendum held on July 10, 2005. The approval in principle of the Parliament, of November 21, 2005, given to the construction of the repository confirmed that the final disposal of radioactive waste serves the interest of the society in large.

Based on the environmental impact assessment the environmental licence was issued which – after an appeal – entered into force in October 2007. On the basis of the pre-construction safety assessment the authority issued the construction licence for the surface parts (technology and central buildings) and also for the future underground disposal chambers in May 2008. The operation licence for the surface part entered into force in October 2008. With this first phase operation licence it became possible to transport waste from the Paks NPP to the new technology building for buffer (predisposal) storage. The first packages (200 l drums with solid LILW) arrived at the end of 2008. At present, tunnelling activities are in progress aiming at the construction of the underground disposal chambers. By 2011, after completing the second phase in the operation licensing procedure, two disposal chambers are planned to be put into operation. Later further chambers will be necessary to dispose of the total (approximately 40000 m^3) LILW waste arising from the 30 year operation of the NPP and its future decommissioning.

Treatment and disposal facilities for radioactive waste from small sources

A Radioactive Waste Treatment and Disposal Facility (RWTDF) for dealing with low and intermediate level radioactive wastes from small sources outside the nuclear power industry was commissioned in 1976. It is situated at Püspökszilágy some 40 km northeast of Budapest. The repository is a typical near-surface facility with a capacity of 5 040 m^3, comprising concrete trenches, or vaults, and shallow wells for spent sealed sources. By the end of 2004 the capacity of the repository was exhausted.

In the past years, work has concentrated on demonstrating the safe operation of the facility and on determining the measures necessary for its future closure. In this regard some reconstruction and upgrading have been done and safety assessments have been carried out, resulting in a safety enhancement programme. This programme is realised in a step-wise fashion. First a so called demonstration program was accomplished to test the recovery technology and collect the necessary information and experience. Long-lived waste and sources were removed from four vaults to be stored in the technology building, pending re-disposal in a HLW repository, the recovered short-lived waste was –as possible – compacted, thus free capacity was created in the vaults.

Based on the results of the demonstration programme, safety assessments will be prepared and the safety enhancement programme will be revised and modified. The next phase of its execution will continue with the vaults in rows I.-II. of the repository and will be completed by 2015.

RESEARCH AND DEVELOPMENT

LLW/ILW treatment

Methods for boric acid recovery and cesium removal from the concentrated liquid waste at the nuclear power plant were developed on a contractual basis with IVO International Ltd. The application of these methods is now in preparation. The possibility of applying other volume reducing technologies, such as incineration and supercompaction, to solid LLW/ILW has also been studied.

LLW/ILW disposal

Most of the R&D performed in Hungary on disposal of LLW/ILW was concentrated on the selection of a suitable site for a mined cavity type of repository. The research included site investigations, laboratory analysis of borehole samples, determination of soil characteristics (i.e. sorption, water permeability, isotope migration rates, etc.) and performance assessment.

Other important areas of R&D include waste characterisation, waste acceptance criteria, and facility design.

HLW

As described under “Programmes and projects”, the Permian Boda Claystone Formation in the Mecsek Mountain area is considered suitable for high-level waste disposal. Now the investigations are carried on to select a site for an underground research laboratory.

DECOMMISSIONING AND DISMANTLING POLICIES AND PROJECTS

The safety codes governing operation of the Paks NPP, the Budapest Research Reactor, the training reactor of the Budapest University of Technology and Economics, and the Interim Spent Fuel Storage Facility require arrangements for decommissioning to be considered at the plant design stage. A preliminary decommissioning plan is an obligatory part of the licensing documentation submitted prior to commissioning. This plan must be updated regularly in accordance with the regulations in force and submitted to the regulatory body. No decommissioning of any Hungarian nuclear facility is planned for the near future. The design lifetime of the nuclear power units at Paks NPP is 30 years, but now a lifetime extension project is in progress.

A study – already twice updated – by the Slovak company DECOM investigated and compared various decommissioning strategies for the nuclear power plant. The scenarios include deferred dismantling and site clearance after 20, 50 and 70 years. The preferred option will be selected in the framework of the elaboration of a national programme for waste and spent fuel management in the coming years.

TRANSPORT

The Hungarian regulations for transport of radioactive material are based on relevant international conventions. The HAEA is the competent authority for licensing of transport packages and transport arrangements. The same general rules apply to the transport of radioactive waste as apply to radioactive materials, except that transport of radioactive waste across national borders is also regulated in accordance with the European Union Directive on transboundary shipment of radioactive waste.

The transport of radioactive waste for disposal or storage in the Radioactive Waste Treatment and Disposal Facility and in the National Radioactive Waste Repository is organised by the Public Agency for Radioactive Waste Management (PURAM) under its own authority, and using its own work force and equipment.

