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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

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Executive summary

Finland signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management on 2 October 1997 and deposited the tools of acceptance on 10 February 2000. The Convention entered into force on 18 June 2001.

The major generators of radioactive waste in Finland are the two nuclear power plants, the Loviisa and Olkiluoto plants. The Loviisa plant has two PWR units, operated by Fortum Power and Heat Oy, and the Olkiluoto plant two BWR units, operated by Teollisuuden Voima Oy. These power plant units were connected to the electrical network between 1977 and 1980. The construction of a new PWR unit started in 2005 in Olkiluoto. It is scheduled to be operational in 2009.

Both operating nuclear power plants have interim storages for spent fuel as well as facilities for the management of low and intermediate level waste. The facility for final disposal of low and intermediate level radioactive wastes was taken into operation at Olkiluoto in 1992 and the facility for disposal of low level waste at Loviisa in 1998. Disposal of spent nuclear fuel is under preparation and has passed the first authorization step, so called Government's Decision-in-Principle, which was endorsed by the Parliament in 2001. The construction of an underground rock characterisation facility started in 2004. No decommissioning projects of nuclear facilities are underway.

Other generators of radioactive waste are the research reactor FiR 1 and various small users of radioactive substances, such as hospitals, universities, research institutes and industry.

Finland has only insignificant amounts of radioactive waste generated from past practices requiring further management measures.

This second National Report includes most of the content of the first National Report, supplemented with more detailed information of the practical implementation of the regulations. Furthermore, the development in waste management policies and practices during the reporting period is described. The major development is related to the preparation for the building of a spent fuel disposal facility, with the underground rock characterisation facility being constructed in Olkiluoto.

The issues requiring further development to enhance the safety are related to storage and disposal of small user waste and spent nuclear fuel. Furthermore, the regulations need to be amended to cover provisions for decommissioning.

In this report,

- the scope of application to the Finnish circumstances is explained as stipulated in Article 3
- policies and practices as well as inventories are summarised as stipulated in Article 32
- the regulatory and practical implementation of each of the Articles 4 to 28 of the Convention is evaluated
- the development in regulations and practical implementation of spent fuel and radioactive waste management since the first Review Meeting of the Convention is described
- issues requiring further development to enhance safety are discussed.

Based on the evaluation, it is the understanding of the Finnish authorities that

- the Finnish nuclear, radiation and waste safety regulations fulfil the obligations of the Convention
- the Finnish regulatory infrastructure is in compliance with the Convention obligations
- the regulatory and licensing policies and the practical implementation of the national spent fuel and radioactive waste management programmes comply with the Convention obligations
- there are some future challenges to enhance safety, notably in the area of decommissioning; these challenges are discussed in the report.

In summary, Finnish authorities conclude that Finland has implemented the obligations of the Convention and meets the objectives of the Convention. This conclusion is submitted for consideration of other Contracting Parties.

Contents

List of acronyms

MTI
Ministry of Trade and Industry

STUK
Radiation and Nuclear Safety Authority

FPH
Fortum Power and Heat Oy (NPP utility)

TVO
Teollisuuden Voima Oy (NPP utility)

Posiva
Posiva Oy (company for spent fuel disposal)

VTT
Technical Research Centre of Finland

GTK
Geological Survey of Finland

NPP
Nuclear power plant

BWR
Boiling water reactor

PWR
Pressurized water reactor

EPR
European pressurized water reactor

ONKALO
Underground rock characterisation facility for spent fuel disposal site confirmation

LILW
Low and intermediate level waste

ILW
Intermediate level waste

LLW
Low level waste

VLLW
Very low level waste

NORM
Naturally occurring radioactive materials

DiP
Decision-in-Principle by the Government

PSAR
Preliminary Safety Analysis Report

FSAR
Final Safety Analysis Report

EIA
Environmental Impact Assessment

YVL Guide
Safety regulation issued by STUK subject to nuclear energy legislation

ST Guide
Safety regulation issued by STUK subject to radiation legislation

SECTION A. Introduction

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was adopted on 29 September 1997 in the Vienna Diplomatic Conference. Finland signed the Convention on 2 October 1997 and deposited the tools of acceptance on 10 February 2000. The Convention entered into force on 18 June 2001.

The fulfilment of the obligations of the Convention and the development after the first Review Meeting are evaluated in this report. The evaluation is mainly based on the Finnish legislation and other regulations as well as on the safety assessments of Finnish radioactive waste disposal facilities and nuclear power plants (NPPs). The assessments on the safety of the NPPs cover also the facilities for predisposal management of operational waste and storage of spent fuel. The plans for decommissioning of nuclear facilities are discussed shortly as well. The management of radioactive waste generated outside the nuclear fuel cycle is discussed as appropriate.

Main regulations in the field of spent nuclear fuel management as well as nuclear and other radioactive waste management are the Nuclear Energy Act and Decree, the Radiation Act and Decree, the Government decisions and the regulatory guides (YVL Guides and ST Guides) issued by the Radiation and Nuclear Safety Authority (STUK). The most essential safety regulations are listed in Section M.

Section 5 of the Nuclear Energy Act requires that the use of nuclear energy, taking into account its various effects, has to be in line with the overall good of the society. Further, Section 6 provides that the use of nuclear energy must be safe; it shall not cause injury to people, or damage to the environment or property. Section 7 requires that sufficient physical protection and emergency planning as well as other arrangements for limiting nuclear damage and for protecting nuclear energy against illegal activities shall be a prerequisite for the use of nuclear energy.

Section 2 of the Radiation Act provides that the benefits accruing from the use of radiation and practices involving exposure to radiation shall exceed the detriment it causes; that the practice shall be organized in such a way that the resulting exposure to radiation hazardous to health is kept as low as reasonably achievable and that no person's exposure shall exceed the maximum values prescribed in the Radiation Decree.

These general safety principles, included in the Nuclear Energy Act and the Radiation Act, apply to management of spent nuclear fuel and of radioactive waste arising from the nuclear fuel cycle. Other radioactive waste is regulated only by the Radiation Act.

Finland is a member state of the European Union. Thus, the regulations of the Union are in force in Finland. When necessary, the Finnish regulations have been modified to take into account the EU regulations. The EC Directives relate e.g. to radiation protection and transboundary movements of radioactive waste, whereas there are so far no regulations pertaining directly to safe management of spent nuclear fuel and radioactive waste.

In Finland, two NPPs, with a total capacity of 2 656 MW_e(net), are currently in operation. The Loviisa plant includes two 488 MW_e PWR units, operated by Fortum Power and Heat Oy (FPH) and the Olkiluoto plant two 840 MW_e BWR units, operated by Teollisuuden Voima Oy (TVO). The NPP units were connected to the electrical network as follows: Loviisa 1 in 1977, Loviisa 2 in 1980, Olkiluoto 1 in 1978 and Olkiluoto 2 in 1980. The construction licence for a new PWR

unit, Olkiluoto 3 of 1600 MW_e was granted by the Government in February 2005. The unit is planned to be operational in 2009.

Both NPPs have storage facilities for fresh and spent fuel and facilities for treatment and storage of low and intermediate level radioactive waste (LILW). The disposal facility for LILW was commissioned at the Olkiluoto site in 1992 and for LLW at the Loviisa site in 1998.

All spent fuel generated at the Olkiluoto plant is stored on-site. Previously the spent fuel of the Loviisa plant was transported to the Mayak facilities in the Russian Federation, after interim storage of a few years. An amendment to the Nuclear Energy Act was passed in 1994 stating that spent fuel generated in Finland has to be treated, stored and disposed of in Finland. Spent fuel shipments to the Russia were terminated at the end of 1996, and since then the spent fuel generated at the Loviisa plant has been stored at the plant. In 1995, a joint waste management company Posiva Oy was established by FPH and TVO for taking care of the disposal of spent fuel.

The Finnish fuel cycle policy is based on the once-through option. In 1999 Posiva proposed, in a Decision-in-Principle application, to site a disposal facility for spent nuclear fuel at Olkiluoto in Eurajoki, a couple of kilometres from the NPP. This application was approved by the municipality of Eurajoki in January 2000, the Finnish Government made the Decision-in-Principle in December 2000 and the Parliament endorsed it in May 2001. The application for the construction licence is scheduled to be submitted by the end of 2012 and the operating licence application around the year 2020.

In the context of endorsement of the Decision-in-Principle concerning the fifth reactor in Finland in May 2002 the Finnish Parliament also endorsed a separate Decision-in Principle on the extension of the Olkiluoto disposal facility to cover the spent fuel from the new unit.

A research reactor FiR 1 (TRIGA Mark II, 250 kW) is situated in Espoo and operated by the VTT, Technical Research Centre of Finland. It was taken into operation in 1962. VTT has also radiochemical laboratories and a hot-cell for testing radioactive materials. Radiochemical and particle accelerator laboratories are also located at the universities of Helsinki, Turku and Jyväskylä.

Two pilot-scale uranium mining and milling facilities were operational in late 1950's – early 1960's. Small amounts of radioactive wastes arise from a number of facilities using radioactive sources in medical, research and industrial applications.

In the safe management of spent fuel and radioactive waste, international co-operation is of high importance, and the Finnish regulatory authorities, nuclear power and waste management companies and research institutes have actively looked for co-operation with foreign organisations. In this respect, especially the activities of the IAEA and OECD/NEA and the R&D framework programmes of the European Union are essential.

This report has been compiled according to the Guidelines Regarding the Form and Structure of National Reports (INFCIRC 604). Pursuant to the Decisions made in the first Review meeting this second National Report includes most of the content of the first National Report, supplemented with more detailed information of the practical implementation of the regulations. Furthermore, the development in waste management policies and practices during the reporting period is described. More emphasis has been given to the management of NORM waste. In the area of spent fuel management, the construction of the deep underground rock characterisation facility has been launched in Olkiluoto. In Loviisa, the cementation facility for ILW and related disposal cavern are under construction and expected to be operational in 2006.

In Section B, policies and practices of waste management in Finland are summarised as stipulated in Article 32, paragraph 1. In section C, the scope of application taking into account the Finnish circumstances is explained, as stipulated in Article 3. Section D provides information on spent fuel and waste management facilities in Finland and the inventories of spent fuel and radioactive waste, as stipulated in article 32, paragraph 2. The implementation of each of the Articles from 4 to 28 of the Convention is separately evaluated in Sections E to J. Section K summarises the development in spent fuel and waste management policies and practices during the reporting period and Section L deals with further development foreseen to improve the safety of spent fuel and radioactive waste management practices.

SECTION B. Policies and practices

Article 32. Reporting, paragraph 1.

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(a) spent fuel management policy;
(b) spent fuel management practices;
(c) radioactive waste management policy;
(d) radioactive waste management practices;
(e) criteria used to define and categorize radioactive waste.

B.1. Criteria used to define and categorize radioactive waste

Nuclear waste is defined in Section 3 of the Nuclear Energy Act as radioactive waste in form of spent fuel or in some other form, generated in connection with or as a result of the use of nuclear energy, and materials, objects and structures which, having become radioactive in connection with or as a result of the use of nuclear energy and having been removed from use, requires special measures because of the danger arising from their radioactivity.

Other radioactive waste than nuclear waste is regulated in the framework of Radiation Act and Decree. According to Section 10 of the Radiation Act, radioactive waste is radioactive materials which have no use and have to be rendered harmless owing to their radioactivity. The definition includes also equipment, goods and materials that are contaminated by radioactive materials. Radioactive materials and radiation appliances containing radioactive material whose owner cannot be found shall also be regarded as radioactive waste.

The main sources of radioactive waste are nuclear wastes generated from the operation of the four power reactors and the research reactor. Other radioactive waste arises from a number of facilities using radioisotopes in medical, research and industrial applications. Respectively, the Finnish waste classification system includes two main categories: nuclear waste and radioactive waste not originating from the nuclear fuel cycle. Waste classification according to their disposal route is illustrated in Figure 1.

Discharges from nuclear facilities

Some liquid and airborne discharges arise from the operation of nuclear facilities. The discharge limits are specific to nuclides or nuclide groups and they are in conformity with the dose constraint of 0.1 mSv per year to the member of the critical group among the general public. A systematic decrease in liquid discharges from NPPs has occurred during the past 10–15 years due to adoption of efficient pretreatment and radionuclide recovery methods. The actual radiation exposures in the environments of the NPPs are currently less than one per cent of the dose constraint.

Low and intermediate level waste from nuclear facilities

The classification system for the purpose of predisposal management of LILW from NPPs is based on activity concentrations, given in Guide YVL 8.3 as follows:

Solid and liquid waste arising from the controlled area of a NPP and that contain almost exclusively short-lived beta and gamma emitters, are grouped into the following activity categories:

- *Low level waste* contains so little radioactivity that it can be treated at the NPP without any special radiation protection arrangements. The activity concentration in waste is then not more than 1 MBq/kg, as a rule.
- *Intermediate level waste* contains radioactivity to the extent that effective radiation protec-

tion arrangements are needed when they are treated. The activity concentration in the waste is then from 1 MBq/kg to 10 GBq/kg, as a rule.

Guide YVL 8.2 provides for conditional and unconditional removal from control. Both options are founded upon the criteria of triviality of dose, as follows:

Radiation exposure to the public or the workers at the waste treatment facility caused by wastes from the use of a NPP or a nuclear facility of other kind shall not exceed

- an effective dose of 10 microSv/year for the most exposed individuals (members of the critical group), and
- a collective dose commitment of 1 manSv from one year of performance of the practice, except when the assessment according to Section 2 of the Radiation Act (optimization) shows that removal from control is the best option.

Mass and surface concentration based activity limits for unconditional removal from control are given in YVL 8.2. The limits can be applied for limited waste quantities not exceeding 100 tonnes/year for one NPP or other nuclear installation. In conditional removal from control the activity concentrations are determined on case-by-case basis but care has to be taken that they do not exceed the exemption limits given e.g. in the Euratom Council Directive 96/92 and Guide ST 1.5.

Guide YVL 8.2 is currently being updated to cover also removal of control from large amount of material resulting from decommissioning and release of regulated sites. The relevant IAEA safety guides will be used as reference for the revision.

Radioactive waste from medical use, research and industry

For small user waste, constraints for disposal in landfill or sewage system are provided in Guide ST 6.2. The criteria are based on the triviality of the dose as above in the case of removal of nuclear waste from control.

According to Guide ST 6.2, 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 as solid waste and within these activity limits is 100 kBq. Sealed sources with higher radionuclide content and other radioactive waste not eligible for disposal to landfill have to be delivered to a site approved by STUK for storage and disposal.

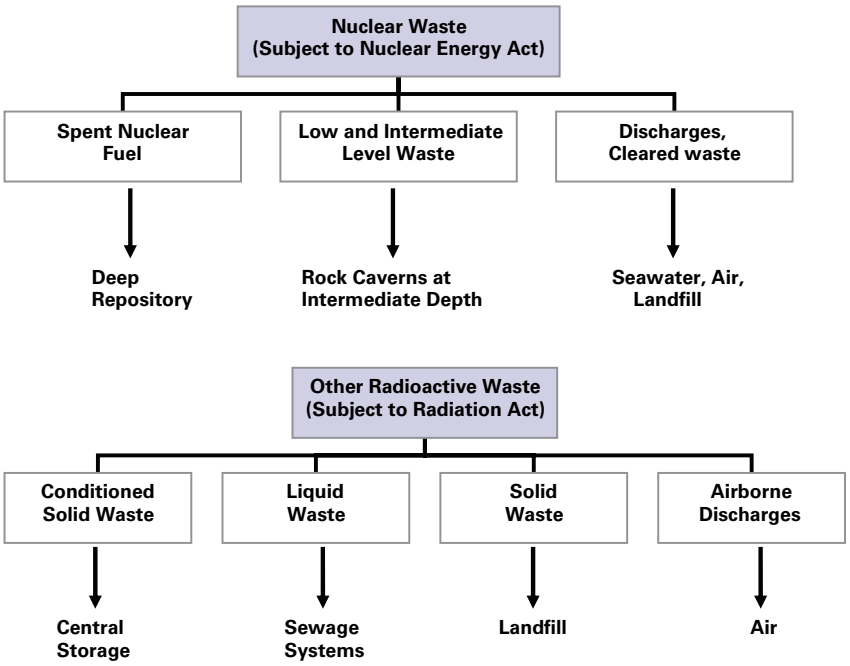

Figure 1. Classification of radioactive waste for disposal purposes.

B.2. Spent fuel and radioactive waste management policy

Spent fuel and nuclear waste

According to Section 6a of the Nuclear Energy Act nuclear waste generated in Finland shall be handled, stored and permanently disposed of in Finland. Respectively, nuclear waste generated elsewhere than in Finland, shall not be handled, stored or permanently disposed of in Finland. There are only minor exemptions to these principles, notably the spent nuclear fuel arising from the research reactor. As stipulated in Section 7 of the Nuclear Energy Decree, that fuel can be handled, stored and disposed of outside Finland, if justified on grounds of safety or due to a significant economic or other weighty reason.

According to Section 9 of the Nuclear Energy Act, generators of nuclear waste are responsible for all nuclear waste management measures and their appropriate preparation, and are also responsible for the expenses arisen. The state has the secondary responsibility in case that any producer of nuclear waste is incapable of fulfilling its management obligation (Nuclear Energy Act, Sections 31 and 32).

The principles of the nuclear waste management policy were originally set in the Finnish Government's policy decision of 1983 and later in the decisions by the Ministry of Trade and Industry (MTI). These decisions set also a long-term schedule for the implementation of nuclear waste management including the site selection and start of the operation of the spent fuel disposal facility.

Other radioactive waste

Other radioactive waste than nuclear waste is regulated in the framework of Radiation Act and Decree. According to Section 50 of Radiation Act the organization engaged in radiation practice is required to take any measures to render harmless radioactive wastes arising from its operation. Rendering radioactive waste harmless means 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. The state has the secondary responsibility in case that a producer of radioactive waste is incapable of fulfilling its management obligation (Radiation Act, Section 51).

Costs and funding

Waste management costs, including those arising from decommissioning of the NPPs, are included in the price of nuclear electricity. Initially, the nuclear power companies had internal funds for that purpose, but by virtue of entry into force of the Nuclear Energy Act, the State Nuclear Waste Management Fund was established under the Ministry of Trade and Industry (MTI) in 1988. To ensure that the financial liability is covered, the nuclear power companies and the operator of the research reactor are each year obliged to present cost estimates for the future management of nuclear wastes and take care that the required amount of money is set aside to the State Nuclear Waste Management Fund. In order to provide for the insolvency of the nuclear utilities, they shall provide securities to MTI for the part of financial liability which is not covered by the Fund. In case of the research reactor, the operator is also fully responsible for spent nuclear fuel and waste management. In that case the state has deposited the necessary funds to the State Nuclear Waste management Fund on behalf of the operator of the research reactor (VTT). More information can be found in F.22.2. Financial resources.

The Radiation Act, Section 19, provides for furnishing the financial security of radioactive waste management for non-nuclear practices as follows: to ensure that the licensee meets the costs incurred in rendering radioactive waste harmless and in carrying out any decontamination measures that may be needed in the environment, it shall furnish security if the operations produce or are liable to produce radioactive waste that cannot be rendered harmless without substantial cost. The Radiation Decree, Section 15, defines more precisely cases where financial security shall be furnished.

B.3. Spent fuel management practices

Spent nuclear fuel from NPPs is stored at the power plant sites until it will be disposed of. Initially, the fuel is cooled for a few years at reactor pools. In addition to the pools in the reactor buildings, the Loviisa NPP has basket type and rack type pool storages attached to the reactor building. The effective storage capacity (excluding reserves for repair work) is about 520 tU. The most recent enlargement of the pool facility was commissioned in 2001. The current capacity is adequate until about 2010. The

needed additional capacity is planned to be achieved by providing pools with dense racks.

At the Olkiluoto plant, the effective capacity (excluding reserves for repair work) of the pools at the reactor buildings is about 370 tU. Subsequently, the spent fuel is transferred to an on-site facility with three storage pools, the capacity of each being about 400 tU, with high-capacity fuel racks. The spent fuel storage facility was commissioned in 1987. The current capacity is adequate until early 2010's. The planning for extension of the storage has been started. The construction of Olkiluoto 3 unit will be taken into account in the design of the extension of the storage.

The nuclear legislation provides for disposal of nuclear waste into the Finnish bedrock. Posiva is implementing the spent fuel disposal programme with the following main targets, which are in line with the Government Policy Decision of 1983:

- Disposal site selection in 2000 (The Olkiluoto site was proposed by Posiva in the Decision-in-Principle application of 1999; this application was approved by the host municipality in January 2000, the Decision was made by the Government in December 2000 and it was ratified by the Parliament in May 2001.);
- Start of construction of an underground rock characterisation facility in Olkiluoto in 2004 (The construction started in July 2004.);
- Preparedness for the application of the Construction Licence in 2012;
- Disposal facility should be ready for operation around in 2020.

The various steps from siting until to closure scheduled for the Olkiluoto disposal facility are illustrated in Figure 2.

The current estimate for the amount of spent fuel to be disposed of in Olkiluoto is 5640 tonnes: 1020 from Loviisa 1 and 2, 2620 tonnes from Olkiluoto 1 and 2, and 2000 tonnes from Olkiluoto 3. The estimates are based on the expectation that the units Loviisa 1 and 2 are operational until 2030, Olkiluoto 1 and 2 until 2040 and Olkiluoto 3 until 2070 (Figure 2). However, the operation licences of the NPPs are granted only for 10 to 20 years at a time.

