STUK-B 114 / APRIL 2010

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Implementing nuclear non-proliferation in Finland

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

Annual report 2009

Olli Okko (ed)

Säteilyturvakeskus
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Radiation and Nuclear Safety Authority
STUK

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STUK • SÄTEILYTURVAKESKUS
STRÅLSÄKERHETSCENTRALEN
RADIATION AND NUCLEAR SAFETY AUTHORITY

Osoite/Address • Laippatie 4, 00880 Helsinki
Postiosoite / Postal address • PL / P.O.Box 14, FIN-00881 Helsinki, FINLAND
Puh./Tel. (09) 759 881, +358 9 759 881 • Fax (09) 759 88 500, +358 9 759 88 500 • www.stuk.fi

ISBN 978-952-478-529-7 (print) Edita Prima Oy, Finland 2010
ISBN 978-952-478-530-3 (pdf)
ISSN 0781-1713

OKKO Olli (ed). Implementing nuclear non-proliferation in Finland. Regulatory control, international cooperation and the Comprehensive Nuclear-Test-Ban Treaty. Annual report 2009. STUK-B 114. Helsinki 2010. 34 pp. + Appendices 4 pp.

Keywords: nuclear safeguards, regulatory control, comprehensive nuclear-test-ban treaty

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 of nuclear fuel cycle related activities. 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 (EC) 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 maintains a central nuclear materials accountancy system and verifies 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. In 2009 three new license applications submitted for nuclear power reactors were reviewed at STUK to assure the applicants' competence to comply with regulatory requirements, including the non-proliferation obligations. The results of STUK's nuclear safeguards inspection activities in 2009 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 one of the

licence holders in 2009, setting required actions to comply with the descriptions of their procedures for nuclear material accountancy and control systems. The number of the inspection days of the international inspectorates was reduced significantly owing to the new state-level integrated safeguards approach for Finland. Neither the IAEA nor the EC 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.

The Finnish Ministry of Employment and the Economy invited the IAEA to conduct an International Physical Protection Advisory Service (IPPAS) mission in Finland. The IAEA-coordinated team identified good practices and gave recommendations and suggestions for further improvement. The security-related tasks at several departments of STUK were identified, and as a consequence of the mission a new Nuclear Security Section was established at the Nuclear Reactor Regulation Department of STUK. Moreover, a threat analysis for generating the design basis threat (DBT) was initiated as a joint task of the Finnish stakeholders in the fields of nuclear security and safeguards. The resulting DBT will be used to guide the physical protection measures.

The human resources development during 2009 was focused on nuclear forensics and security issues related to nuclear materials control. A joint collaboration agreement was signed between STUK and the Institute of Transuranium Elements (ITU) of the EC Joint Research Centre (JRC). STUK and the Finnish Customs continued the joint multi-year border monitoring development project. The project covers updating technical equipment and operational procedures, and customs officers training.

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).

1.1 International safeguards agreements and national legislation

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 3 for the relevant legislation).

Finland was the first state where an INFCIRC[1]/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 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.

[1] INFCIRC = IAEA Information Circulars

The amendment transferred from STUK and the Ministry of Employment and the Economy to the Ministry for Foreign Affairs the export licensing of nuclear materials and other nuclear dual use items including sensitive nuclear technology.

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) 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 Figure 1 for the organisational chart and Figure 9 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 accountancy of nuclear material 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 a part of the facility's quality system and is reviewed and approved by STUK.

With the basic technical characteristics (BTC) submitted by a license holder as groundwork, the European Commission shall adopt particular safeguards provisions (PSP) for that license holder. 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.

