Member State Report of Finland as required under Article 14.1 of Council Directive 2011/70/EURATOM

July 2, 2015

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EXECUTIVE SUMMARY

This is the Finnish National Report, in accordance with the provisions of Article 14 of the European Council Directive (2011/70/EURATOM). The fulfilment of the obligations of the Directive and the developments within waste management are assessed in this report. It describes the waste management facilities and practices in Finland and presents the recent developments.

The Finnish regulatory framework fulfils the requirements of the European Council directive (2011/70/EURATOM) as well as the obligations of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Radioactive waste management is regulated in Finland with two Acts, based on the origin of the radioactive waste. The waste produced in connection with the use of nuclear energy is covered by the Nuclear Energy Act and Decree and subsequent Government Decrees and regulations, whereas the radioactive waste produced in connection with the use of radiation and with practices involving naturally occurring radioactive material (NORM) is covered by the Radiation Act and subsequent Decree and regulations.

In Finland, the producer of nuclear waste is responsible for the implementation and expenses of the pertinent waste management and decommissioning activities, including the related planning, research and development work. Respectively, the user of radioactive substances shall render harmless the radioactive waste arising from operations in question, including those involved with natural radioactive substances.

The Nuclear Energy Act states that nuclear waste generated in Finland with some exceptions shall be treated, stored and permanently disposed of in Finland. Nuclear waste generated elsewhere shall not be handled, stored or permanently disposed of in Finland. The preferable management option for disused sealed sources is to return them to the supplier/manufacturer. It is prohibited to import disused sources to Finland for the purpose of disposal.

Apart from some old mill tailings containing NORM, it is to be noted that Finland has no legacy radioactive waste, and has not had any such activities where such waste would have been generated.

As spent nuclear fuel is defined in the Finnish legislation as radioactive waste, the nuclear power plants (NPPs) at Loviisa and Olkiluoto are the main generators of radioactive waste. Fortum Power and Heat Oy (FPH) operates two VVER units at the Loviisa site and Teollisuuden Voima Oyj (TVO) two BWR units at Olkiluoto. The Loviisa units 1 and 2 were commissioned in 1977 and 1981, and the Olkiluoto units 1 and 2 in 1978 and 1980, respectively. In addition, a new nuclear power plant unit is being constructed at the Olkiluoto site (Olkiluoto 3). As to the future, the Decision-in-Principle (DiP), the first step in the licensing process, was made by the Government for two new reactors in 2010, one for Teollisuuden Voima Oyj at the Olkiluoto site and one for Fennovoima Oy (FV), for which Pyhäjoki was chosen as the site in 2011. Teollisuuden Voima Oyj allowed the DiP to expire, whereas Fennovoima submitted the construction

licence application by the due date. At the Olkiluoto and Loviisa sites there are interim storages for spent fuel as well as repositories for low and intermediate level radioactive wastes. Furthermore, a Triga Mark II research reactor is operated in Espoo by VTT Technical Research Centre of Finland Ltd. However, in 2012 VTT decided to start planning of the decommissioning and eventual shut-down of the research reactor, due to economical reasons. The permanent shut-down took place on June 30th, 2015.

The four Finnish NPP units have operated safely with high capacity factors and generated spent fuel accordingly. The generation of low and intermediate level radioactive waste (LILW) has been kept low. Activities and programmes related to waste management have continued in accordance with the national strategy, milestones and timetable. The licensees and Posiva Oy, the spent fuel disposal implementer, have showed good safety performance and safety management practices in carrying out their responsibilities in spent fuel and radioactive waste management.

The main focus of activities during the last two years has been the spent nuclear fuel disposal project. The construction licence application including the safety documentation for the spent nuclear fuel encapsulation and disposal facilities was submitted to the authorities at the end of 2012. Posiva Oy is aiming to start disposal operations around 2022. The Finnish Radiation and Nuclear safety Authority (STUK) has reviewed Posiva's application and given its statement to the Ministry of Employment and the Economy (MEE) in February 2015.

The recent highlights in Finland have been as follows:

Spent nuclear fuel disposal project has progressed as planned

- The disposal project has reached the construction licence application stage. At the end of 2012 Posiva submitted the construction licence application and its supporting safety documentation to the authorities. MEE started the licensing process and STUK started the safety review and assessment in the beginning of 2013. The preparation of the application has required an extensive effort, from both the regulator and the implementer, in research, technical development and competence development of organisations. STUK has finalized the construction licence application review and assessment and concluded that the encapsulation plant and the disposal facility can be constructed to be safe.

- The construction of the underground rock characterization facility, ONKALO, which started in July 2004, has progressed to disposal depth. Most of the excavation work has been completed by early 2013. The access tunnel reached the length of 4987 m and the depth of 455 m. The main characterisation level is located at the depth of -420 m, but some of the auxiliary rooms are deeper down at the depth of -437 m. Regulatory oversight procedures for ONKALO have been established and continued to be implemented with the depth and detail that would allow the use of the facility as a part of the disposal facility.

Progress has been made in spent fuel management

- In the Loviisa NPP spent fuel storage, the installation of dense fuel racks was started in 2007 and is continuing. The allowable total amount of spent fuel, according to the

renewed operating licence issued in 2007, with additional high density racks, is evaluated by FPH as adequate up to the end of the planned 50 years of operational life of the NPP.

- At the Olkiluoto plant TVO started the construction work for enlarging the interim storage in autumn 2010 and construction and installation work was completed in early 2014. The extension is carried out according to the updated safety requirements which require among other things that the design has to withstand a large airplane impact.

- The safety of the spent fuel storages (at both the Loviisa and the Olkiluoto site) was analyzed as part of the EU stress tests in relation to the Fukushima accident. The results were reported within the Convention on Nuclear Safety, and referred to by the report for Council Directive 2009/71/Euratom.

- Spent fuel of the research reactor FiR 1 is stored on site. VTT has decided to enter into permanent shut-down and decommission FiR 1 due to insufficient funding for continued operation. VTT has prepared the EIA report during 2014 and next VTT will apply for a licence amendment for the research reactor decommissioning. The primary solution for spent fuel management is to return the fuel to the United States. VTT and US DOE are currently negotiating the contract under the present fuel return programme. The situation will be clarified in 2016.

Management of LILW from nuclear facilities has been improved

- Improved facilities for LILW operations at the Loviisa NPP were commissioned in 2010. The LILW repository was enlarged with a new room for waste handling and a tunnel facilitating disposal operations.

- A modified licence to operate the Olkiluoto LILW repository, granted in 2012, allows the disposal of Olkiluoto 3 low and intermediate level operational waste as well as most of the radioactive waste that the government is responsible to take care of. The application contained an updated safety assessment of the facility.

- No spent fuel or radioactive waste incidents in the Finnish NPPs have been reported during the last four years.

The regulatory system has been strengthened

STUK has continued to increase its resources and activities in response to the expanding operations of Posiva in preparing and implementing the review of the disposal facility (encapsulation plant and repository) construction licence application.

- The Finnish nuclear and radiation safety legislation and regulatory guidance were developed further. Legally binding EU directives as well as international guidance, such as IAEA safety standards and WENRA recommendations were taken into account in this work.

- The Nuclear Energy Act was revised and amended in 2011 (Council Directive 2009/71/Euratom), in 2012 (inspection organizations included), and in 2013 (Council Directive 2011/70/Euratom).

- The Radiation Act and Decree were revised in 2013 (Council Directive 2011/70/Euratom and for conformance with the European Community Radiation Protection Legislation).

- The Council Directive 2013/39/Euratom of 5 December 2013 will be implemented into the Finnish legislation during the next four years.

- Detailed safety requirements on the management of spent nuclear fuel and radioactive waste resulting from the production of nuclear energy are provided in STUK's regulatory guides, the YVL Guides. After amending the nuclear energy legislation in 2008, also the revision of the existing YVL guide system was commenced. Forty new YVL guides were issued on December 1st 2013.

- Detailed safety requirements on the management of radioactive waste, subject to the Radiation Act, are provided in STUK's ST Guides. They have been updated in accordance with the changes in the respective legislation.

- In 2012, the Finnish regulatory framework for nuclear and radiation safety was reviewed in the IRRS (Integrated Regulatory Review Service) peer review process. According to the IRRS recommendations, some amendments need to be considered for the legislation mainly concerning the independence of STUK. The amendments to the Nuclear Energy Act and the Radiation Act were under preparation in 2013, approved by the Parliament in early 2015, and approved by the President in May/June 2015. They are expected to enter into force by January 1st 2016. The follow-up IRRS review took place in June 2015.

Technical support and competence have been developed

- VTT Technical Research Centre of Finland Ltd continued to support effectively the regulatory body in safety assessment work, providing safety analysis capabilities and tools e.g. via the regulatory research programmes, and performing reviews of safety analyses. In addition, several national and international experts have supported STUK's review work of the spent fuel encapsulation and disposal safety during the pre-licence phase and in the construction licence review.

- Competence management, especially taking into account the retirement of large post-war age groups, is a concern also in Finland. During 2010–2012, the Ministry of Employment and the Economy set up a committee to report on the availability of competence and resources in the nuclear energy sector. One of the recommendations was that the future needs and focus areas of the Finnish nuclear energy sector research must be accurately defined and a long-term strategy drawn up for research activities. One of the conclusions was also that there is a challenge in maintaining continuity of knowledge and also in attracting new competent personnel. Investments in research and the availability of high-standard education

and training are crucial. At the end of January 2013 the Ministry of Employment and the Economy set up a working group to prepare a research and development strategy. The strategy was completed in April 2014, the translation in September (http://www.tem.fi/files/40977/TEM_jul_17_2014_web_24092014.pdf).

- International cooperation and transparency belong to the cornerstones of the development of the national solutions for spent fuel and waste safety in Finland. In addition to active participation in international and bilateral forums (IAEA, EU, WENRA, OECD/NEA), foreign consultants continued to participate both in regulatory reviews and Posiva's development work.

Challenges for future work

- The main challenges are related to the spent fuel disposal project. The planning and preparation for the construction and for the commissioning phase are challenges both for Posiva and for STUK. Posiva and STUK invest in their processes and resources to ensure that all safety related regulatory and implementation tasks can be performed with high quality and without undue delay.

- The planned Olkiluoto disposal facility currently covers spent fuel from the four reactors in operation and from the one under construction (Olkiluoto 3). As Fennovoima Oy is not an owner of Posiva, the plans of Posiva do not cover disposal of spent fuel from Fennovoima's future NPP unit. According to the Decision-in-Principle Fennovoima must supplement its plan for the disposal of spent nuclear fuel by 2016 by submitting to the Ministry of Employment and the Economy either an agreement with Posiva's owners, i.e. TVO and FPH, on nuclear waste management in cooperation with Posiva as outlined in the application for the Decision-in-Principle, or an environmental impact assessment programme for a spent fuel disposal facility of its own.

- LILW generated from the operation of the research reactor FiR 1 is stored at the reactor facility until decommissioning. VTT is negotiating with the Finnish NPP licensees (TVO and FPH) for possible interim storage and future disposal of decommissioning waste. The licence application concerning decommissioning is planned to be submitted to the Government during the first half of 2016. The actual dismantling of the reactor is planned to last approximately two years.

- The European Commission promotes worldwide co-operation to further develop nuclear, radiation and waste safety through its INSC program and its predecessors. Finland has been and will be a supporter of this European development and involvement. The insufficiency of competent personnel for this work may adversely affect the co-operation.

- Communication has been and will continue to be an increasingly important success factor for STUK, Posiva, and the power companies. The interest in radiation and nuclear safety topics will continue to increase. The media, including the social media, plays an important role in communication.

- While most radioactive waste streams have a disposal solution, a small quantity of the small user waste – consisting of some nuclear material and a few high activity sources – cannot be disposed of in the Olkiluoto LILW disposal facility due to inventory restrictions. An alternative disposal route for these wastes is currently being negotiated.

Conclusion

In conclusion, based on the information presented in the report, Finland complies with the obligations and objectives of the European Council Directive (2011/70/EURATOM). Challenges for the future are recognized, regularly reviewed and addressed. The required effort for continuous improvement is made.

INTRODUCTION

Nuclear and Other Radioactive Waste Management Policy in Finland

Responsibilities

The producer of nuclear waste is responsible for the implementation and expenses of the pertinent waste management and decommissioning activities, including the related planning, research and development work.

The user of radioactive substances shall render harmless the radioactive waste arising from operations in question, including those involved with natural radioactive substances.

The State has the secondary responsibility in case the producer of nuclear or radioactive waste is not capable of fulfilling his management obligation.

Waste management and decommissioning principles

The Nuclear Energy Act states that nuclear waste generated in Finland with some exceptions shall be treated, stored and permanently disposed of in Finland. Nuclear waste generated elsewhere shall not be handled, stored or permanently disposed of in Finland.

Means to reduce the amounts of nuclear waste arising from the decommissioning shall be considered already in the design of a nuclear facility. Decommissioning plans shall be regularly updated during the operation of the facility. Implementation of decommissioning shall not be unjustifiably postponed.

The amount of radioactive waste arising from the uses of radioactive sources or from other radiation practices shall be as low as practicable, however, without jeopardizing

the general principles of radiation protection including optimization. The preferable management option for disused sealed sources is to return them to the supplier/manufacturer. It is prohibited to import disused sources to Finland for the purpose of disposal.

Safety principles and control

Safety of nuclear waste management facilities shall be kept as high as reasonably achievable (the SAHARA principle) and all actions justified by safety research and the progress in science and technology shall be taken into account to enhance safety. Nuclear waste shall be disposed of so that the radiation impact is as low as reasonably achievable (the ALARA principle) and so that no radiation impact exceeding the currently acceptable level will occur in the future and so that ensuring long-term safety is based on passive safety functions.

The Ministry for Employment and the Economy (MEE) determines the principles on the basis of which the nuclear waste management obligation is to be implemented. STUK is responsible for the required safety assessment of the licence applications in the authorization processes and for the control of the safe management of nuclear and other radioactive waste. The construction and operating licences for nuclear waste management facilities are prepared by MEE and granted by the Government.

Nuclear and Other Radioactive Waste Management Strategy in Finland

The waste management history is described in the national programme, giving the basis on which the political and policy decisions were made, leading to the current legislation where all the requirements of Article 4 are taken into account.

Legislation

The main regulations in the field of radioactive waste management are the Nuclear Energy Act (990/1987) and Decree (161/1988), the Radiation Act (592/1991) and Decree (1512/1991), the Government Decrees and the Decisions of the Government, as well as the Regulatory Guides (YVL Guides and ST Guides) issued by the Radiation and Nuclear Safety Authority (STUK). The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management has been signed by Finland in 1997 and it entered into force in 2001. The Finnish regulatory framework fulfils the obligations of the Joint Convention as well as the requirements of the European Council directive (2011/70/Euratom).

Responsibilities of licensees

The producer of nuclear waste is responsible for the implementation and expenses of the pertinent waste management and decommissioning activities, including the related planning, research and development work.

Current and future producers of nuclear waste (the NPP utilities TVO, FPH and FV) take care of interim storage of spent fuel, of conditioning, storage, and disposal of low and intermediate level waste and of planning for and implementation of the decommissioning of the NPPs.

A company, Posiva Oy, jointly owned by FPH and TVO, is responsible for the preparations for and later implementation of its owners' spent fuel disposal. Fennovoima Oy is responsible for its own spent fuel disposal.