Spent fuel will be stored in water pools for some decades and thereafter transferred to the encapsulation and disposal facilities which will be located at Olkiluoto. Spent fuel would be encapsulated in copper-iron canisters each containing 12 BWR or

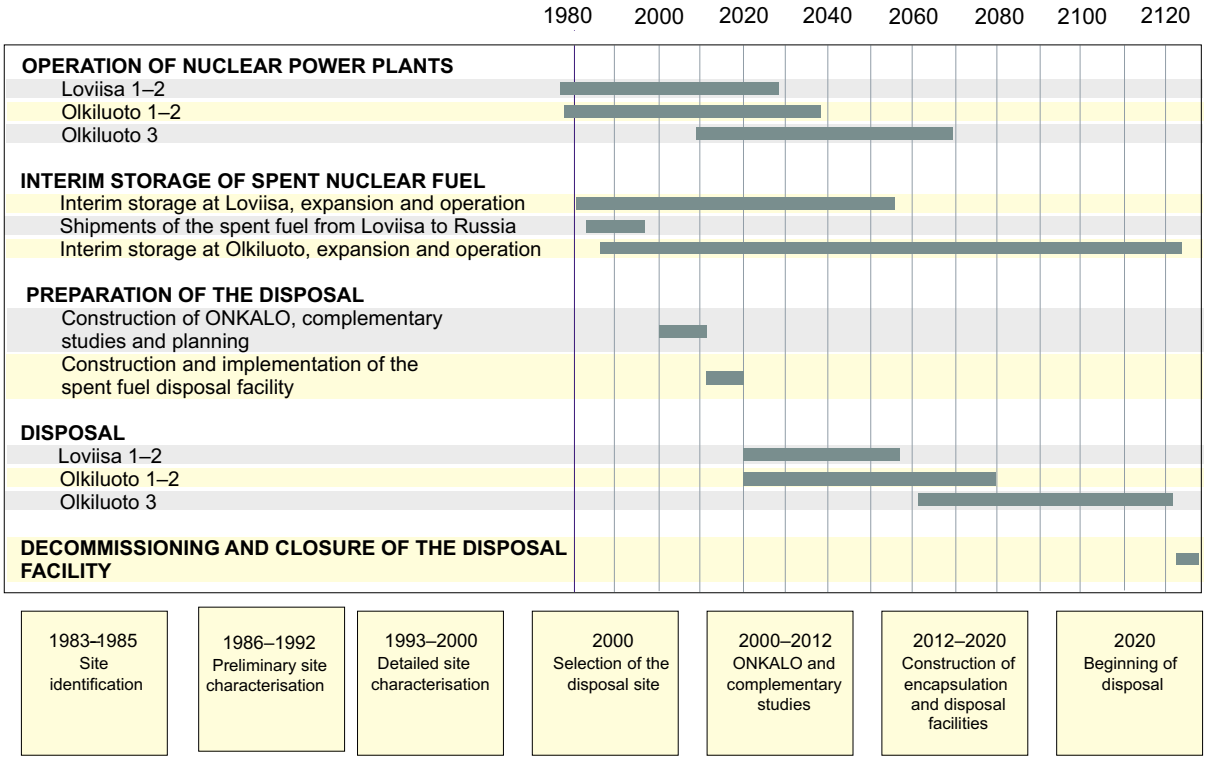

Figure 2. Timetable for the management of spent fuel from the nuclear power plants at Loviisa and Olkiluoto.

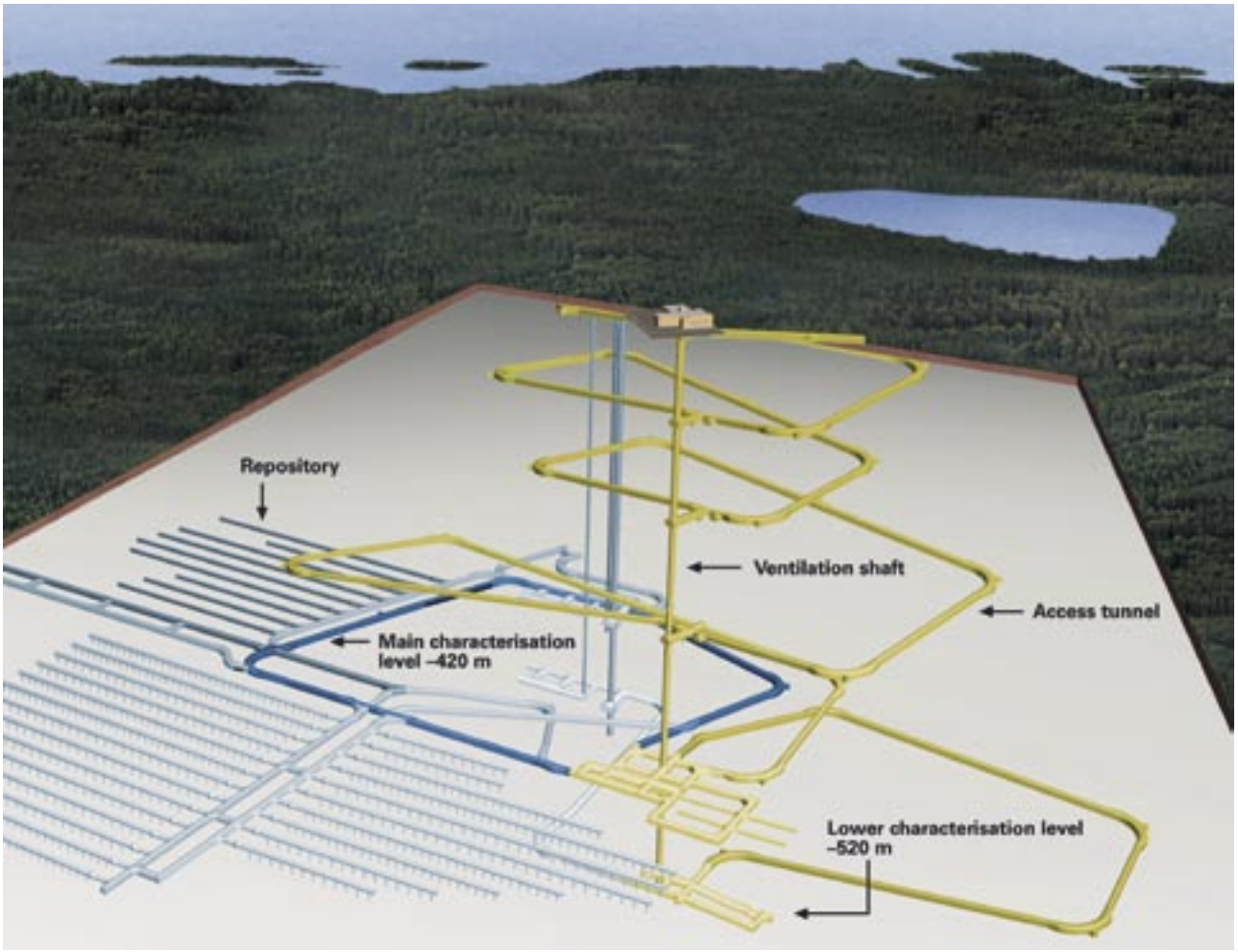

Figure 3. A schematic presentation of the layout of the underground rock characterization laboratory and the network of disposal tunnels.

PWR (Loviisa 1 & 2) fuel assemblies. The canisters for Olkiluoto 3 reactor (EPR) fuel are planned to contain 4 PWR fuel assemblies. The canister design consists of a cast iron insert as a load-bearing element and an outer container of oxygen-free copper to provide a shield against corrosion. The canisters will be emplaced in a network of tunnels, which will be constructed at a depth of about 400 to 500 m in crystalline bedrock. The annulus between the canister and the rock wall will be filled with compacted bentonite. A schematic layout of the underground rock characterization laboratory and the network of disposal tunnels at Olkiluoto are illustrated in Figure 3 and an individual disposal tunnel with canisters surrounded by bentonite back fill in Figure 4. The canisters can be positioned either vertically, as in Figures 3 and 4, or horizontally. Both options are under investigation.

The pre-designs of the encapsulation and disposal facilities, operational and post-closure safety as-

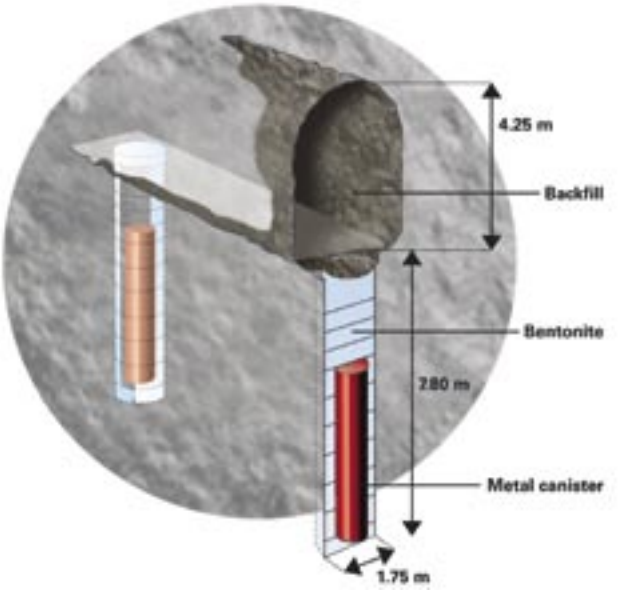

Figure 4. Disposal tunnel and canisters according to the vertical disposal option.

sessments and summaries of site characterisation were included in Posiva's Decision-in-Principle application and in the supporting documents. STUK's preliminary safety appraisal of the Decision-in-Principle application was published in January 2000. The design of facilities and the site baseline description have been updated in 2003–2005.

The spent fuel generated at Olkiluoto 3 will be first transferred to an at-reactor pool storage and after some years to a separate on-site pool storage. Extension of the separate pool storage by early 2010's is under consideration to cover the required storage capacity for the Olkiluoto1, 2 and 3 spent fuel until the final disposal facility is available.

Spent fuel of the research reactor FiR1 is stored at the facility. The decision on the further use of FiR 1 is dependent on the outcome of the efforts to find an alternative, sustainable source of funding of its operation and maintenance. The first option for the management of spent fuel is interim storage at the facility and later on, disposal into the spent fuel repository at Olkiluoto. The second option would be to return the fuel to the United States. Recently the USDoE has made a decision to extend by additional ten years the time schedule for accepting spent fuel from foreign research reactors. Thus, the operation of FiR1 could be continued until 2016 without losing the opportunity to return the spent fuel to the supplier.

Posiva Oy, Teollisuuden Voima Oy and Fortum Power and Heat Oy published in late 2003 a report called "Nuclear waste management of the Olkiluoto and Loviisa power plants. Programme for research, development and technical design for 2004–2006". It is an overview of the R&D and technical design in the field of nuclear waste management by Posiva and its owners in the recent years and also a plan for future activities. It is focused on the years 2004–2006. This new practice of issuing an extensive nuclear waste management report every three years is based on a decision by the MTI letter of 3 December 2002. STUK extensively reviewed the report with the assistance of an external team of experts and suggested several improvements to the programme.

B.4. Radioactive waste management practices

LILW from nuclear facilities

According to the national policy, low and intermediate level wastes from reactor operations are disposed of in the bedrock at the power plant sites. The construction of the repository at the Olkiluoto site began in 1988 and the operation in 1992. The construction of the repository at the Loviisa site was started in 1993 and the part for the LLW disposal was taken into operation in 1998.

The Loviisa repository is located at the depth of approximately 110 m in granite bedrock. The repository consists of two tunnels for solid LLW and a cavern for immobilised ILW (Figure 5). The cavern for ILW has been excavated and the construction and installation works will be completed by the end of year 2006. After the regulatory review that cavern can be taken into operation as well.

The Olkiluoto repository consists of two silos at the depth of 60 to 95 m in tonalite bedrock, one

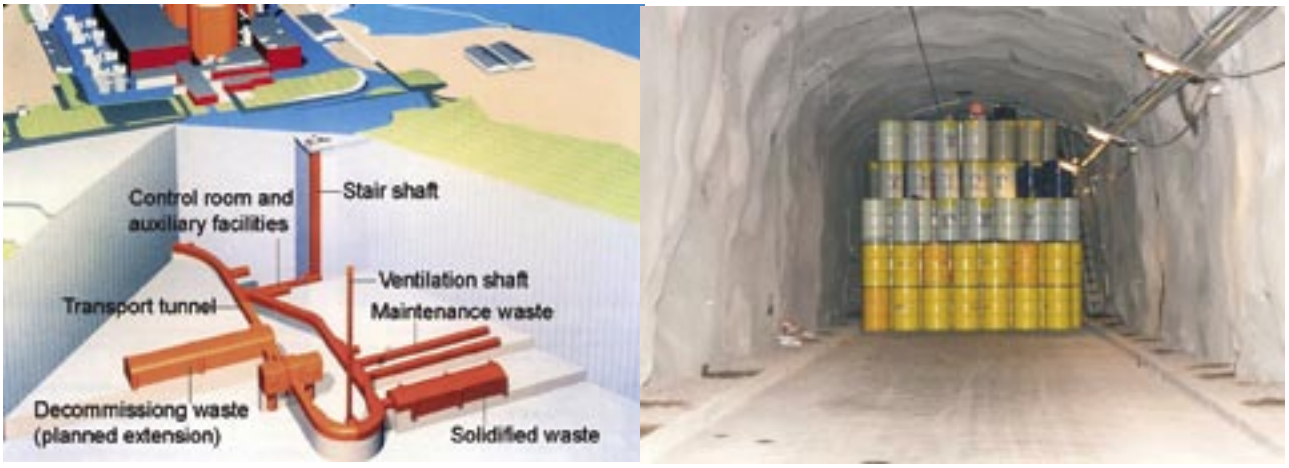

Figure 5. The left picture gives a cross-sectional view of the repository for LILW and the planned extension for decommissioning waste and in Loviisa. The right photograph illustrates the drums of low level maintenance waste in the repository tunnel.

for solid LLW and the other for bituminized ILW. The silo for solid LLW is a shotcreted rock silo, while the silo for bituminized waste consists of a thick-walled concrete silo inside the rock silo. All wastes will be emplaced in concrete boxes that take 16 waste drums. The LILW from Olkiluoto 3 will be disposed of to the same repository. The repository will be extended in the future, to be able to receive all the waste from Olkiluoto 1, 2 and 3 units during the planned 60 years of operation of the units.

Predisposal management of LILW takes place at the NPPs under their Operation Licences and other provisions. The wastes are segregated, treated, conditioned, packaged, monitored and stored, as appropriate, before they are transferred to the disposal facilities.

At Loviisa, wet LILW (radioactive concentrates, such as spent ion exchange resins, evaporator bottoms, corrosion sludge, absorbent carbon sludge and decontamination slurries) are for the time being stored in tanks at the NPP. A cementation facility is under construction and planned to be operational in 2006 after a pertinent regulatory review.

At Olkiluoto, wet LILW is immobilized in bitumen before transfer to the disposal facility. At the both NPPs, solid LLW is after conditioning transferred to the disposal facilities. Sludge, radioactive concentrates and spent ion exchange resins from liquid waste treatment in Olkiluoto 3 are planned to be dried in drums. For disposal the drums are envisaged to be emplaced in concrete boxes, where space between drums is filled with cement.

Options for very low level waste management are either unconditional or conditional removal from control. Such waste can be reused, recycled or disposed at landfills. At Olkiluoto the NPP has its own landfill while the Loviisa NPP has shipped cleared waste to municipal landfills.

Activated metal waste consists of irradiated components and devices that have been removed from inside the reactor vessel. So far this kind of highly activated waste has not been conditioned but is stored at the NPPs and is expected to be conditioned and disposed of together with decommissioning waste of similar type.

LILW generated from the operation of the research reactor FiR 1 is stored at the reactor facility until decommissioning. Disposal of the operational and decommissioning waste from FiR 1 to the disposal facility at Loviisa site is under discussion and further studies were performed in 2004 concerning the feasibility of such disposal. However, no formal agreement or decision has yet been made between VTT and the utility.

Radioactive waste arising from small use of radioactive sources

An applicant for a licence for the use of unsealed sources is required to submit for STUK's approval a waste management plan describing the intended releases of radioactive substances into sewer

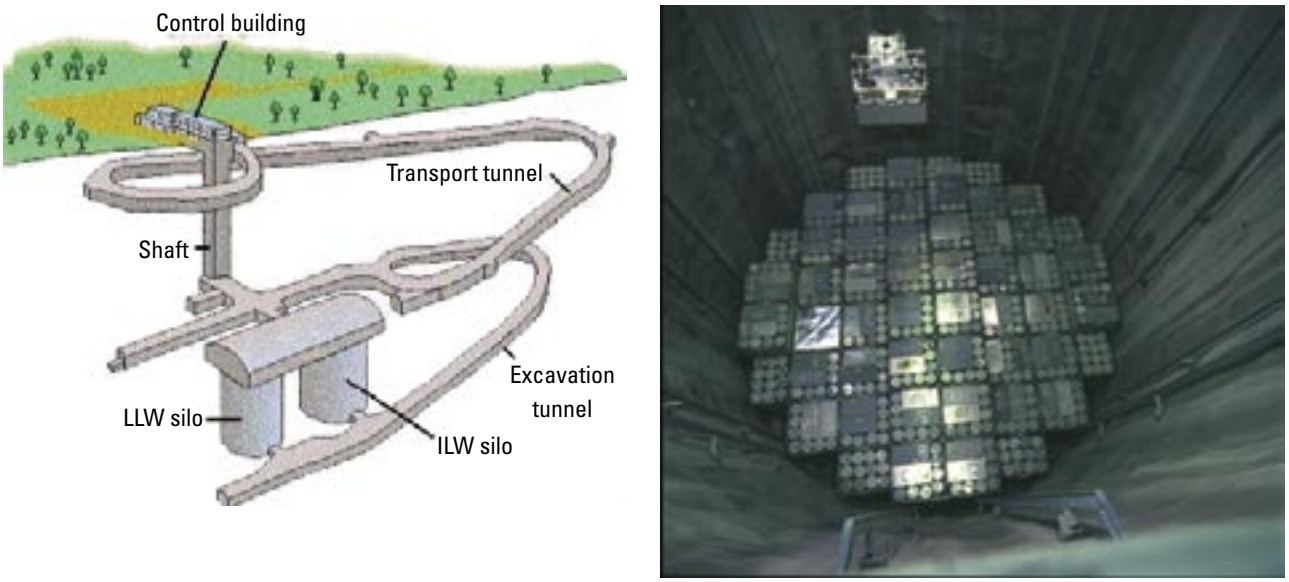

Figure 6. The left picture gives a cross-sectional view of the repository lay-out for LILW at Olkiluoto. The right picture shows the LLW drums in the disposal silo.

system or atmosphere and deliveries of solid radioactive waste to a landfill site or to interim storage. The conditions for such disposal of radioactive waste are then specified in the license, as necessary. The conditions may include site specific limits on discharges, requirements on discharge and environmental monitoring or other control measurements necessary e.g. for estimating doses to the population.

The two options for the management of disused sealed sources are either return to the supplier/manufacturer of the source or delivery to STUK against a waste management fee. STUK takes care of the conditioning and packaging of the sources and they are stored under the administrative control of STUK in a separate cave in the LILW repository at Olkiluoto.

A licensee can be exempted from preparing a waste management plan if the operations are arranged such that the activity limits regarding gaseous or liquid discharges or solid-waste disposal established in the Guide ST 6.2 are not exceeded. However, even in this case STUK may order monitoring of discharges and reporting thereof, if this is considered necessary due to environmental considerations, nature of the work and the nature and amount of radioactive substances in use. In addition, although being below the limits all discharges to the environment shall be as low as reasonably achievable.

In practice, most of waste from the use of unsealed sources in Finland arise in such low activity concentrations or amounts that it is not necessary to arrange the final disposal of generated waste in the same way as e.g. for the sealed sources. A common practice is that radionuclide laboratories store their short lived radioactive wastes at their premises until they have decayed below the limits set for discharges in the Guide ST 6.2. However, some waste resulting from radiochemical research at the VTT are submitted to STUK for storage with the state own waste in Olkiluoto. In addition, the wastes resulting from studies conducted by VTT for FPH are returned back to FPH for disposal in Loviisa LILW repository.

All radionuclide laboratories – thus also the storages and other activities related to waste management – are inspected by STUK regularly, every 1–5 years, depending on the type and size of the practice.

B.5. Decommissioning of nuclear facilities

No nuclear power plants are being decommissioned and such decommissioning projects are neither foreseen in the near future. The VTT Technical Research Centre of Finland has started a more detailed planning of the shutdown and decommissioning of the research reactor as a preparatory action to the possible decision of the closure of the facility. The decision to implement the plan is dependent on the outcome of efforts to arrange alternative, sustainable funding for continued operation.

The utilities are obliged to update the decommissioning plans of NPPs for regulatory review every five years. The latest updates were carried out in 2003. The plan for the Loviisa NPP is based on immediate decommissioning while for the Olkiluoto NPP, a safe storage period of about 30 years prior to dismantling is envisaged. The disposal plans for wastes from decommissioning of the NPPs are based on the extension of the on-site repositories for LILW. Besides the dismantling waste, also activated metal components accumulated during the operation of the reactors could be disposed of in those repositories. The engineered barriers will be selected taking account of the radiological and other safety related characteristics of each waste type. A special feature of the decommissioning plans is the emplacement of large components, such as pressure vessels and steam generators, in the disposal rooms as whole, without cutting them in pieces.

The decommissioning plan of the research reactor FiR 1 is also updated every five year, the latest update being carried out in the year 2000. A more detailed plan will be prepared in 2005. Studies are under way on the technical feasibility of disposing of the decommissioning wastes in the disposal facility at the Loviisa site.

SECTION C. Scope of application

Article 3. Scope of Application

This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

Finland has adopted the once-through nuclear fuel cycle. Thus, all spent nuclear fuel, after it has been permanently removed from the reactor, is in the scope of the Convention.

Airborne and liquid discharges from nuclear and radioactive waste management facilities, notably from NPPs, are included in the scope of this Convention.

No radioactive wastes of military or defence origin exist in Finland.

Waste outside the nuclear fuel cycle, containing only naturally occurring materials (NORM-waste), except sealed radium sources, is not declared as radioactive waste for the purposes of the Convention.