99.8% of all nuclear materials in Finland reside

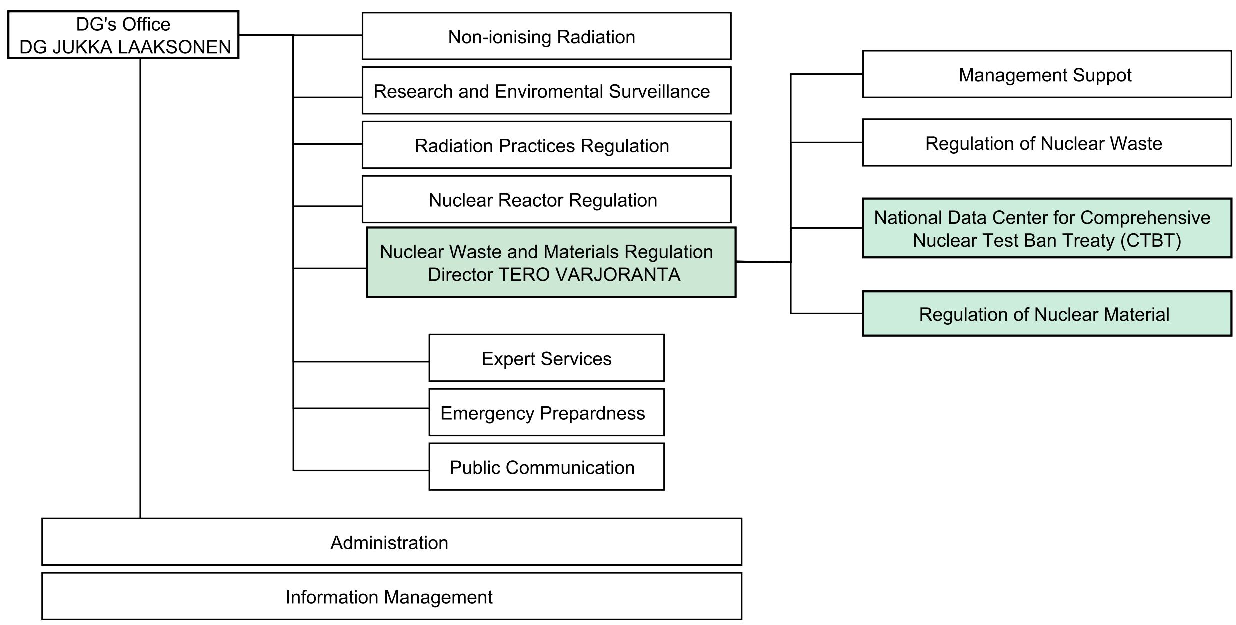

Figure 1. The Nuclear Materials Section and the Finnish National Data Centre for the CTBT within the STUK organisational structure.

at the nuclear power plants (NPP). The nuclear material (uranium, plutonium) amounts in Finland in 1991–2009 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 to the Soviet Union / Russian Federation until 1996 and since then the spent fuel 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, which 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.

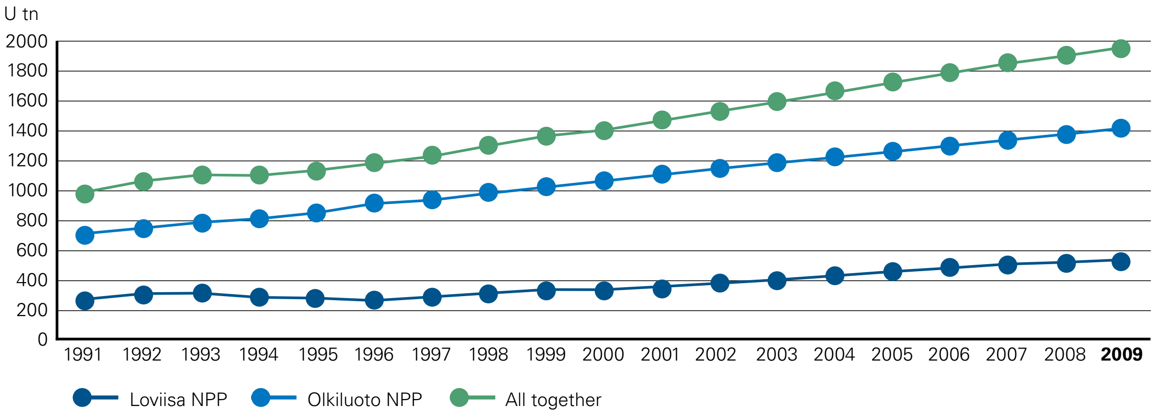

Figure 2. Uranium amount in Finland in 1991–2009.