VTT Ltd, as an operator of the research reactor FiR 1, is responsible for planning and implementation of the spent fuel and waste management and decommissioning of the facility, including the arrangements for the disposal of the arising waste.

Producers of other radioactive waste manage their waste within the limits of their technical capability while ensuring safety and security. Small user waste that cannot be cleared, including spent sealed sources that cannot be returned to the manufacturer, must be handed over to a recognized installation licensed to receive, condition, and transfer radioactive waste to the national central storage operated by STUK.

Waste management and decommissioning objectives

Such low and intermediate level nuclear waste that meets the acceptance criteria for the repositories at the NPP sites will be disposed of without unnecessary delays. Waste that cannot yet be disposed of is stored safely, e.g. liquid waste that is not yet conditioned. Also other low and intermediate level waste, such as decommissioning waste and small user waste, is envisaged to be disposed of in the rock cavern repositories at the NPP sites.

The disposal of TVO's and FPH's spent fuel is under preparation in accordance with a strategic plan, which is in line with the 1983 Government Policy Decision and the 2003 Decision of the Ministry of Trade and Industry. The goal for starting the disposal operations is approximately the year 2022. The spent fuel disposal programme is subject to continuous regulatory review and is now in the construction licence application review phase. STUK has reviewed Posiva's application and given its statement to the Ministry of Employment and the Economy (MEE) in February 2015. The prospective nuclear utility Fennovoima Oy must, by the end of June 2016, present an Environmental Impact Assessment Programme for a spent nuclear fuel disposal facility of its own.

The implementation of decommissioning of the NPPs will be optimized taking into account the technical aspects, radiological impact, future use of the site, availability of competent workforce and the costs. The strategy takes advantage of options for clearance of very low level waste and structures of the plant and on-site disposal of decommissioning waste.

In cases of uses of radiation the accumulation of waste needing to be transferred to the national central storage is minimized by e.g. preferring the returning of disused sealed sources to the manufacturer abroad and allowing the storage of short lived radioactive waste at the licensees' premises for the purpose of aging them under limits set for releasing them from regulatory control. The final disposal of the radioactive waste transferred to the national central storage shall take place as part of the operation of the Olkiluoto LILW disposal facility.

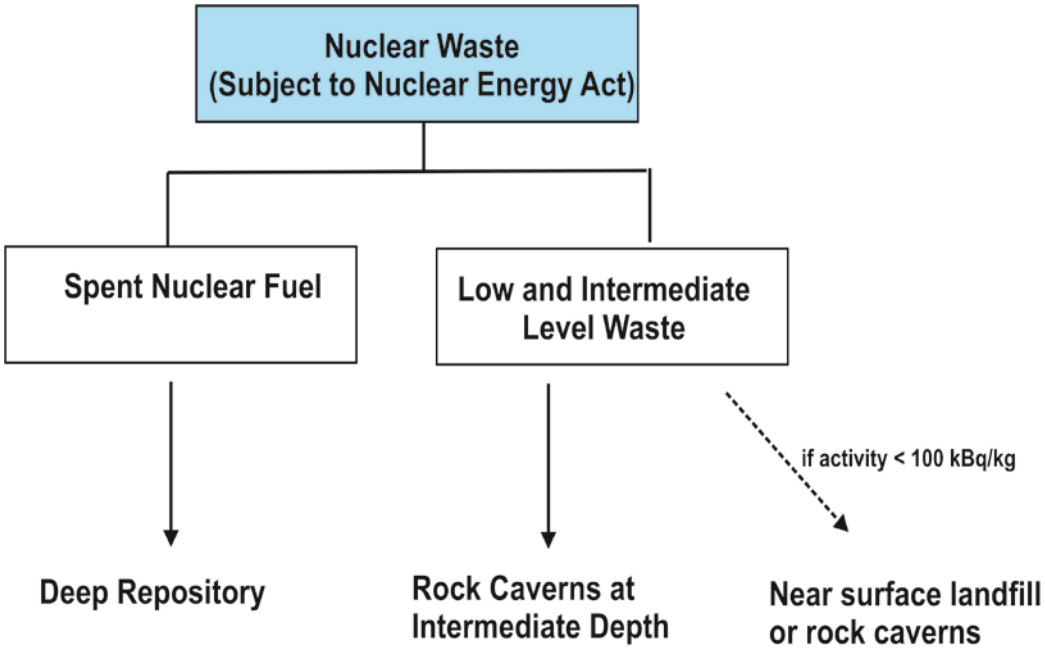
Financial liability system

The producer of nuclear waste is responsible for the implementation and expenses of the pertinent waste management and decommissioning activities, including the related planning, research and development work.

Also under the Radiation Act the costs incurred when rendering radioactive waste harmless shall be borne by the waste generator.

Radioactive waste: legislation and management implementation

In the Finnish legislation, radioactive waste is divided into two categories based on the way it is generated, and covered by the Nuclear Energy Act and related Decrees, and by the Radiation Act and related Decrees, respectively. See Fig. 1.



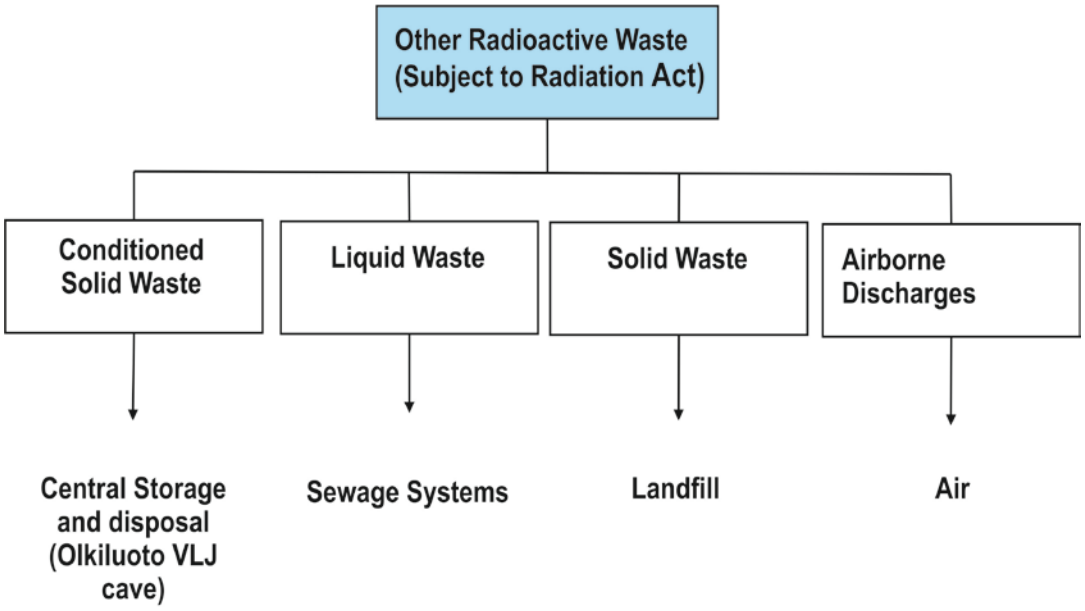


Fig. 1. Radioactive waste and its disposal in the Finnish legislation

Nuclear waste, regulated by the nuclear energy legislation, is defined 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. According to the Nuclear Energy Act a licensee, whose operation generates or has generated nuclear waste, is responsible for all nuclear waste management measures including related planning, research and development work, and is also responsible for the financing the costs of the future management of the waste and of the decommissioning of the facility.

In Finland, the current producers of nuclear waste are the nuclear power plant utilities Teollisuuden Voima Oy (TVO) and Fortum Power and Heat Oy (FPH) as well as VTT Technical Research Centre of Finland Ltd, which operates the research reactor FiR 1. Both nuclear power plants have storage facilities for spent nuclear fuel and facilities for treatment, storage and disposal of low and intermediate level waste (LILW). VTT is responsible for the management of nuclear waste from the research reactor. (Fig. 2)

In 2010 the Finnish Parliament endorsed the Government's Decision-in-Principle (DiP) to build two more NPP units, one by TVO at the Olkiluoto site and the other one by Fennovoima Oy at a new site, Pyhäjoki. TVO allowed the DiP to expire, whereas Fennovoima submitted the construction licence application by the due date.

Posiva Oy (Posiva), jointly owned by FPH and TVO, is responsible for the preparations for and later implementation of spent fuel disposal for its owners.

Fennovoima presents plans for its own nuclear waste disposal in connection with the nuclear power plant construction licence application at the end of June 2015.

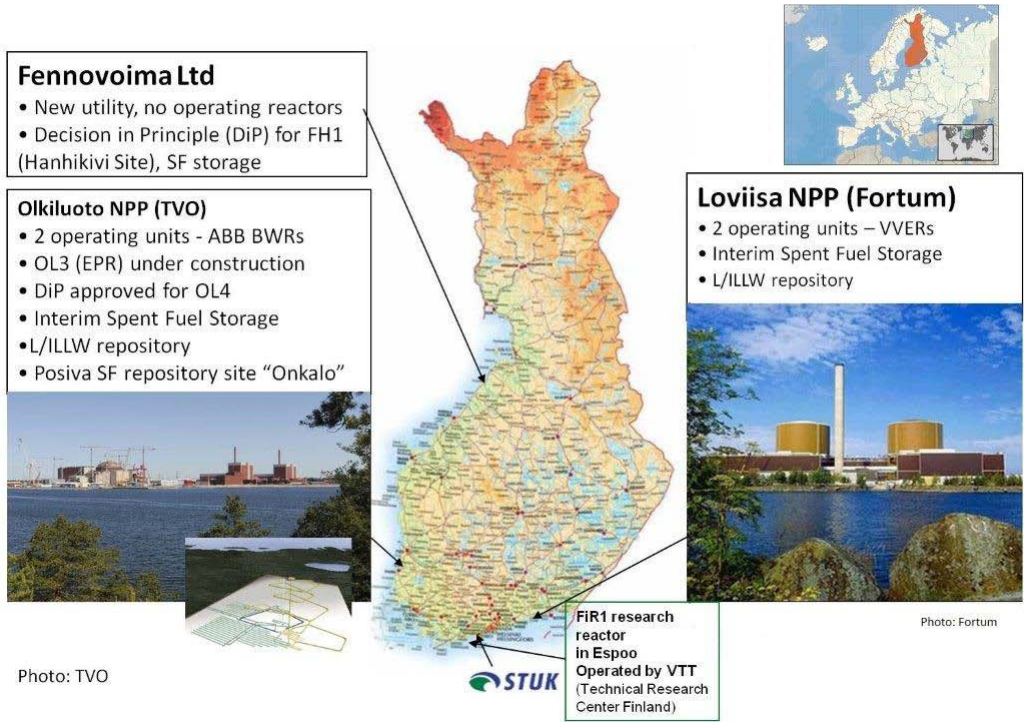


Fig. 2. Producers of nuclear waste in Finland, the situation at the end of 2014

Radioactive waste, regulated by the Radiation Act, denotes radioactive substances, and items contaminated with radioactive substances, which have no use any more and have to be rendered harmless due to their radioactivity. Such waste is generated mainly from the uses of radioactive sources in health care, industry or research.

The licensees under the Radiation Act perform some waste management operations, such as initial storage, clearance and disposal into landfill type sites. Small user waste that cannot be cleared, including spent sealed sources that cannot be returned to the manufacturer, must be handed over to Suomen Nukliditekniikka, a private entrepreneur licensed to receive, condition and transfer radioactive waste to a central storage operated by STUK.

The Government grants licences for nuclear facilities (Fig. 3). The Ministry of Employment and the Economy (MEE) oversees that waste management and related R&D complies with the national policy and, together with the State Nuclear Waste Management Fund, that provisions for future waste management are adequate.

The Ministry of Social Affairs and Health (MSAH) is the supreme authority on the supervision of practices involving exposure to radiation. STUK is responsible for the regulatory oversight of radiation and nuclear safety, for issuing detailed safety regulations and for the technical and safety related review of licence applications and other relevant documents. Licences for uses of radiation are granted by STUK.

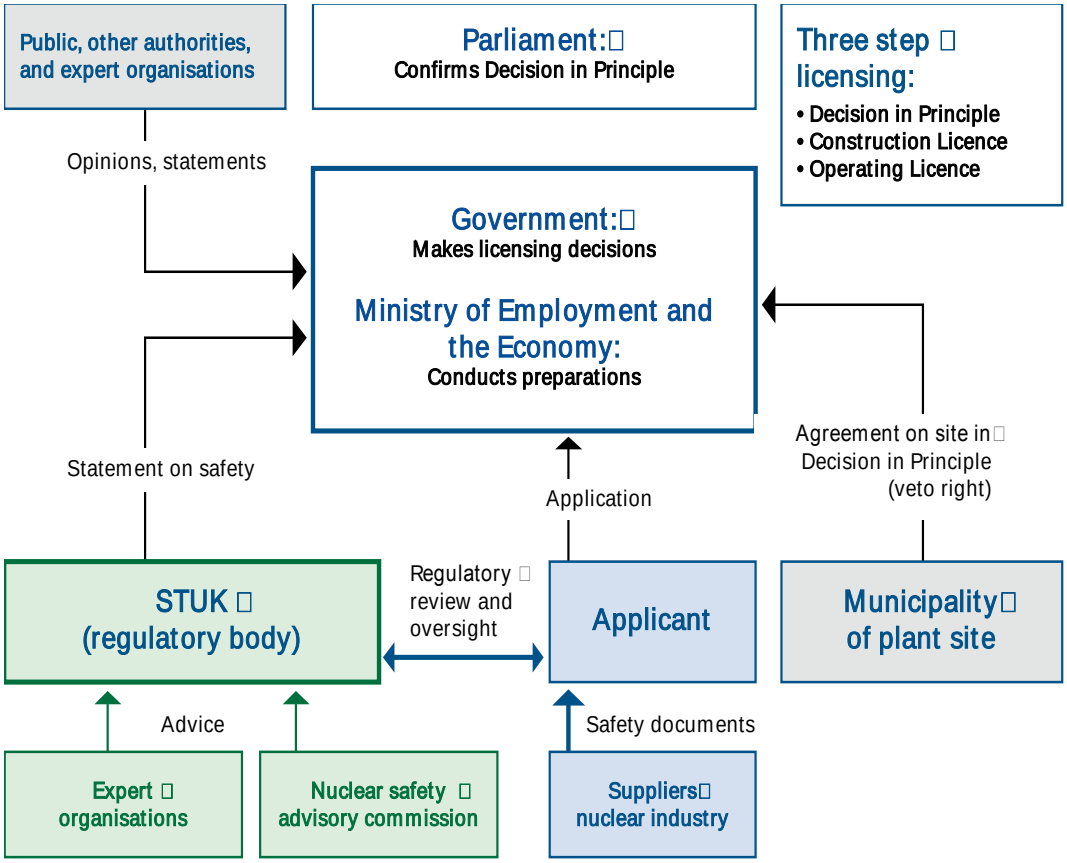


Fig. 3 Licensing process of nuclear facilities in Finland

In order to ensure the quality of its programme, to improve safety and to promote international co-operation and transparency, STUK has organized several international peer reviews on its regulatory approach and activities. The results are discussed in connection with Art. 5.2.

Report preparation

The national report has been prepared by STUK in collaboration with the Ministry of Employment and the Economy. Contributions to the contents were given by TVO, FPH, FV, Posiva, VTT, and the Ministry of the Environment. Materials provided by the licensees in connection with the national report for the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and STUK's annual reports to the MEE and the MSAH, and the Member State Report under Council Directive 2009/71/Euratom were utilized.