SECTION D. Inventories and lists

Article 32. Reporting, paragraph 2

This report shall (also) include:

(a) a list of the spent fuel management facilities subject to this convention, their location, main purpose and essential features;

(b) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain the description of the material and if available, give information on its mass and its total activity;

(c) a list of radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(d) an inventory of radioactive waste that is subject to this Convention that:

- *is being held in storage of radioactive waste management and nuclear fuel cycle facilities;*
- *has been disposed of; or*
- *has resulted from past practices;*

this inventory shall contain the description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(e) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities

D.1. Spent fuel and radioactive waste management facilities

The locations, ownership, characteristics and inventories of spent fuel and radioactive waste management facilities in Finland are given in adjacent tables: spent fuel storages in Table D.1, predisposal waste management facilities in Table D.2 and disposal facilities in Table D.3. More specific inventory data is included in the Annexes.

Table D.1. Spent fuel storage in Finland.

Loviisa nuclear power plant	
Owner:	FPH
Location:	Hästholmen island, town of Loviisa, Southern Finland
Purpose:	Interim storage of spent fuel
Capacity:	520 tU (effective[1])
Inventory (end of 2004):	351 tU (2947 assemblies, maximum burnup 46 MWd/kgU)
Essential features:	• Pool storages inside both reactor buildings • Basket type pool storage in the NPP auxiliary building • Rack type pool storage in the NPP auxiliary building
Olkiluoto nuclear power plant	
Owner:	TVO
Location:	Olkiluoto island, municipality of Eurajoki, South-Western Finland
Purpose:	Interim storage of spent fuel
Capacity:	1570 tU (effective[1])
Inventory (end of 2004):	1026 tU (6050 assemblies, maximum burnup 45 MWd/kgU)
Essential features:	• Pool storages inside both reactor buildings • Pool storage in a separate facility at the NPP site
FiR 1 research reactor	
Operator:	VTT
Location:	Otaniemi, town of Espoo, Southern Finland
Purpose:	Interim storage of spent fuel
Inventory (end of 2004):	2.4 kgU (13 elements, maximum burnup 23 MWd/kgU)
Essential features:	• Racks at the walls of reactor pool • Well type storage under the reactor hall.

[1] The reserve capacity for exceptional unloading of the entire reactor core to storage pool, for storage pool repairs and space for dummy elements are excluded.

Table D.2. Predisposal management of radioactive waste in Finland

Loviisa nuclear power plant	
Owner:	FPH
Location:	Hästholmen island, town of Loviisa, Southern Finland
Purpose:	Treatment, conditioning and interim storage of LILW
Inventory (end of 2004):	1478 m^3
Essential features:	• Pretreatment, compaction and packaging of solid LLW • Pretreatment of liquid LILW • Eight tanks, each 300 m^3, for storage of liquid LILW • Two storage rooms inside the NPP for packed LLW • Storage wells and pools for unconditioned activated waste • On-site light built storage hall for waste candidate for clearance
Olkiluoto nuclear power plant	
Owner:	TVO
Location:	Olkiluoto island, municipality of Eurajoki, South-Western Finland
Purpose:	Interim storage of LILW
Inventory (end of 2004):	506 m^3
Essential features:	• Pretreatment, compaction and packaging of solid LLW • Pretreatment and bitumenisation of liquid LILW • Four buffer storage rooms for conditioned LILW • Pools for storage of unconditioned activated waste • Treatment and storage buildings at the site for unconditioned LLW • On-site storage area for very low level metal components
FiR 1 research reactor	
Operator:	VTT
Location:	Otaniemi, town of Espoo, Southern Finland
Purpose:	Treatment, packaging and interim storage of LILW
Inventory (end of 2004):	6 m^3
Essential features:	• Storage room in the basement of a laboratory building
STUK's waste storage hall	
Owner:	STUK
Location:	Roihupelto, city of Helsinki, Southern Finland
Purpose:	Buffer interim storage of waste from small users
Inventory (end of 2004):	0.5 m^3 (50 GBq)
Essential features:	• Storage room in the basement of STUK's building
Storage for state owned waste	
Owner:	Ministry of Social Affairs and Health
Location:	Olkiluoto island, municipality of Eurajoki, South-Western Finland
Purpose:	Long-term interim storage of sealed sources and other small user waste
Inventory (end of 2004):	47.7 m^3 (24.7 TBq, dominant nuclides H-3, Cs-137, Pu-238, Kr-85, Am-241)
Essential features:	• Rock cavern attached to the Olkiluoto disposal facility

Table D.3. Disposal of radioactive waste in Finland

Loviisa disposal facility	
Owner:	FPH
Location:	Hästholmen island, town of Loviisa, Southern Finland
Purpose:	Disposal of LILW
Inventory (end of 2004):	1234 m³ (0,26 TBq, dominant nuclides Co-60, Ni-63, Cs-137, Sr-90)
Essential features:	• Rock tunnels for LLW
Olkiluoto disposal facility	
Owner:	TVO
Location:	Olkiluoto island, Municipality of Eurajoki, South-western Finland
Purpose:	Disposal of LILW
Inventory (end of 2004):	4140 m³ (62,9 TBq, dominant nuclides Co-60, Ni-63, Cs-137, Sr-90, C-14)
Essential features:	• Rock silo for bituminized ILW • Rock silo for packed LLW

D.2. Small user waste

The licensing database maintained by STUK, includes source-specific information on each sealed source in licensee's possession. This information is updated continuously according to licensees' notifications and observations made during the inspections. Small users of radioisotopes have in their premises radiation sources which are no longer in use but have not yet been declared as radioactive waste. Except of five old ^{60}Co therapy or irradiator sources ranging form 2–54 TBq, the activities in such sources are less than 1 TBq and typically in the range of 0.4–4 GBq (see also Chapter J.28.2.).

D.3. Waste from past practices

There are no significant amounts of waste from past practices requiring further management (see also Chapter H.12.2).

D.4. Decommissioning

No significant facilities subject to nuclear energy or radiation legislation are being decommissioned and no final decisions on such decommissioning projects have been made. In 2002, decommissioning of a sterilisation plant was completed in Ilomantsi, Eastern Finland. The strong Co-60 source was transported abroad for reuse. There was no contamination in the facility.

SECTION E. Legislative and regulatory system

Article 18. Implementing measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The necessary legislative, regulatory and other measures to fulfil the obligations of the Convention have been taken and are discussed in this report.

Article 19. Legislative and regulatory framework

Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

This legislative and regulatory framework shall provide for:

(a) the establishment of applicable national safety requirements and regulations for radiation safety;

(b) a system of licensing of spent fuel and radioactive waste management activities;

(c) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

(d) a system of appropriate institutional control, regulatory inspection and documentation and reporting; the enforcement of applicable regulations and of the terms of the licences;

(e) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

E.19.1. Safety requirements and regulations

In Finland, the legislation for the use of nuclear energy and for radiation protection was established in 1957. Since then, several amendments and new regulations have been issued.

Nuclear legislation and regulations

In 1987, a completely revised Nuclear Energy Act came into force and a supporting Nuclear Energy Decree in 1988. The scope of this legislation covers e.g.

- the construction and operation of nuclear facilities; nuclear facilities refer to facilities for producing nuclear energy, including research reactors, facilities performing extensive disposal of nuclear waste, and facilities used for extensive manufacture, production, use, handling or storage of nuclear materials or nuclear wastes
- mining and enrichment operations aimed at producing uranium or thorium
- the possession, manufacture, production, transfer, handling, use, storage, transport, export and import of nuclear material and nuclear waste as well as the export and import of ores and ore concentrates containing uranium or thorium.

A significant amendment to the Nuclear Energy Act was passed in 1994, to reflect a new policy that emphasises the national responsibility to manage nuclear waste generated in Finland. In general, the export and import of nuclear waste, including spent fuel, is prohibited in the revised Act.

Sections 28–34 of the Nuclear Energy Act set forth the requirements on nuclear waste management and Sections 35–53 for the financial provisions of nuclear waste management. These provisions address also spent fuel management.

Based on the Nuclear Energy Act, the Government has issued the following decisions:

- Decision of the Government on the General Regulations for the Safety of Nuclear Power Plants (395/1991)
- Decision of the Government on the General Regulations for Physical Protection of Nuclear Power Plants (396/1991)
- Decision of the Government on the General Regulations for Emergency Response Arrangements at Nuclear Power Plants (397/1991)
- Decision of the Government on the General Regulations for the Safety of a Disposal Facility for Reactor Waste (398/1991)
- Decision of the Government on the Safety of Disposal of Spent Nuclear Fuel (478/1999).

The general regulations 395/1991, 396/1991 and 397/1991 are applied to a NPP which is defined to be a nuclear facility equipped with a nuclear reactor and intended for electricity generation, or if such or other nuclear facilities have been placed on the same site, the entirety of facilities formed by them. Thus, spent fuel and radioactive waste management at the NPP sites are covered with these regulations. The general regulations are also applied to other nuclear facilities to the extent applicable.

Detailed safety requirements on the management of spent nuclear fuel and radioactive waste resulting from the production of nuclear energy are provided in YVL Guides. YVL Guides also provide administrative procedures for the regulation. YVL Guides are issued by STUK, as stipulated in the Nuclear Energy Act. YVL Guides are rules an individual licensee or any other organisations concerned shall comply with, unless some other acceptable procedure or solution has been presented to STUK by which the safety level laid down in an YVL Guide is achieved.

Legislation and regulations for the use of radiation sources

The Radiation Act and Decree were revised in 1991, taking into account the ICRP Publication 60 (1990 Recommendations of the International Commission on Radiological Protection). The Radiation Act and Decree were further amended in 1998 to be in conformance with the European Community Radiation Protection Legislation including the Council Directive 96/29/EURATOM of 13 May 1996, on the Protection of the Health of Workers and General Public Against the Dangers Arising from Ionizing Radiation. The Council Directive 2003/1227 Euratom of 22 December 2003 on the Control of High-Activity Sealed Radiation Sources and Orphan Sources will be implemented by 31.12.2005 by revising the Radiation Act and Decree accordingly.

Detailed safety requirements on the management of radioactive waste, subject to the Radiation Act, are provided in STUK's ST Guides. The responsible party running a radiation practice is obliged to ensure that the level of safety specified in the ST Guides is attained and maintained.

E.19.2. Licensing

The authorization processes are defined in the legislation. For a NPP, spent fuel storage, nuclear waste disposal facility or other significant nuclear facility the process consists of three steps:

- Decision-in Principle – granted by the Government and confirmed by the Parliament
- Construction Licence – granted by the Government
- Operating Licence – granted by the Government.

The conditions for granting a licence are prescribed in the Nuclear Energy Act (Sections 19–20). The operating licences of a nuclear facility are granted for a limited period of time, generally for 10–20 years. In case the operating licence is granted for longer periods than 10 years, a periodic safety review is anyway required to be presented to STUK. The periodic re-licensing or review have allowed good opportunities for a comprehensive safety review.

Before a construction licence for a NPP, spent fuel storage, nuclear waste disposal facility or other significant nuclear facility can be applied, a Decision-in-Principle (DiP) by the Government is needed. An Environmental Impact Assessment (EIA) procedure has to be conducted prior to the application of the DiP and the EIA report annexed to the DiP application. A condition for granting the Decision-in-Principle is that the construction of the facility in question is in line with the overall good for the society. Further conditions are as follows:

- the municipality of the intended site of the nuclear facility is in favour of constructing the facility

- no factors indicate a lack of sufficient prerequisites for constructing the facility so that the use of nuclear energy is safe; it shall not cause injury to people, or damage to the environment or property.

The entry into force of the Decision-in-Principle further requires a confirmation by a majority of the Parliament. The Parliament can not make any changes to the Decision; it can only approve or reject it as such. The authorization process is described in Figure 7. In the DiP stage the full process is required, for the construction and operation licences the acceptance of the Parliament and the host municipality are not any more needed.

If the licensee intends to make such modifications in the systems, structures, components or operational procedures of a nuclear facility which could affect the safety, the approval of STUK for the modifications is required beforehand according to Section 112 of the Nuclear Energy Decree.

On the basis of Section 16 of the Nuclear Energy Act, minor licences for spent fuel and nuclear waste management activities (export, import, transfer and transport licence and licences for operations) are granted by either Ministry of Trade and Industry or STUK; the licensing authority in each case is specified in the Nuclear Energy Decree.

The licensing system for practises under the Radiation Act is described in Sections 16 and 17 of the Act. The use of radiation requires a safety licence, which can be granted by STUK upon application. A safety licence can be subject to extra conditions needed to ensure safety. In addition, the cases where a licence is not needed are identified, e.g. when the use of radiation or a devise is exempted.

E.19.3. Prohibition of operation without licence

The Nuclear Energy Act and the Radiation Act define the enforcement system and rules for suspension, modification or revocation of a licence. The enforcement system includes provisions for executive assistance if needed and for sanctions in case the law is violated.

E.19.4. Control and enforcement

According to Section 55 of the Nuclear Energy Act, STUK is responsible for the regulatory control of the safety of the use of nuclear energy. The rights and responsibilities of STUK are provided in Sections 55 and 63 of the Nuclear Energy Act. The regulatory control includes safety reviews and assessments as well as inspection activities.

The most important documents of the licensee, which shall comply with the regulations and other safety requirements and are reviewed be STUK, are the preliminary and final safety analysis reports (PSAR and FSAR), technical specifications and the operational manual. STUK's on-site inspections aim e.g. at verifying that the actual operations at the nuclear facilities comply with the regulations and the documents of the licensee.

Section 6 of the Radiation Act provides that

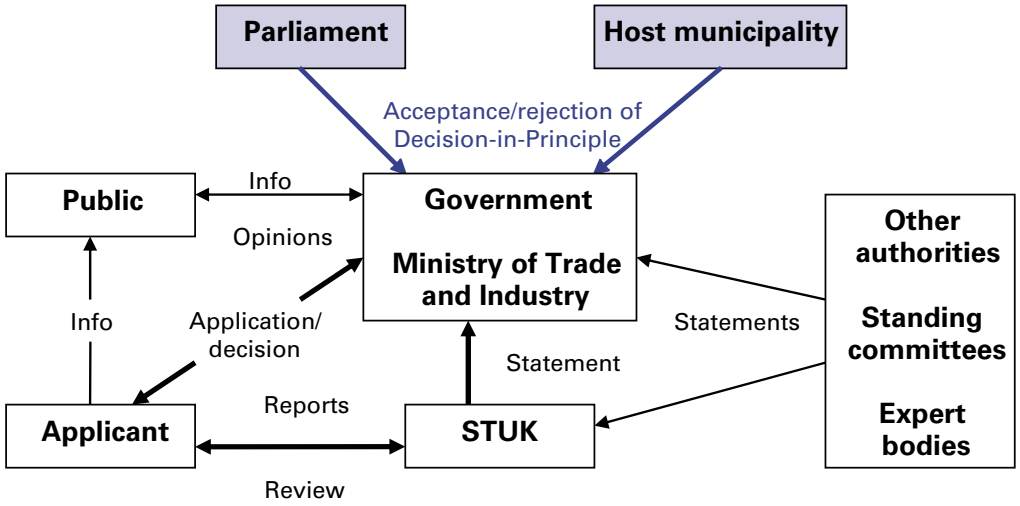

Figure 7. Authorization of nuclear facilities in Finland.

adherence to the Act and regulations issued in accordance with it shall be supervised by STUK. The supervisory rights of STUK are described in Sections 53–58 of the Act.

E.19.5. Clear allocation of responsibilities

According to Section 9 of the Nuclear Energy Act, a licensee, whose operation generate or have generated nuclear waste, shall be responsible for all nuclear waste management measures and their appropriate preparation, and is responsible for the arising expenses. In case of the research reactor, the operator is also fully responsible for spent nuclear fuel and waste management. The State has deposited the necessary funds to the State Nuclear Waste Management Fund on behalf of the operator of the research reactor.

The NPP utilities FPH and TVO themselves take care of interim storage of spent fuel, of management of LILW including disposal, and of planning for the decommissioning of the NPPs. Their jointly owned company, Posiva, is taking care of the preparations for and later implementation of spent fuel encapsulation and disposal.

Section 50 of the Radiation Act provides for management of radioactive waste from non-nuclear applications. The responsible party (i.e. the licensee or any company or organization which uses radiation sources in its practices) is required to take all measures needed to render radioactive waste arising from its operation harmless. In case where the practice produce or may produce radioactive waste that can not be rendered harmless without considerable expenses, a financial security shall be furnished to ensure that these costs and those arising in performing any necessary environmental decontamination measures are met.

The state has the secondary responsibility in case that a producer of nuclear waste (Nuclear Energy Act, Sections 31 and 32) or other radioactive waste (Radiation Act, Section 51) is incapable of fulfilling its management obligation. STUK operates an interim storage of radioactive waste, where limited amounts of spent sealed sources and other radioactive waste are received upon compensation covering their further management costs.

The regulatory responsibilities are discussed under Article 20.

Article 20. Regulatory body

Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

E.20.1. Supreme authorities

The regulatory responsibilities in the area of nuclear waste management are set forth in the Nuclear Energy Act. According to Section 54 of the Act, the overall authority in the field of nuclear energy is the Ministry of Trade and Industry which has the responsibility of formulation of the national energy policy. Section 28 of the Act states that the Ministry shall decide, having consulted, when necessary, the Ministry of the Environment in the matter, the principles on the basis of which the waste management obligation is to be implemented. The Ministry prepares matters concerning nuclear energy, including the nuclear waste management, to the Government for decision-making and grants certain import and export licences for nuclear equipment and materials.

In the area of radioactive, non-nuclear waste management the Ministry of Social Affairs and Health is the supreme authority on the supervision of practices involving exposure to radiation.

E.20.2. Regulatory authority for radiation and nuclear safety

STUK is an independent governmental organisation for the regulatory control of radiation and nuclear safety. No ministry can take for its decision a matter that has been defined by law to STUK. The current Act on STUK was given in 1983 and the Decree in 1997. According to the Decree, STUK has the following duties:

- regulatory control of safety of the use of nuclear energy, emergency preparedness, physical protection and nuclear materials safeguards

- regulatory control of the use of radiation and other radiation practices
- monitoring the radiation situation in Finland, and maintaining preparedness for abnormal radiation situations
- maintaining national metrological standards for radiological measurements
- research and development work for enhancing radiation and nuclear safety
- providing information and publishing reports on radiation and nuclear safety issues, and participating in training activities in the field
- producing expert services in the field
- making proposals for developing the legislation and preparing the decisions of the Government in the radiation and nuclear safety fields, and issuing general guides in these fields
- participating in international co-operation, and taking care of international control, contact or reporting activities as enacted or defined.

STUK is administratively under the Ministry of Social Affairs and Health. Connections to various ministries and governmental organisations are described in Figure 8.

It is emphasised that the regulatory control of the safe use of nuclear energy and radiation is independently carried out by STUK, and it has no responsibilities or duties which would be in conflict with regulatory control.

E.20.3. STUK's regulatory rights, competence and resources

The responsibilities and rights of STUK, as regards the regulation of the use of nuclear energy and the respective waste management, are provided in Sections 55 and 63 of the Nuclear Energy Act. They cover the safety review and assessment of licence applications and the regulatory control of the construction and operation of a nuclear facility. The regulatory control is described in detail in Guide YVL 1.1.

STUK does not grant construction or operating licences for nuclear facilities. However, in practice no such licence would be issued without STUK's statement where the fulfilment of the safety regulations is confirmed.

According to Section 16 of the Radiation Act, STUK grants safety licences for the use of radiation. The regulatory rights of STUK are described in Sections 53–58 of the Act.

The regulatory rights of STUK defined in the Radiation Act and in the Nuclear Energy Act include rights such as to conduct inspections, obtain information and give instructions, and to decide on discontinuation of or restrictions of operation or require modifications to nuclear and other facilities.

The IAEA conducted an independent regulatory review IRRT (International Regulatory Review Team) in STUK with a full-scope IRRT mission in 2000 and a follow-up mission in 2003. The recom-

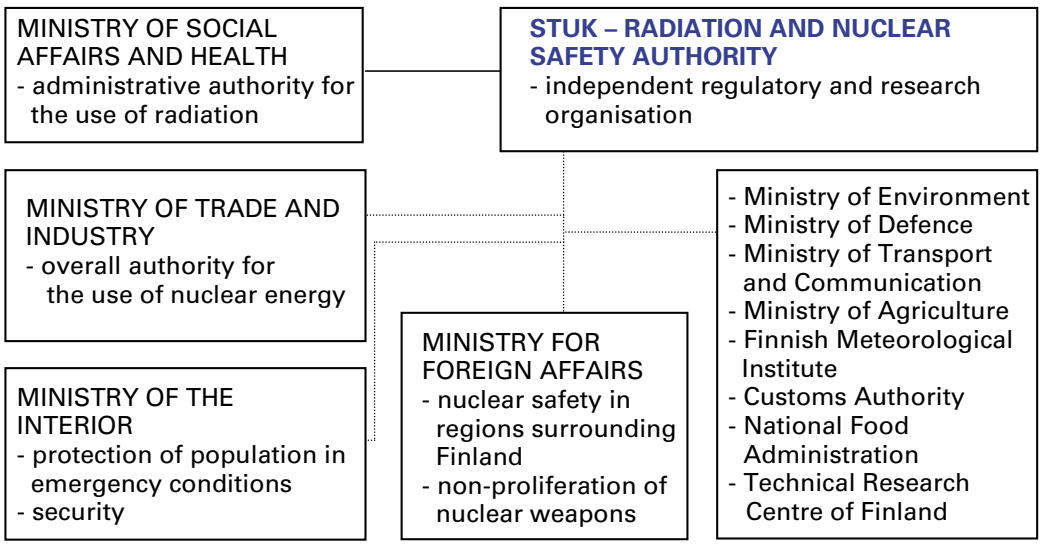

Figure 8. Co-operation between STUK and Ministries and other governmental organisations.

mendations related to waste management included establishing a STUK internal coordinating committee for waste management and transport issues with participation of relevant STUK departments. The committee has proved to be useful.