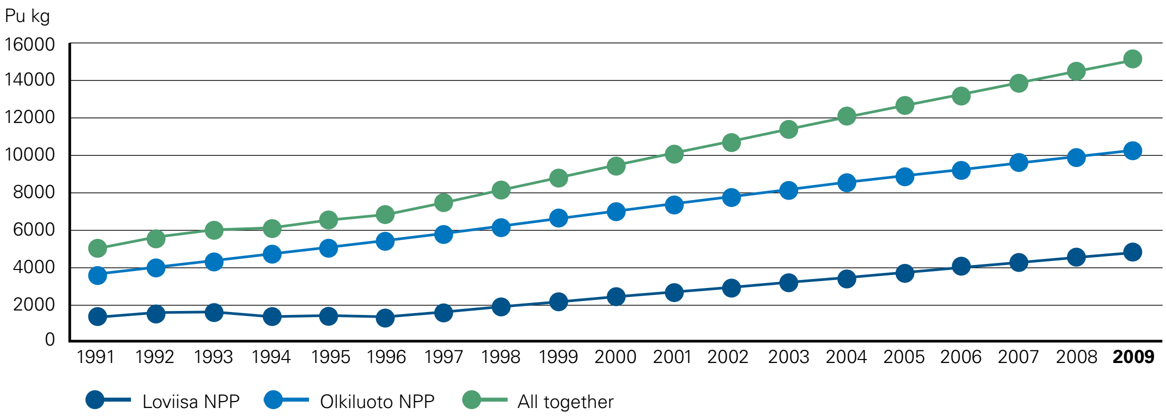

Figure 3. Plutonium amount in Finland in 1991–2009.

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

Teollisuuden Voima Oyj (TVO) owns and operates a nuclear power plant on the Olkiluoto Island 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 facilities other 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 FiR1 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 the Finnish Radiation and Nuclear Safety Authority (STUK), mainly material no longer in use and hence taken into STUK's custody. 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 the whole building where STUK's headquarters are located in Helsinki, 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 does not use nuclear materials as such. However, the by-products of their cobalt purification process contain uranium, which qualifies these by-products as nuclear material. OMG Kokkola Chemicals has an operation license for production, storing and handling nuclear material. 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 has 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

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. Year 2009 introduced a significant change from the traditional safeguards procedures in Finland as the implementation of integrated safeguards began on 15 October 2008. The state-level safeguards approach for Finland reduces the number of annual inspection days of international organisations from 25 days to less than 15, and relies more on the national competent authority. This change is described in detail in Chapter 2.

1.4 Verified declarations for state evaluations

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 has been nominated a site representative, as per European Commission regulation No 302/2005. STUK collects, inspects and reviews the relevant information and then submits the compiled declarations timely to the Commission and the IAEA.

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.

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, as listed in Annex II of the Additional Protocol.

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 are non-destructive assay (NDA) and environmental sampling and satellite imagery.

STUK employs three NDA methods 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. STUK reports to the Commission and the IAEA about the NDA measurement campaigns.

All nuclear materials leave traces of their identity, source of origin and treatment. Safeguards environmental samples (ES) 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. The IAEA may collect independent environmental samples during its complementary access type of inspections.

Satellite imagery is applied to verify the site declaration pursuant to the Additional Protocol. Timely imagery is used to monitor different kinds of activities at the sites or elsewhere in Finland. STUK purchases commercial images and contributes to the work of satellite image analysts of the IAEA and the Commission.

1.5 Export/import control and licensing as elements of nuclear non-proliferation

According to the Finnish Nuclear Energy Act, in addition to nuclear materials also other nuclear fuel cycle related activities are under regulatory control. A license is required for possession, transfer and import of components, equipment, materials and technology suitable for producing nuclear energy (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 and these activities shall be reported to STUK and to the European Commission.

Finland's export control system is based on the EU Council Regulation (EC) No 428/2009 of 5 May 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items. The export of Nuclear Suppliers' Group (NSG) Part 1 and Part 2 items is regulated by the Finnish Act on the Control of Exports of Dual Use Goods. The licensing authority is the Ministry for Foreign Affairs. 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.

1.6 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, STUK is the competent national authority for the regulatory control regarding the transport of radioactive material.

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 such a transport. 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 STUK's contribution to international safeguards development

Nuclear non-proliferation is, by its nature, an international domain. STUK therefore actively participates in international nuclear safeguards related cooperation and development efforts.

