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Implementing nuclear non-proliferation in Finland

Regulatory control, international cooperation and the Comprehensive Nuclear-Test-Ban Treaty

Annual report 2008

Olli Okko (ed)

Säteilyturvakeskus
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Summary

Regulatory control of nuclear materials (nuclear safeguards) is a prerequisite for the peaceful use of nuclear energy in Finland. In order to uphold our part of the international agreements on nuclear non-proliferation – mainly the Non-Proliferation Treaty (NPT) – this regulatory control is exercised by the Nuclear Materials Section of the Finnish Radiation and Nuclear Safety Authority (STUK).

Nuclear safeguards are applied to all materials and activities that can lead to the proliferation of nuclear weapons or sensitive nuclear technology. These safeguards include nuclear materials accountancy, control, security and reporting. The main parties involved in a state nuclear safeguards system are the facilities that use nuclear materials – often referred to as "license holders" or "operators" – and the state authority. A license holder shall take good care of its nuclear materials and the state authority shall provide the regulatory control to ensure that the license holder does. Additionally, the International Atomic Energy Agency (IAEA) evaluates the success of the state safeguards system and the European Commission participates in safeguarding the materials under its jurisdiction.

To guarantee that Finland can assure itself and the international community of the absence of undeclared nuclear activities and materials, STUK is obliged to maintain a central nuclear materials accountancy system and to verify that nuclear activities in Finland are carried out according to the Finnish Nuclear Energy Act and Decree, the European Union's (EU) legislation and international agreements.

Finland has a significant nuclear power production, but the related nuclear industry is rather limited. About 99.8% of the nuclear materials (uranium, plutonium) in Finland reside at the nuclear power plants in Olkiluoto and Loviisa. Most of the remaining 0.2% is at the VTT research reactor in Otaniemi, Espoo. Additionally, there are a dozen minor nuclear material holders in Finland. The construction project for the final disposal facility for spent nuclear fuel does not involve any actual nuclear material yet, but nuclear safeguards are applied to the facility site on the national level already, to prepare for effective future safeguards. The construction project for the new reactor at Olkiluoto is being provided turnkey by the consortium responsible for the delivery. The nuclear technology and instrumentation of the new facility are being imported.

The results of STUK's nuclear safeguards inspection activities in 2008 continued to demonstrate that Finnish licence holders take good care of their nuclear materials. There were no indications of undeclared nuclear materials or activities and the inspected

materials and activities were in accordance with the licence holders' declarations. STUK remarked on the nuclear safeguards systems of three licence holders in 2008, setting required actions for them to update the descriptions of their procedures for nuclear material accountancy and control systems for the nuclear technology and dual use equipment that is in their possession. Neither the IAEA nor the European Commission made any remarks nor did they present any required actions based on their inspections. By their nuclear materials accountancy and control systems, all licence holders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards.

STUK has set up an interdivisional Nuclear Security Task Group in order to improve internal coordination on this topic and to act as the focal point at STUK for issues dealing with nuclear security, counter-terrorism and radiological risk reduction. For a little over a year now the leadership of this task group has been assigned to the Nuclear Materials Section. Two new cooperation initiatives were established among our nuclear security related activities in 2008: STUK is now represented at the Finnish CBRNE Task Force, whose tasks are to advance measures to deter, prevent, detect and respond to illicit CBRN activities, and to enhance coordination and cooperation between national authorities involved in the counter-CBRN effort. The Task Force is lead by the Police Department of the Ministry of the Interior. As part of the national effort to combat illicit trafficking of nuclear and other radioactive materials, STUK and the Finnish Customs started in 2008 a joint multi-year border monitoring development project. The project will cover updating technical equipment as well as operational procedures, such as data transfer to enable swift off-site analysis.

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is one of the elements of the global nuclear non-proliferation effort. STUK has two roles in relation to the CTBT: STUK operates the Finnish National Data Centre (FiNDC) and one of the radionuclide laboratories (RL07) designated in the CTBT. The main task of the FiNDC is to inspect data received from the International Monitoring System (IMS) and to inform the national authority, the Ministry for Foreign Affairs, about any indications of a nuclear weapons test. The FiNDC falls under the non-proliferation process in STUK’s organisation, together with the regulatory control of nuclear materials.

A major goal of all current CTBT related activities is the entry into force of the CTBT itself. An important prerequisite for such positive political action is that the verification system of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is functioning and able to provide assurance to all parties that it is impossible to make a clandestine nuclear test without getting detected. The FiNDC is committed to its own role in the common endeavour so that the verification system of the CTBTO can accomplish its detection task.

Contents

1 Nuclear Non-proliferation implementation in Finland

Nuclear non-proliferation is a prerequisite for the peaceful use of nuclear materials and nuclear energy, globally. In order for Finland to have a nuclear industry, most of which consists of nuclear energy production, it must be ensured that nuclear materials, equipment and technology are used only for their declared, peaceful purposes. The basis for nuclear safeguards is the national system for the regulatory control of nuclear materials and activities. Nuclear safeguards are an integral part of nuclear safety and nuclear security and they are applied both to large and medium-size nuclear industry and to small-scale nuclear material activities. Along with the safeguards, the regulatory process for nuclear non-proliferation includes transport control, export control, border control, international cooperation and conventions, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The following chapters describe how the Finnish nuclear non-proliferation implementation works.

1.1 Nuclear safeguards are based on international agreements and national law

Nuclear safeguards are based on international agreements, the most important and extensive of which is the Treaty on the Non-Proliferation of Nuclear Weapons (Non-Proliferation Treaty, NPT). The Treaty Establishing the European Atomic Energy Community (Euratom Treaty) is the basis for the nuclear safeguards system of the European Union (EU). Finland is bound by both of these treaties, and also has several bilateral agreements in the area of peaceful use of nuclear energy. Upon joining the EU, Finland's bilateral agreements with Australia, Canada and the USA were partly substituted by the corresponding Euratom agreements (see Appendix 4 for the relevant legislation).

Finland was the first state where an INFCIRC/153-type nuclear Safeguards Agreement with the IAEA entered into force (INFCIRC/155, 9 February 1972). When Finland joined the EU (1 January 1995), this agreement was suspended and subsequently the Safeguards Agreement between the non-nuclear weapon Member States of the EU, the Euratom, and the IAEA (INFCIRC/193) entered into force in Finland, on 1 October 1995. Finland signed the Additional Protocol (AP) to the INFCIRC/193 in Vienna on 22 September 1998, with the other EU Member States, and ratified it on 8 August 2000. The Additional Protocol entered into force in April 30, 2004, when all the EU Member States had ratified it. The scope and mandate for Euratom nuclear safeguards are defined in the European Commission Regulation No. 302/2005.

After Finland joined EU as a Member State and therefore joined the Euratom nuclear safeguards, a comprehensive national safeguards system was still maintained. The basic motivation for this is the responsibility assumed by Finland for its nuclear safeguards and nuclear security under the obligations of the NPT.

The national nuclear safeguards derive their mandate and scope from the Finnish Nuclear Energy Act and Decree. These were amended during 2008 as a result of the general constitution-based renewal of the Finnish nuclear legislation system. The amendment of the act was accepted by the Government in 2007 and was approved by the Parliament on 23 May 2008. The Nuclear Energy Decree and four new Government Decrees were approved by the Parliament on 27 November 2008. These amendments and Decrees entered into force on 1 June and 1 December, respectively, and strengthened regulatory control. The role of the persons responsible for nuclear use, including those responsible for safeguards, was raised from the Decree to the Act. The operator's obligation to have a nuclear material accountancy system and the right of STUK to oversee the planning of and generation of design information for new facilities was introduced from STUK regulations to the Decree. One key issue was to update the regulations concerning the export control of nuclear items. The amendment transferred export licensing of nuclear materials and other nuclear dual use items including sensitive nuclear technology from STUK and the Ministry of Employment and the Economy to the Ministry for Foreign Affairs.

As stipulated by the Act, STUK issues detailed regulations on safety and security (the YVL Guides) that apply to the use of nuclear energy. The YVL Guides most relevant to nuclear safeguards are:

- Control of nuclear fuel and other nuclear materials required in the operation of nuclear power plants (Guide YVL 6.1)
- The national system of accounting for and control of nuclear materials (Guide YVL 6.9)
- Reports to be submitted on nuclear materials (Guide YVL 6.10).

Nuclear materials control applies to:

- nuclear material (special fissionable material and source material)
- nuclear dual use items (non-nuclear materials, components, equipment and data suitable for producing nuclear energy or nuclear weapons as specified in INFCIRC/254, Part 1)
- licence holders' activities, expertise, preparedness and competence
- R&D activities related to the nuclear fuel cycle
- nuclear security, and
- safeguards for the final disposal of spent nuclear fuel.

1.2 Parties of the Finnish nuclear safeguards system

The main parties involved in the Finnish nuclear safeguards system are the authorities and the licence holders. Undistributed responsibility for the safety, security and safeguarding of its nuclear materials is on the licence holder. It is the responsibility of STUK as the competent state authority to ensure that the licence holders comply with the requirements of the law and the nuclear safeguards agreements. To complement the national effort, international control is necessary to demonstrate credibility and the proper functioning of the national safeguards system.

1.2.1 Ministries

The Ministry for Foreign Affairs is responsible for national non-proliferation policy and international agreements. The Ministry of Employment and the Economy (MEE, formerly the Ministry of Trade and Industry) is the highest state authority for management and control of nuclear energy. MEE is responsible for legislation related to nuclear energy and it is also the competent safeguards authority mentioned in the Euratom Treaty. Also other ministries, such as the Ministry of the Interior and the Ministry of Defence contribute to the efficient functioning of the national nuclear safeguards system.