STUK has adequate resources to fulfil its responsibilities. The total number of the personnel is about 315, of which more than 100 are directly involved with radiation and nuclear safety regulatory activities. Although only about 10 professionals are working directly in the field of nuclear and radioactive waste management, they are supported by the other staff. The organisation and staffing of STUK is described in the Figure 9.

Practically all of the professional staff of STUK conducting safety review and inspections, preparing regulations and granting licences has a higher university level degree. During the years 2002 and 2003 a competence analysis was made at STUK. This analysis is used in developing the training programmes, which are discussed in more details in Article 22, Human and financial resources. STUK also has close connections with foreign regulatory bodies for exchanging information on important safety issues. The average professional experience of the staff in the field of nuclear and radioactive waste management is about 19 years.

The organisational structure and the responsibilities within STUK are provided in the Quality Manuals of STUK. Also procedures for regulatory control and other activities of STUK are presented in the manuals.

STUK's public communication aims at being proactive, open, timely and understandable. Communication is a privilege and duty of all employees. Good cooperation with the media is emphasized in all communication. The general public and media can reach STUK's experts any time, including nights, weekends and holidays. A prerequisite for successful communication is that STUK is known among media and general public and the information given by STUK is regarded as truthful. Communication is always based on best available information. Even sensitive matters are openly communicated. STUK's web page is an important tool in communication. In recent years STUK has published a series of books on radiation and nuclear safety. The books are intended to be used as handbooks for those who work in the field and for students. Five parts have been issued covering the following fields: radiation and measuring, radiation in the environment, use of radiation, health effects of radiation, and nuclear safety, including waste management. Two more parts regarding non-ionizing radiation (electromagnetic fields and ultraviolet and laser radiation) are scheduled to be published in 2005–2006.

STUK is participating actively in European and international co-operation in the field of nuclear, waste and radiation safety. STUK's experts

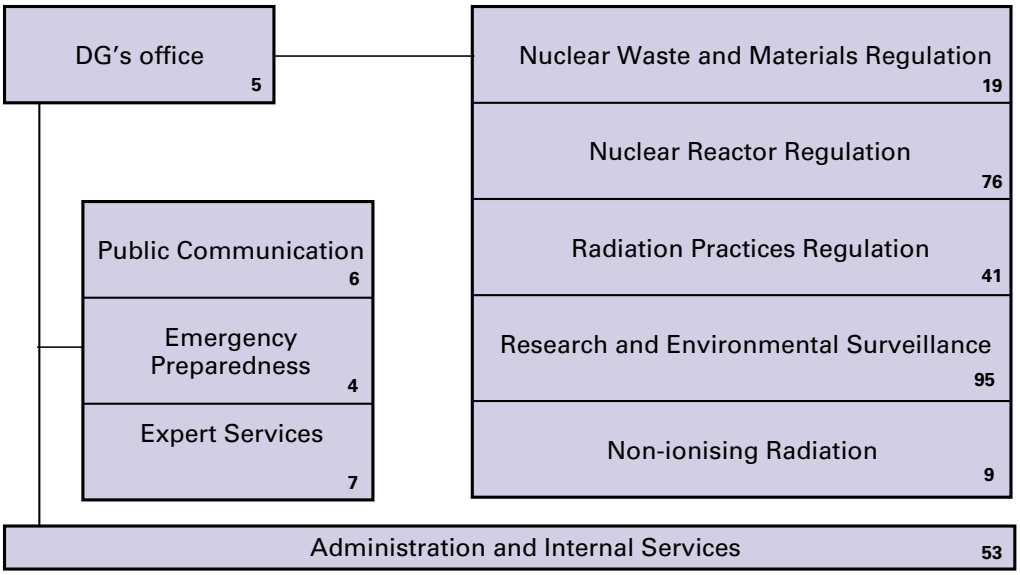

Figure 9. The organisation of STUK and number of personnel in different units at the end of 2004. The total number of the personnel was 315.

have participation, memberships and chairmanships in the OECD/NEA, IAEA, IRPA and ICRP. STUK is also involved in the work of European Commission through Atomic Questions Group, NRWG, CONCERT and RAMG-related PHARE- and TACIS- programmes, EBRD as well as through European regulators' association WENRA. In addition, there are regulatory co-operation through Nordic co-operation programmes. STUK also co-operates actively with the Russian regulator Rostechnadzor, and the multinational group CEG concerning the safety of waste management close to the Finnish borders. Finnish government finances this co-operation.

STUK receives part of its financial resources through the Government budget. In the area of regulatory control, the licence holders pay the regulatory control fees directly to STUK. The amounts charged are under the control of the Ministry of Social Affairs and Health.

E.20.4. Regulatory support organisations

An Advisory Committee on Nuclear Safety has been established by a separate decree. It has a special section for nuclear waste management issues. The Committee gives advice to STUK on important safety issues and regulations. In addition, an Advisory Board for Radiation Safety has been established for advising the Ministry for Health and Social Affairs. The members of both Committees are nominated by the Government.

The main technical support organisations of STUK in the field of nuclear waste management are the VTT Technical Research Centre of Finland and Geological Survey of Finland (GTK). In VTT, GTK and other Governmental institutes, about 30 experts are working in the area of spent nuclear fuel and radioactive waste management.

A support group of international experts has been established by STUK for the ONKALO project. This group consists of experts in geology, rock engineering, geohydrology, geochemistry and seismology. The members of the group assist STUK in the review of the ONKALO plans, reports and investigation material.

Independent expertise in the nuclear waste management field is fostered by a separate national research programme KYT. It focuses on generic studies on nuclear waste management and on such studies on the safety of spent nuclear fuel disposal which are not directly related to Posiva's disposal project.

The Nuclear Energy Act was amended in late 2003 to ensure stable funding for a long term nuclear safety and nuclear waste management research in Finland. The objective of the funds is to guarantee the high level of national safety research and to maintain the national competence in the long run. Money is collected annually from the licence holders to special funds devoted to this purpose. For the waste research, the annual payments are proportional to the assessed liabilities in the Nuclear Waste Management Fund at the end of previous year. The total annual volume of funds for KYT programme for nuclear waste management is about 1 M€. The research projects are selected so that they support and develop the competences in spent nuclear fuel and nuclear waste management. STUK is one of the supervisors of KYT. In addition, STUK finances research assignments supporting more directly regulatory control activities, notably safety reviews of the final disposal of spent fuel.

Reports on the regulatory control of nuclear and radiation safety, including radioactive waste management, are published annually.

SECTION F. Other general safety provisions

Article 21. Responsibility of the licence holder

Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

According to Section 9 of the Nuclear Energy Act a licensee, whose operations generate or have generated nuclear waste is responsible for all nuclear waste management measures and their appropriate preparation, and is responsible for their costs. If the licence holder is found not to be capable to carry out the waste management completely or partly, the Government shall order that such nuclear waste be transferred to the responsibility of the State. The waste management obligation of the licensee will expire when the disposal of nuclear waste has been completed and STUK has confirmed that the nuclear waste is permanently disposed of in an approved manner (Sections 31-34 of the Nuclear Energy Act).

As a precondition for granting a safety licence for the use of radiation the Radiation Act requires in Section 16 that the applicant presents a valid proof on safe management of any radioactive waste, which may be generated. Further, section 50 of the Radiation Act provides that the responsible party shall organize the practice so that it meets all radiation safety requirements prescribed in the Act and take all measures needed to render radioactive waste arising from its operation harmless. The Act also provides for the responsibility of decontamination of the environment, if the radioactive material is released in such an extent that resulting health or environmental hazards requires action. According to Section 50 of the Act, in utilization of natural resources containing radioactive materials, the responsible party shall ensure that radioactive wastes do not pose any health or environmental hazards during the operations, including the final stages.

Section 51 of the Radiation Act provides that if the responsible party does not meet the requirements set for radioactive waste management, the State has the secondary obligation in managing the radioactive waste or residues. The same applies if the origin of waste is unknown, or no primary responsible party can be found.

It is the responsibility of the regulatory body to verify that the licensees fulfil the regulations. This verification is carried out through safety reviews and assessments as well as inspection programmes established by STUK.

Article 22. Human and financial resources

Each Contracting Party shall take the appropriate steps to ensure that:

(a) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

(b) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

(c) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

F.22.1. Qualified staff

According to Section 19 of the Nuclear Energy Act, a necessary condition for granting a construction licence of a nuclear facility is the availability of the necessary expertise. According to Section 20 of the Nuclear Energy Act, an operating licence of a nuclear facility can be granted if the applicant has available the necessary expertise and, in particular, if the operating organisation and the competence of the operating staff are appropriate. Furthermore, a nuclear facility must have a responsible manager and his/her deputy approved by STUK (Section 79 of the Nuclear Energy Act). Thus, the licence holder has the primary responsibility for ensuring that the employees are qualified and authorised to their jobs.

According to the Government Decision 395/1991, NPP personnel shall be well suited for its duties, competent and well trained. Initial, complementary and refresher training programmes shall be established for the personnel. For ensuring safety in all situations, competent personnel shall be available in a sufficient number. This decision covers also spent fuel storage and radioactive waste management at the NPP and on-site LILW disposal facilities. Government Decision 478/1999 on the safety of disposal of spent fuel includes similar requirements. Accordingly, FPH and TVO have special training programs for the NPP personnel in waste management as well as spent fuel handling as a part of the NPP training programme.

Considerable share of Finnish nuclear experts is retiring both within the regulator and the operators in the next 5-10 years. On the same time additional human resources are needed owing to the Olkiluoto 3 project. The challenges are met by training young experts in the nuclear field as a specific co-operation programme of all Finnish nuclear related organizations. During 2003–2005 about 100 young experts have been trained during two five–six weeks training courses emphasizing safety of NPPs but including some basic features of nuclear waste management as well. A third training course will be organized in 2005–2006. Training materials are developed that can be used by the organizations in their internal training programmes as appropriate.

Staff training at Posiva is based on personal training and development plans and company-level plans which are updated annually. The company-level plan includes an orientation program specially structured for new personnel. In addition, an elementary course dealing with the fundamentals in nuclear waste management serves for the orientation as well. Along with the construction of the underground characterisation facility ONKALO, increasing emphasis has been put on training to meet with the requirements on industrial safety, environment and quality.

Posiva has formal bilateral co-operation agreements or understandings with ANDRA (France), DBE (Germany), DoE (USA), NAGRA (Switzerland), NUMO and RWMC (Japan), Ontario Power Generation (Canada), RAWRA (Czech Republic) and SKB (Sweden). Furthermore, Posiva participates in the nuclear waste management related research projects of the Nuclear Energy Research Programme of the European Commission. The long time scales associated with the spent fuel disposal underline the importance of the availability of qualified domestic experts in the field also for far future.

According to Sections 55 and 79 of the Nuclear Energy Act, STUK is responsible for controlling the necessary qualifications on the persons engaged in activities important to safety. STUK has issued requirements on staff qualification and described the respective regulatory control procedures in Guides YVL 1.1 and YVL 1.7.

Section 14 of the Radiation Act prescribes that the responsible party is required to ensure that in safety related matters of the operations the expertise is available, taking into account the nature and the risks posed by the operation. The responsible party can appoint a special radiation safety officer. In a licence application the applicant shall provide information on the competence of the persons working with radiation.

STUK shall lay down the qualifications of the radiation safety officer and other persons, as applicable, and investigate that these qualifications are met (Section 18 of the Radiation Act). The licensee shall provide appropriate training for the employees. The Guide ST 1.4 sets the requirements for the organisation for the use of radiation including the competences needed. The Guide ST 1.8 further sets detailed requirements on radiation protection training for the radiation safety officers and qualified experts. The command that has to be demonstrated by an exam includes a general part cover-

ing basics of radiation protection and the appropriate legislation. Special requirements are attributed to different fields of applications of radiation.

F.22.2. Financial resources

Sections 35 to 53 of the Nuclear Energy Act provide detailed regulations for the financial arrangements for nuclear waste management and the Decree on the State Nuclear Waste Management Fund further specifies the financing system. Generators of nuclear waste are responsible for estimating annually future cost of managing the existing waste, including spent fuel disposal and decommissioning of NPPs. The Ministry of Trade and Industry (MTI) confirms the assessed liability and the proportion of liability to be paid into the Nuclear Waste Management Fund (fund target). The waste generators pay annually the difference of fund target and the amount already existing in the Fund, but can also be reimbursed if the Fund exceeds the liabilities. The waste generators shall provide securities to MTI for the portion of financial liability that is not yet covered by the Fund.

For the FiR1 research reactor somewhat modified practices are followed. The state has initially provided the funds on behalf of the operator (VTT). In the future the State will take care of the payments to cover the difference between the Fund target and the amount already existing in the Fund. The possible interest reimbursements are returned to the State.

The current estimates, including costs from management of existing waste quantities and from decommissioning of current NPPs and the research reactor, arise to about 1400 million Euros with no discounting. At the end of the year 2004, the funded money covered the whole liability corresponding to the current waste amounts. The fund targets and liabilities covered by securities of the nuclear power companies are shown in Figure 10. Only the liabilities regarding the management of waste resulting from the operation and decommissioning of the existing reactors are illustrated here.

According to Section 19 of the Nuclear Energy Act, a Construction Licence for a nuclear facility can be granted only if the applicant has sufficient financial resources. This condition shall be complied with throughout the operation of the facility. For example, the licensee shall have adequate financial resources to enhance the safety of the facility based on operating experience and the results of safety research as well as on the advancement of science and technology. In particular, as provided in Section 20 of the Nuclear Energy Act, the operation of the nuclear facility shall not be started until the Ministry of Trade and Industry has ascertained that the provision for the cost of waste management has been arranged. Furthermore, sections 32 and 34 of the Nuclear Energy Decree provide that the application for the construction and operating licence of a nuclear facility shall include information on the financial resources of the applicant, cost estimates and financial plan for the nuclear facility programme, as well as a description of the

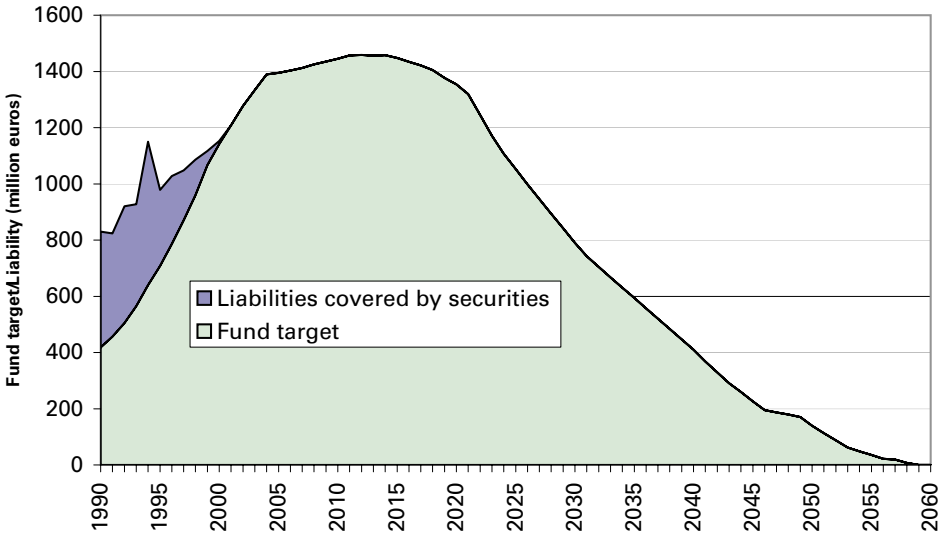

Figure 10. The fund targets (for the existing reactors) in the Nuclear Waste Management Fund and liabilities covered by securities.

timetable of nuclear waste management and its estimated costs.

The financial provisions to cover the possible harms of a nuclear accident have been arranged according to the Paris and Brussels Conventions. Finland has supported the international efforts to revise the Paris and Brussels Conventions for Nuclear Third Party Liability in order to raise the funds made available by the Contract Parties in case of accidents. Accordingly, the amendment of the Finnish Nuclear Liability Act was agreed upon by the Parliament in 2005 but it is pending the coming into force of the amendments of the Paris and Brussels Conventions. The amendments include an unlimited financial liability to licensees.

According to Section 19 of the Radiation Act, the licensee shall furnish security to ensure that it will meet the costs of waste management or any decontamination measures, if the operations are liable to produce radioactive waste that cannot be rendered harmless without substantial cost. The need to furnish security and the amount of it shall be decided by STUK when the safety licence is granted (Section 15 of the Radiation Decree).

F.22.3. Financial provisions for post-closure

According to Section 32 of the Nuclear Energy Act, a condition for the expiry of waste management obligation of a nuclear waste generator is that the waste has been permanently disposed of in an approved manner and a lump sum to the State for the further control of the waste has been paid. Thereafter, the State is responsible for the necessary waste management measures and incurred costs.

According to Section 51 of the Radiation Act, the responsible party and others who have taken part in producing or handling the radioactive materials or waste shall compensate the State for the costs incurred by the measures taken to render the waste harmless and to decontaminate the environment.

Article 23. Quality assurance

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

Sections 35 and 36 of the Nuclear Energy Decree provide that quality assurance programmes for the design and construction as well as for operation of a nuclear facility are required to be submitted to STUK within the construction and operating licence application. The general quality assurance requirements apply to the whole life of a nuclear facility.

According to the Government Decision 395/1991, quality assurance shall refer to all planned and systematic actions necessary to provide adequate confidence that a component, plant, or activity will satisfy given requirements. The Decision requires advanced quality assurance programmes to be employed in all activities which affect safety and relate to the design, construction and operation of a NPP including the waste management facilities within. Similar requirement is included in the Government Decision 478/1999 on the safety of disposal of spent fuel.

Detailed quality assurance requirements, which are applied also to other nuclear facilities than NPPs, are provided in Guides YVL 1.4 and YVL 1.9. The Guide YVL 1.4. is currently being updated but the updating of YVL 1.9 is pending development of the IAEA respective safety guide.

Quality assurance programmes of the licensees/applicants and of the main suppliers are subject to approval by STUK. Furthermore, quality assurance programmes have to be established by all other organisations participating in activities important to safety of the use of nuclear energy.

The operators of the NPPs, FPH, TVO , and the waste management company Posiva have adopted quality management systems consistent with the ISO 9001 standard. The quality management system of the ISO 9001 standard in TVO covers also the construction time of Olkiluoto 3. Moreover, FPH, TVO and Posiva have adopted environmental management system according to ISO 14001. Most of their contractors have also similar quality management systems and the others are currently developing their systems. The implementation of these quality assurance programmes is verified by STUK through audits and inspections. The research institutes of VTT have their own certified ISO9001 Quality Systems that are regularly audited.

STUK's internal Quality Manual includes quality assurance policy, description of the quality management system and organisation, principal and supporting working processes and personnel policy. Numerous internal audits, self-assessments and international evaluations have revealed development areas where improvements are needed and they are currently being tackled by STUK. In addition to STUK's Quality Manual, all organisational units of STUK have their own more detailed Quality Manuals. In 2003 STUK has updated its strategy and its quality policy. The quality management system is implemented through a process oriented approach.

The Quality Manual prepared for the regulatory control of the use of nuclear energy has been benchmarked with other regulators under auspices of OECD/NEA and IAEA working groups and bilateral agreements.

Article 24. Operational radiation protection

Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

(a) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

(b) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

(c) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

(a) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

(b) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

F.24.1. Basic radiation protection requirements

Basic requirements for the safe use of nuclear energy are given in the Nuclear Energy Act. The principles of justification, optimisation and dose limitation are included in Section 2 of the Radiation Act. Occupational dose limits and dose limits for the general public are set forth in Sections 3 to 5 of the Radiation Decree. These limits are in conformity with the ICRP 60 Recommendation (1990) and the Council Directive 96/29 EURATOM.

According to Section 3 of the Radiation Decree the effective dose caused by radiation work to a worker shall not exceed 20 mSv per year as an average over five years or 50 mSv in any single year. As a consequence of the implementation of the Council Directive 96/29 EURATOM, medical surveillance of the employees of the NPPs and other working places where the employees are engaged in radiation work has been performed since 1999 according to a practice based on the Directive.

Section 6 of the Radiation Decree states that detailed instructions on the application of the maximum values laid down for radiation exposure and on the calculation of radiation doses shall be issued by STUK. It further states that notwithstanding the dose limits given in Sections 3 to 5 of the Decree (e.g. the 1 mSv/a limit for the general public), STUK may, in individual cases, set constraints lower than the maximum values, if such constraints are needed to take account of radiation exposure originating in different sources and to keep the exposure as low as reasonably achievable.

F.24.2. Dose constraints

Government Decision 395/1991 includes regulations for limiting the radiation exposure of the general public and the releases of radioactive substances into the environment, arising from the normal operation of a NPP (including spent fuel stor-

age and LILW treatment and storage facilities), as well as from anticipated operational transients and accidents. The constraint for the dose commitment of the individual among the population, arising in one year from the normal operation and anticipated operational transients of a NPP, is 0.1 mSv. The individual dose constraint for postulated accidents is 5 mSv in a year. The dose constraints are defined for the entire NPP, including all units. Thus the future operation of Olkiluoto 3 will not increase the applied dose constraints at the site.

STUK has issued several YVL Guides dealing with radiation protection as regards the design and operation of NPPs (Guides YVL 1.0, 7.1, 7.9, 7.10 and 7.18). They cover also spent fuel storages and on-site waste management facilities, including the operational period of on-site disposal facilities for LILW.

Government Decision 398/1991, dealing with the safety of LILW disposal, provides that the constraint for the expectation value of the annual effective dose to any member of the public is 0.1 mSv. The constraint for the annual dose to any member of the public, arising from accident conditions which are caused by natural events or human actions and which are considered to be plausible, is 5 mSv.