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 the final disposal of spent nuclear fuel in geological repositories deepens the cooperation between Finland and Sweden.

1.8 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.

Comprehensive Nuclear-Test-Ban Treaty (CTBT) Status (31.12.2009)

- *CTBT Member States* 182
- *Total Ratifications* 151
- *Annex 2 Ratifications* 35

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 Finnish 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 an IMS seismology station (PS17 in Lahti), and provides analysis of waveform IMS data (Figure 4).

1.9 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 below), it is clear that the majority of the activities that aim at non-proliferation of nuclear weapons, nuclear materials 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, some 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
- advice to the Finnish Customs on radiation monitoring at the borders, in concept development and technical specifications; training for Customs officers
- 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
- 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.

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].*

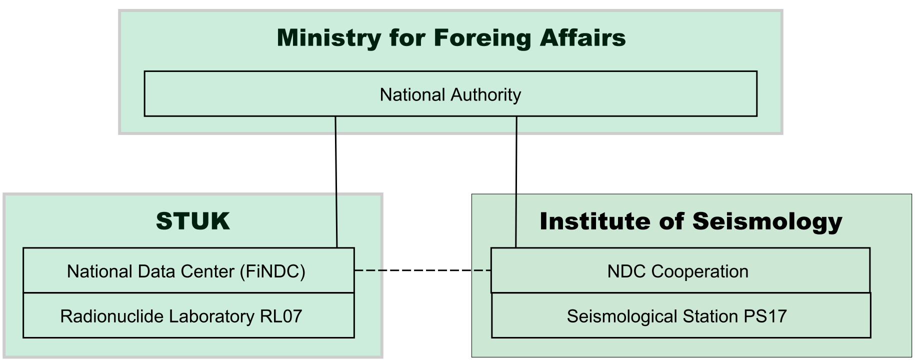

Figure 4. The Finnish CTBT organisation.

2 Themes of the year 2009

2.1 First year with IAEA Integrated Safeguards

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 decreased in 2009 significantly as defined in the state-level safeguards approach for Finland, which was negotiated during 2007 and 2008 (see infobox). The time difference between the unannounced inspections at the two spent fuel storages (i.e. 2 hours for Loviisa and 48 hours for Olkiluoto) is due to the difference in the surveillance at the storages and reasonable access time for a STUK inspector. The notification time will be harmonised to 24 hours after the installation of new surveillance equipment at the Loviisa storage.

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 routine interim inspections decreases. In contrast to this, 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 has 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 since 2007. The implementation procedures were reviewed at four meetings held in Vienna 12 February, 24 June, 5 November, and 10 December 2009, and one meeting held in Luxembourg 17 March 2009. In the meanwhile, the operators updated their handbooks in order to incorporate the necessary actions for the new types of inspections. STUK also increased preparedness for short notice and unannounced inspections and complementary access (unofficially called SNUICA). One of STUK's inspectors is daily prepared to attend, on alert, to a possible IAEA inspection. On 26 February 2009 the IAEA made an unannounced test to assure the performance of the procedures and precautions for the alert of an unannounced inspection.

The number of the IAEA and commission person days is presented in Figure 6. As the result of the new approaches the international organisations performed 11 and 13 inspection days in 2009, which is a significant reduction to the previous

IAEA regular inspections:

Facilities at nuclear power plants (NPP):

- *Physical Inventory Verification (PIV) / Design Information Verification (DIV) 1/year*
- *Random Interim Inspection (RII) at 24/48 h notification (at least 1/year)*

Spent fuel storages at NPPs

- *PIV/DIV 1/year*
- *RII at 2h i.e. Unannounced Inspection (UI)/48h notification (at least 1/year)*

Research reactor and locations outside facilities (LOF)

- *PIV/DIV 1/4-6 years*

New reactor (OL3), under construction

- *DIV and PIV later like at the NPPs*

Repository (Onkalo), under construction

- *PIV/DIV most likely as at SF storages*

Complementary accesses at 2/24 h notification to verify declared activities or to detect undeclared activities.

number of 25–26 inspection days. The on-alert "SNUICA" inspector of STUK attended to two short notice random inspections and to one complementary access. The national State Systems of Accounting for and Control (SSAC) continued with annual routines with approximately 40 inspections, which enabled the reduction in the effort of the international inspectorates. In the future the role of SSAC may be strengthened, e.g. by enabling remote inspections and substituting the international inspectors to a certain extent.