1.2.2 STUK

According to the Finnish nuclear legislation, STUK is responsible for maintaining the national nuclear safeguards system in order to prevent proliferation of nuclear weapons. STUK regulates the license holders' activities and ensures that the obligations of international agreements concerning peaceful use of nuclear materials are met. Regulatory control by STUK includes the possession, use, production, transfer (national and international), handling, storage, transport, export and import of nuclear material and nuclear dual use items. STUK is in charge of Finland's approval and consultation process for IAEA and European Commission inspectors. STUK approves an inspector as long as there are no such issues related to the person in question that might adversely affect nuclear safety or security at Finnish facilities or the non-proliferation of nuclear weapons. The new inspector requests are sent for comments to the operators that hold construction or operating licenses for nuclear facilities. If STUK cannot approve an inspector, it assigns the approval process to the Ministry of Employment and the Economy.

Nuclear safeguards by the Nuclear Materials Section of STUK (see Fig. 1 for the organisational chart and Appendix 3 for the staff) cover all typical measures of a State System of Accounting for and Control of Nuclear Materials (SSAC) and many other activities besides. STUK reviews the license holders' reports (operational notifications, inventory reports), inspects their accountancy, facilities and transport arrangements on site, and performs system audits. Office work constitutes 90% of the inspection effort. STUK runs a verification programme for nuclear activities to assess the completeness and correctness of the declarations by the licence holders. Nuclear safeguards on the national level are closely linked with other functions of nuclear materials control and non-proliferation: licensing, export control, border control, transport control, combating illicit trafficking, the physical protection of nuclear materials, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT) – all duties of the STUK Nuclear Materials Section. Nuclear safety and particularly nuclear security objectives are closely complemented by safeguards objectives.

1.2.3 License holders

Essential parts of the national nuclear safeguards system are the licence holders, in nuclear terminology often called the operators. They perform key functions of the national safeguards system: control of the authentic source data of their nuclear materials and nuclear material accountancy at the facility level for each of their material balance areas (MBA). Each license holders has to operate its safeguards system according to its own nuclear materials handbook. The handbook is part of the facility's quality system and reviewed and approved by STUK.

With the basic technical characteristics (BTC) submitted by a license holder as groundwork, the Commission shall adopt particular safeguards provisions (PSP). PSP are to be drawn taking into account operational and technical constraints and in close consultation with both the person or undertaking concerned and the relevant member state. Until PSP are adopted, the person or undertaking shall apply the general provisions of the Commission regulation No 302/2005.

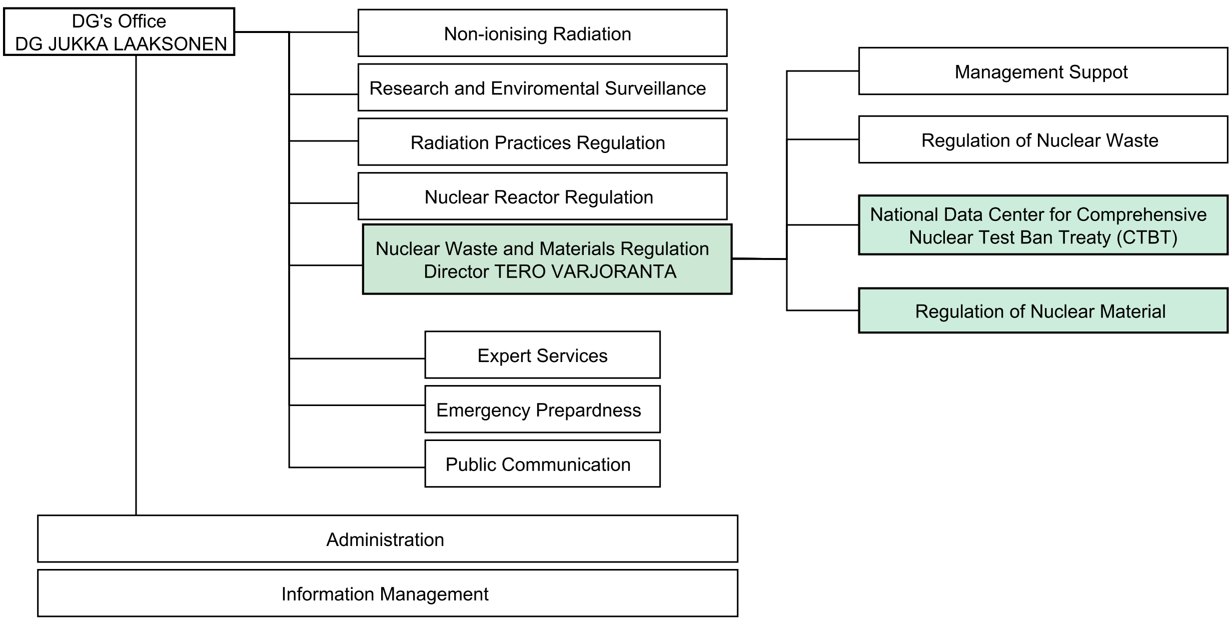

Figure 1. The Nuclear Materials Section and the Finnish National Data Centre for the CTBT within the STUK organisational structure.

99.8% of all nuclear materials in Finland reside at the nuclear power plants (NPP). The nuclear material (uranium, plutonium) amounts in Finland in 1990–2008 are presented in Figures 2 and 3.

Fortum (MBA WL0V)

Fortum is a partly state-owned energy company, one of the largest in the Nordic countries. Fortum operates power plants of several types, nuclear among others.

The nuclear power plant of Fortum Power and Heat is located on the Hästholmen Island in Loviisa on the south-east coast of Finland. This first NPP to have been built in Finland hosts two power reactor units: Loviisa 1 and Loviisa 2. Loviisa 1 started its electricity production in 1977 and Loviisa 2 in 1980. The two units share a common fresh and spent fuel storage and for nuclear safeguards accountancy purposes the whole NPP is counted as one material balance area (MBA code WL0V). The electricity generated by the Loviisa NPP constitutes ca. 10% of the whole electricity production in Finland.

Most of the fuel for the Loviisa NPP has been imported from the Soviet Union / Russian Federation. The spent fuel of the Loviisa NPP was returned back to the Soviet Union / Russian Federation until 1996, and since then it has been stored in the interim storage due to a change in the Finnish nuclear legislation, which today forbids, in general, import and export of nuclear waste.

Particular Safeguards Provisions for the Loviisa NPP that define the European Commission's nuclear safeguards procedures for the facility have been in force since 1998.

The Loviisa NPP site, as per the requirements of the Additional Protocol, comprises the entire Hästholmen Island and extends to the main gate on the continent.

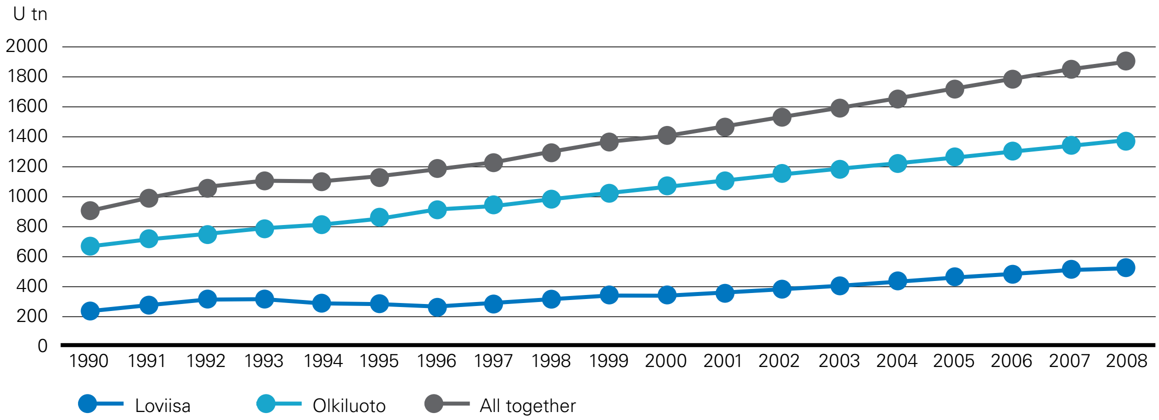

Figure 2. Uranium amount in Finland in 1990–2008.

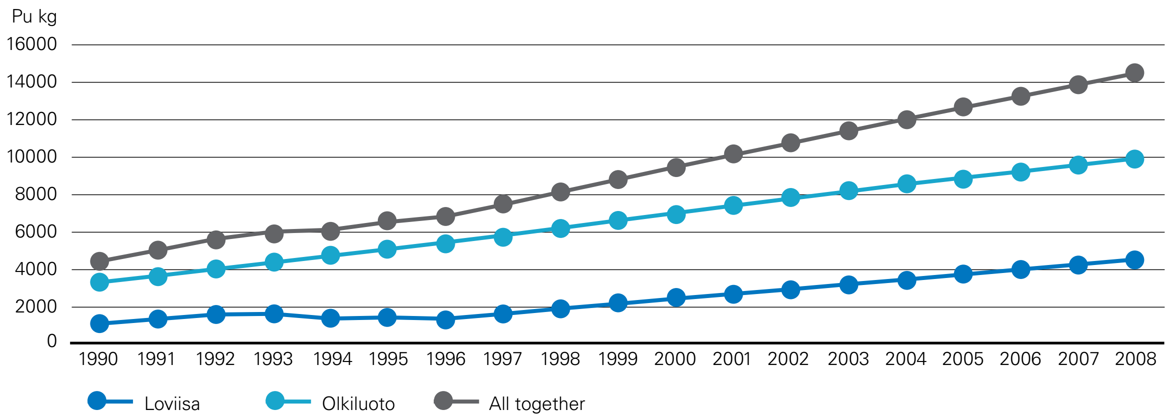

Figure 3. Plutonium amount in Finland in 1990–2008.