According to Government Decision 478/1999, a spent fuel disposal facility and its operation shall be designed so that as a consequence of undisturbed operation of the facility, discharges of radioactive substances to the environment remain insignificantly low. In Guide YVL 8.5 on the operational safety of spent fuel disposal this requirement is interpreted as a constraint of 0.01 mSv annual effective dose to the most exposed members of the public. The radiological consequence of anticipated operational transients as annual effective dose to the most exposed members of the public shall remain below 0.1 mSv. The annual effective dose caused by postulated accidents shall remain below 1 mSv.

F.24.3. Operational experiences

Experience gained from operation of Finnish nuclear facilities shows that the dose constraints have not been exceeded, and that the ALARA principle has been followed. The results of environmental surveillance programmes show that the amount of radioactive materials in the environment of the NPP sites, originating from the Finnish nuclear facilities, has been very low. Calculated radiation exposures to the critical groups in the environment of the NPPs are currently less than one per cent of the dose constraint (Figure 11). The new NPP unit, Olkiluoto 3, will have advanced liquid and gaseous waste treatment systems and it is expected that the discharges from the entire Olkiluoto NPP will remain at the current low level after the commissioning of the new unit. It should also be noted that the dose constraints and actual doses discussed above apply to the entire operation of the NPP and the contributions due to spent fuel storage and waste management are insignificant fractions.

Notification limits for occupational collective doses for the NPP employees given in Guide YVL 7.9 is 2.5 manSv per 1000 MW_e as an average over two consecutive years. A more stringent target

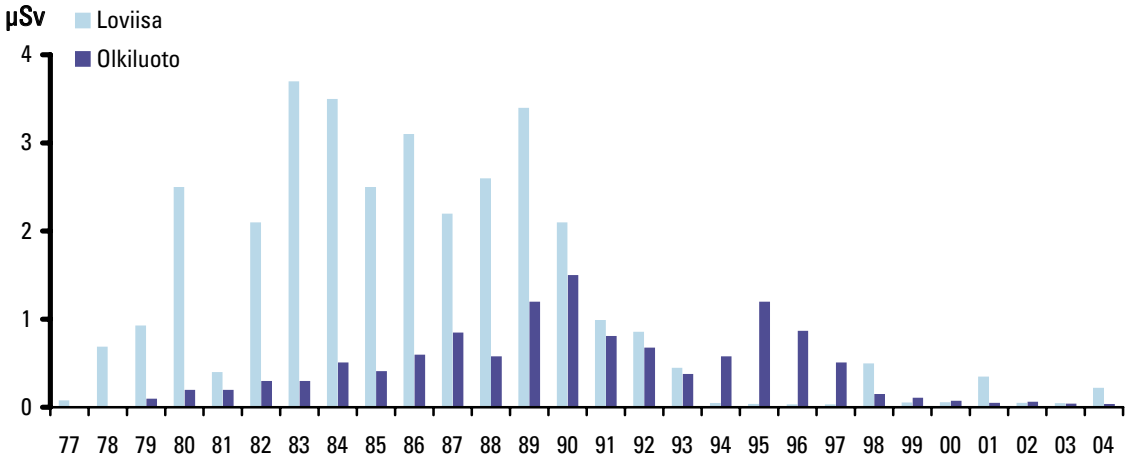

Figure 11. Dose commitments calculated by STUK to members of critical groups in the vicinity of the Finnish NPPs due to annual discharges. The dose constraint is 100 µSv/a.

of 0.5 manSv per 1000 MW_e as an average over the whole lifetime of the plant is set in YVL 7.18 for the design of a NPP. The fraction of occupational collective doses resulting from waste management, decontamination and spent fuel management activities at the both NPPs has been quite small, some hundredths of manSv.

According to Government Decision 395/1991 the probability of nuclear fuel damage shall be low during normal operational conditions and anticipated operational transients. Further requirements concerning the use, handling and storage of fuel are given in Guides YVL 6.1, 6.6 and 6.8. Fuel leakages in the Finnish NPPs have been few and small. Thus, the accumulation of fission products in LILW from NPPs has been relatively low. In 2003, one incident related to spent fuel management was classified as 1 on the INES scale (cf. Section G.9.5) at the nuclear facilities, while no incidents related to radioactive waste management or discharges of radioactive substances have been classified greater than INES 0.

Article 25. Emergency preparedness

Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F.25.1. On-site emergency preparedness

The emergency preparedness plans for spent nuclear fuel storages and radioactive waste management facilities are included in the plans for NPPs. According to Section 20 of the Nuclear Energy Act, adequate on-site emergency preparedness arrangements are required before starting the operation of a nuclear facility. The basic regulations for on-site emergency preparedness for nuclear installations are given in the Government Decision 397/1991 and the detailed requirements by STUK in Guide YVL 7.4.

The licensee is responsible for the on-site emergency response arrangements. Government Decision 397/1991 states e.g. that emergency planning shall be based on the analysis of NPP behaviour in emergencies and on the analysis of the consequences of emergencies. Action in an emergency shall be planned taking into account controllability of events as well as severity of their consequences. Therefore, emergencies are grouped into classes. Decision 397/1991 requires also that appropriate training and exercises shall be arranged to maintain operational preparedness. Exercises shall be arranged in co-operation with the authorities concerned.

On-site emergency exercises are conducted annually so that at least the licensee personnel, local off-site emergency management group and STUK participate in them. There are always observers from STUK and several other organisations assessing the performance of exercising teams.

STUK carries out periodical inspections on-site for verifying operational emergency preparedness. Among other things, the maintenance and adequacy of appropriate rooms and equipment, communication and alarm systems, computerised support systems as well as personnel training and qualifications are inspected.

Concerning the small users, the Radiation Decree, Section 17 stipulates that STUK has to be notified immediately in case of any abnormal occurrences, connected with the use of radiation, that is substantially detrimental to safety, at the place where the radiation is used or in its environment. In addition, STUK has to be informed if a radiation source has disappeared, been stolen, lost or otherwise ceased to be in the licensee's possession.

F.25.2. Off-site emergency preparedness

In addition to the on-site emergency plans established by the licensees, off-site emergency plans are prepared by local authorities. The requirements for off-site plans and activities in a radiation emergency are provided in the Act and Decree of Rescue Services (1999, revised 2003) and in the Decree on Emergency Planning and Public Information issued by the Ministry of the Interior (2001). The full scale off-site emergency exercises are conducted every third year. Smaller scale exercises are held annually at each site with participation of the staff of NPP, local authorities and STUK. In 2000, a national emergency and rescue exercise of the en-

tire governmental organisations was carried out in Finland. A similar exercise is carried out in March–September 2005.

In addition to the domestic nuclear emergency exercises, STUK has taken part e.g. in the international emergency exercises like INEX2-exercises sponsored by the OECD/NEA in 1997–1999 and JINEX-1 organised by the IAEA in 2001. In the beginning of 2005 INEX-3 sponsored by the OECD/NEA was held in Finland. In this exercise recovery management after malevolent significant contamination was tested. STUK also took part the ConvEx-3 exercise organised jointly by all relevant international organisations in May 2005. STUK has also participated as a co-player in the Swedish NPPs' and authorities' emergency exercises.

F.25.3. Early notification and communication

The on-site and off-site plans include provisions to inform the population in the case of an accident. In addition, written information on radiation emergencies, emergency planning and response arrangements have been provided to the population. Such information can also be found in the telephone directories of Finland. Citizens living near nuclear facilities are regularly provided with more detailed written information on nuclear accidents and emergency measures needed.

STUK is the National Warning Point and the National Competent Authority in Finland for any kind of situation which might result in actual or potential detoriation of radiation safety of the population, environment or society. STUK has established an Emergency Preparedness Manual for its own activities in the case of a nuclear accident or radiological emergency. STUK has an expert on duty for 24 hours a day, in order to be able to immediately give advice to local and governmental authorities on needed emergency response actions. These actions can include, e.g. warning the population with a message which can be heard through all radio channels. The message on an exceptional event (alarm) can be received from the operating organisations of the facilities, or automatically from the radiation monitoring network that is dense in the whole country, or from foreign authorities. In addition to the expert on duty for fast emergency response, STUK has a separate 24 hour contact point for media.

Finland is a Contracting Party to the International Convention on Early Notification of a Nuclear Accident, as well as to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, both done in Vienna in 1986. Furthermore, as a Member State of the European Union, the Commission Directives concerning accident situations apply in Finland. In addition, Finland has respective bilateral agreements with Denmark, Germany, Norway, Russia, Sweden and Ukraine. Accordingly, arrangements have been agreed to directly inform the competent authorities of these countries in the case of an accident. Similar arrangements ensure direct notification to the authorities of Estonia. The bilateral agreements also cover the exchange of relevant information on nuclear facilities.

Article 26. Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(a) qualified staff and adequate financial resources are available;

(b) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(c) the provisions of Article 25 with respect to emergency preparedness are applied; and

(d) records of information important to decommissioning are kept.

F.26.1. Regulatory provisions for decommissioning

Section 19 of the Nuclear Energy Act states that sufficient and appropriate methods for arranging the decommissioning of a nuclear facility have to be identified before the construction licence is granted. Guide YVL 1.0 requires that provisions for decommissioning of the NPPs shall be made already during the design phase. Limitation of radioactive waste generation and of the radiation exposure of workers and the environment arising from decommissioning shall be considered.

The decommissioning has been taken into account in the design of the new NPP unit Olkiluoto 3. For example, the layout of the plant has been designed to have an easy access for repair and maintenance. In addition, the buildings and rooms of different radiation levels have been separated to

facilitate the control of contamination and radiation levels and to keep the dose rates low during operation and maintenance. The aim of the design has also been to minimize the amount of radioactive waste, to ease dismantling and removal of components and structural materials, and to reduce decommissioning costs.

The general provisions for licensing and the waste management obligation included in the current nuclear energy legislation are adequate for regulating a decommissioning project. Only minor supplements will be sufficient to the Nuclear Energy Act and Decree. The Government Decisions related to nuclear and waste management safety are at the present under revision and the provisions for decommissioning are planned to be included in the update. In addition, an appropriate YVL-Guide will be developed by STUK. The update of the guide YVL 8.2. on clearance, which is planned for 2006 will cover the removal of control of materials arising from decommissioning of nuclear facilities and of previously licensed sites.

The licensees are responsible for the implementation of decommissioning. In the event that the licensee is incapable of doing so, the state has the secondary responsibility. In this case, the costs are covered by assets collected in the Nuclear Waste Management Fund and by securities provided by the licensees (see Chapter F.22.2). The financing of decommissioning of the research reactor FiR 1 and the management of resulting waste is also covered by assets in the Nuclear Waste Management Fund. The decommissioning of facilities subject to the Radiation Act is covered by the security referred to in Section 19 of the Act.

F.26.2. Decommissioning plans

The four currently existing Finnish nuclear power units have been in operation for 25 to 28 years and are planned to be operated at least for two more decades. No nuclear power plants are being decommissioned and such decommissioning projects are neither foreseen in the near future. The current licence of FiR 1 research reactor is valid until 2011. Nevertheless, the operator of FiR1, VTT Technical Research Centre of Finland has started a more detailed planning of the shutdown and decommissioning of the research reactor as a preparatory action to the possible decision of the closure of the facility. The decision to implement the plan is dependent on the outcome of efforts to arrange alternative, sustainable funding for continued operation of the research reactor.

According to the governmental policy decision of 1983 and later decisions by the Ministry of Trade and Industry, the licensees are obliged to prepare decommissioning plans for regulatory review and to update them every five years. These plans aim at ensuring that decommissioning can be appropriately performed when needed and that the estimates for decommissioning costs are realistic. The latest updates of the NPP decommissioning plans were published at the end of 2003. The next plan for the Olkiluoto NPP to be prepared by the end of 2008 will also include the decommissioning plan for Olkiluoto 3.

The decommissioning plans include assessments of occupational and off-site safety of the operations. They include rather detailed descriptions of the required dismantling and waste management operations and estimates of workforce and other resources needed. The plans are based on the actual designs of the nuclear facilities and they take into account the activity inventories in the facilities. The contamination levels in the facilities are followed by means of specific monitoring and recording programmes.

The cost estimates of decommissioning are depending on the amount of waste to be disposed as radioactive and thus the limits to be applied for removal of material from control (clearance limits). The respective Guide YVL 8.2 is being revised to cover also bulk amount of waste resulting from decommissioning and the premises for release of regulated sites.

The decommissioning plan for the NPP units Loviisa 1 and 2 is based on 50 years operation and immediate dismantling. Large and heavy reactor components, e.g. reactor pressure vessels and steam generators, will be removed intact without cutting them in pieces. The advantages of the method are saving of time and occupational radiation doses. Activated components accumulated during the operation will be packed into the reactor vessels which will serve as additional barriers. The waste will be disposed to Loviisa site by extending the current LILW repository. (C.f. Figure 5)

The next decommission plan for Olkiluoto 1 and

2 units will be based on 60 years of operation and 30 years of safe enclosure. For Olkiluoto 3, immediate dismantling is considered as an option as well. As in the case of Loviisa, the reactor pressure vessels of Olkiluoto 1 & 2 are planned to be removed and disposed as such, in one piece at Olkiluoto site.

The decommissioning plan of the research reactor FiR 1 is also updated every five year, the latest update being carried out in the year 2000. A more detailed plan will be prepared in 2005. Studies are under way on the technical feasibility of disposing of the decommissioning wastes in one of the disposal facilities at the NPP sites.

SECTION G. Safety of spent fuel management

Article 4. General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(a) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(b) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(c) take into account interdependencies among the different steps in spent fuel management;

(d) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(e) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(f) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(g) aim to avoid imposing undue burdens on future generations.

G.4.1. Scope and principal regulations

Finland has adopted once-through strategy for spent nuclear fuel management as described in Section B. Spent fuel is currently stored at the NPPs while the operation of the final disposal facility is scheduled to commence in 2020. The discussion in this Section is limited to the interim storage of spent fuel whereas the final disposal plans for spent fuel are discussed in Section H, Safety of radioactive waste management.

The general regulations for the safety of spent fuel storage are included in Government Decision 395/1991. More specific technical requirements are given in Guides YVL 1.0 and 6.8.

G.4.2. Criticality and removal of residual heat

According to Government Decision 395/1991, the possibility of a criticality accident shall be extremely low. Guide YVL 1.0 stipulates that a NPP shall have sufficient rooms and systems for the safe handling, treatment, storage and inspection of fresh and spent fuel. Fuel criticality shall be prevented primarily by the use of appropriate storage structures. Appropriate technical and administrative arrangements are to be made during fuel storage and transfer to prevent fuel damage. Spent fuel cooling must be possible even if a single failure occurs. Guide YVL 6.8 gives limits for the multiplication factor (<0.95) and coolant temperature in normal (<60ºC) and postulated accident conditions (<100ºC). The technical specifications of the facilities give more detailed requirements for criticality prevention and residual heat removal.

G.4.3. Waste minimization

Relevant to the objective of waste minimization is the requirement provided by the Guide YVL 6.8: the storage conditions shall be such that corrosion of fuel and storage equipment is minimized. The coolant shall be kept sufficiently clear and clean to facilitate e.g. checking of fuel identification. Requirements for safety related systems in the storage facility are also given. In Olkiluoto leaking fuel bundles are placed in the fuel pool in hermetically closed capsules to minimize the Cs-activity in the fuel pool clean-up system and in effluents. In Loviisa the integrity of the nuclear fuel is secured. Also the cobalt content of the shielding elements

(dummy elements) has been decreased, which results to smaller amount of activation product in the cooling water.

G.4.4. Interdependencies

The Finnish once-through spent fuel management scheme provides that he fuel is stored in pools at both power plant sites and is planned to be disposed of in Olkiluoto, in the vicinity of the largest present interim storage. Spent fuel transport, encapsulation and disposal plans have been adapted to the fuel types and storages at both the Olkiluoto and Loviisa NPPs. The plans need to be amended to take into account of the dimensions and other characteristics of the fuel of the new unit Olkiluoto 3. The implementing organisation for spent fuel disposal, Posiva, is owned by the NPP utilities. Thus, the interdependencies between different steps are taken into account in practice.

Though the current policy is based on the once-through option, reprocessing of spent fuel would be technically feasible later on due to the lengthy interim storage period. The selected disposal concept would, to the great extent, be applicable to disposal of high level reprocessing waste as well.

G.4.5. Protection of individuals, society and the environment

The operational radiation protection requirements for spent fuel storage are discussed under Article 24. Operating experiences as discussed under Article 9 indicate that spent fuel storage has caused practically no releases and occupational radiation exposures have been very low.

G.4.6. Biological, chemical and other hazards

The biological, chemical and other non-radiological hazards posed by the spent fuel storage are low compared to the potential radiological hazards. Such hazards are regulated by legislations related to general occupational safety and management of hazardous substances.

G.4.7. Protection of future generations and avoidance of undue burdens on future generations

Interim storage of spent fuel is envisaged to last only some decades. The current high level of safety can be maintained during that time by means of appropriate operational, maintenance and surveillance procedures. The costs of storage will be covered by the assets collected in the State Nuclear Waste Management Fund. Thus the future generations are adequately protected and they will neither be imposed to any other undue burdens.

Article 5. Existing facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

As described in Chapter D.1., the existing spent nuclear fuel storages in Finland are at the Loviisa and Olkiluoto NPPs and are covered by their Operation Licences. In addition, 22 spent fuel elements are stored at the FiR 1 under the research reactor licence.

G.5.1. Safety reviews

The latest comprehensive safety assessments of the Loviisa and Olkiluoto NPPs, including the spent fuel storages, were carried out in connection with re-licensing of the operation of the plants in 1998.

The current operating licences of the Loviisa 1 and 2 and Olkiluoto 1 and 2 are valid up to the end of 2007 and 2018, respectively. For the Loviisa units the operating licence renewal application will be submitted to the authorities for regulatory review by the end of 2006. For the Olkiluoto units the utility must by the end of 2007 submit to STUK a comprehensive periodic safety review report, after which STUK makes its own safety assessment.

The comprehensive safety assessments for applications for the renewal of licences include updating e.g. the following safety relevant documents:

- Final safety analysis reports
- Quality assurance programmes for operation
- Technical specifications
- Programmes for periodic inspections
- Plans for nuclear waste management, including decommissioning and disposal
- Timetable of nuclear waste management and estimated costs
- Plans for physical security and emergency preparedness
- Administrative rules for the facilities

- Programmes for radiation monitoring in the environment of the facilities
- Licensee assessments of compliance with the regulations, including assessment of the fulfilment of YVL Guides
- Licensee assessments of how an adequate safety level has been maintained.

The periodic safety review report should include the same update information, as appropriate.

In addition to the review of the above mentioned documents, STUK has also made independent safety assessments and annually a number of regular and topical inspections to the facilities. The statements of STUK given to the Ministry of Trade and Industry in 1998 concluded that, as regards radiation and nuclear safety, the conditions at the Loviisa and Olkiluoto NPPs comply with the Finnish nuclear energy legislation and regulations.

International OSART (Operational Safety Review Team) missions have visited the Olkiluoto NPP in March 1986 and the Loviisa NPP in November 1990. Independent safety reviews were conducted by World Association of Nuclear Operators (WANO) at Olkiluoto and Loviisa NPPs in 1999 and 2001, respectively.

The safety of the FiR 1 research reactor was reviewed in the context of the renewal of the operating licence in 1999. The new licence is valid until the end of 2011. The safety of the FiR 1 reactor is continuously reviewed by means of STUK's periodic inspection programme and other regulatory control measures. Under the terms of reference of INFCIRC/18/Rev.1, an IAEA team last visited Finland in 1999 for evaluating the nuclear safety and radiation protection at the FiR 1.

G.5.2. Need for safety enhancement

Continuous safety assessment and enhancement approach applied in Finland is based on Government Decision 395/1991 stating that operating experience from NPPs (including the spent fuel storages) as well as results of nuclear safety research shall be systematically followed and assessed. For further safety enhancement, such actions shall be taken that are justified considering operating experience and the results of safety research as well as the advancement of science and technology.

In conclusion, the safety review required by Article 5 of the Convention has already been carried out. Safety improvements have been annually implemented at the Loviisa and Olkiluoto plants including the facilities for spent nuclear fuel handling and interim storage since the commissioning. There exists no urgent need for additional improvements to upgrade the safety of these facilities.

Article 6. Siting of proposed facilities

Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:

(a) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;

(b) to evaluate the likely safety impact of such a facility on individuals, society and the environment;

(c) to make information on the safety of such a facility available to members of the public;

(d) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

The siting decisions for the existing Finnish NPPs were made more than 30 years ago; extensions of their spent fuel storages were made later on and are again foreseen by the end of this decade. The new NPP unit, Olkiluoto 3, with attached spent fuel management facilities, obtained the construction licence in February 2005.

G.6.1. Siting process and site-related factors

A Decision-in-Principle by the Government is required according to Section 11 of the Nuclear Energy Act for the construction of a major nuclear facility. This decision, which ultimately has to be endorsed by the Parliament, has to be made before

the submittal of an application for a construction licence. The decision-in Principle procedure is described in Chapter E.19.2.

According to Section 24 of the Nuclear Energy Decree, the application for a Decision-in-Principle has to include e.g.:

- an outline of the ownership and occupation of the site
- a description of settlement and other activities and town planning arrangements at the site and in its vicinity
- an evaluation of the suitability of the planned location and the restrictions caused by the nuclear facility on land use in the immediate vicinity
- an assessment report in accordance with the Act on the Environmental Impact Assessment Procedure (468/1994) as well as a description on the design criteria that will be observed by the licence applicant in order to avoid environmental damage and to restrict the burden to the environment.

Detailed requirements on the EIA procedure including public hearings are provided in the Decree on Environmental Impact Assessment Procedure (792/1994).

The suitability of the site has to be confirmed in the application for a construction licence. This application includes also up-to-date descriptions similar to the above. The requirements for siting a NPP are given in Guide YVL 1.10.