2.2 Applications for new facilities, safeguards in design

Three power companies submitted their application for a Decision-in-Principle to construct new nuclear power plants in Finland. Both existing nuclear power companies TVO and Fortum applied for a new reactor at their power stations; whereas the newcomer, Fennovoima applied for one or two reactors at a new power station site. The company indicated 3 candidates for the new site. Later in the year 2009 the number of potential candidates was reduced to 2, both located on the shoreline of the Bothnian Bay. The nuclear future in Finland was discussed in public during the whole year 2009, and a decision is expected to be prepared at the Ministry for Employment and the Economy in the beginning of 2010. During 2009 STUK reviewed the applications for nuclear safety, security, safeguards etc. as defined in the Nuclear Energy Act. The plan to conduct the non-proliferation control was reviewed by the Nuclear Materials Section.

New applications for a Decision-in-Principle were submitted to the Finnish government by Posiva for the purpose of enlarging the geological repository at Olkiluoto to such an extent that covers the rock volume needed to dispose of the spent fuel of the proposed new reactor units of the owners of Posiva; i.e. the Loviisa 3 and Olkiluoto 4 reactors. The Nuclear Material Section assured that the applicant has the required competence to carry out nuclear non-proliferation control.

The new applications and practices obtained at the current construction sites in Olkiluoto clearly pointed out the need to bring in the safeguards requirement at an early stage of facility design. The early design information is generated, in principle, before the construction, but when planning the installation of containment and surveillance equipment and cabling, some of the desired precautions were missing both at the Olkiluoto 3 and the Onkalo facilities since they were not indicated on the official documents early enough. In order to improve and facilitate the future implementation of safeguards at new facilities STUK joined the Safeguards by Design Support Programme of the IAEA.

2.3 The IPPAS mission to strengthen the non-proliferation and physical protection regimes at STUK

The IAEA provides a service of international advisory missions for the benefit of the state regimes for nuclear safety, security and safeguards. These peer reviews are a way for a state to receive feedback in order to continue development and to create transparency and trust. At the end of 2008 the Finnish Ministry of Employment and the Economy invited the IAEA to conduct an International Physical Protection Advisory Service (IPPAS) mission in Finland. The goal was to get an independent assessment of the national nuclear security infrastructure: of planning, implementation and regulatory control of security in the use of nuclear energy and in the use of radiation. The IAEA-coordinated team carried out the mission – mainly on the state-level arrangements – in the summer of 2009. It identified good practices and gave recommendations and suggestions for further improvement. The cooperation between the security authorities was on a high level, and some suggestions were made to improve and clarify the guidelines and requirements and to focus more to unannounced inspections. The mission was considered useful, and the work is under way to take advantage of its results.

The security-related tasks at several departments of STUK were both self-assessed and reviewed by the IPPAS mission; and as consequence of the mission's recommendations, a new Nuclear Security Section was established at the Nuclear Reactor Regulation Department of STUK. The safeguards-related tasks of the nuclear non-proliferation regime are handled in cooperation with this new office. Moreover, a threat analysis for generating the design basis threat (DBT) was initiated as a joint task of the Finnish stakeholders in the field of nuclear security. These include, in addition to the nuclear stakeholders, the Police Department of the Ministry of the Interior, which is in charge of the Finnish chemical, biological, radiological, and nuclear (CBRN) task force. The purpose of the task force is to advance measures to deter, prevent, detect and respond to illicit CBRN activities.

2.4 RADAR – a joint development project by Finnish Customs and STUK

Cooperation between STUK and the Finnish Customs is close: in 2009 these authorities had a budget of 0.9 M€ to spend on upgrading and investing in new equipment for the use of the Finnish Customs. The project, called RADAR, is expected to continue until 2014. The RADAR project covers maintaining and updating technical equipment, training customs officers, as well as developing operational procedures, such as data transfer to enable swift off-site analysis. While the implementation of radiation monitoring at the Finnish 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.