Teollisuuden Voima (MBAs W0L1, W0L2, W0LS and W0L3)

Teollisuuden Voima Oyj (TVO) owns and operates a nuclear power plant in Olkiluoto, in Eurajoki on the west coast of Finland. The Olkiluoto NPP consists of two nuclear power reactor units, Olkiluoto 1 and Olkiluoto 2, and an interim spent fuel storage. Olkiluoto 1 was connected to the electricity grid in 1978 and Olkiluoto 2 in 1980. The Olkiluoto NPP contributes ca. 16% of the whole electricity production in Finland. At the Olkiluoto NPP there are three active material balance areas (MBA codes W0L1, W0L2, W0LS).

Presently, the uranium in TVO's nuclear fuel is mainly of Australian, Canadian and Russian origin. This uranium is enriched in the Russian Federation or in the EU and the fuel assemblies are manufactured in Spain and Sweden.

The Finnish Government granted a licence for constructing a new nuclear reactor, Olkiluoto 3, on 17 February 2005. As a part of the licensing process, TVO's plan for arranging the necessary measures for preventing proliferation of nuclear weapons was approved by STUK. The construction and assembly work of the reactor unit is underway. The European Commission has assigned the MBA code W0L3 for Olkiluoto 3.

TVO owns most of the area of the Olkiluoto Island, but the NPP site, as per the requirements of the Additional Protocol, comprises the fenced areas around the reactor units, the spent fuel storage and the storage for low and intermediate level waste as well as the Olkiluoto 3 construction site.

VTT FiR1 research reactor (MBA WRRF)

Small amounts of nuclear materials are located at other facilities than nuclear power plants. The most significant of those facilities is the VTT research reactor FiR1 (MBA code WRRF) in Otaniemi, Espoo. The research reactor was the first nuclear reactor built in Finland. It reached criticality on 27 March 1962.

Particular Safeguards Provisions that define the European Commission's nuclear safeguards procedures for the facility have been in force for VTT FiR1 from 1998.

The VTT FiR site, as per the requirements of the Additional Protocol, consists of the whole building around the research reactor, although there are non-nuclear companies and university premises in the same building.

STUK (MBA WFRS)

Small quantities of nuclear materials are stored by STUK, mainly material no longer in use and hence taken into STUK's custody. The Radiation and Nuclear Safety Authority (STUK) was founded in 1958 and is located at its current premises in Roihupelto, Helsinki since 1994. The STUK MBA (WFRS) consists of the STUK headquarters and the "Central interim storage for small-user radioactive waste" at the Olkiluoto NPP site.

The STUK site, as per the requirements of the Additional Protocol, consists of STUK's headquarters, but non-STUK premises in the building are excluded. The storage at Olkiluoto is included in the NPP's site declaration.

The University of Helsinki, Laboratory of Radiochemistry (MBA WHEL)

The Laboratory of Radiochemistry at the University of Helsinki (HYRL) uses small amounts of nuclear materials. HYRL is located at the Kumpula university campus in Helsinki.

The HYRL site, as per the requirements of the Additional Protocol, comprises the whole building that hosts the laboratory.

OMG Kokkola Chemicals (MBA WKK0)

The OMG Kokkola Chemicals facility is not using nuclear materials as such. However, the by-products of their cobalt purification process contain uranium, which qualifies them as nuclear material. OMG Kokkola Chemicals has an operation license for storing, handling, and shipping this nuclear material to Comurhex in France. OMG Kokkola Chemicals is located on the west coast of Finland.

Other nuclear material holders

There are about 10 minor nuclear material holders in Finland. One of them is an actual material balance area: University of Jyväskylä, Department of Physics (JYFL, MBA code WDPJ), but in fact the nuclear material in JYFL has been derogated and exempted by the European Commission and the IAEA. Other minor nuclear material holders are members of a Catch-All-MBA (CAM), for purposes of international nuclear safeguards. Most of these have depleted uranium as radiation shielding material.

Posiva (MBA W0LF)

Posiva Oy is the company responsible for the final disposal of spent nuclear fuel in Finland. It is owned by TVO and Fortum. Posiva has been excavating an underground rock characterisation facility called "Onkalo" in Eurajoki since 2004, and thus preparing for the construction of the final disposal facility. While neither a license holder nor a nuclear material holder yet, Posiva and its activities are highly relevant to the national safeguards system because Posiva is foreseen to develop a new type of facility, the geological repository, where the nuclear material cannot be re-verified once it has been encapsulated and emplaced. In the IAEA safeguards approaches it has been suggested that the geological formation should be under safeguards during the whole lifetime of the underground facility. Therefore, Posiva is been required to develop a non-proliferation handbook, such as a nuclear materials handbook, to describe Posiva's safeguards procedures and reporting system already before becoming a nuclear material holder. The European Commission has already at this early stage assigned the MBA code W0LF for Onkalo.

1.3 IAEA and Euratom safeguards in Finland: enabled by the state, checking on the state

The IAEA and the European Commission nuclear safeguards both have their separate mandates to operate in Finland. These two international inspectorates have agreed on cooperation (New Partnership Approach, NPA), which aims to reduce undue duplication of effort. In Finland this has thus far not decreased the number of inspection days and there is overlap in the Commission's and the IAEA's safeguards activities. In 2008 the IAEA safeguards activities were carried out without significant changes to the previous years. Discussions in a constructive atmosphere are ongoing between the IAEA, the Commission, and the EU Member States to enhance cooperation and find the synergies that would improve the efficiency of the three levels of nuclear safeguards in place in the EU. Finland endeavours to participate actively in this process.

1.4 Declarations provide the basis for state evaluation by the IAEA

A state's declarations on its nuclear materials and activities are the basis for the state evaluation by the IAEA under the obligations of the Additional Protocol.

In Finland, the state has delegated its responsibility for these declarations to STUK. STUK collects, inspects and reviews the relevant information and then submits the compiled declarations to the IAEA. STUK has been nominated a site representative, as per European Commission regulation No 302/2005. STUK also reviews the declarations about Finland that are submitted by the Commission. All declarations submitted by STUK are copied to the IAEA and the Commission.

In Finland, there are five sites in the sense of the Additional Protocol: the two nuclear power plant (NPP) sites: the Olkiluoto NPP and the Loviisa NPP, and three minor sites: VTT, STUK and the Laboratory of Radiochemistry at the University of Helsinki. STUK reviews and verifies the correctness and completeness of the information about the sites provided by the license holders. In order to confirm the comprehensiveness of the site maps they are, in some cases, compared with satellite imagery.

STUK reviews annually the information about research and development activities that might be eligible for declaration, as well as activities specified in Annex I of the Additional Protocol. STUK maintains the information on general plans related to the nuclear fuel cycle for the next 10 years and keeps account of the exports of specified equipment and non-nuclear materials listed in Annex II of the Additional Protocol.

1.5 Non-destructive assay and environmental sampling complement nuclear accountancy

Technical analysis methods are one tool for a state nuclear safeguards system to ensure that nuclear materials and activities within the state are in accordance with the licence holders' declarations and that there are no undeclared activities. Such methods can provide information on the identity of the nuclear materials and confirm that licence holders' declarations are correct and complete with respect to e.g. the enrichment of uranium, the burnup, and the cooling time of nuclear fuel. The technical analysis methods in use at STUK are non-destructive assay (NDA) and environmental sampling (ES).

STUK employs three methods for NDA. All of them are suitable for verifying spent nuclear fuel. One method lends itself for rapid scanning, as the detector is mounted on the fuel transfer machine and the fuel elements can be measured from above the fuel pond without moving the elements. The other two methods, on the other hand, allow confirming with greater confidence the correctness of the declared burnup and the cooling time. With the most precise method, the absence of a fuel pin or pins from a fuel element can be discovered.

All nuclear materials leave traces of their identity, source of origin and treatment. Safeguards environmental samples are used to investigate these traces, which provide further clarity in establishing whether the nuclear activities are in accordance with the declarations. In the Finnish nuclear safeguards system environmental samples are collected as surface swipes.

1.6 Export/import control and licensing are also elements of nuclear materials control

According to the Finnish Nuclear Energy Act also nuclear fuel cycle related activities are under regulatory control. A license is required for possession, transfer, export and import of components, equipment, materials and technology suitable for producing nuclear energy or nuclear weapons (nuclear dual use items). The list of these other items is based on Nuclear Suppliers' Group (NSG) Guidelines (INFCIRC/254 Part 1). The license holder is required to provide STUK annually with a list of the above mentioned items. Moreover, the export, import, and transfer of such items shall be reported to STUK.

Mining and enrichment operations that aim to produce uranium or thorium are also under nuclear safeguards and regulatory nuclear safety control. A company or a person carrying out these activities shall have a license and an accounting system to keep track of the amounts of uranium and thorium. A license is also required to export and import uranium or thorium ore or ore concentrates and these activities shall be reported to STUK and to the European Commission.

Finland's export control system is based on Regulation No 1334/2000 of the Council of the European Union (EC). This regulation sets up a Community regime for the control of export of dual use items and technology. The export of Nuclear Suppliers' Group (NSG) Part 1 items is regulated by the Finnish Nuclear Energy Act and of Part 2 items by the Finnish Act on the Control of Exports of Dual Use Goods. The authority in the former case is STUK or the Ministry of Employment and the Economy and in the latter case the Ministry for Foreign Affairs. In both cases an authorization is required to export nuclear items outside the European Union. A license is also required for EU internal transfers of NSG Part 1 items excluding non-sensitive nuclear materials.

In addition to the dangerous goods transport regulations, the Finnish Nuclear Energy Act sets specific requirements for the transport of nuclear material: a licence granted by STUK is needed for it. Usually the transport licences are granted for a fixed period, typically for a few years. A transport plan and a security plan approved by STUK are mandatory for each transport of nuclear material. A certificate of nuclear liability insurance shall also be delivered to STUK before the transport. Furthermore, a package may be used for the transport of fissile nuclear material only after the package design has been approved by STUK.