In the design of a NPP, including spent fuel management facilities, site-related external events have to be taken into account. Government Decision 395/1991 provides that the most important safety functions shall remain operable in spite of any natural phenomena, estimated to be possible at the site, or other events external to the plant. Specific provisions against seismic events are provided in Guide YVL 2.6.

G.6.2. Safety impact

STUK makes a preliminary safety appraisal of the Decision-in-Principle application and reviews the construction and operation licence applications, including all site-specific safety reports. These reports deal e.g. with meteorology, hydrology, population and use of land and sea area as well as other items mentioned above. During the operation of the nuclear facility, the final safety analysis report, including the descriptions of its site-specific parts, has to be periodically reviewed and updated as needed.

More details of safety assessments are included in Chapter G.8.

G.6.3. Availability of information

The availability of information in case of the siting process for a major nuclear facility is based on the Finnish legislation on the openness of information, notably on the Act on the Openness of Government Activities (621/1999). Further requirements are based on the Act and Decree on the Environmental Impact Assessment Procedure and the Nuclear Energy Act. The first step of consultation with the general public is the Environmental Impact Assessment (EIA) process. Public hearings are arranged both in the preparation stage of the EIA programme and during the actual assessment. The responsible contact authority for that process is the Ministry of Trade and Industry. The EIA report must be attached to the application for the Decision-in-Principle.

Section 13 of the Nuclear Energy Act states that, before the Decision-in-Principle is made, the applicant shall make available to the public an overall description of the facility, of the environmental effects it is expected to have and of its safety. The Ministry of Trade and Industry shall provide residents and municipalities in the immediate vicinity of the nuclear facility as well as local authorities chance to present their opinions in writing before the Decision-in-Principle is made. Furthermore, the Ministry shall arrange a public hearing in the municipality where the planned site of the facility is located and during this hearing the public shall have the opportunity to give their opinions either orally or in writing. The presented opinions have to be made known to the Government. Section 14 of the Act provides further that a necessary prerequisite for the Decision-in-Principle is that the planned host municipality for the nuclear facility is in favour of siting the facility in that municipality.

G.6.4. Consulting of Contracting Parties

Finland is a Contracting Party to the Convention on Environmental Impact Assessment in a Transboundary Context, done in Espoo in 1991.

The Finnish policy is, as stipulated in Sections 14 and 15 of the Act on the Environmental Impact Assessment Procedure, to provide full participation to all neighbouring countries, which can be affected by the nuclear facilities in question. In addition, the bilateral agreements mentioned in Chapter F.25.3. include provisions to exchange information on the design and operation of nuclear facilities. The most recent consultation with neighbouring countries took place in the context of the Environmental Impact Assessment carried out for the Decision in Principle of the new NPP unit, Olkiluoto 3.

Article 7. Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(b) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(c) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

The general design of the nuclear facility and the technology used is assessed by STUK for the first time in the context of review of the application for a Decision-in-Principle and performing a preliminary safety appraisal of the facility. More detailed safety assessments are carried out by STUK when reviewing the applications for construction licence and operating licence. Design is reassessed against advancement of science and technology, when the operating licence is renewed. The new NPP unit under construction, Olkiluoto 3, has a pool type interim storage for spent fuel. The preliminary safety analysis report and other safety related documents for that facility were reviewed in 2004 as a part of the construction licence process. The fuel building of the new unit is designed to withstand a large aeroplane crash.

G.7.1. Limitation of radiological impacts

According to Section 19 of the Nuclear Energy Act the prerequisite for granting a construction licence is that the nuclear facility is appropriate in respect to safety of the planned operations and that the environmental protection has been taken into account appropriately. Section 32 in the Nuclear Energy Decree requires that the construction licence application shall include a description of the effects of the nuclear facility on the environment and a description of the design criteria that will be observed by the applicant in order to avoid environmental damage and to restrict the burden on the environment. More detailed requirements are given in Government Decision 395/1991 and in Guide YVL 1.0.

The limitation of radiological impact is discussed in more details in Section F in the context of Article 24 (Chapters F.24.1 and F.24.2).

G.7.2. Provisions for decommissioning

In the context of licensing requirements, Section 32 of the Nuclear Energy Decree lays down that the application for a construction licence has to include a description of the applicant's plans and available methods for arranging nuclear waste management, including the decommissioning of the nuclear facility and the disposal of nuclear wastes, and a description of the timetable of nuclear waste management and its estimated costs. More detailed requirements for the construction permit application are given in Guide YVL 1.0. The requirements regarding decommissioning plans are discussed in Chapter F.26.2.

G.7.3. Tested technology

The requirement to use proven or otherwise carefully examined, high quality technologies is stated in the design requirements provided in the Government Decision 395/1991. Detailed requirements on the design of spent fuel handling systems are given in Guides YVL 1.0 and YVL 6.8. Spent fuel storage at the Finnish NPPs is based on pool technology, of which extensive experiences exists worldwide.

Article 8. Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(b) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (a).

The requirements of performing the initial safety assessment and environmental impact assessment for nuclear facilities are discussed in the context of Article 6 (Chapters G.6.1–G.6.2). A safety analysis is included in the Decision-in-Principle application. The analysis is further elaborated in the preliminary safety analysis report (PSAR) and final safety analysis report (FSAR) attached to the applications for construction and operating licences, respectively. According to Section 112 of the Nuclear Energy Decree, FSAR has to be continuously kept up-to-date.

Government Decision 395/1991 requires that if compliance with the safety regulations cannot be directly ascertained, fulfilment shall be demonstrated by the necessary experimental and calculation methods. Safety of facilities for spent fuel storage and the design of the pertinent safety systems shall be substantiated by accident analyses. Analyses shall be maintained and revised when necessary, taking into account operating experience, the results of experimental research and the advancement of calculating methods.

The safety assessments are reviewed by STUK with support of independent safety analyses and/or external experts. The licences and related safety documents of the on-site spent fuel storages are attached to those of the respective NPPs and also the renewal review processes take place concurrently.

Article 9. Operation of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(b) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(c) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(d) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(e) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(f) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(g) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

G.9.1. Initial authorisation

According to Section 36 of the Nuclear Energy Decree, the final safety analysis report is required to be submitted to STUK when applying for an operating licence. More detailed requirements are given in Guide YVL 1.1. The requirements for safety assessment are discussed in detail under Article 8.

Requirements for the commissioning programme for NPPs and associated spent fuel storages are set forth in Guide YVL 2.5. According to the Guide, the purpose of the commissioning programme is to give evidence that the plant has been constructed and will function according to the design requirements. Through the programme possible deficiencies in design and construction can also be observed. The commissioning programme is described in the preliminary and final safety analysis reports, which are submitted to STUK for approval.

G.9.2. Operational limits and conditions

According to Section 36 of the Nuclear Energy Decree, the applicant for an operating licence has to provide STUK with the technical specifications.

They shall at least define limits for the process quantities that affect the safety of the facility in various operating states, provide regulations on operating restrictions that result from component failures, and set forth requirements for the testing of components important to safety.

In Government Decision 395/1991, it is further required that appropriate procedures shall exist for the operation, maintenance, in-service inspections and periodic tests as well as transient and accident conditions. Guide YVL 6.8 provides that conditions ensuring safe storage, handling and inspection of fuel shall be drawn up and included in the technical specifications for the plant unit.

The technical specifications are subject to the approval of STUK prior to the commissioning of a facility. Strict observance of the technical specifications is verified by STUK through a regular inspection programme. Technical specifications are updated based on operational experiences, tests, analyses and plant modifications. Some recent incidents that have resulted to update of technical specifications are discussed in G.9.5.

G.9.3. Established procedures

Guide YVL 1.9 on quality assurance requires that documents and procedures for operation, maintenance, inspection and testing are established and that these documents are continuously kept up-to-date, mutually consistent and in accordance with the state of affairs. The responsibilities and administrative procedures indicating how to take care of these actions are described in the quality assurance programme of the facility. The procedures shall be approved by the licensee itself, and most of them are required to be submitted to STUK for information. Detailed requirements are presented in appropriate YVL Guides. STUK verifies by means of inspections and audits that approved procedures are followed in the operation of the facility.

G.9.4. Engineering and technical support

The staffing, training and qualifications of the personnel are discussed in general in Chapter F.22.1. The licensee has the primary responsibility for ensuring that his employees are qualified and authorised to their jobs and that the continuity of the expertise is secured for the operational lifetime of the facility. Guide YVL 1.7 specifies the expertise requirements for technical support staff. Guide YVL 6.8 requires specially that fuel may be handled only by personnel who has the appropriate training and whose competence has been ascertained. Fortum Nuclear Services Ltd is working as a technical supporting organization for the Loviisa NPP personnel also in waste management and nuclear fuel questions. For TVO the respective support organizations are sections of Nuclear Engineering and Power Plant Engineering.

Competence of the engineering and technical support is supervised by the licensee. In addition, STUK carries out inspections and audits by which also the competence of the support staff is evaluated.

G.9.5. Operating experiences, incident reports and evaluation

Government Decision 395/1991 requires that operating experience as well as results of safety research shall be systematically followed and assessed. For further safety enhancement, actions shall be taken which can be regarded as justified considering operating experience and the results of safety research as well as the progress of science and technology. Guide YVL 1.11 provides detailed requirements and administrative procedures for the systematic evaluation of operating experiences, and for the planning and implementation of corrective actions. The licensees have duly developed the required procedures for analysing operating experiences.

According to Guide YVL 6.8, a spent fuel condition surveillance program, subject to STUK's approval, shall be drawn up in order to monitor the effects of long-term storage on spent fuel.

Guide YVL 1.5 provides in detail the reporting requirements on incidents, operational disturbances and events, which have to be reported to STUK. It also defines requirements for the contents of the reports and the administrative procedures for reporting, including time limits for submitting of various reports. STUK publishes the operational events in its quarterly reports on nuclear safety that are also available to the general public through internet or paper reports in Finnish. STUK Annual Report on nuclear safety summarizes events from the whole year and is available to the general public through internet or paper reports both in Finnish and in English.

TVO conducted and reported in 2002 a periodic

safety evaluation of the separate spent fuel storage at the Olkiluoto site. Some deficiencies in the structures, systems or procedures were identified and a plan for corrective actions has been made and implemented accordingly.

Some events related to the storage of spent fuel have been reported in recent years. In 2003, one event classified level 1 on the International Nuclear Event Scale (INES) was reported at Olkiluoto 1. The annual operating test of the floor drainage level measurement in the spent fuel storage, specified in the Technical Specifications, had in several years not been performed to four level controls that are located in not easily accessible rooms. The respective Technical Specifications were specified in more detail and training on the basics of Technical Specifications was arranged for the personnel.

In 2004, one event on the INES scale 0 related to fuel handling errors was reported both by FPH and TVO. At Loviisa spent fuel was being moved from a transfer rack to the storage pool at the spent fuel storage when one fuel assembly was erroneously lowered to a wrong storage slot. Later analyses showed that the situation would not have significantly endangered the workers or the surrounding population. Subsequently, TV- camera was installed in the refuelling machine so that the driver can better see the X- and Y-coordinates. The technical specifications were updated accordingly.

At the spent fuel storage of the Olkiluoto plant the fuel handling machine erroneously grabbed the fuel element, which consists of the fuel assembly and its shroud tube, by the assembly alone, and not by the shroud tube. In consequence of the event TVO revised the fuel handling measures and related procedures. The transfer machine's programmable controller was modified and the transfer machine was fitted with a more powerful camera. The event was of minor safety significance. Had the fuel assembly sustained damage, even then the radiation safety of workers or the environment would not have been endangered.

Leakages through the steel liners in fuel pools at the Finnish NPPs have been very infrequent. Over years only one leakage requiring repair works has been discovered in liners of a pool where spent fuel is being stored.

G.9.6. Decommissioning plans

The preparation and updating of decommissioning plans, as required in Section 19 of the Nuclear Energy Act and the Decision by Ministry of Trade and Industry is discussed in Chapter F.26.

Article 10. Disposal of spent fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

According to the Finnish waste management policy, spent fuel is regarded as waste and shall be permanently disposed of in Finland. Therefore, disposal of spent fuel is discussed in Section H, in the context of safety of radioactive waste management.

SECTION H. Safety of radioactive waste management

Article 11. General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(a) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(b) ensure that the generation of radioactive waste is kept to the minimum practicable;

(c) take into account interdependencies among the different steps in radioactive waste management

(d) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(e) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(f) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(g) aim to avoid imposing undue burdens on future generations.

H.11.1. Scope and principal regulations

In this Section, management of LILW from nuclear facilities, including disposal, management of other radioactive waste and the plans for spent fuel encapsulation and disposal are discussed. The relevant general regulations are, beside the Nuclear Energy Act and Decree, Government Decision 395/1991 for predisposal management of LILW from NPPs, Government Decision 398/1991 for disposal of LILW from NPPs and Government Decision 478/1999 for spent fuel encapsulation and disposal. More detailed technical requirements on LILW management and LILW and spent fuel disposal are given in Guides YVL 8.1 to 8.5. Radioactive waste subject to Radiation Act is regulated by Guide ST 6.2.

H.11.2. Criticality and removal of residual heat

In LILW management within the once-trough fuel cycle the criticality and residual heat pose no special problem.

Government Decision 478/1999 on spent fuel encapsulation and disposal requires that the formation of such spent fuel configurations that would cause an uncontrolled chain reaction of fission shall be prevented by means of structural design of systems and components. Guide YVL 8.5 further specifies that the transport casks, storage rooms and handling equipment as well as the waste canisters shall be designed so that no critical fuel concentrations may be formed in any operational situations, including anticipated operational transients and postulated accidents. The canisters emplaced in the geological repository shall retain their subcriticality in the long-term, when the internal structures of the canisters may have corroded and the canisters partly filled with groundwater.

A spent fuel disposal canister must meet the normal criticality safety criteria. The effective multiplication factor must be less than 0.95 also when the canister is in the most reactive credible configuration (optimum moderation and close reflection). Uncertainties in the calculation methods may necessitate the use of an even lower reactivity limit.

Furhermore, a canister used for final disposal

of nuclear fuel must be sub-critical also under very unfavourable conditions, i.e. for instance, when:

- the fuel in the canister is in the most reactive credible configuration
- the moderation by water is at its optimum
- the neutron reflection on all sides is as effective as credibly possible.

The criticality safety of the copper/iron canisters developed for the final disposal of the Finnish spent nuclear fuel has been studied by Posiva with the MCNP4C Monte Carlo code.

All the three types of spent fuel disposal canisters planned to be used for final disposal in Finland have been analysed. It has been proved in an earlier study by Posiva (1995), that a version of the VVER canister loaded with twelve similar fresh VVER 440 assemblies with the initial enrichment of 4.2% fulfils the criticality safety criteria. Also an earlier design of the BWR canister loaded with twelve fresh BWR assemblies of so-called ATRIUM 10x10-9Q type with the initial enrichment of 3.8% and without burnable absorbers has been proved to meet the safety criteria.

In the recent study in 2005 the main emphasis has been on the EPR canister. This new canister type fulfils the criticality safety criteria only if the so called burnup credit principle is applied in calculations. The fuel bundles to be loaded in an EPR canister should have been irradiated at least to a burnup of 20 MWd/kgU. In the year 2005 study only a few calculations have been carried out for the present versions of VVER and BWR canisters and the results are in good agreement with the previous ones.

Residual heat generation of spent fuel will be taken into account in the design of the encapsulation facility and the disposal concept. Guide YVL 8.4 prescribes that spent fuel disposal shall be implemented with due regard to long-term safety, and in doing so, one aspect to be considered is the reduction of the activity and heat generation prior to disposal. Guide YVL 8.5 requires the safety systems in the encapsulation facility, intended for the prevention of overheating of spent fuel assemblies, to be designed with regard to the single failure criterion. Posiva's spent fuel disposal canister and its loading has been designed so that the multiplication factor (kc) remains below 0.95 and the outer temperature below 100ºC.

The maximum specified canister surface temperature is 100ºC and a margin of 10ºC is used in the dimensioning calculations. The maximum temperature of disposal canister surface is reached within 10 to 15 years after the disposal.

Thermal dimensioning including the detailed heat transfer phenomena in the near field and optimisation of the repository has been studied. The canisters are planned to be emplaced in disposal holes in tunnels with a span of 8.6 m for VVER 440 canister, 11 m for BWR canister and 10.6 m for EPR canister. The distance between parallel disposal tunnels is 25 m in the planned reference case.

H.11.3. Waste minimization

Waste minimization is in the interest of the nuclear power companies, as less waste to be disposed of implies smaller disposal costs. Guide YVL 8.3 underlines that generation of waste shall be limited i.a. by proper planning of repair and maintenance wastes and by means of decontamination, clearance and volume reduction practices. The Guide also refers to sound working methods for waste minimization, e.g. by volume reduction of waste, by avoiding transfer of unnecessary objects and materials in the controlled areas and by adoption of working processes that create little or easily manageable wastes.

Removal of very low level waste from control (clearance) is regulated by virtue of Guide YVL 8.2. Both conditional and unconditional removal from control is effectively used for waste minimization by the NPPs. Clearance criteria, limits and procedures are discussed in Section B.1.

The accumulation of LILW in the Loviisa and Olkiluoto NPPs is depicted in Figure 12. The average annual accumulation of LILW to be disposed of has been fairly low: about 80 m^3 per reactor. The accumulation of waste has in some years even turned to decline by effective waste minimization measures, such as radiochemical treatment of liquid waste and campaigns for removal of very low level waste from control and compaction of maintenance waste.

FPH developed in 1990's together with University of Helsinki (Laboratory of Radiochemistry) sophisticated selective ion exchange methods for purification of liquid waste (especially the removal of Cs, Sr and Co). The benefits of the system can be seen

in Figure 12 and also in the decrease of the doses to the critical group shown in Figure 11.

TVO has made a construction change in both plants in the condensate polishing system to decrease the temperature and thus increasing the lifetime of precoat resins. The amount of spent resins has decreased considerably. Low and intermediate level waste subject to long-term storage at the Olki-luoto plant mostly includes components removed from inside the reactor pressure vessels, which are stored in the fuel pools. The cutting up and final disposal of steam separators started in 2004. The same year, TVO begun to use a crusher to cut pipes and other metal components in small pieces for minimizing the waste volume.

At the new Olkiluoto 3 NPP unit an in-drum drying facility will be used for conditioning of liquid wastes, which provides very effective volume reduction.

Considering the design and operation of the encapsulation and disposal facility for spent fuel, Government Decision 478/1999 requires that the dispersion of radioactive substances inside the facilities as a consequence of handling of spent fuel shall be limited to the minimum. The released solid, liquid and particulate airborne radioactive matter shall be collected and treated as radioactive waste. Guide YVL 8.5 gives more detailed requirements in order to meet these objectives.

The laboratories using radioactive sources in medical and research applications usually store their short lived radioactive waste at their premises until it has decayed below the limits set for discharges in the Guide ST 6.2. Only small amounts of waste need to be conditioned for disposal.

H.11.4. Interdependencies

Both power plants have their own LILW disposal facilities, thus the premises for considering interdependencies in the waste management chain are excellent. Interdependencies of the various steps in waste management are taken into account in the NPPs' Operational Manuals. In Loviisa all the waste treatment, conditioning, handling, storing, transport and disposal operations are carried out at the Loviisa NPP site (on Hästholmen) by the operators of the Loviisa NPP. Only the spent nuclear fuel will be transported for disposal from the Loviisa NPP site to the disposal facility at Olkiluoto. In case of the Olkiluoto NPP, all steps of the waste management take place at the site.

The in 2005 updated Guide YVL 8.3 on treatment and storage of LILW from NPPs requires that a licence for a NPP unit must include an approved

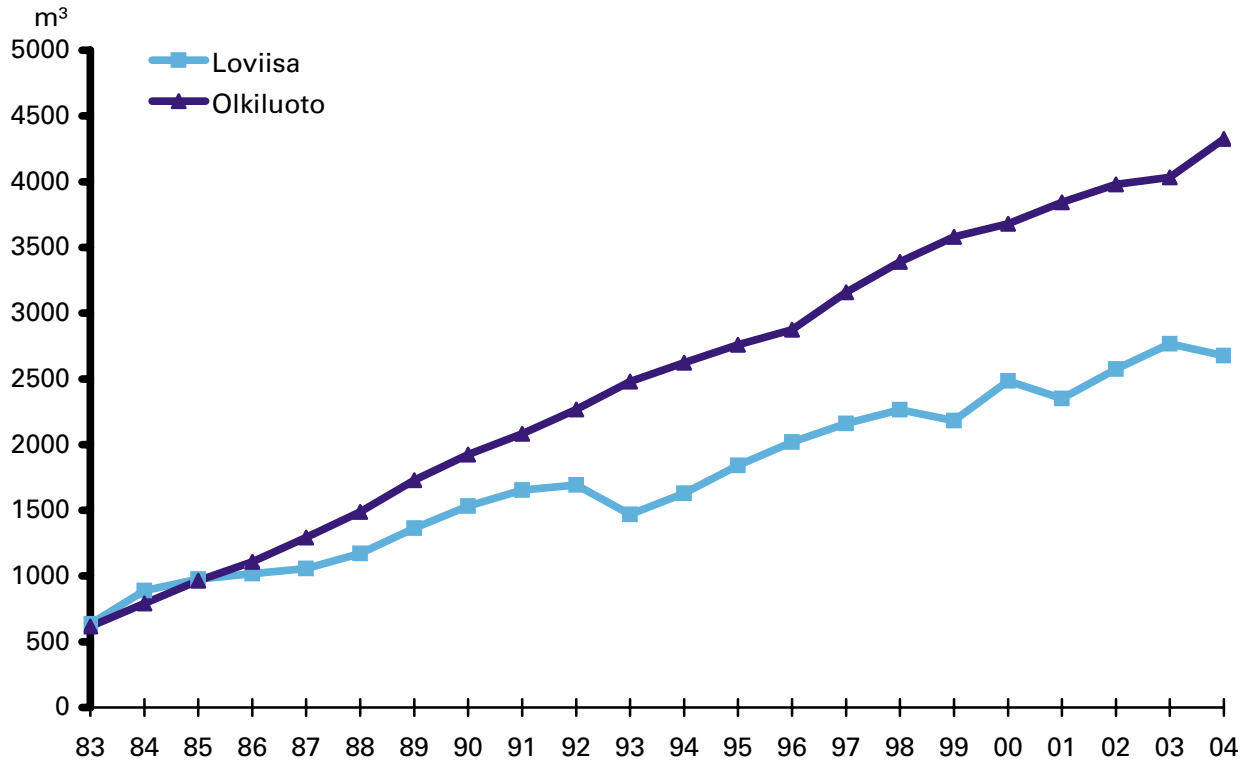

Figure 12. Accumulation of LILW in Loviisa and Olkiluoto NPPs.

generic waste management plan which takes into account e.g. the segregation, categorisation and conditioning of waste in an appropriate way with regard its further management. The Guide also provides for the consideration of the requirements of waste packages related to their final disposal. These requirements may concern e.g. the structure of the waste packages, their physical and chemical composition, their resistance to external and internal loads and the amount and stability of radioactive substances in the waste packages.