COMPETENT AUTHORITIES

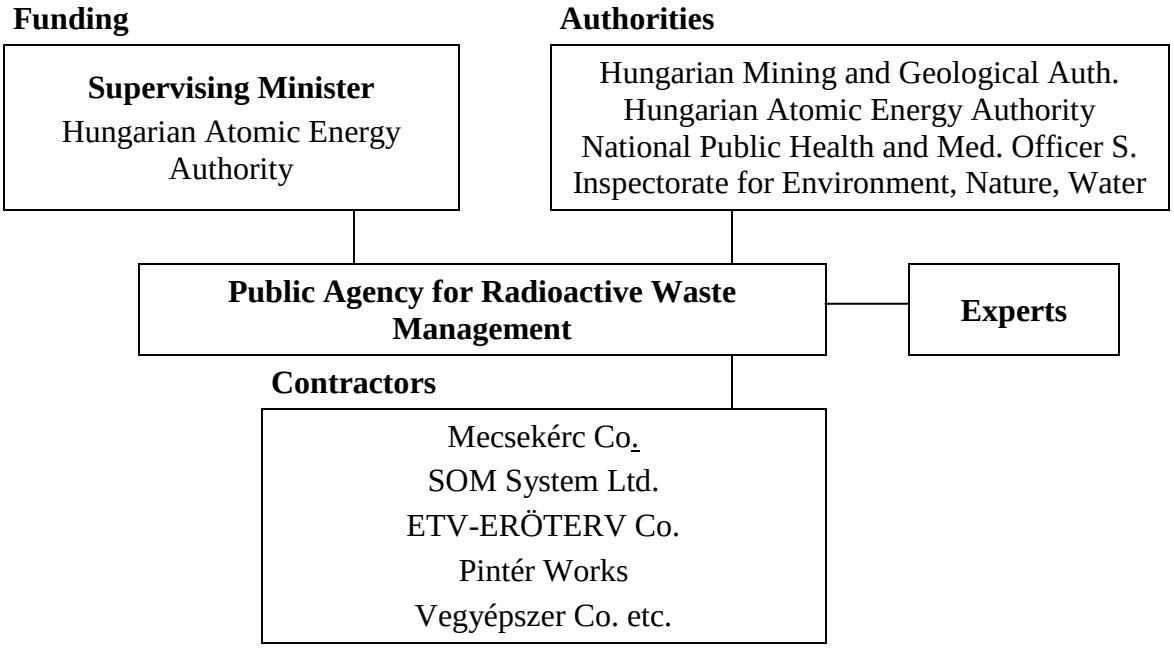
The Hungarian Atomic Energy Authority (HAEA) is responsible for regulation of nuclear facilities, including the Interim Spent Fuel Storage Facility. It is a central public administrative organisation and deals with the peaceful uses of nuclear energy, under Government supervision. Some specific aspects of its licensing procedures are handled by other special authorities.

The Minister of Health is responsible for licensing and supervision of the siting, construction, commissioning, operation, modification and closure of radioactive waste disposal facilities. This is carried out by way of the National Public Health and Medical Officer Service, with expert advice and technical assistance provided by the National Research Institute for Radiobiology and Radiohygiene.

Under the Act CXVI on Atomic Energy of 1996 and Government Decree 240/1997 (XII.18.), a Central Nuclear Financial Fund was set up in January 1998 exclusively for financing radioactive waste disposal, interim storage and disposal of spent fuel, and decommissioning of nuclear facilities. The Minister supervising the HAEA has jurisdiction over the Fund, while HAEA is responsible for its administration.

Also under the Act CXVI on Atomic Energy of 1996 the Government authorised the Director General of the HAEA to establish the Public Agency for the Radioactive Waste Management (PURAM), which has been in operation since June 1998. PURAM undertakes the work associated with disposal of radioactive waste, interim storage and disposal of spent fuel, and decommissioning of nuclear facilities.

The relationships between the authorities and bodies involved in licensing and supervision of nuclear facilities and radioactive waste management are depicted in the diagram below.



FINANCING

Although the HAEA is responsible for its management, the Central Nuclear Financial Fund is a separate state fund pursuant to the Act XXXVIII of 1992 on Public Finance. Payments into the Fund are defined in accordance with the plans for radioactive waste disposal, interim storage and disposal of spent fuel, and decommissioning of nuclear facilities.

The levels of annual payment into the Fund by the Paks NPP are proposed by the Minister supervising the HAEA, in the process of preparing the Central Budget. Payments are based on advice from PURAM and approved by the HAEA and by the Hungarian Energy Office. The payments made by the Paks NPP are then taken into account in setting the price of electricity.

The institutes and businesses, other than the Paks NPP, that dispose of radioactive waste in the Radioactive Waste Treatment and Disposal Facility are also liable for contributions to the Fund in accordance with a price list set out in a ministerial decree. For those nuclear installations financed from the Central Budget, the Budapest Research Reactor and the training reactor of the Budapest University of Technology and Economics, payment into the Fund is provided from the Central Budget, as required.

At the end of 2008, the total sum accumulated in the Fund was 129,5 billion HUF.

PUBLIC INFORMATION

For more information, the websites of the relevant organisations are listed below.

Government
The Hungarian Atomic Energy Authority (HAEA) , Budapest
Website: http://www.haea.gov.hu/english/index.html**;** E-mail: molnarb@haea.gov.hu
Management
Public Agency for RW Management
H-2040, Budaörs, Puskás Tivadar u. 11
Website: www.rhk.hu E-mail: peter.ormai@rhk.hu
Research
KFKI **Atomic Energy Research Institute (AEKI),** Budapest,
Website: http://www.kfki.hu/~aekihp/
Institute of Nuclear Research of the Hungarian Academy of Sciences, Debrecen,
Website: http://www.atomki.hu/
National Research Institute for Radiobiology and Radiohygiene, Budapest,
Website: http://www.osski.hu/; E-mail: osski@hp.osski.hu
Nuclear Safety Research Institute Ltd. (NUBIKI), Budapest,
E-mail: nubiki@nubiki.hu
The Institute of Nuclear Techniques of the Technical University of Budapest (BME NTI), Budapest, Website: www.reak.bme.hu
The Institute for Isotopes of the Hungarian Academy of Sciences, (MTA IKI) Budapest
Website: http://www.iki.kfki.hu/
Industry
The Power Engineering and Contractor Co. (ETV-ERÖTERV Co., Budapest), Budapest
Website: www.etv.hu
E-mail: eroterv@etv.hu .