1.7 The regulatory control of transport covers nuclear materials

The requirements for the transport of radioactive material are set in the Finnish regulations on the transport of dangerous goods. The requirements are based on the IAEA safety standard Regulations for the Safe Transport of Radioactive Material, TS-R-1, and their purpose is to protect people, environment and property from the harmful effects of radiation during the transport of radioactive material. Based on these regulations on the transport of dangerous goods, STUK is the competent national authority for the regulatory control regarding the transport of radioactive material.

1.8 STUK contributes intensively to international safeguards development

Nuclear non-proliferation is, by nature, an international domain. This is seen in our daily work and, hopefully, throughout the chapters of this report. In this section some specific international nuclear safeguards related cooperation and development efforts that STUK participates in are described.

STUK is a member of the European Safeguards Research and Development Association (ESARDA), and has nominated Finnish experts to its committees and most of the working groups. STUK participates in the ESARDA Executive Board meetings and the Presidency of ESARDA is currently held by a STUK representative.

STUK's expert participates in the work of the Atomic Questions Group (AQG) of the Council of the European Union and contributes to the Safeguards Experts meetings.

The Standing Advisory Group on Safeguards Implementation (SAGSI) comprises a group of nuclear safeguards experts from the IAEA Member States, appointed by the IAEA Director General to advise on safeguards implementation issues. One of the experts in this group is a STUK staff member.

Upon request by the IAEA, STUK's experts have contributed to the IAEA's international evaluation missions, such as the International SSAC Advisory Service (ISSAS). The ISSAS mission reviews State Systems of Accounting for and Control of Nuclear Materials (SSAC) and provides suggestions for improving them.

STUK keeps close contacts with the respective Nordic authority organisations. The development of final disposal of spent nuclear fuel in geological repositories deepens the cooperation between Finland and Sweden.

1.9 The Comprehensive Nuclear-Test-Ban Treaty: a global technology-based non-proliferation tool

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) is an important part of the international regime for the non-proliferation of nuclear weapons. The CTBT bans any nuclear weapon test explosions in any environment. This ban is aimed at constraining the development and qualitative improvement of nuclear weapons, including also the development of advanced new types of nuclear weapons.

The CTBT was adopted by the United Nations General Assembly, and was opened for signature in New York on 24 September 1996. The CTBT will enter into force after it has been ratified by the 44 states listed in its Annex 2. These 44 states participated in the 1996 session of the Conference on Disarmament and possess nuclear power or research reactors.

A global verification regime is being established in order to monitor compliance with the CTBT. The verification regime consists of the following elements: the International Monitoring System (IMS), a consultation and clarification process, on-site inspections and confidence-building measures.

Finland has signed and ratified the CTBT. In addition to complying with the basic requirement of the CTBT of not to carry out any nuclear weapons tests, Finland takes part in the development of the verification regime.

In the CTBT framework, the national authority is the Ministry for Foreign Affairs. STUK has two roles: STUK operates the Finnish National Data Centre (FiNDC) and one of the radionuclide laboratories (RL07) designated in the CTBT. The main task of the FiNDC is to inspect data received from the IMS and inform the national authority about any indications of a nuclear weapons test. The radionuclide laboratory contributes to the IMS by providing support in the radionuclide analyses and in the quality control of the radionuclide station network. The third major national collaborator is the Institute of Seismology at the University of Helsinki, which runs a seismology station (PS17 in Lahti), which is included in the IMS, and provides analysis of waveform IMS data (Figure 4).

1.10 Nuclear safeguards and nuclear security have much in common

STUK is the national authority for the regulatory control of nuclear and radiological safety, security and safeguards. All these three regimes are means to a common end: protection of people, society, environment and future generations from the harmful effects of ionising radiation. From the definition of nuclear security, as referred to in the IAEA Nuclear Security Plan 2006–2009 (see infobox), it is clear that the majority of the activities that aim at non-proliferation of nuclear weapons, nuclear materi-

Comprehensive Nuclear-Test-Ban Treaty (CTBT) Status (31.12.2008)

- *CTBT Member States* 180
- *Total Ratifications* 148
- *Annex 2 Ratifications* 35

Definition of nuclear security: *The prevention and detection of and response to theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities (working definition established by the fifth meeting of the Advisory Group on Nuclear Security 1–5 December 2005) [IAEA Nuclear Security Plan 2006–2009].*

als and sensitive nuclear technology contribute to nuclear security. Moreover, such classical elements of security as physical protection of nuclear materials and facilities contribute to non-proliferation. Within STUK's organisation, a few of its nuclear security related tasks fall – solely or partly – under the duties of the nuclear non-proliferation process and the Nuclear Materials Section:

- national system for the control of nuclear materials and nuclear dual use items facilitating international nuclear safeguards activities in Finland
- regulatory control of the transport of nuclear materials
- import and export control
- cooperation with other national authorities in prevention of illegal activities related to nuclear or other radioactive materials: threat assessment, information sharing
- advice to the Finnish Customs on radiation monitoring at the borders, in concept development and technical specifications; training for Customs officers.
- national technical contact point for international conventions, resolutions and agreements against proliferation of nuclear weapons and sensitive technology (e.g. UNSC Resolution 1540)
- participation in the work of the international nuclear safeguards and nuclear security communities and working groups (IAEA, ESARDA, AQG, ITWG,…)
- participation in STUK's response in cases of radiological or nuclear incidents, e.g.:
- advice to the Finnish Customs on interpretation of radiation detections at borders, more sophisticated on-site measurements and analyses in response to border monitoring alarms.

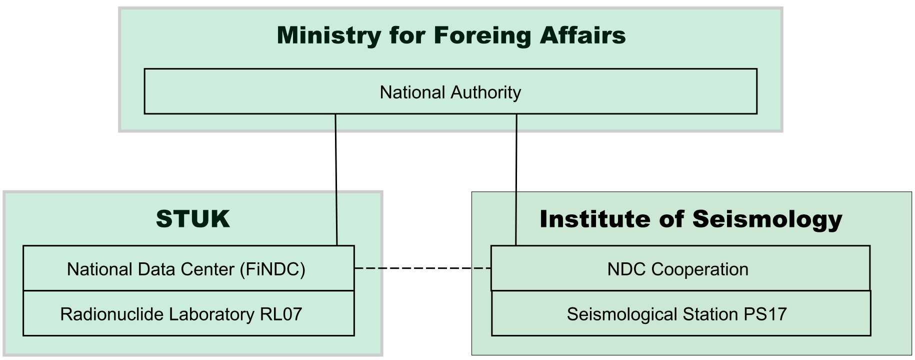

Figure 4. The Finnish CTBT organisation.

2 Theme of the year 2008: Implementing IAEA Integrated Safeguards

Integrated safeguards include traditional nuclear safeguards as per INFCIRC/193, and safeguards activities in accordance with the Additional Protocol, fitted together. While this should not lead to an increase in inspections, it should enable the IAEA to assure itself of the absence of undeclared nuclear activities in a state. In practice, the number of IAEA inspections is expected to decrease. However, the IAEA will additionally perform 1–3 unannounced inspections per year in a state that has a number and type of nuclear installations that resembles the situation in Finland.

STUK organised information meetings on the effects of integrated safeguards for the nuclear power plant operators and preparatory trilateral meetings with the IAEA and the Commission in 2007. This work continued successfully during 2008. At two trilateral meetings, held in Helsinki 13 March and in Luxembourg 7 May 2008, the implementation procedures were agreed upon. In the meanwhile, the operators updated their handbooks in order to incorporate the necessary actions for the new types of inspections. Also STUK increased preparedness for short notice and unannounced inspections.

The IAEA's integrated nuclear safeguards entered into force in Finland on 15 October 2008. The international organisations (the IAEA and the European Commission) performed their inspections according to the annual schedule throughout the year 2008. The number of the routine inspections is expected to decrease in the future. A national seminar was arranged by STUK on 4 November 2008 to inform all Finnish parties about the new framework.

Important events related to the Additional Protocol and Finland

- ***IAEA Board of Governors approves a model protocol 1997***
- ***EU Member States sign the Additional Protocol 22 September 1998***
- ***Finland ratifies the Additional Protocol 8 August 2000***
- ***Additional Protocol enters into force in the EU 30 April 2004***
- ***Finland (STUK) submits initial declarations 8 July 2004***
- ***European Commission submits initial declarations about Finland 22 September 2004***
- ***First Complementary Access (24 h), at the Laboratory of Radiochemistry at the University of Helsinki site 21 December 2004***
- ***Annual declaration updates 4 May 2005 (Finland) and 13 May 2005 (Commission)***
- ***First set of 2c questions from IAEA 15 July 2005***
- ***STUK's answers to the first 2c questions 8 September 2005 (Finland)***
- ***Commission's answers to the first 2c questions 13 December 2005 (Commission) and 24 January 2006 (Commission + Finland)***
- ***Annual declaration updates May 2006, 2007, 2008***
- ***2a(ix)(a) declarations submitted quarterly***
- ***Implementation of the IAEA Integrated Safeguards from 15 October 2008***

3 Activities in 2008

3.1 The regulatory control of nuclear materials

In 2008 safeguards activities were carried out without significant changes to the previous years. The inspections carried out during the year are listed in Appendix 2. The development of inspection person days is presented in Figures 8 and 9. Nuclear material inventories are shown in Figures 2 and 3 and in Appendix 1.

3.1.1 Declarations, complementary accesses and approvals of new international inspectors

All the relevant license holders sent their updated information for the national declaration, which is compiled by STUK, in time by 1 March 2008.

STUK submitted annual declaration updates to the IAEA on 15 May 2008 and the European Commission submitted its declaration updates also on 15 May 2008 as required.

The IAEA carried out a complementary access (with a 24-h advance notification) at the Laboratory of Radiochemistry at the University of Helsinki on 11 November 2008. The Commission participated in this access although the main targets of the inspection were the current research and development activities at the University site (Figure 5).