The MEE has been responsible for defining and describing the national programme.

REPORTING ARTICLE BY ARTICLE

ARTICLE 4 – General principles

Art. 4.1

Member States shall establish and maintain national policies on spent fuel and radioactive waste management. Without prejudice to Article 2(3), each Member State shall have ultimate responsibility for management of the spent fuel and radioactive waste generated.

The Finnish policy on the ultimate responsibility for spent fuel and radioactive waste management is declared in the legislature, in the Nuclear Energy Act (990/1987) and in the Radiation Act (592/1991).

The Nuclear Energy Act states that nuclear waste generated in connection with or as a result of use of nuclear energy in Finland shall be handled, stored and permanently disposed of in Finland.

In addition, the Nuclear Energy Act states that nuclear waste generated in connection with or as a result of the use of nuclear energy elsewhere than in Finland, shall not be handled, stored or permanently disposed of in Finland.

The cases to which these legal requirements do not apply are listed in the Nuclear Energy Decree (161/1988).

The Radiation Act declares the duties and responsibilities as follows:

- The responsible party shall take the measures necessary to render harmless any radioactive waste arising from its operations.
- If the responsible party fails to discharge the duty of care referred to in the Radiation Act (Section 50), then the State shall take the measures necessary to render any radioactive waste harmless and to decontaminate the environment.
- The State shall also take measures when the origin of the waste is unknown, or when no responsible party subject to a primary duty of care can be found.
- It is prohibited to import radioactive waste to Finland for the purpose of disposal.

Art. 4.2

Where radioactive waste or spent fuel is shipped for processing or reprocessing to a Member State or a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, shall remain with the Member State or third country from which the radioactive material was shipped.

As described in Art. 4.1, according to the Nuclear Energy Act (Section 6a) 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 nuclear waste arising from the use of a research reactor in Finland (the Nuclear Energy Act (Section 6a)). As stipulated in the Nuclear Energy Decree (Section 7b), the spent fuel from a research reactor in Finland 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.

The other exemption is nuclear waste containing minor quantities of radioactive material (e.g. contaminated metal components) and which is delivered to another country for treatment in the appropriate manner. There have been few cases and in all of them the radioactive waste has been returned to Finland for disposal.

Radioactive waste shall not be exported to a country whose technical, legislative or administrative facilities are inadequate for the care of radioactive waste (the Radiation Act (Section 52a)).

Disused radiation sources that were not manufactured in Finland may not be imported to Finland as radioactive waste (the Radiation Act (Section 52a)).

Shipments of radioactive waste and spent fuel shall be arranged in the manner prescribed in Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel, referred to as the Shipments Directive (the Radiation Act (Section 52a) and the Nuclear Energy Act (Section 55b)).

Art. 4.3(a)

National policies shall be based on all of the following principles:

(a) the generation of radioactive waste shall be kept to the minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials;

According to the Nuclear Energy Act (Section 27a) the amount of nuclear waste generated in the use of nuclear energy must be kept as small as is reasonably possible with practical measures, both regarding volume and activity, without compromising the general principles set forth in the Nuclear Energy Act (Sections 5 to 7).

Regulatory Guide YVL D.4 underlines that generation of waste shall be reduced i.a. by proper planning of repair and maintenance 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 into the controlled areas and by adoption of working processes that either create only small amounts of waste or the created waste is easily manageable.

The release of very low level waste from regulatory control (clearance) is regulated by virtue of Guide YVL D.4. Both conditional and unconditional clearances are effectively

used for waste minimization by the NPPs. Clearance criteria, levels and procedures are given in Guide YVL D.4.

The average annual accumulation of LILW to be disposed of has been fairly low: about 85 m^3 per plant (each having two operational reactor units). The accumulation of waste has in some years even turned to decline by effective waste minimization and volume reduction measures, such as radiochemical treatment of liquid waste, campaigns for removal of very low level waste from control, and compaction of maintenance waste. Some large metal components of NPP origin have been transported for treatment to Studsvik facility in Sweden. Activation products or external contamination containing parts or components that have been separated from the metal are transported back to Finland for disposal.

According to the Radiation Act (Section 49a) the amount of radioactive waste generated by the use of radiation and other radiation practices shall be kept as low as reasonably achievable without endangering the implementation of the general provisions of the Radiation Act (Section 2). The concept of clearance is used allowing for the reuse and recycling of material (based on the criteria and values given in IAEA publication GSR Part 3).

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 Guide ST 6.2. Only small amounts of waste need to be conditioned for disposal.

Art. 4.3(b)

(b) the interdependencies between all steps in spent fuel and radioactive waste generation and management shall be taken into account;

According to the Nuclear Energy Act, a licensee, whose operation generates or has generated nuclear waste, is responsible for all nuclear waste management measures including related planning, research and development work, and is also responsible for the financing the costs of the future management of the waste and of the decommissioning of the facility. Therefore, the interdependencies and different requirements of the different phases of the process must also be taken care of by the licensee.

Guide YVL B.4 sets requirements on the nuclear fuel. The integrity of nuclear fuel shall be ensured during its operation, handling, transport, long-term storage and final disposal. Guide YVL D.3 concerns the handling and storage of the nuclear fuel. The integrity of nuclear fuel rods shall be secured in the handling, storage, and encapsulation of nuclear fuel.

Guide YVL D.4 on treatment and storage of LILW from NPPs requires that waste is treated, e.g. segregated, categorised and conditioned, in an appropriate way with regard to its further management.

The Radiation Act requires the radioactive waste, its handling, storage and disposal to be defined and planned for in advance, and the plans to be included in the licence application (Section 16). The amount of generated waste shall be kept as low as practicable, however without jeopardizing the general principles for radiation protection (justification, optimization and dose limitation) governing the practice as a whole (the Radiation Act (Section 49a)).

The interdependencies within the spent fuel and radioactive waste management are minimal, due to the legal requirement that the generator of such waste is responsible for all the management of that waste and the fact that the NPP licensees are operating the spent fuel interim storages and the repositories for LILW at the NPP sites.

Art. 4.3(c)

(c) spent fuel and radioactive waste shall be safely managed, including in the long term with passive safety features;

The Finnish legislation does not directly mention passively safe repositories but requires repositories with effective containment for relevant time spans that do not require post-closure monitoring (the Nuclear Energy Act (Section 7h)). Repositories shall be based on multiple safety functions achieved through mutually complementary barriers (multibarrier principle) so that a deficiency of an individual safety function provided by a barrier or a predictable geological change will not jeopardize long-term safety.

The Nuclear Energy Act (Section 7h) defines the safety responsibilities as follows:

"The nuclear facility shall have the facilities, equipment and other arrangements required to ensure the safe handling and storage of nuclear material required by the plant and any nuclear waste generated during operation.

"Nuclear waste shall be managed so that after disposal of the waste no radiation exposure is caused, which would exceed the level considered acceptable at the time the final disposal is implemented.

"The disposal of nuclear waste in a manner intended as permanent shall be planned giving priority to safety and so that ensuring long-term safety does not require the surveillance of the final disposal site.

"Nuclear waste management plans shall be kept up to date as provided in Section 28 of the Act.

According to Guide YVL D.3 the storage conditions of spent fuel shall be designed so that the condition of fuel assemblies, fuel racks, or storage pools will not significantly deteriorate during the storage period. When the handling, storage, and encapsulation

processes for nuclear fuel are designed, priority shall be given to simple and inherently safe concepts.

Guide YVL D.4 handles the predisposal management of the LILW and decommissioning. The design of a processing and storage facility for operational waste or the decommissioning of a nuclear facility shall give priority to concepts where high temperatures, elevated pressures or other operational conditions that increase the accident potential are not necessary. Priority shall also be given to concepts that are based on inherently safe systems and components. The safety of a permanently closed nuclear facility that has been brought to a state of monitored storage shall, to the extent practicable, be independent of active systems and operational actions.

The institutional radioactive waste stored in the national central storage shall be disposed later in the Olkiluoto LILW waste repository. Therefore, the post-closure safety features are the same as those for nuclear based LILW in Olkiluoto.

Art. 4.3(d)

(d) implementation of measures shall follow a graded approach;

Generally, all authorities shall observe the Administrative Procedure Act (434/2003). In the Administrative Procedure Act (Section 6) it is stated that an authority shall treat the customers of the administration on an equal basis and exercise its competence only for purposes that are acceptable under the law. The acts of the authority shall be impartial and proportionate to their objective. They shall protect legitimate expectations as based on the legal system.

In particular, the Nuclear Energy Act states (Section 7a) that safety requirements and measures to guarantee safety shall be designed and applied in proportion to the risks associated with the use of nuclear energy.

The general principles are set in the Nuclear Energy Act and in the Nuclear Energy Decree. More detailed requirements, related to the safety of disposal of nuclear waste, are presented in the Government Decree (736/2008). Guides YVL D.3, YVL D.4 and YVL D.5 refine details for safe operation of waste management and disposal facilities and long-term safety of disposed waste.

In the Radiation Act (Section 14) it is stated that the responsible party shall be required to take such measures to improve radiation safety as are justifiable with respect to their nature, costs and positive impact on radiation safety.

Art. 4.3(e)

(e) the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;

According to the Nuclear Energy Act (Section 9) a licensee whose operations generate or have generated nuclear waste (licensee under a waste management obligation) shall be responsible for all nuclear waste management measures and their appropriate preparation, as well as for their costs (waste management obligation).

According to the Radiation Act (Section 50) the responsible party shall take the measures necessary to render harmless any radioactive waste arising from its operations. A financial guarantee for ensuring appropriate management of disused sources shall be furnished for practices where possible waste management costs are considerable (Section 19) including the use of some High Activity Sealed Sources (Section 31f).

Art. 4.3(f)

(f) an evidence-based and documented decision-making process shall be applied with regard to all stages of the management of spent fuel and radioactive waste.

According to the Nuclear Energy Act (Section 8) the use of nuclear energy without a licence is prohibited. The use of nuclear energy covers e.g. construction and operation of nuclear facilities, mining and milling operations aimed at producing uranium or thorium, possession, fabrication, production, transfer, handling, use, storage, transport and import of nuclear material and nuclear waste, export of nuclear waste as well as the export and import of ores containing uranium or thorium.

It is the licensee's obligation to ensure safe use of nuclear energy. Therefore the licence applicant shall submit a detailed demonstration of safety to STUK's review and assessment according to regulations such as the Nuclear Energy Act, the Nuclear Energy Decree, Government Decrees and YVL Guides.

A safety licence issued by STUK is needed for the use of radiation sources. The application shall include a waste management plan (the Radiation Act (Section 16)). When the practice ends the licensee shall provide evidence on the appropriate management of radioactive waste under its responsibility (the Radiation Act (Section 20)). When transferring radioactive waste, the transferor must ensure that the transferee has a safety licence enabling it to hold the waste (the Radiation Act (Section 52)). Import, export or transport of radioactive waste via Finnish territory is subject to STUK's separate approval for each such transaction (the Radiation Act (Section 52a)).

Art. 4.4

Except for the provisions set out in Article 2(3):

(a) repatriation of disused sealed sources to a supplier or manufacturer;

(b) shipment of spent fuel of research reactors to a country where research reactor fuels are supplied or manufactured, taking into account applicable international agreements;

(c) the waste and spent fuel of the existing Krško nuclear power plant, when it concerns shipments between Slovenia and Croatia.

Radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with

Article 16(2) of Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use a disposal facility in one of them.

Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:
(a) the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ('the Joint Convention');
(b) the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this Directive; and
(c) the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination.

According to the Nuclear Energy Act (Section 6a) 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.

The Nuclear Energy Decree (Chapter 7c) specifies the procedure for those cases where import and export of nuclear waste may still take place. Before a decision is made on a licence to export nuclear waste, STUK shall ensure that the export of nuclear waste meets the requirements of the Council Directive on the supervision and control of shipments of radioactive waste and spent nuclear fuel (2006/117/Euratom).

The Radiation Act states (Section 52a) that radioactive waste shall not be exported to a country whose technical, legislative or administrative facilities are inadequate for the care of radioactive waste. Disused radiation sources that were not manufactured in Finland may not be imported to Finland as radioactive waste.

ARTICLE 5

Art. 5.1(a)

Article 5.1 Member States shall establish and maintain a national legislative, regulatory and organisational framework ('national framework') for spent fuel and radioactive waste management that allocates responsibility and provides for coordination between relevant competent bodies. The national framework shall provide for all of the following:
(a) a national programme for the implementation of spent fuel and radioactive waste management policy;

In Finland, the policies and strategies for radiation and nuclear safety are mainly expressed through legislation.

Finland was active in the process of developing a proposal for a European Council Directive on the management of spent fuel and radioactive waste. In 2013, the Nuclear Energy Act and the Radiation Act were amended to implement the Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the

responsible and safe management of spent fuel and other nuclear and radioactive waste. The principles of graded approach and of keeping the generation of radioactive waste to the minimum which is reasonably practicable were included in both Acts. In the Nuclear Energy Act the provisions of self-assessment and peer review were updated to cover also waste management.

The latest revisions and amendments to the Nuclear Energy Act and the Radiation act, as well as the respective Decrees, define the requirements on the national programme for spent fuel and radioactive waste management in Finland. The amendments also define the responsibilities for the implementation of the national programme.

Art. 5.1(b)

(b) national arrangements for the safety of spent fuel and radioactive waste management. The determination of how those arrangements are to be adopted and through which instrument they are to be applied rests within the competence of the Member States;

As described in Introduction, the actors in the radiation safety field are the Ministries as legislative bodies, the Government with the legislative authority, STUK as the regulatory body, and the licensees as operators in the field. Spent fuel and radioactive waste management always requires a licence.

The Finnish Constitution is the cornerstone of all legislation and exercise of public power. The Constitution stipulates how and by whom the acts and decrees as well as delegation of legislative powers can be issued. The decisions are taken by the Parliament or the Government as appropriate. It is a general principle that the ministries are responsible for preparation of legislation. The Ministry of Employment and the Economy (MEE) is responsible for the legislation in the nuclear energy field and the Ministry of Social Affairs and Health (MSAH) for the use of radiation (acts and decrees). As prescribed by the Act on STUK (1069/1983) STUK participates in the preparatory legislative work, making proposals for the development of legislation in the field of nuclear and radiation safety.

The arrangements for the safety of spent fuel and radioactive waste are governed by the Nuclear Energy Act and the Radiation Act and the subsequent Decrees.

Detailed safety regulations (YVL Guides) concerning the nuclear safety are issued by STUK based on the Nuclear Energy Act (Section 7r). Concerning the safety in the use of radiation, more detailed regulations on achieving the standard of safety (ST Guides) are issued by STUK based on the Radiation Act (Section 70).

These Guides are binding regulations for the licensees, while preserving the licensee's right to propose an alternative procedure or solution to that provided in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with the Nuclear Energy Act, STUK may approve the procedure or solution by which the safety level set forth is achieved.

Art. 5.1(c)

(c) a system of licensing of spent fuel and radioactive waste management activities, facilities or both, including the prohibition of spent fuel or radioactive waste management activities, of the operation of a spent fuel or radioactive waste management facility without a licence or both and, if appropriate, prescribing conditions for further management of the activity, facility or both;

According to the Nuclear Energy Act (Section 8) the use of nuclear energy without a licence is prohibited.