Interdependencies in the context of spent fuel management are discussed in Chapter G.4.4.

H.11.5. Protection of individuals, society and the environment

The operational radiation protection of radioactive waste management facilities is discussed under Article 24.

Regarding the long term radiation protection requirements for LILW disposal, Government Decision 398/1991 requires that the radiation exposure arising from the disposed waste shall be kept as low as reasonably achievable. The constraint for the expectation value of the annual dose to any member of the public is 0.1 mSv. The constraint for the annual dose to any member of the public, arising from accident conditions which are caused by natural events or human actions and which are considered possible, is 5 mSv. The increase in the total activity concentration of radioactive substances in the biosphere, arising from the disposed waste, shall remain insignificant in any part of the biosphere.

According to the Decision, disposal of LILW shall be based on multiple natural and engineered barriers. Engineered barriers shall effectively limit the migration of radioactive substances from the waste emplacement rooms for at least 500 years. Thereafter, natural barriers in the first place shall be able to limit the migration of radioactive substances to the biosphere at a level that is in compliance with the requirements for radiation protection. The requirements are specified in Guide YVL 8.1.

The Government Decision 478/1999 requires that the operation of a spent fuel encapsulation and disposal facility shall not cause radiation exposure that could endanger occupational or public safety or could otherwise harm the environment or property. They shall be designed so that as a consequence of undisturbed operation of the facility, discharges of radioactive substances to the environment would remain insignificantly low, that the annual effective dose to the most exposed members of the public as a consequence of anticipated operational transients remains below 0.1 mSv and as a consequence of postulated accidents below 1 mSv. In Guide YVL 8.5 the requirement of insignificantly low exposure posed by the normal operation has been interpreted to mean 0.01 mSv/a.

Regarding the long term radiation protection requirements for spent fuel disposal, Government Decision 478/1999 requires that in the period of first several thousands of years the annual effective dose to the most exposed members of the public shall remain below 0.1 mSv and the average annual effective doses to other members of the public shall remain insignificantly low. Beyond that period the average quantities of radioactive substances over long time periods, releasing from the disposed waste and migrating further to the environment, shall remain below the nuclide specific constraints defined by STUK. These constraints are given in the Guide YVL 8.4 as limits for annual activity releases to the environment. They are defined so that, at their maximum, the radiation impacts arising from disposal are comparable to those arising from natural radioactive substances and, on a large scale, the radiation impacts remain insignificantly low.

In addition, the Guide YVL 8.4 gives due regard to the protection of the living nature requiring that disposal of spent fuel shall not affect detrimentally to species of fauna and flora. This shall be demonstrated in the safety assessment by assessing the typical radiation exposures of terrestrial and aquatic populations in the disposal site environment, assuming the present kind of living populations. These exposures shall remain clearly below the levels which, on the basis of the best available scientific knowledge, would cause decline in biodiversity or other significant detriment to any living population. Moreover, rare animals and plants as well as domestic animals shall not be exposed detrimentally as individuals.

H.11.6. Biological, chemical and other hazards

Other hazards than those posed by radiation are considered in the EIA reports in the same way

as in the connection with other industrial activities but are not especially dealt with in the safety analysis of LILW repositories.

Disposed LILW consists of NPP's trash waste, scrap metal, filter elements and liquids and sludge. These materials nor their immobilisation matrixes are not harmful to the environment as such, but may contain harmful residues like heavy metals.

Some studies on radioactive nickel releases from repository have been carried out in Finland. The results show that the potential annual release is small. In the same way it can be argued that also the release rate of chromium and poorly soluble lead and cadmium will be small. The chemical effects of the Swedish LILW disposal facility (SFR) have been studied more thoroughly. SFR and the Finnish LILW facilities are similar regarding to structure and the type and content of disposed waste. Swedish studies indicate that the increase of heavy metal concentration in seawater would be negligible, mostly due to the barriers in repository.

If the waste is isolated properly, the discharges to the environment are quite small when compared with other forms of industry or other sources of hazardous wastes. At least as long as the engineered barriers are isolating the radioactive waste also the other harmful substances are effectively isolated from the environment. Furthermore, the LILW repositories are located in areas which do not contain exploitable groundwater reserves for communities.

Biological, chemical and other hazards may be related to some wastes arising from medical and research applications. The requirements of the relevant non-radiation related regulations, including those related to general occupational health, are applied as appropriate.

H.11.7. Protection of future generations and avoidance of undue burdens on future generations

The limitation of the potential hazard to future generations posed by disposal of LILW or spent fuel is discussed above under Chapter H.11.5. Government Decision 478/1999 on the safety of disposal of spent nuclear fuel states that, in any assessment period, disposal shall not cause health or environmental effects that would exceed the maximum level considered acceptable during the implementation of disposal.

The Finnish nuclear waste management policy is based on the ethical principle to avoid transferring undue burdens to future generations. Disposal facilities for LILW are operational at both NPP sites and are planned to host also decommissioning waste and waste from small users. Active institutional controls are not needed to ensure the safety of these disposal facilities in the post-closure period. Preparations for spent fuel disposal have progressed in accordance with the objectives set by the Government in 1983. The costs of disposal of LILW and spent fuel as well as decommissioning of the NPPs and the FiR 1 research reactor are covered by assets collected in the Nuclear Waste Management Fund.

Government Decision 478/1999 includes the following statements concerning implementation and timing of spent fuel disposal: the implementation of disposal, as a whole, shall be planned with due regard to safety. The planning shall take account of the decrease of the activity of spent fuel by interim storage and the utilisation of best available technology and scientific knowledge. However, the implementation of disposal shall not be unnecessarily delayed. Disposal shall be planned so that no monitoring of the disposal site is required for ensuring long-term safety and so that retrievability of the waste canisters is maintained to provide for such development of technology that makes it a preferred option.

Article 12. Existing facilities and past practices

Each Contracting Party shall in due course take the appropriate steps to review:

(a) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(b) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

H.12.1. Existing facilities

The predisposal management facilities for low and intermediate level radioactive waste in Loviisa and Olkiluoto NPPs and the FiR 1 research reactor are covered by the respective Operation Licences of the reactors. The safety reviews carried out in the context of renewal of the Operation Licences are described in Chapter G.5.1 and the conclusions drawn are valid for LILW management as well. At the Loviisa NPP, a waste solidification facility based on cementation is currently under construction. The appropriate amendment of the FSAR has to be approved by STUK before the start of the operation of the facility.

The IRRT mission carried out in STUK in 2000 recommended that a system for independent inspection of packages for LILW disposal should be developed. The NPP operators have their own LILW repositories in the respective NPP areas and thus the quality assurance of waste packages is in the interest of the operator and no external checking of the packages has been carried out so far. At the present the development of an inspection system based on the proposal made by VTT is going on.

The LILW disposal facilities have separate licences. According to the Government Decision 398/91 thorough assessments of the safety of the facilities were carried out by the licensees and reviewed by STUK in connection with the construction and operation licence applications. The safety reassessment review of the LILW disposal facilities will be made at 15 years interval. The Olkiluoto LILW disposal facility was taken into operation in 1992 and consequently its safety review is to be made in 2007. In the same context the suitability of the waste packages from the new Olkiluoto 3 NPP unit for disposal in the facility will be evaluated. The first stage of the Loviisa LILW disposal facility (LLW disposal tunnel) was taken in operation in 1998. The second stage of the facility (ILW disposal tunnel) is currently under construction and the FSAR of the facility will be accordingly updated and reviewed by STUK in 2006.

The accumulation of LILW in Loviisa and Olkiluoto NPP's is depicted in Figure 12. At the end of year 2004 about 46% of the accumulated waste has been disposed of in Loviisa and 89% in Olkiluoto.

In conclusion, the safety reviews regarding the predisposal management of LILW at NPPs and research reactor required by Article 12 are continuously being carried out. Safety improvements have been annually implemented at the Loviisa and Olkiluoto plants, including the facilities for waste management, since their commissioning. There exists no urgent need for additional improvements to upgrade the safety of these facilities.

H.12.2. Past practices

In 1958–1961, a company established by the Finnish industry carried out uranium mining and enrichment activities in a pilot scale in the municipality of Eno in the Eastern part of Finland. About 31 000 tonnes of uranium ore were excavated from small open mines and an underground mine. After the termination of the activities the mines were left open and the mine and mill tailings were left at the site.

The restoration of the site was carried out in 1992–1994 by the current owner of the area. The mine and mill tailings were covered with layers of clay and gravel and a soil layer on the top. Finally, trees were planted on top of the disposal site. Furthermore, the bottom sediment of a nearby lake was covered by a layer of soil and other material. STUK inspected the work and carried out environmental surveillance in the area. Five years after the completion of the restoration, STUK, having carried out further environmental studies, concluded that no radiation risk is posed to the human health by the disposed mining and milling waste and confirmed the waste to be permanently disposed of in accordance to the requirements of Section 32–34 of Nuclear Energy Act. However, restrictions for utilization of the site were imposed: any permanent occupancy, construction work or earthmoving is not allowed in the area.

Very small scale uranium mining and milling activities were carried out in 1956–1959 in Askola, Southern Finland; only about 1000 tonnes of ore was treated. The owner of the site did some restoration work in the area in late 1980's and reported to STUK in 1991. The conclusion of the inspection made by STUK was that the restoration was not yet satisfactory and the case is still open. Even so, the area does not pose any immediate hazard to the nearby population or the environment.

Article 13. Siting of proposed facilities

Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

(a) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

(b) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

(c) to make information on the safety of such a facility available to members of the public;

(d) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

In Finland, the siting decisions for the LILW repositories at NPP sites were made in 1983. In the context of the Decision-in-Principle process in 2000, Olkiluoto was selected as the site for a spent fuel disposal facility. Posiva started in 2004 the construction of the underground characterization laboratory ONKALO (Figures 13 and 14) in order to obtain the confirmative data and information for the application of the construction license to be filed with the Government by the end of 2012.

The description of siting procedures, provided under Article 6 (Chapters G.6.1–G.6.5.) for NPPs (including spent fuel storages), is also applicable for facilities intended for predisposal management of LILW at the NPPs and for disposal of LILW or spent fuel and is not repeated here.

Concerning siting a disposal facility for spent nuclear fuel, Government Decision 478/1999 states that the geological characteristics of the disposal site shall be favourable for the isolation of the disposed radioactive substances from the environment. An area having a feature that is substantially adverse to long-term safety shall not be selected as the disposal site. Guide YVL 8.4 specifies the site suitability criteria.

The various steps of the siting process concerning the final disposal of spent fuel are detailed in Table H.13.1.

Table H.13.1. Siting of the spent fuel disposal facility.

	Site characterisation phase
1983–1999	Site investigations and regulatory reviews • Countrywide site screening 1983-85 • Preliminary site investigations at five areas 1987–1992 • Detailed site investigations at four areas 1993–1999 • Regulatory reviews in 1986 and 1993

	Environmental impact assessment process
1997 **1998**	EIA Programme • 20 scoping workshops organised by Posiva in four municipalities • EIA programme report, February 1998 • Public hearings in four municipalities • Statements and written opinions to MTI • Judgement by MTI, November 1998
1999	EIA Report • Report, May 1999 • Public hearings in four municipalities • Statements and written opinions to MTI • Judgement by MTI, November 1999

	Decision-in-Principle process
1999	Application for DiP • DiP application submitted to the Government, May 1999 • EIA report annexed to the application
2000	Handling of application • Public hearing in Eurajoki municipality • Statements and written opinions to MTI • Preliminary safety appraisal by STUK, January 2000 • Consent statement by Eurajoki municipality, January 2000 • DiP by the Government, December 2000
2001	• Ratification of the DiP by the Parliament, May 2001
2002	Ratification to expand the DiP for the spent fuel from the fifth NPP unit

Figure 13. The opening of the ONKALO tunnel in October 2004.

Figure 14. Geological mapping in the access tunnel of ONKALO.

Article 14. Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(b) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(c) at the design stage, technical provisions for the closure of a disposal facility are prepared; the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

The discussion under Article 7 (Chapter G.7) is valid for predisposal management facilities for LILW, which are covered by the licence of the NPPs and Government Decision 395/1991.

The design requirements for LILW and spent fuel disposal facilities and the measures to limit radiological impacts from these facilities are discussed in Chapter H.11.6. An animated photograph of the repository of spent fuel at Olkiluoto is shown in Figure 3. The design of Loviisa and Olkiluoto LILW disposal facilities are illustrated in Figures 5 and 6, respectively.

Government decision 398/1991 prescribes that the underground spaces of a LILW disposal facility shall be closed so that the intrusion into the waste emplacement rooms is difficult and that the sealed excavations will not affect adversely groundwater flow rates of flow paths in the rock surrounding the waste emplacement rooms. Closure may commence after the STUK has approved the closure plan for the disposal facility. Guide YVL 8.1 concerning safety of disposal of LILW lays down that the choice of engineered barriers shall be based on technical designs considered reliable and on materials having experimental or other reliable evidence of long-term stability.

Government Decision 478/1999 concerning the safety of the spent fuel encapsulation and disposal stipulates that the planning of the implementation of disposal shall take into account the utilization of the best available technology and scientific knowledge. More detailed requirements on the design principles are given in Guides YVL 8.4 and 8.5.

Conceptual plans for the closure of the disposal facilities have been included in their initial designs (e.g. the PSAR designs of the LILW repositories and the Decision-in-Principle design of the spent fuel repository). These closure plans will be reconsidered in the context of later licensing stages or periodic safety assessments.

Article 15. Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(b) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(c) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (a).

The discussion under Article 8 on safety assessment of spent fuel storage is valid for predisposal management of LILW because both activities are covered by the licence of the NPP and Government Decision 395/1991.

Predisposal management of wastes not under nuclear legislation involves generally operations which may not cause any extensive hazards: handling of sealed sources, segregation and packaging of small amounts of LLW. Thus no comprehensive safety or environmental impact assessments are needed but the safety of the required operations is evaluated in the context of the licensing processes.

The Government Decision 398/91 on the safety

of LILW disposal requires that compliance with the regulations for radiation protection and the performance of barriers shall be demonstrated by safety analyses. Such analyses shall cover expected conditions and events as well as disturbances and accidents significant to radiation protection. Guide YVL 8.1 states that these analyses shall be specific to the disposal facility and site and they shall cover both the operational and the post-operational period. Such safety analyses shall be presented in connection with the preliminary safety analysis report, the final safety analysis report, and the final closure plan.

The Decision 478/1999 concerning the safety of spent fuel encapsulation and disposal lays down that, if compliance with the requirements for the operational safety of the facility cannot be directly ascertained, it shall be demonstrated by experimental or computational methods or their combination. The computational methods used shall be reliable, well validated and based on conservative assumptions and input data.

Compliance with long-term radiation protection objectives as well as the suitability of the disposal concept and site shall, according to the Decision 478/1999, be justified by means of a safety assessment that addresses both the expected evolutions and unlikely disruptive events impairing long-term safety. The safety assessment shall consist of a numerical analysis based on experimental studies and be complemented by qualitative expert judgement whenever quantitative analyses are not feasible or are too uncertain. Guides YVL 8.4 and 8.5 give more detailed requirements e.g. on the content and extent of the safety assessments as well as scenarios and time periods to be considered.

Operational safety of the spent fuel disposal facility has been assessed during the Environmental Impact Assessment procedure 1997–1999. Since then, complementary research has been executed by Posiva in this field, showing that the radiation doses in operational incidents and postulated accidents will remain below limit values given by the authorities. In recent years, the improvements in the design have given reason to assume that the radiation safety of the disposal facility is currently much better than that indicated in the earlier assessment carried out in 1999, and is thus at an acceptable level. Several incident risks or accident risks described in the assessment 1999 are reduced or eliminated as a result of the more advanced facility design.

An essential part of Posiva's spent fuel disposal program is the investigations to be carried out in an underground rock characterisation facility (ONKALO), which is being constructed at the Olkiluoto site. These investigations aim at confirming the suitability of the bedrock for disposal and acquiring research data for the design of the disposal facility and for its safety evaluation. The ONKALO is intended to become later a part of the repository itself and the construction licence application is scheduled to be submitted in 1012.

STUK has launched a regulatory oversight program for the ONKALO project. The general aim of STUK's control is to ensure that the provisions in the legislation, safety standards and international treaties are being followed in the implementation of the ONKALO and the subsequent disposal facility projects. STUK's oversight aims at timely detecting any problems and presenting them to the implementer. The regulatory control and related communications aims also at reinforcing the general confidence in the final disposal project and STUK's actions.

Article 16. Operation of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(a) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(b) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(c) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(d) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(e) procedures for characterization and segregation of radioactive waste are applied; incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(f) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(g) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(h) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

The discussions on and references to nuclear energy legislation, general safety regulations and STUK's guidance discussed under Article 9 are also valid for predisposal management of LILW from NPPs and for the operational period of a LILW disposal facility. Therefore only some special features related to disposal of LILW or spent fuel, as well as those related to radioactive waste from small operators, are presented here.

H.16.1. Initial authorization

The Guide YVL 8.5 on the operational safety of the spent fuel encapsulation and disposal provides that the compliance with the safety requirements concerning the undisturbed operation shall be verified during the commissioning tests of the facility. Furthermore, the functioning of the safety systems designed to operate during operational transients and accidents shall be tested during the preoperational testing of the facility, if feasible. In performing the tests Guide YVL 2.5 is referred to.

H.16.2. Operational limits and conditions

Government Decision 478/1999 on spent fuel encapsulation and disposal facility provides that technical and administrative requirements and restrictions for ensuring the operational and long-term safety shall be set forth in the technical specifications of the facilities. Appropriate instructions shall exist for the operation, maintenance, regular in-service inspections and periodic tests as well as for transient and accident conditions. The reliable function of systems and components shall be ensured by adequate maintenance, regular in-service inspections and periodic tests.

H.16.3. Updated assessment for post closure period

Government Decision 398/91 on the safety of LILW disposal requires an updated safety assessment to be presented in the context of the final closure plan of a LILW disposal facility. Guide YVL 8.1 further provides that the safety assessment shall be revised whenever such new data have been obtained that might decisively alter the results of the safety assessment with respect to the safety requirements.

H.16.4. Characterization and segregation of waste, incident reports

The guidance and requirements for LILW characterization and segregation is provided in Guide YVL 8.3.

Guide YVL 1.5 provides in detail the reporting requirements on incidents, operational disturbances and events, which have to be reported to STUK. It also defines requirements for the contents of the reports and the administrative procedures for reporting, including time limits for submitting of various reports. STUK publishes the operational events in its quarterly reports on nuclear safety that are also available to the general public through internet or paper reports in Finnish. STUK Annual Report on nuclear safety summarizes events from the whole year and is available to the general public through internet or paper reports both in Finnish and in English.

In 2004 two incidents took place at the Loviisa NPP related to the removal of control of scrap metal that was sent to steelworks for recycling. In the scrap metal consignments, objects exceeding the alarm limits of the steelworks were detected and they were returned to the NPP. To avoid corresponding problems in the future, FPH is developing its practices for segregation, activity measurement and storage of scrap metal candidate for removal of control.

H.16.5. Closure plans

In accordance with Government Decision 398/91 the closure of a LILW disposal facility may be commenced after STUK has approved the closure plan. The closure plan shall include a description of the technical implementation of the closure of the repository, an updated safety analysis, summary of geological investigations performed during the operational period and a plan for post-closure surveillance.

Article 17. Institutional measures after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(a) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(b) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(c) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

H.17.1 Records

Government Decision 398/91 on the safety of LILW disposal states that a record shall be kept on the emplaced wastes including waste package specific information on waste type, on the radioactive substances involved, on the location of packages in the waste emplacement rooms and other necessary data. This record shall be sent to STUK who shall arrange for its long-term depositing. The Guide YVL 8.1 adds that during the operational period the records referred to above shall be annually complemented and submitted to STUK. At the time of the closure of the repository, the record of the disposed waste and the relevant information in the FSAR will be converted into a national archive for long-term deposition.

Guide YVL 8.4 on long-term safety of spent fuel disposal provides that, on the basis of primary records and verification measurements, adequate inventory data of the nuclear materials and nuclear wastes to be disposed of shall be obtained during the operational period of the disposal facility for long-term deposition.

H.17.2. Institutional control

Two types of institutional control may be implemented: restrictions in land use (passive control) and technical post-closure surveillance (active control).

According to the Nuclear Energy Act, Section 63, STUK's supervisory rights include issuing land use restrictions after the closure of the disposal facility when deemed necessary. Government Decision 398/91 on LILW disposal further provides that an adequate protection zone shall be reserved around the disposal facility. According to Guide YVL 8.1 it can be assumed that human activities, affecting the repository or the nearby host rock, are precluded for 200 years at the most by means of land use restrictions and other passive controls. This assumption is relevant for the choice of scenarios in the safety assessment.