In 2008, altogether 11 IAEA and 20 Commission new inspectors were approved to perform inspections at nuclear facilities in Finland.

Figure 5. Complementary access to verify the activities at the Laboratory of Radiochemistry.

3.1.2 The Loviisa NPP

In 2008, STUK accepted Loviisa NPP's updated nuclear materials handbook and approved two new persons to be appointed responsible for nuclear safeguards at the NPP. STUK granted the operating company Fortum three import licenses. These covered the import of fresh nuclear fuel, equipment and automation technology.

The refuelling and maintenance outage of the Loviisa 1 reactor unit took place in the period 9.8. – 29.9.2008 and that of the Loviisa 2 reactor unit in the period 20.9. – 10.10.2008. The Loviisa 1 outage was longer than expected. The whole core was unloaded to facilitate the planned maintenance of the pressure vessel, but a few technical failures mainly associated with the crane that lifted the reactor internals extended the outage and delayed the scheduled inspections. During the outage the IAEA carried out an ad hoc inspection to verify the content of the transfer cask that was to be moved from the reactor hall on 16 August 2008. Before the closing of each reactor, STUK, the IAEA, and the European Commission identified the fuel assemblies in the reactor cores and verified/item counted the loading ponds. The Loviisa 1 core was inspected on 9 September 2008 and the Loviisa 2 core on 27 September 2008, in connection with the physical inventory verification (PIV). In addition to the PIV and the core controls, four routine inspections were carried out with the IAEA and the Commission in February, May, July and November. The post-PIV inspection took place on 13 October. In addition to inspections performed together with the IAEA and the Commission, STUK identified in September the fuel followers to be loaded into the reactor.

At the Loviisa NPP STUK performed two non-destructive assay (NDA) verification measurement campaigns on spent fuel elements in 2008. The first campaign, 2–3 April, was carried out with FORK equipment on 18 spent fuel elements. FORK equipment delivers a gross gamma signal from an ionisation chamber and a neutron count rate from a fission chamber. STUK's FORK equipment is sometimes referred to as eFORK (enhanced FORK), because it incorporates a CdZnTe-gamma spectrometer. One IAEA inspector followed the campaign as an observer.

The second campaign, 11–12 November, was carried out with upgraded spent fuel attribute tester (SFAT) equipment with a CdZnTe-gamma spectrometer. Traditionally, a SFAT device is equipped with a lower resolution NaI detector. Altogether 89 fuel elements were verified. The verification results were archived in the STUK NDA measurement database developed for the purpose. The measurements and the environmental samples collected at the Loviisa NPP did not indicate any inconsistencies in the reporting by the operator.

The safeguards system of the Loviisa NPP was under review owing to personnel changes, new IAEA approaches, and not least because of the unlicensed import of neutron flux detectors. The import was declared once the safeguards staff of the NPP was informed that the devices had entered the facility. The purchase mechanism of the NPP was inspected on June 17 2008. Euratom representatives joined in this system audit as their field trial. The NPP quality manuals were reviewed with the focus on nuclear material accountancy practices and guidance. STUK remarked that the operator shall update the purchase procedure and incorporate it in the safeguards handbook.

On the basis of its own assessment as well as of IAEA and Commission inspection results, STUK concluded that Fortum's Loviisa NPP has complied with its nuclear safeguards obligations in 2008.

3.1.3 The Olkiluoto NPP

In 2008, STUK approved one new person to be appointed responsible for nuclear fuel transfers to the Olkiluoto NPP. STUK granted to the TVO eight import licences. These covered the import of fresh nuclear fuel and nuclear dual use items, i.e. technology and instrumentation for the operating units and for the new reactor.

The refuelling and maintenance outage of the Olkiluoto 2 reactor unit took place in the period 4.5.–12.5.2008 and that of the Olkiluoto 1 reactor unit in the period 13.5.–3.6.2008. Before the reactors were closed, STUK, the IAEA, and the European Commission identified the fuel assemblies in the reactor cores and verified/item counted the loading ponds. Olkiluoto 1 was inspected on 25 May 2008 and Olkiluoto 2 on 9–10 May 2008. STUK, the IAEA and the Commission verified the physical inventory in the Olkiluoto spent fuel storage on 16–17 October 2008. In total, four routine inspections were performed by STUK, the IAEA, and the Commission, one inspection for each material balance area (MBA) at the Olkiluoto NPP: in February, May, July, and October. In November 2008 the surveillance cameras at the spent fuel storage were updated.

At the Olkiluoto NPP STUK performed only one non-destructive assay (NDA) verification measurement campaign on spent fuel elements in 2008. During the campaign STUK performed Gamma Burnup Verification (GBUV) measurements at the Olkiluoto 2 reactor hall on 24–26 June 2008. Altogether 41 spent fuel assemblies were verified. The campaign was unique as this was the first time when GBUV measurements were made at the Olkiluoto 2 reactor hall. This campaign showed that the measurement and analysis methods used are as applicable to assemblies with very short cooling times as they are to assemblies with longer cooling times, which are typically the targets for measurements in the campaigns. These measurements also gave good information about the visibility of short-lived nuclides when measuring this kind of assemblies with short cooling times. The results were archived in the mobile version of the NDA measurement database.

The second scheduled campaign had to be postponed owing to the failure of the electronics of the upgraded spent fuel attribute tester (SFAT) equipment. The measurement campaign performed at the Olkiluoto NPP did not indicate any inconsistencies in the reporting by the operator.

The construction of the new reactor OL3 has proceeded to such a phase that nuclear items are to be imported to the site. The turbine hall with its instrumentation proceeds well, but the reactor building is delayed. However, the main components are under manufactory and STUK's regulatory control; e.g. the reactor pressure vessel was built in Japan and transported to the site at the end of 2008. TVO also prepared a draft for the Basic Technical Characteristics (BTC) of the new unit. This draft was reviewed by STUK, the IAEA, and Euratom at a meeting on 18 June. TVO submitted the BTC of OL3 16 September 2008. Another meeting on the subject was held in Olkiluoto on 15 October 2008. Thus, the inspectorates have the possibility to plan the surveillance and containment measures in advance. The official BTC is due at least 200 days before the first consignment of nuclear material is to be received. The commissioning of the unit is postponed until 2012.

STUK carried out a system inspection at the Olkiluoto NPP on 18 March 2008 in order to assess the present practices at the facility. The site declaration as per Additional Protocol was also reviewed, but the main focus was on the reporting of the deliveries for the new reactor. The inspection confirmed to STUK that the purchase practices are well under safeguards control.

On the basis of its own assessment as well as of IAEA and Commission inspection results, STUK concluded that TVO's Olkiluoto NPP has complied with its nuclear safeguards obligations in 2008.

3.1.4 The VTT FiR1 research reactor

In 2008, STUK approved the VTT FiR1 research reactor's updated nuclear materials handbook.

Safeguards inspectors from STUK, the IAEA, and the European Commission verified the nuclear material inventory of VTT on 12–13 June 2008. There were some rounding inconsistencies in using the new Euratom Nuclear Materials Accounting System (ENMAS) reporting, but the nuclear material inventory was concluded to be correct. The inspection exceptionally took two days because of an urgent need to use the reactor combined with the need to verify nuclear materials at all Key Measurement Points (KMPs), as special arrangements are needed to access one of these.

STUK carried out two additional inspections. During the inspection of nuclear material 16 fuel rods were measured and verified using a UPu Detective device in June. The non-nuclear items – in particular the graphite and control rods – were also inspected. STUK remarked that the operator shall update the nuclear materials handbook to cover the bookkeeping and reporting of nuclear items and equipment.

The IAEA or the Commission did not have any clarification requests on their inspection. The inventory of nuclear materials at the FiR1 research reactor in the end of 2008 is presented in Table 3 (Appendix 1).

On the basis of its verification and assessment, STUK concluded that the VTT FiR1 research reactor has complied with its nuclear safeguards obligations in 2008.

3.1.5 Minor nuclear material holders

In 2008 STUK inspected the reports from the minor nuclear material holders. The IAEA carried out a complementary access to the Laboratory of Radiochemistry at the University of Helsinki site in November. STUK and Euratom participated in this access. The international inspectorates did not make other types of inspections to the minor holders.

On the basis of its assessment, STUK concluded that the minor nuclear material holders have complied with their nuclear safeguards obligations in 2008.

3.1.6 The final disposal facility

In order to confirm that the excavated underground space corresponds to documentation, STUK carried out three regular on-site inspections at the underground premises of the Onkalo in 2008. The IAEA and the European Commission participated as observers in these on-site inspections, the Commission in June and the IAEA both in June and in November. The purpose of these visits was to familiarise the international inspectorates with Posiva's and STUK's non-proliferation activities for Onkalo and with their approaches to the future safeguards for final disposal.

STUK requested, as a result of its 2007 audit, Posiva to update the procedures described in their non-proliferation handbook. The update was partly due to developing methods at Posiva and partly intended to clarify the descriptions of some of Posiva's practices. The update was revised in spring 2008 and finally approved by STUK on 25 June 2008.

STUK declared the Onkalo project within article

2a(x) of the Additional Protocol to the Safeguards Agreement. The Commission assigned the Material Balance Area (MBA) code W0LF to Onkalo in January 2008.

3.1.7 Nuclear dual use items, export/ import control and licenses

In 2008 STUK issued seven licences for importing nuclear equipment and made one statement to the Ministry of Employment and the Economy on an application for an import licence for nuclear technology. The Ministry issued the import licence and STUK the possession licence for this technology used for the design of equipment for a nuclear facility. STUK also visited the company to examine the nuclear-related activities.