The licensing process is defined in the legislation. The licences are prepared by the Ministry of Employment and the Economy and granted by the Government. For a NPP, a spent nuclear fuel storage, a nuclear waste disposal facility or another significant nuclear facility the process consists of three stages:

- Decision-in-Principle – made by the Government and ratified 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 18 to 20).

Before a Construction Licence for a NPP, spent fuel storage, nuclear waste disposal facility or other significant nuclear facility can be applied for, a Decision-in-Principle by the Government and a subsequent ratification of the DiP by the Parliament are required. An Environmental Impact Assessment (EIA) procedure has to be conducted prior to the application of the DiP and the EIA report has to be 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 of the society. Further conditions are as follows:

- The municipality of the intended site of the nuclear facility is in favour of constructing the facility (right of veto);
- No factors have appeared which indicate that the proposed facility could not be constructed and operated in a safe manner.

The entry into force of the Government's Decision-in-Principle further requires ratification by the Parliament. The Parliament cannot make any changes to the Decision; it can only approve or reject it as such. The authorization process of a nuclear facility is described in Fig. 3 in Introduction. In the construction and operating licence phases the acceptance of the Parliament and the host municipality are no more needed.

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 a longer period than 10 years, a periodic safety review is required to be presented to STUK (Guide YVL A.1). When applying for an amendment to the construction licence or operating licence or renewal of operating licence of a nuclear facility, the same procedures shall be observed as when applying for a new licence, to the extent applicable (the Nuclear Energy Decree (Section 40)).

On the basis of the Nuclear Energy Act (Section 16), minor licences for spent fuel and nuclear waste management activities (export, import, transfer and transport licence and licences for operations) are granted by STUK.

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

As the regulatory body STUK has the right to prescribe licence conditions for further management of the activity.

Art. 5.1(d)

(d) a system of appropriate control, a management system, regulatory inspections, documentation and reporting obligations for radioactive waste and spent fuel management activities, facilities or both, including appropriate measures for the post-closure periods of disposal facilities;

According to the Nuclear Energy Act, STUK is responsible for the regulatory oversight of the safety of the use of nuclear energy. Based on the Nuclear Energy Act (Section 63) STUK has the right to inspect and control operations in nuclear facilities and for this purpose to have access to any place where such an operation is being carried out, as well as to carry out measurements required for supervision, to take and to receive samples and to install equipment necessary for such supervision. STUK oversees also the construction of a nuclear facility (the Nuclear Energy Decree (Section 109)).

STUK has established an inspection program for nuclear facilities that covers all relevant areas of nuclear safety and security. STUK's Periodic Inspection Program is focused on the licensee's main working processes and covers management and organizational aspects, broad overlapping processes (such as assessment and improvement of safety, safety functions, operational safety, radiation protection, waste management) as well as detailed technical issues.

STUK issues YVL Guides that require performing detailed regulatory inspections for certain areas (e.g. construction, operator competence). These technical inspections supplement other regulatory inspections by giving STUK detailed knowledge of safety related systems, structures and components.

All the inspections are carried out according to a detailed plan and inspection findings and the related regulatory requirements are presented in the inspection protocol (inspection report). All inspections are documented in a database that is used to monitor the inspection findings. STUK's inspection findings are also communicated directly to the licensee after an inspection. Inspection results are followed in the regulatory process and communicated to the staff of the regulatory body.

Guides YVL A.9 and A.10 provide in detail the reporting requirements on operation and on incidents, operational disturbances, and events which have to be reported to STUK.

They also define requirements for the contents of the reports and the administrative procedures for reporting, including time limits for submitting various reports.

STUK publishes the operational events in its quarterly reports on nuclear safety that are also available to the general public in Finnish. Pursuant to the Nuclear Energy Decree (Section 121), STUK is obliged to report on regulatory oversight in the field of nuclear energy once a year to the Ministry of Employment and the Economy. STUK's Annual Report summarizes the operation and events from the whole year and is available to the general public in Finnish and in English.

According to the Government Decree (736/2008), records shall be kept of the disposed waste which includes waste package specific information on waste type, radioactive substances, location in the waste emplacement rooms and other necessary data. STUK maintains a database where the nuclear waste data reported annually by the operators of the NPPs are stored. Guide YVL A.9 gives general requirements for reporting to STUK and includes provisions for waste management reporting. More detailed requirements for waste management records are given in Guides YVL D.4 and YVL D.5. During the operational period the records referred to above shall be annually complemented and submitted to STUK. STUK shall organize the storing of the information on the disposal facility and the disposed waste in a permanent manner. At the time of the closure of the repository, the records of the disposed waste and the relevant information in the FSAR will be converted into a form for long-term deposition approved by the national archive.

A licensee with a waste management obligation shall apply for an order on the expiry of his waste management obligation when all the measures necessary for closing the disposal facility have been completed (the Nuclear Energy Decree (Section 84)). A prerequisite for the expiry of the waste management obligation is that STUK has confirmed that the nuclear waste has been permanently disposed of in a manner it has approved (the Nuclear Energy Act (Section 33)) and that the measures specified in the Nuclear Energy Act (Section 32) have been duly completed. According to Guide YVL D.5 a precondition for the permanent closure of a disposal facility is that STUK has approved the closure plan, which shall include:

- a description of the technical implementation of the closure of the repository;
- an update of the safety case; and
- a plan for the potential post-closure monitoring measures and a proposal for the restriction zone with prohibition on measures referred to in the Nuclear Energy Decree (Section 85).

As producers of nuclear waste, TVO and Fortum are under the Nuclear Energy Act responsible for implementing the management of nuclear waste produced in the Olkiluoto and Loviisa nuclear power plants as well as for the costs thus incurred. VTT is responsible for the nuclear waste management for FiR 1. According to the legislation, the Ministry of Employment and the Economy decides on the principles to be followed in nuclear waste management. The legislation provides that the parties with the nuclear waste management obligation must also provide the Ministry with regular reports on how they have planned to implement the measures included in nuclear waste management and their preparations. The report is submitted at three-year intervals, and

it must describe in detail the measures for the next three-year period and also present an outline of the plans for the subsequent three-year period.

According to the Radiation Act (Section 53), STUK is authorized to inspect any radiation practices and it has access to places in which the practices are performed. STUK is authorized to conduct tests and measurements, to take or obtain necessary samples, and to install the devices needed for regulatory purposes at the said places or in the vicinity. In addition, STUK is authorized to obtain the notifications, data and documents needed for regulatory purposes.

All radioactive sources the activity of which is above the exemption level as well as their transfers have to be notified to STUK. This requirement applies to sources in use as well as radioactive waste. When an operator wishes to end a particular practice, it has to demonstrate that it has in an acceptable manner relinquished or rendered harmless the radioactive substances in its possession. In practice this is done by sending the source in question to the manufacturer or handing it over to the recognized installation for rendering the source harmless. There is one operating recognized installation in Finland, and it regularly reports to STUK of the waste received.

Art. 5.1(e)

(e) enforcement actions, including the suspension of activities and the modification, expiration or revocation of a licence together with requirements, if appropriate, for alternative solutions that lead to improved safety;

The procedures used in the enforcement of regulatory requirements are based on the mandate of the regulatory authorities given in the legislation. The enforcement tools and measures of STUK are provided in the Nuclear Energy Act (Chapter 10). Enforcement measures defined in the Nuclear Energy Act (Sections 66 and 67) are a conditional fine, a threat that the activity is interrupted or limited, and a threat that the work is done at the cost of the neglecting organization.

In addition to administrative enforcement measures it is possible to get assistance from police authorities in a situation where STUK interrupts an activity or limits it, based on acute safety reasons (the Nuclear Energy Act (Sections 67 and 68) and the Radiation Act (Sections 55 and 58)).

In the most severe case the authority that has granted a licence may revoke it wholly or partly, if implementation of the general principles for the use of nuclear energy as laid down in the Nuclear Energy Act is essentially endangered (the Nuclear Energy Act (Section 26)).

The choice of procedure applied in each situation is primarily based, following the principle of graded approach, on the safety significance of the situation. There are different levels of enforcement activities. The applied procedures in situations which have minor safety significance are an oral notice and a request for action by a protocol made by the inspector. A written notice and an order for action by STUK's decision are used if there are factors adding to the seriousness of the situation or matter. STUK's internal guides cover the different cases and the appropriate actions.

Coercive measures are used to reinforce STUK's order by a conditionally imposed fine, a threat to interrupt or limit the operation or to have the neglected obligation fulfilled at the expense of the neglecting party.

The most often used enforcement action is STUK's decision. In the decision the nature of the deficiency is stated and a time limit is set for the implementation of the required measures.

STUK ensures that the licensee effectively implements the remedial actions raised by the enforcement actions through document control, reporting, within the periodic inspection programme, inspections required by YVL Guides or other inspection activities. Reporting and the procedures relating to the operational experience feedback are described in Guides YVL A.9 and A.10, respectively.

The grounds for exercising the decision-making authority power is described in Guide STUK 2.1 (Rules of Administration) and more detailed procedures for immediate enforcement authority of inspectors are given in Guide YTV 6.3. Effective legal tools are available to STUK, but they are seldom needed. It is not STUK's policy to threaten the licensees with fines or other penalties, but instead to motivate them to maintain high quality of work and good safety culture and to encourage open discussions with the regulators.

STUK's rights to control radiation practices and to enforce regulatory requirements are prescribed in the Radiation Act (Chapters 14 and 15). STUK is authorized to:

- conduct inspections and obtain information (Section 53)
- issue orders pertaining to ensuring radiation safety
- issue order that a practice be discontinued or restricted (Section 55)
- prohibit the sale or other transfer of radiation appliances, radioactive substances, equipment and other products pertaining to safety of radiation practice which do not meet relevant safety requirements (Section 56)
- to issue a threat of fine (Section 59)
- to issue a threat that the neglected measure be performed at the defaulter's expense (Section 59).

An order to discontinue or restrict a practice can be issued by an individual inspector onsite if a practice causes an obvious detriment to health or the danger thereof. In this case the Section Head and the Director of Radiation Practices Regulation Department have to be informed without delay. The order is confirmed formally later by a written decision by the Director of the Radiation Practices Regulation Department.

The Radiation Act (Section 60) includes reference provisions concerning penalties prescribed in the Penal Code for:

- the use of radiation in a manner liable to endanger life or health
- environmental damage occasioned contrary to the Radiation Act and to provisions issued pursuant thereto
- careless handling of radioactive material or a radiation device.

Radiation offences are prescribed in the Radiation Act (Section 61). The public prosecutor may prefer not to charge for an offence referred to in the Radiation Act before obtaining a statement on the matter from STUK.

STUK's procedures for enforcement in the use of radiation are described in STUK's internal guides.

Art. 5.1(f)

(f) the allocation of responsibility to the bodies involved in the different steps of spent fuel and radioactive waste management; in particular, the national framework shall give primary responsibility for the spent fuel and radioactive waste to their generators or, under specific circumstances, to a licence holder to whom this responsibility has been entrusted by competent bodies;

According to the Nuclear Energy Act (Section 9), a licensee, whose operation generates or has generated nuclear waste, shall be responsible for all nuclear waste management measures and their appropriate preparation, and the utilities are also responsible for the arising expenses. This obligation cannot be delegated or transferred to another party.

The NPP utilities FPH and TVO themselves take care of the interim storage of spent fuel, of the management of LILW including storage and disposal, and of the planning for and implementation of the decommissioning of the NPPs. Their jointly owned company, Posiva, is taking care of the preparation for and later implementation of spent fuel encapsulation and disposal. The DiP of a NPP granted to Fennovoima Oy requires the presentation of waste management plans in the construction licence application submitted at the end of June 2015.

The Radiation Act (Section 50) provides for the 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 the measures needed to render the radioactive waste arising from its operation harmless. In case where the practice produces or may produce radioactive waste that cannot 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 a producer of nuclear waste (the Nuclear Energy Act (Sections 31 and 32)) or other radioactive waste (the Radiation Act (Section 51)) is incapable of fulfilling its management obligation.

Art. 5.1(g)

(g) national requirements for public information and participation;

The availability of information related to 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 (468/1994) and Decree (713/2006) 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) procedure. Public hearings are arranged both in the programme phase of the EIA and during the actual assessment. The responsible contact authority for that procedure is the Ministry of Employment and the Economy. The EIA report must be attached to the application for the Decision-in-Principle.

The Nuclear Energy Act (Section 13) 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 Employment and the Economy shall provide residents and municipalities in the immediate vicinity of the nuclear facility as well as local authorities a 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. The Nuclear Energy Act (Section 14) further provides 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.

Before granting the licence for construction or operation of a nuclear facility MEE informs the public where the application is available for perusal, and requests the public to express their statements and opinions by the virtue of the Administrative Procedure Act (Section 41).

According to the Act and Decree on the Environmental Impact Assessment Procedure the decommissioning of a nuclear facility requires that an Environmental Impact Assessment (EIA) should be performed. In 2014 the required EIA was completed for the planned decommissioning of the Finnish research reactor (FiR 1).

Art. 5.1(h)

(h) the financing scheme(s) for spent fuel and radioactive waste management in accordance with Article 9.

The producers of spent fuel and radioactive waste are responsible for all the costs generated in the waste management process. The framework for the financing system is described below.

The Nuclear Energy Act (Sections 35 to 53) provides 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. The financial provisions are described in greater detail in the Decision of the Government on Financial Provisions for the Cost of Nuclear Waste Management (168/1988). The producers of nuclear waste are obliged to present every three years justified estimates of the future cost of managing their existing waste, including spent nuclear fuel disposal and decommissioning of facilities. The Ministry of Employment and the Economy (MEE)

confirms annually the assessed liability and the proportion of liability the Nuclear Waste Management Fund has to reach (the fund target). The tasks of the Nuclear Waste Management Fund are described in detail in the Government Decree on the State Nuclear Waste Management Fund (161/2004). The waste generators pay annually the difference between the fund target and the amount already existing in the Fund, but can also be reimbursed if the funded amount exceeds the liabilities. The waste generators shall provide securities to MEE for the portion of financial liability that is not yet covered by the Fund.

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, the licensee shall furnish securities if the operations produce or are liable to produce radioactive waste that cannot be rendered harmless without substantial cost. The Radiation Act (Section 31f) provides for furnishing security in case of using high activity sealed sources.

Art.5.2

Member States shall ensure that the national framework is improved where appropriate, taking into account operating experience, insights gained from the decision-making process referred to in Article 4(3)(f), and the development of relevant technology and research.

The Nuclear Energy Act (Section 7a) states as to continuous improvement: The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience and safety research and advances in science and technology.

Finland is a contracting party to the international treaties and conventions for ensuring safety in the utilization of nuclear energy and radiation. Finland also has several bilateral agreements for exchange of information on nuclear facilities and on notification of a nuclear and radiation emergency. In addition, STUK has made bilateral arrangements with several foreign regulatory bodies, which generally cover exchange of information on safety regulations, operational experiences, waste management etc.

Finland has implemented the Code of Conduct on the Safety and Security of Radioactive Sources and the Code of Conduct on research reactors.

STUK participates actively in European and international co-operation in the field of nuclear and radiation safety and security as well as safety of waste management.

The IAEA safety standards and WENRA harmonised safety requirements are addressed when developing Finnish legislation, regulation and requirements. In practice, currently, the most important references considered in rulemaking are the IAEA safety standards and the WENRA reference levels. Considering the WENRA reference levels, the Finnish policy is to include all of them when updating the regulatory guides.