Government Decision 398/91 further states that provisions shall be made for such reliable technical post-closure surveillance measures that will not have an adverse impact on the safety of disposal. The closure plan shall include inter alia a plan for post-closure surveillance (Guide YVL 8.1). However, technical post-closure surveillance shall not be taken into account as a safety supporting factor in the safety analyses.

Government Decision 478/1999 on spent fuel encapsulation and disposal states that the design, operation and closure of a disposal facility shall be implemented so that control of nuclear materials can be arranged in accordance with pertinent regulations. More detailed technical requirements are given in Guide YVL 8.5. *STUK is, in co-operation with the IAEA, creating basis for the safeguards of the underground rock characterization facility to be a part of the repository*

H.17.3. Potential intervention measures

After approval of the closure of a LILW or spent fuel repository, the State bears the responsibility of the waste repository and all intervention measures that may be needed (Nuclear Energy Act, Section 34). Such measures are unlikely because the repository concepts are based on multiple engineered barriers ensuring effective long-term containment of the disposed waste.

SECTION I. Transboundary movement

Article 27. Transboundary movement

Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

(a) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

(b) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

(c) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

(d) a Contracting Party which is a State of origin shall authorize a accordance with the consent of the State of destination that the requirements of subparagraph (c) are met prior to transboundary movement;

(e) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

Nothing in this Convention prejudices or affects:

(a) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

(b) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

(c) the right of a Contracting Party to export its spent fuel for reprocessing;

(d) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

I.27.1. Regulations

Regulations on transport of all kinds of dangerous goods are laid down in Act and modal Degrees on Transport of Dangerous Goods. As far as radioactive material is of concern, additional requirements are given in Radiation Act and Decree as well as Nuclear Energy Act and Decree. When transboundary movement of radioactive material is of concern, the Regulation 93/1493/EURATOM on shipments of radioactive substances between Member States shall be applied. The requirements are also

in accordance with the European Council Directive 92/3/EURATOM on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community. Further guidance is given in the Guide YVL 6.5.

I.27.2. Experiences

According to an agreement between Finland and the Soviet Union spent fuel was to be shipped from the WWER type Loviisa power plant to the Soviet Union/Russian Federation. Subsequent to the amendment of the Nuclear Energy Act approved by the Finnish Parliament in 1994, the transportation was ceased in 1996. During the years 1981–1996 altogether about 330 tU was returned. The spent fuel was transported by a special train in TK-6 transport casks under special safety arrangements.

Besides the shipments of spent fuel discussed above, there have been few cases of transboundary movements of small quantities of radioactive waste, notably for research purposes.

SECTION J. Disused sealed sources

Article 28. Disused sealed sources

Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J.28.1. Regulatory control of sealed sources

Regulatory control of radioactive sources is based on the Radiation Act and regulations issued pursuant thereto, into which the provisions of the European Union radiation protection directives (Council Directive 96/42 EURATOM, and Council Directive 97/43 EURATOM etc.) have been implemented. Other EU regulations are applicable as well, e.g. the Council Regulation 1494/93/EURATOM on shipments of radioactive substances between the Member States.

According to Section16 of the Radiation Act prior authorization is required for all activities with radioactive sources, e.g. for the use, manufacture, trade in, holding and disposal of sources. A safety licence is granted by STUK upon 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 Sections 14-20 of the Radiation Decree. All premises where radioactive sources are employed are inspected by STUK regularly, every 1–5 years, depending on the type and extent of the practice. For sealed sources the inspection frequency is normally once in 5 years. The main objective of an inspection is to validate that radioactive sources are used and stored safely and other conditions set in the safety licence preserve. The inspector shall identify each sealed source. Any discrepancies to licensing information concerning placing of sources, new sources and sources taken out of use are recorded for amending the licence accordingly.

The Radiation Decree, Section 17 provides that STUK has to be notified immediately, if a radiation source has disappeared, been stolen, lost or otherwise ceased to be in the licensee's possession. Licensing information is stored in a database maintained by STUK, including also source-specific information on each sealed source in licensee's possession. Source-specific information is updated continuously according to licensees' notifications and observations made during the inspections. Some low-activity radioactive sources, such as calibration sources employed in laboratories as well as sources in the storages of dealers (e.g. importers of radioactive sources) are not individually registered into STUK's database. However, records of transfers of sources maintained by dealers are reported to STUK annually and they are also subject to inspection by STUK at any time. In 2005, STUK conducted a campaign where all holders of sealed sources were requested to check each source in its possession and to send a report to STUK confirming that all the sources included in the STUK source register were verified and describing any possible differences observed.

J.28.2. Handling of disused sealed sources

The Radiation Act, Section 10 states that radioactive sources that have no use and must be rendered harmless owing to their radioactivity are radioactive waste. Guide ST 5.1 dealing with sealed sources specifies that disused sources shall not be stored unnecessarily. In practice, however, it is sometimes difficult to define whether a stored source might have some use in the future. The annual fee for holding a licence depends on the number of sources in licensee's possession and, therefore, there is some

financial incentive to transfer 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. The number of unused sources stored in the premises of various licensees is currently about 600, i.e. 10% of the total number of sealed sources in use (total number of licensed sources is about 6200).

TVO has leased to the State a cavern in the LILW disposal facility at Olkiluoto for interim storage of non-nuclear radioactive waste. Disused sources are collected to the laboratory of STUK's Department of Research and Environmental Surveillance where they are repacked, as necessary, and then transferred to the storage at Olkiluoto. The operation of the storage is regulated by STUK's Department of Nuclear Waste and Materials Regulation.

When new sources are authorized for use, STUK requires the applicant to present a plan on measures to be taken when it becomes a disused source. Essentially there are two options; either to have an agreement with the provider on returning the source or that the source will be transferred to the central disposal storage at the costs of the licensee. The first option is preferred and it is foreseen that in the future an agreement on returning the source to the provider shall be required for all sources.

Sources manufactured in Finland can be returned to Finland once they have become disused sources.

J.28.3. Orphan sources

According to the Radiation Act (Section 50) the licensee is required to take all the measures needed to render harmless radioactive wastes arising from its operations. If the origin of the waste is unknown, like in case of orphan sources, the State has the obligation to render the radioactive waste harmless (Section 51). In such case, the licensee – if identified later – shall compensate the State for the costs incurred in such action.

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 portable monitors at their disposal. A systematic border control for monitoring radioactive materials was started in mid 1990's, and in 1997, the top year, 23 shipments were stopped at the border. After that the number of turned-back shipments has fallen drastically and no illicit radioactive material was detected at the Finnish border control between 2001 and 2004.

All important users of scrap metal have installed fixed monitors at the gates of their installations. 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.

During the last ten years, of the order of ten sealed radioactive sources has been found among imported scrap metal. Orphan sources, whose owner can not be identified, are delivered to the State interim storage at Olkiluoto.

SECTION K. Development in spent fuel and radioactive waste management during the reporting period

K.1. NORM waste

As stated in Section C, Finland does not declare as radioactive waste for the purposes of the Convention waste containing only naturally occurring radioactive materials and not arising from the nuclear fuel cycle (NORM waste), except sealed radium sources. Irrespective, STUK has completed a pre-study on NORM waste in Finland. It concluded that some legislative amendments are needed in order to deal with NORM waste in an appropriate manner. It also discussed ways to improve management practices of some NORM waste types. The appropriate ST Guide 12.2 is being amended to give more specific requirements for NORM wastes. In addition, STUK has prepared an information leaflet on NORM wastes and their management targeted to potential generators of NORM waste.

K.2. Completion of the spent fuel and radioactive waste management systems

Posiva is carrying out various kind of preparatory work for spent fuel disposal, as discussed earlier in this report. Presently Posiva is constructing a deep underground rock characterisation facility (ONKALO) in Olkiluoto. The facility will be used for the detailed investigations for confirmation of the suitability of the site, facilitation of the repository design and obtaining site specific data for safety assessment. A regulatory oversight plan for Olkiluoto spent fuel disposal site confirmation activities has been developed and is at the present being implemented. This was also recommended by the IRRT team.

At the Loviisa NPP, the solidification plant based on cementation is under construction and intended to be in operation in 2006. Simultaneously, the cavern for solidified ILW in the LILW repository is being constructed and scheduled to be operational in 2006 after the regulatory review by STUK.

Subsequent to the decision by TVO on the construction of the new PWR unit (Olkiluoto 3), the safety of the related spent fuel and waste management facilities were assessed in 2004 by STUK in the context of the construction licence process. Detailed plans for the modification of the spent fuel and waste management programme will be included in the utilities triennial report for research, development and technical design; the next one for the period 2007–2009 will be published in 2006.

K.3. Decommissioning of nuclear power plants and research reactor

As discussed in Chapter F.26.2., no decommissioning projects of nuclear power plants are foreseen in the near future. The decommissioning plans of the NPPs and the research reactor, including the cost estimates for the decommissioning work and the disposal of waste arising, are updated every 5 years. The cost estimates are depending on the amount of waste to be disposed of as radioactive, and thus on the limits to be applied for removal of material from control (clearance limits). Therefore, the Guide YVL 8.2 is currently being updated to cover removal of control from bulk amount of material resulting from decommissioning and also release of previously regulated sites. The current limits given in Guide YVL 8.2 are relevant only for restricted amount of material (100 tonnes per NPP, annually).

SECTION L. Future challenges to develop spent fuel and radioactive waste management

L.1. Small user waste

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. The lack of capacity concerns essentially some high-activity sealed sources and, therefore, the issue is being considered in conjunction with the implementation of the EU HASS Directive (Council Directive 2003/122/Euratom). According to the Directive, arrangements for the management of these sources (once they become disused) must be in place by the end of 2007.

L.2. Completion of the spent fuel and radioactive waste management systems

The storage capacity for spent fuel in both NPPs needs to be extended within 5–6 years. In Loviisa, increasing the density of fuel racks in the prevailing pool storages will be sufficient while in Olkiluoto, two more storage pools are envisaged to be constructed.

Regarding the spent fuel disposal, the application for the construction licence including comprehensive preliminary safety assessment is scheduled to be submitted in 2012 and the facility is planned to be ready for operation in 2020.

L.3. Decommissioning of nuclear power plants and research reactor

In order to facilitate the decommissioning amendments are needed to the legislation and regulations. Minor supplements will be sufficient to the Nuclear Energy Act and Decree. The Government Decisions related to nuclear and waste management safety are currently under revision and the provisions for decommissioning will be included in the update. In addition, a new YVL Guide concerning decommissioning will be developed.

SECTION M. Annexes

List of spent fuel storages and inventory of spent fuel

Loviisa NPP

Storage	Inventory (end of 2004)/ storage capacity (effective)	
	Mass (tU)	Fuel assemblies
Pool storage in Loviisa 1 reactor building	24.3/57	204/481
Pool storage in Loviisa 2 reactor building	27.0/58	227/485
Basket type pool storage at the NPP	53.6/57	450/480
Rack type pool storage at the NPP	246.0/433	2066/3640
Total inventory	**351**	**2947**

Olkiluoto NPP

Storage	Inventory (end of 2004)/ storage capacity (effective)	
	Mass (tU)	Fuel assemblies
Pool storage in, Olkiluoto 1 reactor building	118.4/269	717/1520
Pool storage in Olkiluoto 2 reactor building	83.4/276	495/1560
Separate storage facility at the NPP site	824.3/1204	4838/7146
Total inventory	**1026**	**6050**

FiR 1 research reactor

Storage	Inventory (end of 2004)/ storage capacity (effective)	
	Mass (kU)	Fuel assemblies
Spent fuel racks in the reactor pool	1.64	9
Well under the floor of the reactor hall	2.37	13
Total inventory	**4**	**22**

List of radioactive waste management facilities and inventory of radioactive waste

Loviisa NPP

Storage	Inventory (end of 2004)	
	Volume (m^3)	Activity (TBq)
Storage room for LLW inside the NPP	200.2	0.22
Storage room for ILW inside the NPP	5	not measured
Tank storage for wet LILW	1110	15.2
Storages for activated metal waste	27.7	high (not measured)
On-site storage hall for VLLW	133.3	low

Olkiluoto NPP

Storage	Inventory (end of 2004)	
	Volume (m^3)	Activity (TBq)
Buffer storage rooms inside the NPP	102	3.5
On-site storages for scrap metal	385	low
Storages for activated metal waste	1	high (not measured)
Spent oil candidate for clearance	18	low
Interim storage for state owned waste	47.7	24.7

FiR 1 research reactor

Storage	Inventory (end of 2004)	
	Volume (m^3)	Activity (TBq)
Waste storage in the laboratory building	6	0.002

STUK's waste storage

Storage	Inventory (end of 2004)	
	Volume (m^3)	Activity (TBq)
Storage room in STUK's building	0.5	0.05

List of laws, regulations, guides and other relevant documents

The regulations marked with * can be found in English on STUK's website.

Law, decrees and general safety related regulations

- Nuclear Energy Act (990/1987) *
- Nuclear Energy Decree (161/1988) *
- Decree on the State Nuclear Waste Management Fund (162/1988)
- Act on Third Party Liability (484/1972)
- Decree on the Implementation of Third Party Liability (486/1972)
- Radiation Act (592/1991)
- Radiation Decree (1512/1991)
- Act on the Finnish Centre for Radiation and Nuclear Safety (1069/1983)
- Decree on the Radiation and Nuclear Safety Authority (618/1997)
- Decree on Advisory Committee on Nuclear Safety (164/1988)
- Decree on Advisory Committee on Nuclear Energy (163/1988)
- Act on the Environmental Impact Assessment Procedure (468/1994)
- Decree on Environmental Impact Assessment Procedure (792/1994)
- Act on the Openness of Government Activities (621/1999)
- Act on Rescue Services (561/1999)
- Decree on Rescue Services (857/1999)
- Decree of Ministry of Interior Concerning Planning for Nuclear or Radiological Emergences and for Informing the Public about Radiation Hazards (774/2001)
- Act on Transport of Dangerous Goods (719/1994)
- Decision in Principle of 10th November 1983 by the Government on the Objectives to be Observed in Carrying out Research, Surveys and Planning in the Field of Nuclear Waste Management, Nuclear Law Bulletin, No 33 (1984) pp.42-44
- Decision of the Government on Financial Provision for the Costs of Nuclear Waste Management (165/1988)
- Decision of the Government on the General Regulations for the Safety of Nuclear Power Plants (395/1991) *
- Decision of the Government on the General Regulations for Physical Protection of Nuclear Power Plants (396/1991) *
- Decision of the Government on the General Regulations for Emergency Response Arrangements at Nuclear Power Plants (397/1991) *
- Decision of the Government on the General Regulations for the Safety of a Disposal Facility for Reactor Waste (398/1991) *
- Decision of the Government on the General Regulations for the Safety of Spent Fuel Disposal (478/1999) *

Relevant EU Directives and Regulations

- Council Directive 96/29/EURATOM of 13 May 1996 on the protection of the health of workers and general public against the dangers arising from ionizing radiation
- Council Directive 97/43/EURATOM of 30 June 1997 on health protection of individuals against dangers of ionizing radiation in relation of medical exposure, and repealing Directive 84/466EURATOM
- Council Directive 92/3/EURATOM of 3 February 1992 on the supervision and control of shipments of radioactive waste between Member States and into and out of the Community
- Council Directive 2003/122/EURATOM of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources
- Council Regulation 93/1493/EURATOM of 8 June 1993 on shipments of radioactive substances between Member States

Guides issued by STUK (only Guides relevant to this report included)

- YVL 1.0 Safety criteria for design of nuclear power plants, 12 January 1996 *
- YVL 1.1 The Finnish Centre for Radiation and Nuclear Safety as the regulatory authority in control for the use of nuclear energy, 27 January 1992 *
- YVL 1.4 Quality assurance of nuclear power plants, 20 September 1991 *
- YVL 1.5 Reporting nuclear power plant operation to the Radiation and Nuclear Safety Authority, 8 September 2003
- YVL 1.7 Functions important to nuclear power plant safety, and training and qualification of personnel, 28 December 1992 *

- YVL 1.8 Repairs, modifications and preventive maintenance at nuclear facilities, 2 October 1986 *
- YVL 1.9 Quality assurance during operation of nuclear power plants, 13 November 1991 *
- YVL 1.10 Requirements for siting a nuclear power plant, 11 July 2000 *
- YVL 1.11 Nuclear power plant operating experience feedback, 22 December 1994 *
- YVL 2.5 The commissioning of a nuclear power plant, 29 September 2003
- YVL 2.6 Seismic events and nuclear power plants, 19 December 2001
- YVL 6.1 Control of nuclear fuel and other nuclear materials in the operation of nuclear power plants, 19 June 1991 *
- YVL 6.5 Supervision of nuclear fuel transport, 4 April 2005
- YVL 6.6 Surveillance of nuclear fuel performance, 5 November 1990 *
- YVL 6.8 Handling and storage of nuclear fuel, 13 November 1991 *
- YVL 7.1 Limitation of public exposure in the environment of and limitation of radioactive releases from nuclear power plants, 14. December 1992 *
- YVL 7.4 Nuclear power plant emergency preparedness, 9 January 2002
- YVL 7.9 Radiation protection of nuclear power plant workers, 21 January 2002
- YVL 7.10 Monitoring of occupational exposure at nuclear power plants, 20 January 2002
- YVL 7.18 Radiation safety aspects in the design of a nuclear power plant, 26 September 2003 *
- YVL 8.1 Disposal of low and intermediate level waste from the operation of nuclear power plants, 20 September 2003 *
- YVL 8.2 Premises for removal of nuclear waste from regulatory control, 25 March 2002 *
- YVL 8.3 Treatment and storage of low and intermediate level waste at a nuclear power plant, 29 June 2005 *
- YVL 8.4 Long-term safety of disposal of spent nuclear fuel, 23 May 2001 *
- YVL 8.5 Operation of the final disposal facility for spent nuclear fuel, 23 December 2002 *
- ST 1.1 Safety of Radiation Practices, 23 May 2005 *
- ST 1.4 Radiation User's Organization, 16 April 2004 *
- ST 1.5 Exemption of the Use of Radiation from the Safety Licence and Reporting Obligation, 1 July 1999 *
- ST 1.8. Qualifications of Persons Working in Radiation User's Organization and Radiation Protection Training Required for Competence, 16 April 2004 *
- ST 5.1 Radiation Safety of Sealed Sources and Equipment Containing Them, 17 February 1999 *
- ST 6.2 Radioactive Wastes and Discharges, 1 July 1999 *
- ST 12.2 Radioactivity of Construction Materials, Fuel Peat and Peat Ash, 8 October 2003

References to official national and international reports related to safety

- The Final Disposal Facility for Spent Nuclear Fuel, Environmental Impact Assessment Report, Posiva Oy, 1999
- Vieno, T., Nordman, H., Safety Assessment of Spent Fuel Disposal in Hästholmen, Kivetty, Olkiluoto and Romuvaara, TILA-99, POSIVA 99-07, March 1999
- Ruokola E (ed.). Posiva's Application for a Decision in Principle Concerning a Disposal Facility for Spent Nuclear Fuel. STUK's Statement and Preliminary Safety Appraisal, STUK-B-YTO 198**,** March 2000.
- Nuclear Waste Management of the Olkiluoto and Loviisa Power Plants: Programme for Research, Development and Technical Design for 2004–2006, TKS-2003, Posiva Oy, December 2003.
- Statement of Position by the Finnish Radiation and Nuclear Safety Authority Regarding the Construction of the Third Unit at Olkiluoto Nuclear Power Plant, January 2005.
- Plan for Oversight of the Underground Rock Characterization Facility at Olkiluoto, STUK, May 2005.
- Regulatory Control of Nuclear Safety in Finland, Annual Report 2004, STUK-B-YTO 239, April 2005
- Radiation Practices, Annual Report 2004, STUK-B-STO 59, May 2005
- Compliance with the Obligations of the Convention on Nuclear Safety, Finnish National Report as Referred to in Article 5 of the Convention on

Nuclear Safety, STUK-B-YTO 177, September 1998
- Finnish Report on Nuclear Safety, Finnish Second National Report as Referred to in Article 5 of the Convention on Nuclear Safety, STUK-B-YTO 210, September 2001
- Finnish Report on Nuclear Safety, Finnish 3rd National Report as Referred to in Article 5 of the Convention on Nuclear Safety, STUK-B-YTO 234, September 2004
- Finnish Report on the Safety of Spent Fuel and Radioactive Waste Management, Finnish national Report as Referred to in Article 32 of the Joint Convention on the Safety of Spent Fuel and Radioactive Waste Management, STUK-B-YTO 223
- Compliance with the General Regulations for the Safety of Nuclear Power Plants (Government Decision 395/1991), the Loviisa plant, STUK-B-YTO 179, September 1998
- Compliance with the General Regulations for the Safety of Nuclear Power Plants (Government Decision 395/1991), the Olkiluoto plant, STUK-B-YTO 180, September 1998

References to reports of international review missions performed at the request of the Contracting Party

- Technical Notes of the International Regulatory Review Team (IRRT) Mission to Finland, 12–13 March 2000, IAEA, Vienna, 2000
- Regulatory Review Team (IRRT), Follow-Up Mission to Finland, 31 August – 9 September 2003, IAEA/NSNI/IRRT/03/03, IAEA, Vienna, 2003
- Evaluation of the Finnish Nuclear Waste Management Programme, Report of the WATRP Review Team / International Atomic Energy Agency, Waste Management Assessment and Review Programme, Ministry of Trade and Industry, Helsinki, 1994
- Operational Safety of Nuclear Installations, Finland (Olkiluoto), OSART Mission (Operational Safety Review Team), IAEA-NENS-86/2, IAEA, Vienna, September 1986
- Operational Safety of Nuclear Installations, Finland (Loviisa), OSART Mission (Operational Safety Review Team) 5-23. November 1990
- Integrated Safety Assessment of Research Reactors (INSARR), Report to the Government of Finland, NSNI/INSARR/1999-2, IAEA, Vienna, August 1999