3.1.8 Transport of nuclear material

In 2008, fresh nuclear fuel was imported to Finland from Spain, Sweden and the Russian Federation (Appendix 1, Table 1). In relation to these imports, STUK granted two new transport licences, approved four transport plans and inspected two fresh nuclear fuel transports. One inspection concentrated on the arrival at the nuclear power plant whereas the other covered the loading and transport arrangements at the Finnish border station. Furthermore, STUK approved one package design for a package to be used in the transport of fissile material.

3.1.9 International transfers of nuclear material

In 2008, TVO reported to STUK about its international fuel contracts and fuel transfers. STUK carried out an on-site inspection where TVO's nuclear material accountancy on the fresh fuel imported in 2008 was verified against the original shipment documents covering the international transfers. Based on the findings, STUK concluded that TVO has complied with its safeguards obligations in purchasing the nuclear fuel and managing its international transfers.

3.2 International developments in safeguards

In the international nuclear safeguards development fora, one major topic during the year 2008 was the beginning of the IAEA Integrated Safeguards in Europe. The roles, responsibilities and practices of the three levels of safeguards in place within the EU: those of the IAEA, those of the European Commission and those of the EU Member States were discussed in a constructive atmosphere, with the objective of enhancing cooperation and improving cost efficiency. The amendments in the Russian nuclear regulation also reflected on the Finnish–Russian cooperation programme and on international relations in a constructive manner.

STUK contributed to the work of IAEA's Standing Advisory Group on Safeguards Implementation (SAGSI) in 2008 through the participation of one expert as a member of this group. Safeguards implementation issues considered by SAGSI during the year were the IAEA draft version of the Vision 20/20 study and long term strategic plan, state-level technical objectives, the integrated safeguards approach for geological repositories, and the enhanced cooperation between the IAEA and national safeguards system.

The bi-annual meeting of the Nordic Society on Safeguards was held in Fredrikstad, Norway in October 2008. The topics covered the main developments in the field of safeguards: the prerequisites for and experiences from the implementation of integrated safeguards in the Nordic countries, the integration of nuclear security and safeguards, and the future possibilities of the thorium fuel cycle. STUK made a strong contribution with six papers.

In 2008 STUK participated in the European Safeguards Research and Development Association's (ESARDA) working groups, especially the Integrated Safeguards Working Group (IS WG). STUK contributed to the 30th Annual Meeting of ESARDA in Luxembourg by attending several working group sessions and the steering committee meeting. STUK participated in the ESARDA Executive Board meetings in 2008 and STUK's representative continued her term as the Vice-President of ESARDA throughout 2008. At the beginning of 2009 STUK's representative started her two-year term as the President of ESARDA. In order to expand the understanding of the role and practices of international safeguards she opened "The Safeguardian Angel" blog at http://www.stuk.fi/blog/.

In 2008, the group of experts for Application of Safeguards to Geological Repositories (ASTOR) met in Las Vegas, Nevada, USA. There were two participants from STUK. The IAEA had finally prepared the Integrated Safeguards Approach and Design Information Questionnaire documents for conditioning plants and geological repositories. These documents form the basis for safeguarding the final disposal of spent fuel. The trilateral meeting between the IAEA, the European Commission and the States (Finland and Sweden) on the implementation of safeguards to geological repositories was held in Vienna on 12 December 2008.

STUK participated in the European Emergency Management Conference in November and in the discussions of the European Union Strategy for the Baltic See Region in December 2008. The Baltic See Region is by now developing to a learning platform beneficial to the European Union and to the wider global context.

3.3 Bilateral cooperation and peer-to-peer exchanges strengthen regional security

Finland's bilateral cooperation programmes in the area of non-proliferation are directed mainly towards our neighbouring countries outside the EU and are motivated by the continued need for enhancement of the regional security environment. Accordingly, STUK continued its cooperation programme with the Russian Federation in 2008. The focus in 2008 was on the cooperation with the Russian nuclear security and safeguards authorities, mainly through peer-to-peer exchanges. Collaboration with Ukraine in search for mutually beneficial areas for future cooperation led to an agreement about a programme for the next 2–3 years and the tasks identified for the 2008 programme were started.

3.3.1 Cooperation with the Russian Federation continues

The cooperation programme with the Russian Federation included the review of Russian norms and guidelines that deal with the quality assurance of nuclear fuel production and the accountancy and control of radioactive materials and waste. The documents reviewed covered also physical protection requirements for nuclear materials and facilities and guidelines regulating the inspections to be carried out by the authority to verify the compliance with these requirements. The reviewed documents are by now in force and implementation support is envisioned as one of the programme directions in the future.

The demonstration of the complete product of the spent fuel attribute tester (SFAT) measurement device programme to the Russian Federal Ecological, Technological and Nuclear Inspectorate, Rostechnadzor, was successfully carried out in November 2008. Further use of this technology is envisioned in other types of facilities in Russia.

The second joint training course for the Finnish and Russian Customs Authorities was organised in May 2008. There were again 24 participants from several Customs points in both countries. The first part of the course included lectures at STUK and excursions to the Helsinki port and to two border crossing stations at the Finnish–Russian border (Figure 6). The second part of the course, which focussed on technical details and practical exercises, was conducted at the St. Petersburg Customs Academy (Figure 7).

STUK participated in the Tripartite seminar in Obninsk in October 2008. The seminar was

Figure 6. Bilateral training of Customs officers took place at border crossing stations, here at the Vainikkala rail road crossing.

Figure 7. Practical training at the St. Petersburg Customs Academy to locate and identify nuclear and radioactive materials in a car.

convened to celebrate the 10th anniversary of the organising scientific institute and that of the cooperation between the United States of America, the Russian Federation, and the European Commission that is aimed at improving the nuclear material accountancy, control, and protection in Russia. The results of this cooperation – alike those of the Finnish–Russian bilateral cooperation – have led to the development of and amendments in Russian nuclear legislation in 2008 in the field of nuclear materials regulation.

3.3.2 The programme with Ukraine moves ahead

STUK's cooperation programme with Ukraine for the next 2–3 year period includes activities and tasks in the following areas:

- assessment of regulatory documents in the area of nuclear safeguards and nuclear material security, including physical protection;
- specification of ways and technical means which will enable reliable and efficient monitoring and investigation of incidents involving nuclear or other radioactive materials or waste (mobile laboratory);
- support of the development of nuclear material fuel verification capacity of the Ukraine national nuclear safeguards system, particularly for spent fuel;
- information technology support for building inspector capacity in the areas of nuclear safeguards and security, including physical protection;
- coordinated support for establishment of a functional web-based information portal for the State Nuclear Regulatory Committee of Ukraine.

The State Nuclear Regulatory Committee of Ukraine visited STUK and learned about the functional capacity and technical specifications of the Mobile Laboratory. The considerations are by now underway to deliver the Laboratory as soon as technically possible. The functional specifications for the Electronic Performance Support System (EPSS) for inspectors were developed and the system will be ready for demonstration during the first half of 2009.

3.4 Nuclear security activities rely on cooperation between authorities

3.4.1 Finnish Customs and STUK launched a joint development project

Cooperation between STUK and the Finnish Customs is close: in 2008 these authorities started a joint multi-year border monitoring development project. The project will cover updating technical equipment as well as operational procedures, such as data transfer to enable swift off-site analysis. While the implementation of radiation monitoring at borders is fully under the jurisdiction of the Finnish Customs, STUK's role is to provide expert advice. This long-standing cooperation involves concept planning, technical specifications and operations: interpretation of alarms and analysis of measurement results. The continuation of Customs officers' bilateral training in radiation detection is covered in chapter 3.3.1.

3.4.2 Radiation detections at borders is typically caused by fertiliser shipments

There were ten radiation detections at borders in 2008, reported to STUK by the Finnish Customs. The detections were typically caused by naturally occurring radionuclides (NORM) in fertilisers and building materials. None were related to nuclear materials.

3.4.3 STUK joined in the Finnish CBRNE Task Force

Since 2008 STUK is represented by two members in the Finnish CBRNE Task Force (Fi-CBRNETF). The Task Force was established to advance measures to deter, prevent, detect and respond to illicit CBRN activities, and to enhance coordination and cooperation between national authorities involved in the counter-CBRN effort. Fi-CBRNETF is lead by the Police Department of the Ministry of the Interior. It has members from ten authorities and it is linked to several other counter-CBRN expert organisations.

3.5 The Finnish National Data Centre for the Comprehensive Nuclear-Test-Ban Treaty

3.5.1 International cooperation is the foundation of CTBT verification

During 2008 the Finnish National Data Centre (FiNDC) participated in meetings of the Working Group B (WGB) of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). WGB is a policy making organ for the technical development of the verification regime. By participating in the work of WGB and its subsidiaries (workshops and expert groups), FiNDC can provide technical expertise to the CTBTO, while also attending to the Finnish national interests.

3.2.2 The analysis pipeline is a well established daily routine

The FiNDC continued developing its own routine monitoring system for the data received from the International Monitoring System's network (IMS). The FiNDC routinely analyses all radionuclide measurement data generated at the IMS radionuclide stations across the world. The IMS network is still developing, and the number of operational air filter stations was about 55 at the end of 2008 (in the final stage there will be 80). The operational stations generated approximately 700 spectra per day for the FiNDC analysis pipeline to handle. The analysis pipeline is linked to the LINSSI database and equipped with an automated alarm system, to enable efficient and fully automated screening of the data.

The number of IMS stations equipped with xenon measurement capabilities was 17 at the end of 2008. Although the IMS xenon systems are still working in a preliminary mode, the FiNDC analyzes also this data. Xenon measurements are especially important for CTBT verification, because xenon, as a noble gas, will leak also from underground tests, which seldom release particulates.