In 2009 RADAR invested in neutron measurement capability at the Finnish–Russian Border. A number of equipment electronics were also upgraded. A second major investment was purchasing a hand held spectral personal radiation devices (SPRD) for customs use. There were two radiation detections at borders in 2009, reported to STUK by the Finnish Customs. The detections were caused by routine medical nuclides in travellers.

3 Safeguards activities in 2009

3.1 The regulatory control of nuclear materials

The application of integrated safeguards began in Finland on 15 October 2008. Thus, in the year 2009 the number of the IAEA inspections was reduced from the approximately 25 person days to 15. Similarly, the European Commission reduced its inspection activities significantly. STUK continued with national safeguards measures as in the past. Nuclear material inventories at the end of 2009 are shown in Tables 2 and 3 and in Appendix 1. The development of inspections and inspection person days is presented in Figures 5 and 6. Inspections of STUK, the IAEA and the Commission in 2009 are presented in Table 4 (Appendix 2).

3.1.1 Declarations 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 2009. STUK submitted Finland's annual declaration updates to the IAEA on 14 May 2009 as required. In addition STUK submitted the quarterly declarations on

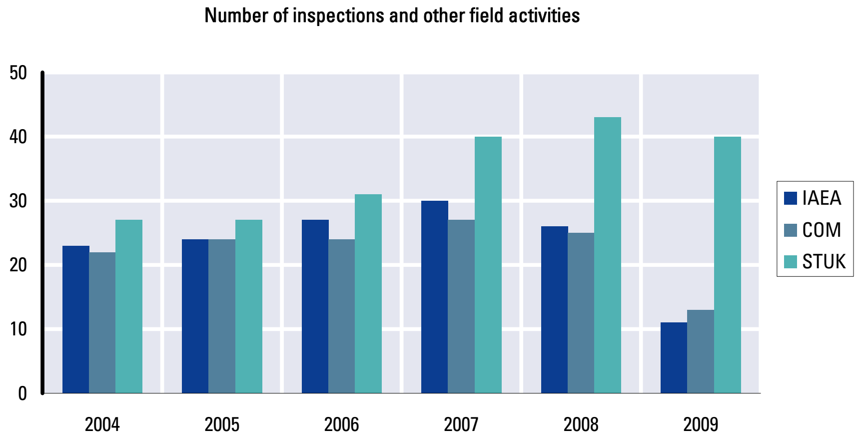

Figure 5. The number of inspections from 2004 to 2009.

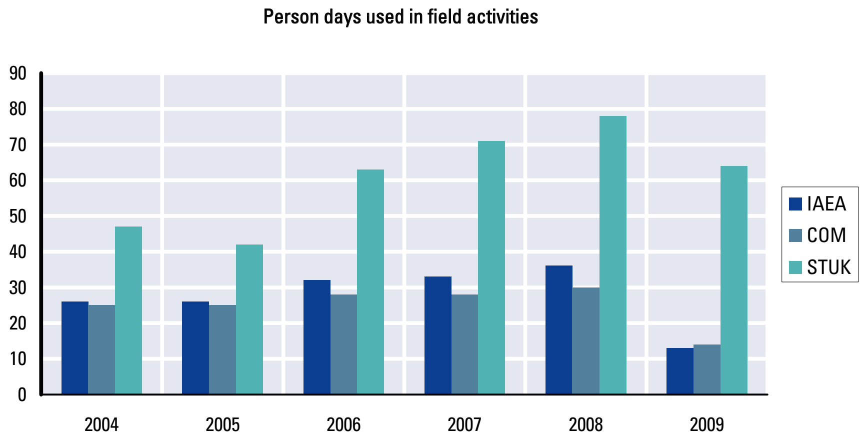

Figure 6. Inspection person days from 2004 to 2009.

exports in February, May, August and November.

In 2009, altogether 44 IAEA and 6 Commission new inspectors were approved to perform inspections at nuclear facilities in Finland. In addition to these, STUK informed the operators about one Commission inspector who had already been approved to Non Nuclear Weapons States.