The Finnish government has requested several international peer reviews concentrating on the safe use of nuclear energy. These peer reviews have been focused on regulatory activities (IRRT), waste management (EU Peer Review), nuclear power plants (OSART), research reactor (IAEA) and in physical protection (IPPAS) as well as on environmental surveillance program (EC). In addition STUK's research activities have been evaluated by international teams.

Two peer reviews especially should be mentioned: the peer review on activities related to the spent fuel disposal project in 2009 and the IRRS in 2012. As one of the results, the amendments to the Nuclear Energy Act and the Radiation Act were prepared in 2013, approved by the Parliament in early 2015, and approved by the President in May/June 2015. They are expected to enter into force by January 1st 2016. The follow-up IRRS review took place in June 2015.

Finland has been active in making Finnish experts available in international peer reviews. STUK's experts have participated in several IRRT/IRRS missions, and STUK's experts also have been nominated to the EU IRRS mission expert pool.

STUK analyses both domestic and foreign operational experience from various sources to identify lessons learned and to improve safety at nuclear facilities and activities. STUK uses the feedback from both operational and regulatory experience for improving review, assessment, and inspection activities and for developing the regulatory guides.

STUK has made arrangements for receiving and collating information from other countries and relevant authorized parties. STUK actively disseminates lessons learnt from operational experiences to the international community. The most important arrangements are the Incident Reporting Systems (IRS) on incidents and operational events by IAEA and OECD/NEA. STUK has voluntarily provided experts to work in EU Clearinghouse on Nuclear Power Plant Operational Experience Feedback (Petten).

STUK also gathers information directly from its cooperation with other regulators, especially with the regulators and plants of Sweden and Russia having similar operating plants (BWRs, VVERs) as Finland. Other sources of operating experience are meetings of regulator groups: OECD/NEA/WG's, WENRA, NERS, VVER-forum, MDEP, EU-projects and early information channels like IAEA/NEWS and WGPCNEWS as well as OECD/NEA Topical Databases.

ARTICLE 6

Art. 6.1

Each Member State shall establish and maintain a competent regulatory authority in the field of safety of spent fuel and radioactive waste management.

Supreme authorities

According to the Nuclear Energy Act (Section 54), the overall authority in the field of nuclear energy is the Ministry of Employment and the Economy (MEE) which has the responsibility of formulating the national energy policy. The MEE prepares matters concerning nuclear energy, including nuclear waste management, for the Government for decision-making. The Nuclear Energy Act (Section 28) 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.

As stipulated in the Radiation Act (Section 5), which covers radioactive, non-nuclear waste management, the Ministry of Social Affairs and Health (MSAH) is the supreme authority on the supervision of practices involving exposure to radiation.

Regulatory authority for radiation and nuclear safety

The Radiation and Nuclear Safety Authority of Finland (STUK) is an independent governmental organization for the regulatory control of radiation and nuclear safety. In accordance with the Nuclear Energy Act, the Radiation Act, the Act on the Radiation and Nuclear Safety Authority of Finland (1069/1983) as well as other regulations and international agreements, the Radiation and Nuclear Safety Authority shall be responsible for:

1) regulatory control of the safety of the use of nuclear energy, and regulatory control of physical protection, emergency preparedness and nuclear materials;
2) regulatory control of the use of radiation and of other radiation practices;
3) monitoring the radiation situation in Finland, and for maintaining preparedness for abnormal radiation situations;
4) maintaining national metrological standards in its field of activity;
5) pursuing research and promoting development to enhance radiation and nuclear safety;
6) providing information on radiation and nuclear safety issues, and for participating in training activities in the field;
7) producing expert services applicable in its field of activity;
8) making proposals for developing legislation in its field of activity, and for issuing general guides concerning radiation and nuclear safety; as well as
9) contributing to international co-operation in its field of activity, and for taking care of international control, contact and reporting activities, as enacted or prescribed.

The Parliament has accepted on the 10th March 2015 and the President in May/June 2015 the amendments to the Nuclear Energy Act and the Radiation Act in such a way

that the mandate of STUK is increased. Based on the changes STUK has the authority to issue mandatory technical safety regulations. Further, based on the changes of the Nuclear Energy Act the Government has to take into account the proposals included in the STUK's statements when considering the conditions of the Decision-in-Principles and licences for nuclear facilities.

STUK does not grant construction or operating licences for nuclear facilities. However, no such licence can de facto be issued without STUK's safety review and statement on the fulfilment of the safety regulations.

The regulatory oversight is described in detail in Guide YVL A.1.

According to the Radiation Act (Section 6) STUK is responsible for controlling that the Radiation Act and other regulations based on the Act are followed. According to the Radiation Act (Section 16), STUK grants safety licences for the use of radiation. The regulatory rights of STUK are described in the Radiation Act (Sections 53 to 58).

STUK's Advisory Board was established in March 2008. The Advisory Board helps STUK to develop its functions as a regulatory, research and expert organization in such a way that the activities are in balance with the society's expectations and the needs of the citizens. The Advisory Board can also make assessments of STUK's actions and give recommendations to STUK. STUK nominates the members of the Advisory Board.

STUK's reports on the regulatory oversight of nuclear and radiation safety, including radioactive waste management, are published annually.

Art. 6.2

Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organization concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste, in order to ensure effective independence from undue influence on its regulatory function.

STUK is administratively under the Ministry of Social Affairs and Health. Connections to various ministries and governmental organizations are described in Fig. 4.

It is emphasised that the regulatory oversight of the safe use of nuclear energy and radiation is independently carried out by STUK and other governmental bodies cannot take for their decision a matter that has been delegated by law to STUK. STUK has no responsibilities, duties or functions which would be in conflict with the regulatory oversight.

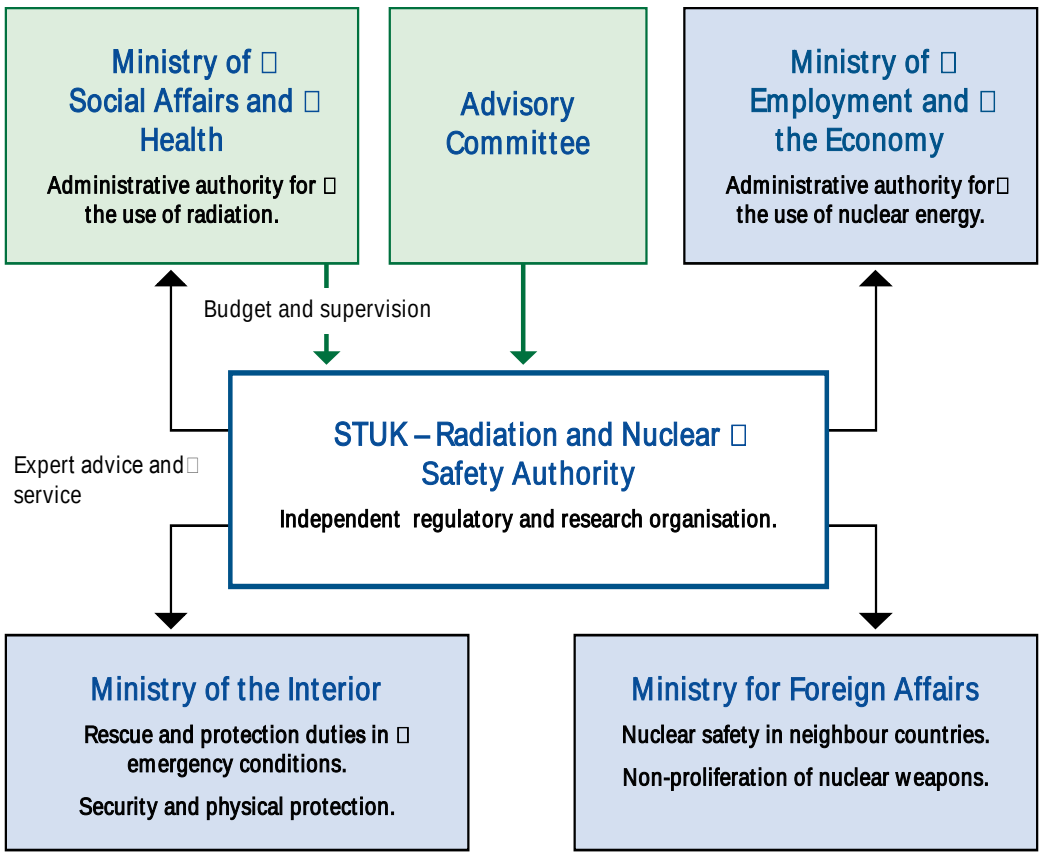


Fig. 4. Co-operation between STUK and Ministries and other governmental organizations.

Art. 6.3

Member States shall ensure that the competent regulatory authority is given the legal powers and human and financial resources necessary to fulfil its obligations in connection with the national framework as described in Article 5(1) (b), (c), (d) and (e).

STUK's legal powers are described under Art. 6.2 and Art. 5.1(e).

STUK's human resources

STUK has adequate resources to fulfil its responsibilities. The total number of the personnel (at the end of 2014) was 342, most of which are directly involved with radiation and nuclear safety as well as nuclear safeguards and security related regulatory activities. In addition, STUK has its own R&D programme supporting its regulatory needs related to nuclear waste safety, and has organized international expert support groups for the safety issues of the disposal site, disposal technology and safety assessment. During 2013 and 2014 the main emphasis of the expert groups has been supporting the regulatory review of the construction licence application for spent

nuclear fuel encapsulation and disposal facility. However, also in these areas STUK's expertise has to be extensive enough to enable STUK to make the regulatory decisions.

To ensure that STUK has the appropriate number of people with relevant competencies, the following general process is applied. STUK establishes its strategy normally for a five year period. The strategy is implemented by department specific operating programmes for the same period. The operating programmes are updated annually when annual operating plans are established. These plans reflect as accurately as possible the regulatory duties and work of STUK. STUK's competence and human resource needs are evaluated in each step mentioned above (strategy, operating programmes and annual plans) from the organizational level to the individual level. Resource needs identified during the planning are documented in human resource plans and the needs also influence the training programme. STUK's Management System provides more guidance on the personnel administration, resource allocation and competence management.

STUK trains its personnel continuously. Training programmes are established on the organizational as well as on the individual level reflecting the tasks and responsibilities of the individual. Individual needs for training are indentified in the course of work and during the annual planning. STUK has carried out self-assessments to explore the level of knowledge, skills and abilities available and necessary for regulatory functions. IAEA's SARCoN tool has been piloted in the nuclear safety department. Inspectors working for the control of the use of radiation are required to have a formal qualification of radiation safety officer. STUK has determined the prerequisites for qualification for inspectors working in nuclear safety regulation and the need for additional training was assessed in autumn 2013. The first training courses started in March 2014. Training programmes for mechanical engineers were developed in autumn 2014.

In October 2012, an IRRS mission (IAEA's Integrated Regulatory Review Team) was carried out. The main conclusion based on the IRRS results was that there exists no urgent need for additional improvements to upgrade the safety of the Finnish radioactive and nuclear waste management. The scope of the mission was nuclear facilities (except the research reactor FiR 1), radiation sources and transport. FiR 1 was excepted because preparations for the environmental impact assessment for the decommissioning of this reactor were commenced earlier in 2012. In its preparations for the IRRS mission, STUK carried out a comprehensive self-assessment and developed a preliminary action plan for improvement.

As a result of the IRRS mission, the review team recognized several strengths and good practices such as the effective safety assessment of new nuclear power plants, STUK's organization and conduction of emergency exercises and STUK's active contribution to the global improvement of radiation and nuclear safety. They also identified areas for improvement, such as a need to strengthen the legislative framework by embedding in the law the separation of STUK from entities having responsibilities or interests that could unduly influence STUK's decisions, enhancing the effectiveness of STUK's inspection activities and implementing an independent monitoring programme for the environment of NPPs.

The results as well as the action plan with timetable for each suggestion and recommendation based on the IRRS mission results and the self-assessment are

published on STUK's website (http://www.stuk.fi/stuk/en_GB/irrs-2012). These actions have been incorporated in the operating programmes and annual plans. A follow-up mission took place in June 2015.

The objective of STUK's public communication is to be proactive, open, timely and understandable. Communication is considered a privilege and duty of all employees. Good cooperation with the media is emphasized in all communication. 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 the best available information. Even sensitive matters are openly communicated. More details are given in connection with Article 10.

Regulatory support organizations and technical and scientific programmes

The main national technical support organization of STUK in the field of nuclear energy is VTT Technical Research Centre of Finland Ltd. In VTT and other Governmental or University institutes, tens of experts are working in the area of safety of nuclear power plants as well as spent nuclear fuel and radioactive waste management.

STUK's Advisory Commission on Nuclear Safety has been established by a separate Decree (164/1988). This Commission gives advice to STUK on important safety issues and regulations. The Commission also gives its statements on licence applications. It has two international Committees, one for nuclear waste safety (NWSC) and one for reactor safety (RSC).

In addition, an Advisory Commission on Radiation Safety has been established for advising the Ministry for Health and Social Affairs. The members of the Advisory Commission on Nuclear Safety and the Advisory Commission on Radiation Safety are nominated by the Government.

To assist STUK's work in nuclear security, an Advisory Committee on Nuclear Security was established in 2009. The members of the committee come from the various Finnish authorities, and the nuclear licensees also have their representatives. The duties of the committee include the assessment of the threats in the nuclear field as well as consultation to STUK in important security issues. The committee also aims to follow and promote both the international and internal co-operation in the field of nuclear security.

Financial resources of regulatory body

STUK receives about one third of its financial resources through the government budget. The costs of regulatory oversight are charged in full to the licensees. The model of financing has been applied since 2000 and has ensured that any decreases in government budget have not had direct influence on regulatory oversight activities. Therefore, STUK has been able to plan and allocate its use of resources (including recruitments) flexibly and according to the needs in the areas of safety significance.

In the area of regulatory oversight of waste management, STUK receives about 10% of its financial resources through the Government budget. Per legislation, the licence holders pay the regulatory expenses to STUK. In 2014 the costs of the regulatory

oversight of nuclear safety were 19.6 million €. The total costs of nuclear safety regulation were 20.7 million €. Thus the share of activities subject to a charge was 94.7%.

ARTICLE 7

Art. 7.1

Member States shall ensure that the prime responsibility for the safety of spent fuel and radioactive waste management facilities and/or activities rest with the licence holder. That responsibility cannot be delegated.

In Finland, the responsibility for safety rests with the licensee and this responsibility cannot be delegated as prescribed in the Nuclear Energy Act (Section 9).

As a precondition for granting a safety licence for the use of radiation the Radiation Act requires (Section 16) that the applicant presents valid proof on the safe management of any radioactive waste which may be generated. Further, the Radiation Act (Section 50) provides that the responsible party shall organize the practice so that it meets all radiation safety requirements prescribed in the Act and shall take all the measures needed to render radioactive waste arising from its operation harmless. The Radiation Act also provides for the responsibility of decontamination of the environment, if the radioactive material is released in such an extent that the resulting health or environmental hazards require action. According to the Act (Section 50), 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 measures taken while stopping these activities.

The Radiation Act (Section 51) 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 the waste is unknown, or no primary responsible party can be found.

Art. 7.2

Member States shall ensure that the national framework in place require licence holders, under the regulatory control of the competent regulatory authority, to regularly assess, verify and continuously improve, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity in a systematic and verifiable manner. This shall be achieved through an appropriate safety assessment, other arguments and evidence.