4 Conclusions

The results of STUK's nuclear safeguards inspection activities continued to demonstrate that the Finnish licence holders take good care of their nuclear materials. There were no indications of undeclared materials or activities and the inspected materials and activities were in accordance with the licence holders' declarations. STUK remarked on the nuclear safeguards systems of three licence holders in 2008, setting required actions for them to update the descriptions of their procedures for nuclear material accountancy for and control of the dual use items – i.e. nuclear technology and special equipment – that is in their possession. Neither the International Atomic Energy Agency (IAEA) nor the European Commission made any remarks nor did they present any required actions based on their inspections. By their nuclear materials accountancy and control systems, all license holders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards and non-proliferation. The international inspectorates, the IAEA and the European Commission, were able to reduce their inspection efforts in Finland. The application of integrated safeguards began in Finland on 15 October 2008.

In 2008 STUK performed 31 safeguards inspections at the Finnish nuclear power plants (NPP), 13 at the Loviisa NPP and 18 at the Olkiluoto NPP. The Commission took part in 23 and the IAEA in 24 inspections, too. STUK performed three non-destructive assay (NDA) measurement campaigns, two at the Loviisa NPP and one at the Olkiluoto NPP. At other facilities, STUK performed four safeguards inspections, of which the Commission and the IAEA took part in the Physical Inventory Verification (PIV) at the VTT Research reactor. Also NDA measurements were carried out at the VTT. The new mobile database performed well for its purpose, but instrument failures caused extra maintenance and development tasks. At the underground research premises for the geological repository of spent fuel, STUK performed three safeguards inspections, of which the Euratom took part in one and the IAEA in two inspections. The IAEA carried out complementary access at the University of Helsinki. The IAEA sent its safeguards statements to the Commission, which amended them with its own conclusions and forwarded them to STUK. The conclusions by the Commission were in line with the IAEA's remarks as well as STUK's findings; there were no outstanding questions by the IAEA or the Commission at the end of 2008. Inspections and inspection person days of STUK, the IAEA and the Commission in 2008 are presented in Table 4 (Appendix 2). The development of inspections and inspection person days from 2003 to 2008 are presented in Figures 8 and 9.

The Finnish CBRNE Task Force was established in 2008. STUK is represented by two members. The purpose of the Task Force is to advance measures to deter, prevent, detect and respond to illicit CBRN activities, and to enhance coordination and cooperation between national authorities involved in the counter-CBRN effort. For example, STUK Nuclear Materials Section cooperates closely with the Finnish Customs to offer expert advice in development of radiation monitoring at borders, including training for Customs officers. STUK cooperation programmes in the area of non-proliferation emphasise the importance of the regional nuclear security environment and of peer-to-peer exchanges between the regulatory authorities. Most of the methods of implementing non-proliferation contribute directly also to nuclear security.

A major goal of all current Comprehensive Nuclear-Test-Ban Treaty (CTBT) related activities is the entry into force of the CTBT itself. To reach this goal, major steps have to be taken in the political arena, and an important prerequisite for positive political action is that the verification system of the CTBTO is functioning and able to provide assurance to all parties that it is impossible to make a clandestine nuclear test without getting detected. FiNDC is committed to its own role in the common endeavour so that the verification system of the CTBTO can accomplish its detection task. While still incomplete, the verification system has already demonstrated its potential for detecting nuclear tests.

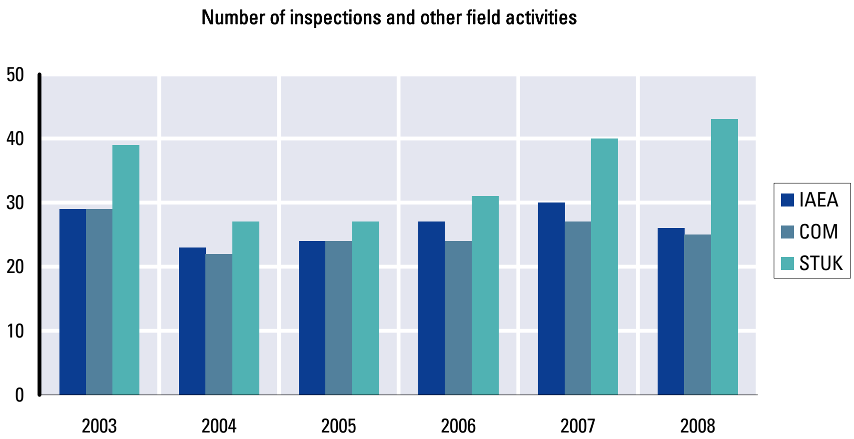

Figure 8. The number of inspections from 2003 to 2008.

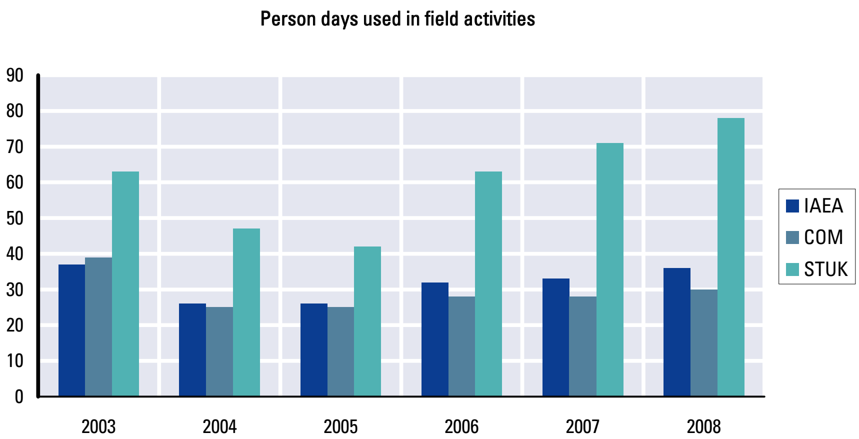

Figure 9. Inspection person days from 2003 to 2008.

5 Publications

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6 Abbreviations and acronyms

ADR
European Agreement concerning the International Carriage of Dangerous Goods by Road

AP
Additional Protocol to the Safeguards Agreement

AQG
Atomic Questions Group of the Council of the European Union

ASTOR
Application of Safeguards to Geological Repositories

BTC
Basic Technical Characteristics

CA
Complementary Access

CBRN
Chemical, biological, radiological and nuclear (such as in “protective measures taken against CBRN weapons or hazards”)

CdZnTe
Cadmium zinc telluride

CTBT
Comprehensive Nuclear-Test-Ban Treaty

CTBTO
Comprehensive Nuclear-Test-Ban Treaty Organization

DIQ
Design Information Questionnaire

DIV
Design Information Verification

DU
Depleted uranium

eFORK
enhanced FORK with a CdZnTe-gamma spectrometer (see FORK)

ES
Environmental Sampling

ESARDA
European Safeguards Research and Development Association

EU
European Union

FA
(1) Facility Attachment according to the Safeguards Agreement (INFCIRC/193), (2) Fuel Assembly

FiNDC
Finnish National Data Centre for the CTBT

FINSP
Finnish Support Programme to the IAEA Safeguards

FORK
Spent fuel verifier with gross gamma and neutron detection

GBUV
Gamma Burnup Verifier

GICNT
Global Initiative for Combating Nuclear Terrorism

HEU
High-enriched uranium

HPGe
High-Purity Germanium

IAEA
International Atomic Energy Agency

IMS
International Monitoring System (of the CTBTO)

INFCIRC
Information Circular (IAEA document type, eg. INFCIRC/193, Safeguards Agreement, or INFCIRC/140, the Non-Proliferation Treaty)

IPPAS
International Physical Protection Advisory Service

IS
Integrated Safeguards

ISSAS
International SSAC Advisory Service

ITWG
International Technical Working Group for combating illicit trafficking of nuclear and other radioactive materials

KMP
Key Measurement Point

LINSSI
an SQL database for gamma-ray spectrometry

MBA
Material Balance Area

MEE
Ministry of Employment and the Economy

NDA
Non-Destructive Assay

NM
Nuclear Material

NPP
Nuclear Power Plant

NPT
The Treaty on the Non-proliferation of Nuclear Weapons (INFCIRC/140, "Non-Proliferation Treaty")

NSG
Nuclear Suppliers' Group

Onkalo
Underground rock characterisation facility (for the final disposal of spent nuclear fuel)

PIV
Physical Inventory Verification

PSP
Particular Safeguards Provisions

PTS
Provisional Technical Secretariat (to the Preparatory Commission of the CTBT)

Pu
Plutonium

RL07
Radionuclide Laboratory to the CTBT hosted by STUK (FIL07)

SA
Subsidiary Arrangements

SAGSI
Standing Advisory Group on Safeguards Implementation

SFAT
Spent Fuel Attribute Tester

SKI
Swedish Nuclear Power Inspectorate, present SSM

SNRI
Short Notice Random Inspection

SSAC
State System of Accounting for and Control of Nuclear Materials

SSM
Swedish Radiation Safety Authority

Th
Thorium

U
Uranium

UI
Unannounced Inspection

UNSC
United Nations Security Council

VTT
Technical Research Centre of Finland

WGB
Working Group B (of the CTBTO)

APPENDIX 1 Nuclear materials in Finland in 2008

Table 1. Summary of nuclear material receipts and shipments in 2008.

To	From	FA	LEU (kg)	Pu (kg)
WOL1	Spain	110	19 483	–
WOL2 (1/3)	Sweden	60	10 371	–
WOL2 (2/3)	Sweden	60	10 360	–
WOL2 (3/3)	Sweden	6	1 036	–
WOLS	WOL1	41	6 783	60
WOLS	WOL1	41	6 780	60
WOLS	WOL2	41	6 884	62
WOLS	WOL2	41	6 871	62
WOLS	WOL2	41	6 885	62
WLOV	Russian Federation	108	12 194	–
WLOV	Russian Federation	81	10 159	–

WOL1, WOL2 & WOLS = Olkiluoto NPP, WLOV = Loviisa NPP, FA = fuel assembly; LEU = low-enriched uranium, Pu = plutonium.
Note: WOL1 and WOL2 shipments are marked only once into the table as WOLS receipts.