The continuous safety assessment and enhancement approach applied in Finland is based on the Nuclear Energy Act (Section 7a) stating that the safety of the use of nuclear energy shall be as high as reasonable achievable. To further enhance safety, all actions justified by operational experiences, safety research and the progress in science and technology shall be taken.

The safety impact of a spent fuel management facility is analysed either in the safety analysis reports presented as part of the construction and operating licence applications of NPPs regarding spent fuel storage or separately for the planned encapsulation plant

and disposal facility for spent fuel. The safety impact of the radioactive waste management facility is analysed in the safety analysis reports presented as part of the construction and operating licence applications of the facility.

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

The operating licences for nuclear facilities are granted for a limited period of time.

For the licence renewal and the Periodic Safety Review, a comprehensive re-assessment of safety, including the environmental safety of the nuclear facility and the effects of external events on the safety of the facility, shall be performed. STUK reviews the licence applications, including all site-specific safety reports.

The comprehensive safety assessments for applications for the renewal of licences are required to include the updates of 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
- 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' requirements
- Licensee assessments of how an adequate safety level has been maintained

The periodic safety review report shall include the same information, updated as appropriate.

The latest comprehensive safety assessments of the Loviisa and the Olkiluoto NPPs, including the spent fuel storages and the LILW management at the NPP, were carried out for the Loviisa NPP in connection with re-licensing of the operation of the plant in 2006-2007 and for the Olkiluoto NPP in connection of the periodic safety review in 2009. A comprehensive safety assessment for the Olkiluoto spent fuel storage was carried out in 2009 and reviewed by STUK 2010 in connection with licensing the construction of the storage extension. The application for authorizing the commission of the spent fuel interim storage extension was submitted in 2014.

The latest comprehensive safety assessment of the radioactive waste disposal facility (VLJ repository for TVO) was carried out in 2011-2012. To cover the needs of the disposal of operational waste from the OL3 unit and the disposal of other radioactive waste (managed by STUK) TVO applied for a change in the operation licence conditions. This change was accepted by the Ministry of Employment and the Economy in 2012. The comprehensive safety assessment of the Loviisa LILW repository was carried out as a periodic safety review during 2013 and 2014.

The re-licensing safety reviews and statements by STUK given to the Ministry of Employment and the Economy concluded that, as regards radiation and nuclear safety, the conditions at the Loviisa and the Olkiluoto NPPs comply with the Finnish nuclear energy legislation and regulations. In addition to the review of the above mentioned documents, STUK has also performed independent safety assessments and has annually made a number of regular and topical inspections to the facilities.

Safety improvements have been annually implemented at the Loviisa and the Olkiluoto plants including the facilities for spent nuclear fuel handling and interim storage since the commissioning. At the Olkiluoto spent fuel storage recent safety improvements have been carried out in connection with the enlargement of the spent fuel storage. There exists no urgent need for additional improvements to upgrade the safety of these facilities.

The safety of the FiR 1 research reactor was reviewed in the context of the renewal of the operating licence in 2011. The present licence is valid until the end of 2023. However, in the summer of 2012 VTT made the decision to end the operation. During the decommissioning phase the safety will be reviewed focused on the safety of the decommissioning in particular. The first step in this phase has been the preparation of the programme for the environmental impact assessment (EIA) during 2013-2014. The EIA report was prepared by VTT in 2014.

Following the accident at the Fukushima Dai-ichi nuclear power plant, national safety assessments as well as EU level stress tests were initiated in Finland during 2011 and 2012. The safety of spent fuel storages were assessed as part of NPP safety assessments. STUK has reviewed the results and made licensee specific decisions in July 2012. Based on the results, it is concluded that no such hazards or deficiencies have been found that would require immediate actions at the Finnish NPPs. However, areas where safety can be further enhanced have been identified and there are plans on how to address these areas.

The power companies have collected the action lists after the stress test evaluations and the actions are ongoing. The R&D activities needed to fulfil the actions are carried out in the national research programmes SAFIR2014/SAFIR2018, KYT2014/KYT2018 and in Nordic nuclear energy related R&D co-operation, also proprietary R&D projects have been launched. As an example of the actions taken, in the Olkiluoto NPP water connections have been installed to allow the replenishment of spent fuel pools of the power plant units and of the on-site interim storage facility from a mobile water source. Also the safety of the interim storage facilities against external flooding has been markedly improved.

Art. 7.3

As part of the licensing of a facility or activity the safety demonstration shall cover the development and operation of an activity and the development, operation and decommissioning of a facility or closure of a disposal facility as well as the post- closure phase of a disposal facility. The extent of the safety demonstration shall be commensurate with the

complexity of the operation and the magnitude of the hazards associated with the radioactive waste and spent fuel, and the facility or activity.

The licence applications for a new licence or for the renewal of an existing licence include the documents required by the Nuclear Energy Decree (Sections 35 and 36): Preliminary or Final Safety Analysis Reports; Probabilistic Risk Analysis Reports; Quality Assurance Programmes for Construction and Operation; Safety Classification Document, Operational Limits and Conditions Document (Technical Specifications); Programmes for Periodic Inspections; Plans for Physical Protection and Emergency Preparedness; Manuals for Accounting and Control of Nuclear Materials; Administrative Rules for the Facilities; Programmes for the radiological baseline survey or the results of the radiological baseline survey; Programmes for Radiation Monitoring in the Environment of the Facilities; Decommissioning plans.

The design of the facility is described in the Preliminary Safety Analysis Report (PSAR) and in the Final Safety Analysis Report (FSAR). These reports are submitted to STUK for approval in connection with, respectively, the applications for Construction and Operating Licences. According to the Nuclear Energy Decree, the FSAR has to be continuously updated.

The Government Decree (717/2013) requires that the nuclear power plant safety and the technical solutions of its safety systems, including systems for spent fuel interim storage, shall be assessed and substantiated analytically and, if necessary, experimentally. These include analyses of operational occurrences and accidents, strength analyses, failure mode and effect analyses, and probabilistic risk assessments. Analyses shall be maintained and revised if necessary, taking into account operating experience, the results of experimental research, plant modifications and the advancement of computational methods.

The safety case shall be presented in connection with the construction licence application and the operating licence application of the nuclear waste facility. The safety case shall be updated at 15 year intervals unless otherwise provided in the licence conditions. Furthermore, the safety case shall be updated prior to the permanent closure of the facility.

According to the Government Decree (736/2008), compliance with safety requirements concerning the operation of a nuclear waste facility shall be proven in connection with commissioning as far as possible. Insofar as this is not possible, operational safety shall be demonstrated through experimental or computational methods, or via a combination thereof.

According to Guide YVL D.5 a safety assessment, or a safety case as in the Government Decree, shall include:

- a description of the disposal system and the definition of barriers and safety functions;
- a specification of performance targets for the safety functions;
- a definition of the scenarios (scenario analysis);

- a functional description of the disposal system and a description of the conditions prevailing in the disposal site by means of conceptual and mathematical modelling, and the determination of necessary model parameters;
- an analysis of the quantities of radioactive substances that are released from the disposed waste, penetrate the barriers and enter the biosphere, and an analysis of the resulting radiation doses;
- whenever possible, an estimation of the probabilities for activity releases and radiation doses arising from unlikely events impairing long-term safety;
- uncertainty and sensitivity analyses and complementary qualitative considerations; and
- a comparison of the outcome of the analyses against the safety requirements

The safety case shall be carefully documented. The basic assumptions that underlie each part of the safety case along with the methods employed, the results obtained and the relation of the part to the case as a whole shall be easy to ascertain (clarity), and the rationale for the assumptions, input data and the models adopted shall be easy to find in the documentation (transparency and traceability).

The quality of the safety case shall be ascertained through the management system related to the design, construction and operation of the disposal facility. The party implementing the project shall have an expedient organization, adequate competence and an appropriate information management system in place. The various stages of the preparation of the safety case shall be systematically planned, and the reliability of the results of crucial studies and analyses shall be ascertained e.g. by means of independent expert reviews or analyses.

Regarding the disposal of spent fuel, compliance with long-term radiation protection objectives as well as the suitability of the disposal concept and site shall, according to the Government Decree (736/2008), be justified by means of compliance with the long-term radiation protection objectives, equally the suitability of the disposal concept and site shall be justified through a safety case that addresses both the expected evolutions and unlikely disruptive events impairing long-term safety.

The licensee shall carry out a periodic safety review for the disposal of nuclear waste at least once in every 15 years, unless otherwise provided in the conditions of the operating licence. The periodic safety review shall include assessments of the disposal facility's safety status and the long-term safety of the disposal as well as potential development targets in order to maintain and enhance safety. The safety analysis report and the safety case shall be updated to reflect the results of the safety review. The periodic safety review shall be conducted in compliance with the requirements of Guide YVL A.1, where applicable.

The Nuclear Energy Act (Section 7g) states that provisions for decommissioning shall be included in the design of a nuclear facility. In the context of the licensing requirements, the Government Decree (717/2013) states that the design of a NPP shall take into account decommissioning so as to limit waste volumes and radiation exposure both to the workers and to the environment. The Nuclear Energy Decree (Section 32) provides 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 waste, and a description of the timetable of nuclear waste management and the estimated costs. More detailed requirements are given in Guides YVL A.1 and YVL D.4.

According to the Nuclear Energy Act (Section 28) the licensees are obliged to prepare decommissioning plans for regulatory review and to update them every six years. These plans aim at ensuring that decommissioning can be appropriately performed when needed and the estimates for decommissioning costs are realistic.

Detailed requirements for the contents of the post-closure safety case are provided in Guide YVL D.5 (Annex A). The post-closure safety case shall include a description of the disposal system: quantities of radioactive substances; waste packages; buffer materials; backfill materials; structures for isolation and closure; excavated rooms; the geological, hydrogeological, hydrochemical, thermal and rock mechanical characteristics of the host rock; and the natural environment at the disposal site. The post-closure safety case shall define the safety concept, barriers and safety functions with their performance targets. The safety case shall include an assessment of the confidence level with regard to compliance with the safety requirements and of the uncertainties with the greatest impact on the confidence level.

The four reactor units in Finland have been operated for 33 to 37 years. These units are planned to be operated further up to the total operation period of 50 yrs (Lo 1 & 2) and 60 yrs (OL 1 & 2). No nuclear power plants are currently being decommissioned and the first project of this kind will be the decommissioning of the research reactor which will take place in the near future. The current licence of the research reactor FiR 1 is valid until 2023. Nevertheless, in July 2012 the operator VTT Technical Research Centre of Finland Ltd made the decision for the shutdown of the reactor and started a more detailed planning of the reactor decommissioning and dismantling. The first step in the decommissioning phase was the Environmental Impact Assessment (EIA) process which was finalized in 2014. Next VTT will update the decommissioning plan for the reactor in more detail and apply for the licence for decommissioning.

The latest update of the Loviisa NPP decommissioning plan was issued at the end of 2012 by Fortum Power and Heat. Teollisuuden Voima Oyj's decommissioning plan has been updated and submitted to the authorities at the end of 2014.

The preliminary safety analysis report and the other safety related documents for the extension of the Olkiluoto spent fuel interim storage facility were reviewed in 2010. The extension is designed and the design of the existing part of storage is updated to withstand a large aeroplane crash.

The preliminary safety analysis report and safety related documents for Posiva's final disposal facility of spent fuel have been reviewed and assessed in the process of the construction licence application in 2014. Several improvements for safety have been required by the regulatory body and they will be fulfilled while detailed design of the plant will be finalized for application of operating licence.

Concerning safety after closure of the spent fuel repository, Posiva continued the safety assessment work after the Decision-in-Principle with the goal of being ready to submit the construction licence application for the Olkiluoto encapsulation and disposal

facilities in 2012. A framework for the development of the post-closure safety case was first reported in 2005 and updated in 2008. Posiva has developed the safety case portfolio to meet the regulatory requirements and to show the safety assessment methodology. Posiva submitted the construction licence application at the end of 2012.

In 2013 and 2014 STUK carried out an overall assessment of the post-closure Safety Case submitted to STUK in connection with the application for a construction licence, establishing the sufficiency and adequacy of the information provided, and issuing a decision on accepting the document for a more detailed review process. STUK's regulatory review of the construction licence application was completed in February 2015, and to support the more detailed review STUK also used outside experts. STUK concluded, based on the licence application review and assessment, that the safety requirements have been met.

The predisposal management of radioactive waste subject to the Radiation Act 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.

Art. 7.4

Member States shall ensure that the national framework require licence holders to establish and implement integrated management systems, including quality assurance, which give due priority to safety and are regularly verified by the competent regulatory authority.

According to the Nuclear Energy Act (Section 7j) the management system of a nuclear facility shall pay particular attention to the impact of safety related opinions and the attitudes of the management and personnel towards the maintenance and development of safety, alongside systematic operating methods and their regular assessment and development.

The importance of a good safety culture is emphasized in the Government Decree on the Safety of disposal of nuclear waste (736/2008, Section 20) where it is stated as follows:

- "Organisations participating in the design, construction, operation and decommissioning or closure of a nuclear waste facility shall employ a management system for ensuring the management of safety and quality. The objective of the management system is to ensure that safety is prioritised without exception, and that quality management requirements are commensurate with the significance to safety of the activity. This management system shall be systematically assessed and further developed.
- "Safety and quality management shall cover all activities influencing the safety of the nuclear waste facility. For each activity, requirements significant in safety terms shall be identified, and planned measures described in order to ensure compliance with requirements. The processes and procedures shall be systematic and based on instructions.
- "Systematic procedures shall be in place for identifying and correcting deviations significant in safety terms.

- "The licensee shall commit and oblige its employees and suppliers, subcontractors and other partners contributing to safety relevant activities to engage in systematic safety and quality management.

STUK's Guide YVL A.3 sets general requirements for management systems. Guide YVL A.3 is based on IAEA GS-R-3. The management system must support the characteristics of the organizational culture that promote good safety culture, and the management must express its commitment to safety. Safety culture expertise must be available for developing the licensee's processes, procedures and measures to ensure and improve the safe operation of the facility. The development of the safety culture must be target oriented and systematic. The licensee also has to establish a process to measure, assess and improve its safety culture.

Guide YVL A.5 concerns nuclear facility construction and modification. Also in this guide there are requirements concerning safety culture and risk management. The management systems of the licensees and applicants are subject to approval by STUK. During construction and modifications the licensee must ensure that the contributing parties are able to perform according to safety requirements and there must be training on safety culture issues for the personnel taking part in the activities. The licensee must have procedures for evaluating and developing the safety culture of the contributing parties.

STUK regularly reviews the licensees' management systems.

Regarding the uses of radiation, the spectrum of practices is very wide starting from "one-man-company" to very large organizations. Therefore, a graded approach is applied regarding requirements on management systems. Guide ST 1.1 stipulates: "The statutory requirements of the responsible party can be best met through the use of a management system (a quality system) that is designed for use in the radiation practice. The management system shall be described in guidelines and other documents, and all respective documents shall be arranged to form a unified, continuously updated totality (the procedures manual or similar)." In addition, there are in place many practice specific requirements for quality assurance (i.e. measures that must be implemented but which are not necessarily a part of a formal management system).

Measures taken by licence holders

The licensees (FPH and TVO) and the nuclear waste management company Posiva have adopted certified quality management systems consistent with the ISO 9001 standard. TVO has developed and implemented a project specific ISO 9001 certified quality management system for the construction phase of the Olkiluoto 3 unit. The quality management system of VTT Technical Research Centre of Finland Ltd is also based on the quality standard ISO 9001. The management systems of the aforementioned organizations fulfil also the requirement set in Guide YVL A.3. Moreover, FPH, TVO and Posiva have adopted an environmental management system according to ISO 14001.