Table 2. Fuel assemblies at 31 December 2008.

MBA	FA/SFA *)	LEU (kg)	Pu (kg)
WLOV	4 599/3 781	532 701	4 550
WOL1	1 123/551	191 751	806
WOL2	1 140/568	191 133	837
WOLS	5 863/5 863	994 990	8 298

MBA = material balance area, FA = fuel assembly, SFA = spent fuel assembly

*) FAs in core are accounted as fresh fuel assemblies
(Loviisa 313 FAs and Olkiluoto 500 FAs per reactor)

Table 3. Total amounts of nuclear material at 31 December 2008.

MBA	natural U (kg)	LEU/HEU (kg)	DU (kg)	Plutonium (kg)	Thorium (kg)
WL0V	–	532 702	–	4 550	–
W0L1	–	191 794	– [a)]	807	–
W0L2	–	191 172	–	837	–
W0LS	–	994 990	–	8 298	–
WRRF	1 511	60.1	0.002	–	–
WFRS	44.7	1.4	857	0.003	2.5
WKK0	2 250	–	–	–	–
WHEL	40.4	0.3	20.0	0.003	2.5

MBA = material balance area, WRRF = VTT FiR-1/VTT Processes, WFRS = STUK, WKK0 = OMG Kokkola Chemicals, WHEL = Laboratory of Radiochemistry at the University of Helsinki, U = uranium, LEU =low-enriched uranium, HEU = high-enriched uranium, DU = depleted uranium.

[a)] TVO has ca. 10.3 kg DU samples for training and exhibition purposes at the Olkiluoto NPP.

APPENDIX 2 IAEA, European Commission and STUK safeguards field activities in Finland in 2008

Table 4. IAEA, Commission and STUK safeguards inspections on site.

General information			Inspections			Inspection person days		
MBA	**Date**	**Inspection type**	**IAEA**	**COM**	**STUK**	**IAEA**	**COM**	**STUK**
WLOV	12 February	Routine inspection	1	1	1	2	1	1
ONKALO	13 February	Routine inspection	0	0	1	0	0	1
WOL1,WOL2, WOLS	14–15 February	Routine inspection	3	3	3	6	3	3
Loviisa Site	14 March	Site verification	0	0	1	0	0	1
WOL1, WOL2, WOLS, Olkiluoto site	18 March	System inspection and site verification	0	0	1	0	0	2
WLOV	9 April	Systems inspection	0	0	1	0	0	2
WLOV	6 May	Routine inspection	1	1	1	1	1	1
WOL1,WOL2, WOLS	8–10 May	Routine inspection WOL1, WOLS + PIV WOL2	3	3	3	3	3	3
STUK	20 May	Environmental sampling	0	0	1	0	0	2
HYRL	21 May	Environmental sampling	0	0	1	0	0	2
WOL1,WOL2	23–25 May	Post PIV WOL 2 PIV WOL1	2	2	2	2	2	2
WOL1	10 June	Post-PIV	1	1	1	1	1	1
ONKALO	11 June	As built DIV	0	0	1	0	0	1
VTT	12–13 June	PIV	1	1	1	2	2	2
TVO Helsinki Office	13 June	TVO's international transfers NMAC inspection	0	0	1	0	0	1
WLOV	17 June	System inspection	0	0	1	0	0	2
WLOV	29 July	Routine inspection	1	1	1	1	1	1
WOL1, WOL2, WOLS	31 July – 1 August	Routine inspection	3	3	3	3	3	3
WLOV	16 August	Extra inspection on cask fransfer from reactor hall to SFS	1	0	1	1	0	1
WLOV	9 September	Core verification of LO1	1	1	1	1	1	1
WLOV	27 September	Core verification of LO2	1	1	1	1	1	1
WLOV	13 October	Post-PIV	1	1	1	1	1	1
ONKALO	14 October	As built DIV	0	0	1	0	0	1
WOL1, WOL2, WOLS	16–17 October	Routine inspection WOL1,WOL2, PIV WOLS	3	3	3	3	3	3
WHEL	11 November	Complementary Access	1	1	1	2	1	1
WRRF	20 November	VTT nuclear dual use items	0	0	1	0	0	3
WOLS	25–26 November	Installation of surveillance camera + change of seals	1	1	1	4	4	2
WLOV	27 November	LO2 camera central unit service + change of seals	1	1	1	2	2	1
TRANPORT INSPECTIONS								
TVO Olkiluoto	25–26 February	Transport inspection	0	0	1	0	0	6
Fortum Loviisa	28 October	Transport inspection	0	0	1	0	0	3
NDA MEASUREMENTS								
WLOV	2–3 April	FORK	0	0	1	0	0	6
WOL2	24–26 June	GBUV	0	0	1	0	0	9
WRRF	29 October	UPu, Detective (+ES)	0	0	1	0	0	2
WLOV	11–12 November	Loviisa SFAT	0	0	1	0	0	6
TOTAL			**26**	**25**	**43**	**36**	**30**	**78**

Note: At the Olkiluoto NPP, inspections are counted per MBA. MBA = material balance area, PIV = Physical Inventory Verification, CA = Complementary Access, ES = Environmental Sampling, NM = nuclear material, SFAT/eFORK/GBUV = methods of non-destructive assay.

APPENDIX 3 The staff of STUK's Nuclear Materials Section and Director of Department of Nuclear Waste and Materials Regulation and his Deputy

Table 5. The staff of STUK Nuclear Materials Section and Director of Department of Nuclear Waste and Materials Regulation and his Deputy. All section staff participate in the core safeguards tasks. Additionally, each person has some special areas of expertise to focus on.

Ms. Elina Martikka	Section Head	
Mr. Antero Kuusi	Assistant Inspector	Data bases, non-destructive assay
Mr. Tapani Honkamaa	Senior Inspector	Non-destructive assay, FINSP to the IAEA safeguards
Mr. Marko Hämäläinen	Senior Inspector	Inspection coordination, handbooks, Additional Protocol implementation
Ms. Anna Lahkola	Inspector	Transport of nuclear materials, central accountancy
Mr. Olli Okko	Senior Inspector	Safeguards of research and development, final disposal
Ms. Paula Karhu	Inspector	Nuclear security, environmental sampling, internal audit
Ms. Ritva Kylmälä	Secretary	
Mr. Mikael Moring	Senior Inspector	Finnish National Data Centre for the CTBT, non-destructive assay, environmental sampling
Mr. Tero Varjoranta	Director, Nuclear Waste and Materials	
Ms. Arja Tanninen	Deputy Director	Licensing, permits

Figure 10. Staff of Nuclear Materials Section.

APPENDIX 4 International agreements and national legislation relevant to nuclear safeguards in Finland

Valid legislation, treaties and agreements concerning safeguards of nuclear materials and other nuclear items at the end of 2008 in Finland (Finnish Treaty Series, FTS):

1. The Nuclear Energy Act, 11 December, 1987/990 as amended.

2. The Nuclear Energy Decree, 12 February, 1988/161 as amended.

3. The Treaty on the Non-proliferation of Nuclear Weapons INFCIRC/140 (FTS 11/70).

4. The Agreement with the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article III, (1) and (4) of the Treaty on Non-Proliferation of Nuclear Weapons (INFCIRC/193), 14 September 1997. Valid for Finland from 1 October 1995.

5. The Protocol Additional to the Agreement between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article iii, (1) and (4) of the Treaty on Non-Proliferation of Nuclear Weapons, 22 September 1998. Entered into force on 30 April 2004.

6. The Treaty establishing the European Atomic Energy Community (Euratom Treaty), 25 March 1957:
   - Regulation No 5, amendment of the list in Attachment VI, 22 December 1958
   - Regulation No 9, article 197, point 4 of the Euratom Treaty, on determining concentrations of ores, 2 February 1960.

7. Commission Regulation (Euratom) No 302/2005, 8 February 2005.

8. Council Regulation (EC) No 1334/2000 setting up a Community regime for the control of exports of dual use items and technology as amended.

9. The Agreement with the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy (FTS 16/69). Articles I, II, III and X expired on 20 February 1999.

10. The Agreement with the Government of the Russian Federation (the Soviet Union signed) and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy (FTS 39/69). Articles 1, 2, 3 and 11 expired on 1.12.2004.

11. The Agreement between the Government of the Kingdom of Sweden and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy 580/70 (FTS 41/70). Articles 1, 2 and 3 expired on 5.9.2000.

12. The Agreement between Sweden and Finland concerning guidelines on export of nuclear materials, technology and equipment (FTS 20/83).

13. The Agreement between the Government of Republic of Finland and the Government of Canada and Canada concerning the uses of nuclear materials, equipment, facilities and information transferred between Finland and Canada (FTS 43/76). Substituted to the appropriate extent by the Agreement with the Government of Canada and the European Atomic Energy Community (Euratom) in the peaceful Uses of Atomic Energy, 6 October 1959 as amended.

14. The Agreement on implementation of the Agreement with Finland and Canada concerning the uses of nuclear materials, equipment, facilities and information transferred between Finland and Canada (FTS 43/84).

15. The Agreement between the Government of Republic of Finland and the Government of Australia concerning the transfer of nuclear material between Finland and Australia (FTS2/80). Substituted to the appropriate extent by the Agreement between the Government of Australia and the European Atomic Energy Community concerning transfer of nuclear material from Australia to the European Atomic Energy Community.

16. The Agreement for Cooperation with the Government of the Republic of Finland and the Government of the United States concerning Peaceful Uses of Nuclear Energy (FTS 37/92). Substituted to the appropriate extent by the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy with European Atomic Energy Community and the USA.

17. The Comprehensive Nuclear-Test-Ban Treaty (FTS 15/2001). This treaty was ratified by Finland in 2001, but will not enter into force before it is ratified by all 44 states listed in Annex II of the treaty.