Loviisa NPP

Fortum has in their management system established documented quality and safety policies for the Loviisa NPP. That includes also the conditioning, storage and disposal of LLW and ILW as well as the intermediate storage of spent fuel on the NPP site. The management system aims at filling all the requirements stated in the YVL guides and is continuously developed. The development of the Loviisa NPP's quality management system is based on the principle of continuous improvement in accordance with the observations and remarks made in quality audits and quality assessments. The Loviisa NPP has also made organizational changes that aim at promoting safety and safety culture development. There is a unit especially dedicated for operational experience and safety culture. In addition, the Loviisa NPP has an independent advisory body for safety issues, i.e., a nuclear safety committee with external expert members.

Fortum has continued having international evaluations of safety management and procedures at the Loviisa NPP in order to improve its own operations and management system. IAEA carried out an OSART safety review in Loviisa in March 2007, with a follow-up review in July 2008. WANO peer review was performed in March 2010, with a follow-up review in April 2012. In the latest WANO follow-up review, WANO stated that most development actions were completed whereas a couple of them are still in progress, although they have been appropriately started. Fortum has clearly defined the responsibilities for developing the management system and reformed the management procedures for reviewing the system.

Olkiluoto NPP

TVO has documented quality and safety policies for the Olkiluoto NPP that are binding for all persons working for the NPP, also for those working with the conditioning, storage and disposal of LLW and ILW as well as the intermediate storage of spent fuel on the NPP site. TVO is actively developing the management system towards a process based management system due to the growing organization and the need for systematic and efficient operations throughout the organization. TVO has also defined so called 'Management Expectations' flyers, where the managers communicate very clearly their expectations for safe working and safety attitudes. The Olkiluoto NPP has worked several years with safety culture evaluation and development. TVO has founded a special safety culture team that is independent from operations and construction. This team meets regularly about 10 times a year and the objective is to form a comprehensive view of the safety culture situation in the whole TVO and report and give suggestions for improvement actions to the top management of the organization.

TVO has assessed the safety culture of the Olkiluoto NPP employing several methods. The safety culture issues have been regularly discussed in the internal safety committee. The self-assessment is repeated approximately every third year. Personnel surveys and the peer review method of the World Association of Nuclear Operators (WANO) have also been utilised actively. TVO has continued using and developing the safety culture promotion and assessment methods concerning the Olkiluoto unit 3 project and the contributing parties. Assessment method consists of a questionnaire, interviews and analysis of safety observations, authority inspections and non-conformance records.

Posiva

Posiva's application for the construction licence included also a framework for the management system and the quality manual.

Posiva's contractors supplying products important to safety shall have a quality management system fulfilling the requirements of Guide YVL A.3. These organizations also have to prepare a supply specific quality assurance programme. STUK verifies with graded approach the implementation of the quality management systems and the quality assurance programmes through reviews and inspections. Posiva submitted its quality management manual to STUK for approval in connection with the construction licence application. STUK approved Posiva's manual with conditions in 2013 and continues verifying the implementation of the management system with quality assurance related inspections.

VTT

The quality management system of VTT Technical Research Centre of Finland Ltd, the operator of the research reactor FiR 1, is based on the quality standard ISO 9001. When the decommissioning and dismantling activities of FiR 1 start, VTT will prepare additional instructions to supersede and complete the present operating management system of the research reactor.

Suomen Nukliditekniikka

Being a very small company (the owner being the only worker), there is no formal management system in place. However, all important working procedures having safety relevance are prescribed in the company's internal documents.

Article 7.5

Member States shall ensure that the national framework require licence holders to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to the safety of spent fuel and radioactive waste management as laid down in paragraphs 1 to 4.

Finances

The financing system is covered in the Nuclear Energy Act (Chapter 7).

A financing system for the costs of future waste management and decommissioning exists (the National Nuclear Waste Management Fund) to ensure that the producers of nuclear waste bear their full financial liability on the coverage of those costs and that the costs can be covered even in case of insolvency of the waste generator. The pertinent licence-holders submit the technical plans and cost calculations, on which the liability estimates are based, for regulatory review at three year intervals. After confirmation of the financial liabilities, the licensees pay fees to the State controlled fund and provide securities for the liability not yet covered by the funded money. (More details are given in Art. 9.)

The licensee under a waste management obligation shall supply the State with collateral securities fulfilling the conditions laid down in the Nuclear Energy Act (Section 45), prior to the commencement of the waste generating operation.

Human resources

According to the Nuclear Energy Act (Section 19), a necessary condition for granting a construction licence of a nuclear facility is the availability of the necessary expertise. According to the Nuclear Energy Act (Section 20), an operating licence of a nuclear facility can be granted if the applicant has the necessary expertise available and, in particular, if the operating organization 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 (the Nuclear Energy Act (Section 7k)).

The Government Decree on the Safety of the disposal of nuclear waste (736/2008, Section 21) requires that the organisation shall have access to the professional expertise and technical knowledge required for the safe operation of the nuclear waste facility and long-term safety of nuclear waste disposal. Duties significant to safety shall be designated. Training programmes shall be prepared for the development and maintenance of the professional skills of the persons working in these positions, and adequate command of the knowledge required for the positions shall be verified.

According to the Nuclear Energy Act (Sections 55 and 7k), STUK is responsible for controlling the necessary qualifications of the persons engaged in activities important to safety. Guide YVL A.4 sets more specific requirements for safety critical positions, e.g. for the responsible manager and persons responsible for safeguards, emergency preparedness and security. The Guide has also specific requirements on management and leadership competence.

Accordingly, personnel and human resources related issues are included in STUK's inspection programmes for Posiva and for the nuclear power plants. During the years 2011–2013 STUK has paid attention especially to assessing the organization and personnel planning of Posiva. STUK has reviewed Posiva's organization, human resources and competence as part of the evaluation of the construction licence application for the spent nuclear fuel encapsulation plant and disposal facility.

As required by the Government Decree (736/2008), the NPP utilities and Posiva have special training programmes including waste management for their personnel. Staff training at Posiva is based on personal-level training and development plans and company-level plans which are updated annually.

In activities related to the use of radiation other than in nuclear facilities the Radiation Act (Section 14) 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 shall appoint a 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 qualification requirements are met (the

Radiation Act (Section 18)). The licensee shall provide appropriate training for the employees. Guide ST 1.4 sets the requirements for the organization for the use of radiation including the competences needed. Guide ST 1.8 further sets detailed requirements on radiation protection training for the radiation safety officers and qualified experts. The competence that has to be demonstrated by an exam includes a general part covering the basics of radiation protection and the appropriate legislation. Special requirements are attributed to different fields of applications of radiation.

ARTICLE 8

Member States shall ensure that the national framework require all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills.

Research

According to the Nuclear Energy Act the nuclear power companies are required to take care of the management of the nuclear waste resulting from their operation, including all activities, preparations and plans. These are to be presented in the complete nuclear waste management plan, which also needs to cover research and development activities (R&D). The R&D within nuclear waste management is aimed at storage and disposal of spent fuel, handling, storage and disposal of nuclear power plant waste, decommissioning of nuclear power plants and novel solutions for nuclear waste management.

The contents of nuclear waste management plans are defined by the Nuclear Energy Decree. The plans have to be reported to the MEE for appraisal every three years.

Since 1989 there have been research programmes in nuclear waste management coordinated by the public administration. Starting in 2003, after the change of the Nuclear Energy Act (Section 53b) the public research within nuclear waste management has been organized into national nuclear waste management research programmes (KYT), which aim at ensuring availability of independent expertise to the authorities and regulators within nuclear waste management, independent in this case indicating independent of licence holders' or licence applicants' viewpoints or interests. The research subject areas cover different types of waste, safety aspects in geological disposal, and alternative technologies.

The framework programme for KYT2014 can be found at KYT's website http://kyt2014.vtt.fi/eng/researchprogramme.htm and for its successor KYT2018 https://www.tem.fi/files/41406/TEMjul_51_2014_web_12112014.pdf

An international peer review of the KYT programme was organised by the MEE in 2012. The results of the peer review are published at KYT's website http://kyt2014.vtt.fi/docs/TEM_report_10_2013_final.pdf

STUK participates in the international cooperation within research related to nuclear waste. Finnish research organizations and Posiva participate in the research programmes by EU. Posiva has been one of the co-founders of the disposal technology community IGD-TP (Implementing Geological Disposal - Technology Platform).

Finland also participates in the work of the waste committee (Radioactive Waste Management Committee RWMC) of Nuclear Energy Agency NEA and its three working groups. Stakeholder Confidence (FSC) concentrates on societal acceptance of nuclear waste management. Integration Group for the Safety Case (IGSC) concentrates on the safety of disposal from different aspects and on developing the safety case of the disposal. Working Party on Decommissioning and Dismantling (WPDD) concentrates on strategies and dismantling technologies, regulation, waste, financial aspects and costs of decommissioning.

Since 2001 Posiva and the Swedish nuclear waste management company SKB (Svensk Kärnbränslehantering Ab) have had a bilateral agreement on extensive cooperation in spent fuel disposal research and development work. The forms of cooperation have varied from information exchange to common projects, depending on the subject matter.

In addition, Posiva is co-operating with other European waste management organizations in the framework of the Technology Platform for Implementing Geological Disposal of Radioactive Waste (IGD-TP). Posiva also has bilateral agreements or understandings on international cooperation with several research and implementing organizations acting in the area of nuclear waste management. Posiva also participates in the 7th Framework programme of the European Commission and in various projects of the Nuclear Energy Agency of the OECD.

During 2010–2012 a committee set up by the Ministry of Employment and the Economy prepared a report aiming at giving recommendations and steps to be taken until the 2020's for ensuring competence and resources needed for the nuclear energy sector. The participants of the committee represented different organizations involved in the activities related to nuclear energy. One of the recommendations of the committee was that the future needs and focus areas of the Finnish nuclear energy sector research must be accurately defined and a long-term strategy drawn up for further development of research activities. This calls for a separate joint project among research organizations and other stakeholders in the field. The Report of the Committee for Nuclear Energy Competence in Finland can be found on (http://www.tem.fi/files/33099/TEMjul_14_2012_web.pdf).

At the end of January 2013 the Ministry of Employment and the Economy set up a working group to prepare a research and development strategy. Results of the research and development strategy work have been published in English in September 2014. http://www.tem.fi/files/40977/TEM_jul_17_2014_web_24092014.pdf.

The recommendations of the working group are the following:

1. The areas of focus in nuclear energy research must be compiled into wide-ranging national programmes.
2. The scientific level of Finnish nuclear energy research needs to be raised.

3. Active participation is needed on international research that is important for Finland through broad-based national multidisciplinary collaboration.
4. To secure the quality and quantity of researcher education, a broad and comprehensive doctoral programme network needs to be established for the nuclear energy field.
5. Building, maintaining, and utilising infrastructure requires coordination at the national level. Financing needs to be considered strategically and the roles of national financiers need to be clarified.
6. In research activities input is needed into the development of innovations. The growth of business operations and internationalisation are supported by bringing the players together under Team Finland.
7. It is proposed that an advisory committee be set up in connection with the Ministry of Employment and the Economy (MEE) linked with nuclear energy research and co-operation as a permanent expert body to support decision-making in national questions related to the nuclear energy.

Implementation of these recommendations will require concrete actions concerning funding of the national nuclear safety R&D programmes, including nuclear waste safety.

The current main R&D programmes on nuclear waste management in Finland are the following:

- The programme of Posiva Oy; the programme is mainly aimed at planning and implementing the disposal of spent nuclear fuel from TVO and FPH;
- The KYT programme (KYT 2014/KYT2018), administrated by the MEE; is aimed at supporting the further development and maintenance of the overall national competence and the sufficient and comprehensive expertise needed for regulatory purposes, and at assessing alternative solutions for the long-term management of spent fuel.
- The programme of STUK; aimed at supporting the regulatory decision making of STUK when regulating Posiva and the power companies;
- The NPP utilities FPH and TVO have their own R&D programmes for low and intermediate level wastes (treatment, conditioning/solidification, storage, and disposal) and decommissioning of nuclear power plants.

Skills development

The long time scales associated with the spent fuel disposal underline the importance of the availability of qualified domestic experts in the field also in the future. However, changes in energy markets and the fast development of technology will bring new challenges to the knowledge base, and this requires special effort by all the parties. Also a considerable share of Finnish nuclear experts, within the regulator, the operators as well as within research institutes and universities, is currently retiring and at the same time additional human resources are needed owing to the spent fuel disposal project and the new NPP projects. The challenges are tackled by training young experts in the nuclear safety field in two specific training related co-operation programmes of Finnish organizations active in the nuclear energy field.

In 2010 the first course covering comprehensively nuclear waste management ("National YJH course") was launched. The impetus for the course development resulted from an evaluation of the KYT2010 programme (Finnish Research Programme on Nuclear Waste Management) pointing out the need to address competence maintenance also by the means of training, not only of research projects.

The National YJH course curriculum was designed based on earlier Finnish experiences in teaching the nuclear waste management subjects. The current course with a six day curriculum has been running since 2011 for around 20-25 students at a time and equalling 2 ECTS credits (ECTS = European Credit Transfer and Accumulation System), with around 100 participants altogether by the end of 2014. The training content is produced also jointly by the participating organizations, which form also the planning group that is chaired by the Ministry of Economy and the Employment. The practical course coordination has been carried out by Aalto University. (More information can be found at http://www.euronuclear.org/events/nestet/nestet2013/transactions/nestet2013-needs.pdf).

In 2012, the three Universities Aalto, Helsinki University and Lappeenranta University of Technology set up a Doctoral programme YTERA (YTERA – Doctoral Programme for Nuclear Engineering and Radiochemistry), which is funded by the Academy of Finland, the universities and the industry (the NPP utilities and Posiva). The Doctoral Programme covers all fields of nuclear engineering and radiochemistry including nuclear waste management. The Programme has seven full-time doctoral students and around 25 associated doctoral students. The current programme period runs until the end of 2015 (http://physics.aalto.fi/studies/ytera/).

In addition, during 2003–2013 several hundreds of experts have been trained during the 5–6 weeks training courses ("YK course") emphasizing the safety of NPPs and including some basic features of nuclear waste management, specifically the safety of the interim storage of spent fuel. The 11th training course was organized in 2013–2014 and the 12th course for 2014–2015 started in autumn 2014.

The intention is to continue with the training courses on an annual basis as long as there are enough participants who need the training. Training materials have been developed so that they can be used by the organizations in their internal training programmes as appropriate.

Regarding the uses of radiation sources, the licensee shall ensure that it has at its disposal the expertise needed in the view of the nature and extent of the operation (the Radiation Act (Section 14)). The licensee shall nominate a Radiation Safety Officer (RSO) who has the competence defined by STUK (the Radiation Act (Section 18)). In some practices, also experts with particular competence shall be nominated. The competences needed are prescribed in Guide ST 1.4. The related training requirements, including the syllabus for such training, for RSOs are established in Guide ST 1.8. In addition, the licensee shall arrange appropriate training, including refresher training, to workers involved in the use of radiation (the Radiation Act (Section 14a)). More detailed requirements on the training are given in Guide ST 1.8.

ARTICLE 9

Member States shall ensure that the national framework require that adequate financial resources be available when needed for the implementation of national programmes referred to in Article 11, especially for the management of spent fuel and radioactive waste, taking due account of the responsibility of spent fuel and radioactive waste generators.

Financial arrangements under the Nuclear Energy Act

The State Nuclear Waste Management Fund (VYR) was established by the Nuclear Energy Act coming into operation in 1988. The Nuclear Energy Act (Sections 35 to 53) provides detailed regulations for the financial arrangements for nuclear waste management and the Government Decree on the State Nuclear Waste Management Fund (161/2004) further specifies the financing system. The financial provisions are described in greater detail in the Government Decision on Financial Provisions for the Cost of Nuclear Waste Management (165/1988). The Nuclear Waste Management Fund is independent of the State budget, but it is controlled and administered by the Ministry of Employment and the Economy.

The producers of nuclear waste are obliged to present every three years justified estimates of the future cost of managing their existing waste, including spent nuclear fuel disposal and decommissioning of facilities. The Ministry of Employment and the Economy (MEE) confirms annually the assessed liability and the proportion of liability the Nuclear Waste Management Fund has to reach (the fund target). The tasks of the Nuclear Waste Management Fund are described in detail in the Government Decree on the State Nuclear Waste Management Fund. The waste generators pay annually the difference between the fund target and the amount already existing in the Fund, but can also be reimbursed if the funded amount exceeds the liabilities. The waste generators shall provide securities to MEE for the portion of financial liability that is not yet covered by the Fund.

The costs of the disposal of LILW and spent fuel, as well as of the decommissioning of the NPPs and the FiR 1 research reactor, are covered by assets collected in the Nuclear Waste Management Fund. The obligation for financial provision starts when MEE or STUK grants a licence for operations that produce nuclear waste. For new NPPs the obligation to set assets in the Fund starts when the NPP has an operation licence and fuel is loaded in the reactor.

Also the cases of eventual unplanned decommissioning and post-closure of facilities currently in operation are provided for annually.

According to the Nuclear Energy Act (Section 32), 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 the incurred costs.

Financial arrangements under the Radiation Act

As specified in the Radiation Act, the licensee is responsible for the costs incurred in rendering radioactive waste harmless. Section 19 lists the requirements for furnishing security as follows:

"To ensure that the costs incurred in rendering radioactive waste harmless and in performing any necessary environmental decontamination measures are met, the holder of a safety licence shall furnish the security stipulated by the Radiation Decree, when:

1. the licence is granted for extensive manufacture of, use of, or trade in radioactive substances or radiation sources containing such substances, or
2. the operations produce, or may produce radioactive waste that cannot be rendered harmless without considerable expenses.

The provisions of paragraph 1 hereof shall not apply to the State, municipalities, intercommunal organizations or public corporations."

The Radiation Decree further specifies when a financial security needs to be furnished, e.g. for a sealed source or other radioactive waste with substantial liability. The State has the secondary responsibility in case the producer of radioactive waste is not capable to fulfil his management obligation.

In case where the practice produces or may produce radioactive waste that cannot 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 licensee is responsible for decommissioning also in cases of uses of radioactive sources subject to the Radiation Act. The licensee shall provide evidence that all disused sources have been transferred from the site appropriately and, where appropriate, that there is no remaining contamination. The Radiation Act prescribes (Sections 19 and 31f) practices subject to a financial provision at the licensing phase to ensure the availability of sufficient funds to cover decommissioning costs.

ARTICLE 10

Art. 10.1

Member States shall ensure that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority inform the public in the fields of its competence. Information shall be made available to the public in accordance with national legislation and international obligations, provided that this does not jeopardise other interests such as, inter alia, security, recognised in national legislation or international obligations.

The Act on STUK states STUK's duties as follows: In order to prevent and restrict the harmful effects of radiation, to exercise regulatory control of the safety of the use of radiation and nuclear energy as well as the related research, training and

communications the Radiation and Nuclear Safety Authority is established subordinate to the Ministry of Social Affairs and Health.

The Decree on STUK further defines STUK's responsibilities. Among others STUK shall be responsible for providing information on radiation and nuclear safety issues, and for participating in training activities in the field.

The Act on the Openness of Government Activities applies to the documents and information delivered to STUK and those prepared by STUK. Under the Act everyone has the right to obtain information from official documents in the public domain. Official documents are in the public domain unless specifically otherwise provided for. The provisions on the secrecy of documents and information on the use of nuclear energy are set out in the Openness Act and in the Nuclear Energy Act (Section 78). A document or information shall be kept secret when it's necessary to protect e.g. security arrangements, preparations for emergency conditions or private economic interests.

In addition, the Openness Act also requires authorities to produce data material describing their activities, such as publications, brochures and statistics as well as information on their socially significant decisions. The authorities shall also ensure that documents pertinent to their activities are easily accessible for example in data networks and libraries. The Openness Act also imposes on the authorities the obligation to inform the public of their activities.

In 2013, Finland joined the Open Government Partnership in order to get a new boost to continuous work towards active citizen participation and open government (the global Open Government Partnership initiative aims at promoting more transparent, effective and accountable public administration). The first national action plan started July 1st 2013 and STUK is implementing it for its part. Clear official language has emerged as a critical factor in open government in Finland and in STUK.

Teollisuuden Voima and Posiva communicate the operations and their impact on its stakeholders openly, honestly, and without delay, in compliance with legislation and the obligation to provide information. The companies engage in open, objective, and interactive cooperation with its stakeholder groups including own employees and the general public especially in the neighbourhood of the nuclear power plant. The objective is to increase knowledge of nuclear power and waste management as well as to support open and constructive interaction among the different stakeholder groups. TVO and Posiva also listen and observe the concerns of stakeholder groups. The most important matter of concern is the safety of nuclear power production and the final disposal of nuclear fuel. The communication activities are geared around these topics and provide in-depth information about how the companies ensure the safety of the operations.

Art. 10.2

Member States shall ensure that the public be given the necessary opportunities to participate effectively in the decision- making process regarding spent fuel and radioactive waste management in accordance with national legislation and international obligations.

Public and stakeholder participation in the licensing process of a nuclear facility

The availability of information related to 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. 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) procedure. Public hearings are arranged both in the programme phase of the EIA and during the actual assessment. The responsible contact authority for that procedure is the Ministry of Employment and the Economy. The EIA report must be attached to the application for the Decision-in Principle.

The Nuclear Energy Act (Section 13) 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 Employment and the Economy shall provide residents and municipalities in the immediate vicinity of the nuclear facility as well as local authorities a 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. The Nuclear Energy Act (Section 14) further provides 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.

The public has several possibilities of participating in the decision making. It must, however, be noted that the responsibility for the safety issues and related decisions always lies with the regulatory body.

The Radiation Act does not prescribe any formal public participation procedures. The EIA process is the only formal process in connection with major undertakings.

Availability of information

STUK puts special interest in internet to inform public and interested stakeholders about nuclear and radiation safety in general, risks related to radiation and use of nuclear energy, safety requirements, roles and responsibilities of STUK, STUK's organization, current activities and operating experience, significant regulatory decisions taken, and safety research.

The objective of STUK's public communication is to be proactive, open, timely and understandable. Communication is considered to be a privilege and duty of all employees. Good cooperation with the media is emphasized in all communication. A

prerequisite for successful communication is that STUK is well known among media and general public and the information given by STUK is regarded as truthful. Communication is always based on the best available information. Even sensitive matters are openly communicated.

The communication strategy states that

- regulatory processes and decisions have to be clear and understandable to general public
- information on STUK's website (STUK's decisions, event descriptions etc.) is timely
- interaction with media is important.

STUK utilises many means to communicate with public and interested stakeholders, such as meetings, seminars, and training courses. All these are tailored and targeted to different stakeholders and interest groups.

STUK's own web site is a very important tool in communication. STUK's web pages can be found (www.stuk.fi) in Finnish, Swedish and in English. STUK is also active in using channels of social media and is able to adapt to the changes in the field. Currently STUK is active in using Twitter, Facebook, YouTube and Flikr.

STUK also publishes printed information materials and has published for example 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.

Communication will become an increasingly important success factor for STUK, Posiva, and the power companies. The interest in radiation and nuclear safety topics will continue to increase. The media, including the social media, plays an important role in communication.

Consulting of Contracting Parties

Finland is a party to the Convention on Environmental Impact Assessment in a Transboundary Context, done in Espoo in 1991. The Finnish policy is (Act 468/1994 on the Environmental Impact Assessment) to provide full participation to all neighbouring countries which can be affected by the nuclear facilities in question.

ARTICLES 11 AND 12

Article 11.1 Each Member State shall ensure the implementation of its national programme for the management of spent fuel and radioactive waste ('national programme'), covering all types of spent fuel and radioactive waste under its jurisdiction and all stages of spent fuel and radioactive waste management from generation to disposal.

The National Programme is submitted as a separate document. It contains the policy and the strategy for spent fuel and radioactive waste management.

In Finland, the policies and strategies for radiation and nuclear safety are mainly expressed through legislation.

The latest revisions and amendments to the Nuclear Energy Act and the Radiation act (as well as the respective Decrees) define the requirements on the national programme for spent fuel and radioactive waste management in Finland. The amendments also define the responsibilities for the implementation of the national programme.

The links to the current legislation (Acts and Decrees) are given at the end of this document.

Article 11.2 Each Member State shall regularly review and update its national programme, taking into account technical and scientific progress as appropriate as well as recommendations, lessons learned and good practices from peer reviews.

The peer reviews and the measures taken due to their recommendations, as well as how to include the advances in science and technology, are described under Art. 5.2.

The review and update process of the national programme is described in that document. That document also describes the measures taken to notify significant changes of the national programme to the Commission.

Article 12.1 The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:

...

(c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste

The inventory of the spent fuel and radioactive waste (at the end of 2013) is attached to the end of this document.

Article 12.2 The national programme together with the national policy may be contained in a single document or in a number of documents.

The national programme and policy are contained in one single document.

LINKS TO LEGISLATION

Nuclear Energy Act 990/1987

amendment 269/2011
amendment 622/2011
amendment 410/2012
amendment 60a 410/2012
amendment 499/2013
amendment 676/2015

Nuclear Energy Decree 161/1988

amendment 755/1013

Radiation Act 592/1991

amendment 500/2013
amendment 676/2015

Radiation Decree 1512/1991

Spent fuel and radioactive waste inventory in Finland at the end of 2013

List of spent fuel storages and inventory of spent fuel

Loviisa NPP

Storage	*Inventory (end of 2013)/ storage capacity*	
	Mass[1] (tHM)	*Fuel assemblies*
Pool storage in Loviisa 1 reactor building	30.3/57	252/481
Pool storage in Loviisa 2 reactor building	10.7/58	89/485
Basket type pool storage at the NPP	57.7/57	480/480
Rack type pool storage at the NPP	461.5/582	3836/4842
Total inventory/storage capacity (gross)	560/756	4657/6288
Total effective[2] storage capacity	620	5157

Olkiluoto NPP

Storage	*Inventory (end of 2013)/ storage capacity*	
	Mass[1] (tHM)	*Fuel assemblies*
Pool storage in Olkiluoto 1 reactor building	109.2/259.6	650/1520
Pool storage in Olkiluoto 2 reactor building	111.5/266.4	685/1560
Separate storage facility at the NPP site	1153.3/1220.5	6761/7146
Total inventory/storage capacity (gross)	1373.9/1746.4	8096/10226
Total effective[2] storage capacity	1575.6	9226

FiR 1 research reactor

Storage	*Inventory (end of 2013)*	
	Mass (kgU)	*Fuel elements*
Wet storage	2.04	11
Dry storage	2.41	13
Total inventory	4.45	24

[1] tHM means that the spent fuel inventory is presented in tonnes of heavy metals.

[2] In the effective capacity 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.

List of radioactive waste management facilities and inventory of radioactive waste

Loviisa NPP

Storage	*Inventory (end of 2013)*	
	Volume (m^3)	*Activity (TBq)*
Storage room for LLW inside the NPP	209.0	0.18
Storage room for ILW inside the NPP	38.13	0.16
Tank storage for wet LILW	1230[3]	16.7[3]
Dry silos for ILW	39.5	high (not measured)
On-site storage hall for VLLW	96.0	low

Olkiluoto NPP

Storage	*Inventory (end of 2013)*	
	Volume (m^3)	*Activity (TBq)*
Buffer storage rooms inside the NPP	194	22.1
On-site storages for operational waste	176	low
Pool storage for activated metal waste	53	high
Spent oil candidate for clearance	11	low
Interim storage for state owned waste	56	51.4

FiR 1 research reactor

Storage	*Inventory (end of 2013)*	
	Volume (m^3)	*Activity (TBq)*
Waste storage in the laboratory building	6	0.001

Storage for small user waste

Storage	*Inventory (end of 2013)*	
	Volume (m^3)	*Activity (TBq)*
Roihupelto, Storage room in STUK's building	2	3.8

Storage for small user waste containing nuclear material

Storage	*Inventory (end of 2013)*
	Volume
Roihupelto, Storage room in STUK's building	HEU 0.8 g LEU: 536 g UNat: 574 g DU: 369 kg Th: 199 g

[3] Tank storage for wet LILW includes sediment matter on the bottom of the tanks, estimated to be about 60 m^3.

Storage for state owned waste

Storage	*Inventory (end of 2013)*	
	Volume (m^3)	*Activity (TBq)*
Rock cavern attached to the Olkiluoto disposal facility	56 m^3	50.14 TBq

List of disposal facilities and volumes of disposed radioactive waste

Loviisa disposal facility	**Inventory (end of 2013)**	
	Volume (m^3)	*Activity (TBq)*
	1886	0.45

Olkiluoto disposal facility	**Inventory (end of 2013)**	
	Volume (m^3)	*Activity (TBq)*
	5681	52.0

Estimates of future quantities of radioactive waste, spent fuel and decommissioning waste

Spent fuel

Spent fuel produced by the current Olkiluoto NPP units OL1and OL2 and the current Loviisa NPP unit LO1and LO2 is estimated at 4000 tU during their lifetime.

The OL3 unit under construction is estimated to produce approximately 2 500 tU of spent fuel during its lifetime of 60 years.

The Fennovoima unit currently at planning stage is expected to produce 1800 tU maximum of spent fuel during its lifetime of 60 years.

For VTT's research reactor FiR1 the total mass of spent fuel is about 340 kg, of which approximately 25 kg is uranium.

LILW

The power plant at Olkiluoto produces approximately 150-200 m^3 of LILW annually. When the third unit will be in operation the amount will rise to approximately 300 m^3.

The total volume of the decommissioning waste of the Olkiluoto power plant (units 1 and 2) will be 32 000 m^3, including package.

The Loviisa power plant produces approximately 100-150 m^3 of LILW annually.

The total volume of the decommissioning waste of the Loviisa power plant will be 30 000 m^3, when packed.

The Fennovoima plant is expected to produce approximately 90 m^3 of LILW annually.

The research reactor FiR1 has produced a small amount (around 600 kg) of low activity resins.

The decommissioning of the reactor is expected to produce approximately 30 m^3 of nuclear waste, such as concrete, metallic structures and reactor graphite.

At the disposal stage of the spent fuel the encapsulation plant is expected to produce approximately 1 600 m^3 of liquid waste during operation and approximately 100 m^3 during decommissioning. When dried and packed the amount of waste is around 16 m^3 in total.

Other radioactive waste

The interim storage for state owned waste at Olkiluoto has a total volume of 100 m^3 maximum, of which 56 m^3 is in use at the end of 2013. The annual increment is 1-3 m^3.