3.1.2 The Loviisa nuclear power plant site

In 2009, STUK accepted Loviisa nuclear power plant's (NPP) updated nuclear materials handbook. STUK granted the operating company Fortum two import licenses for nuclear dual use items, i.e. instrumentation

The refuelling and maintenance outage of the Loviisa 1 reactor unit took place in the period 23 August – 9 September 2009 and that of the Loviisa 2 reactor unit in the period 12–30 September 2009. Owing to the new integrated safeguards approach for Finland, the IAEA and the Commission performed a pre-inspection with STUK before the outage, on 18 August 2009, and the physical inventory verification (PIV) after the outage, on 6–7 October 2009. During the outage and before the closing of each reactor, STUK identified the fuel assemblies in the reactor cores and item counted the loading ponds. The Loviisa 1 core was inspected on 31 August 2009 and the Loviisa 2 core on 21 September 2009. In addition to the PIV and the core controls, STUK carried out four routine inspections. No IAEA/Commission random interim inspection took place at the Loviisa facility in 2009.

There were a few technical malfunctions and human errors that delayed the refuelling and inspections at the Loviisa facility. During the Loviisa 1 core inspection it was observed that one absorber was missing in the core, although it had been manually reported and inspected by the operator. The failure was noticed the missing assembly moved to its location, and precautions made to avoid the same mistake in the future. Changes in the operator's procedures were requested before the refuelling of the Loviisa 2 unit.

The whole Loviisa 2 core was unloaded to identify leaking fuel assemblies that were observed during the operational period. One leaking fuel assembly was identified and replaced. There were technical shortcomings with the fuel handling machine in the Loviisa 1 unit, wherefore the outage was delayed. During the PIV inspection on 6 October the crane in the spent fuel storage failed, and all of the fuel ponds could not be verified. The non-accessible pond was sealed in order to facilitate a short re-inspection. The crane was repaired by October 20, and the re-inspection will take place 19-20 January 2010. During the inspection new surveillance cameras were installed at the spent fuel storage. This allows changes and simplifications in the integrated safeguards approach for the Loviisa NPP in the future.

At the Loviisa NPP STUK performed two non-destructive assay (NDA) verification measurement campaigns on spent fuel elements in 2009. The first campaign, 24–25 March, was carried out with FORK equipment, which 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. Measurements were made on four spent fuel elements. This was less than the planned number of elements, as equipment malfunction forced an early termination of the measurements. To compensate for this, the number of elements to be measured in the second campaign was increased.

The second NDA campaign, 19–20 August, 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 102 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.

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 2009, although the full PIV was still pending.

3.1.3 The Olkiluoto nuclear power plant site

In 2009, STUK approved one new person to be appointed responsible for nuclear safeguards at the Olkiluoto NPP. During 2009 STUK also granted to the TVO one export and 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 export of two spent fuel rods for research purpose. Furthermore, one licence was granted for transfer of depleted uranium samples to STUK.

The refuelling and maintenance outage of the Olkiluoto 1 reactor unit took place in the period 3–12 May 2009 and that of the Olkiluoto 2 reactor unit in the period 13–30 May 2009. Similarly to the Loviisa NPP, the IAEA and the Commission performed a pre-inspection with STUK 28–29 April 2009, before the outage, and the physical inventory verification (PIV) after the outage, 2–4 June 2009. The IAEA carried out complementary access on 29 April, most likely in order to complete the previous complementary access to the waste treatment buildings at site. In addition, the random interim inspections to Finland were addressed to the Olkiluoto NPP: on 18 March 2009 to the spent fuel storage and on 18 November to the Olkiluoto 2 unit.

During the refuelling and maintenance outage STUK identified the fuel assemblies in the reactor cores and verified/item counted the loading ponds before the reactors were closed. The Olkiluoto 1 reactor was inspected on 9 May 2009 and the Olkiluoto 2 reactor on 27 May 2009. The outage and the core verification at Olkiluoto 2 were delayed for a day and a half owing to a failure in the fuel handling machine. STUK carried out four routine inspections for the Olkiluoto site and each of the material balance areas (MBA) at the Olkiluoto NPP.

At the Olkiluoto NPP STUK performed only one non-destructive assay (NDA) verification measurement campaign on spent fuel elements in 2009. During the campaign STUK performed Gamma Burnup Verification (GBUV) measurements at the Olkiluoto spent fuel storage 15–17 April 2009. Altogether 25 spent fuel assemblies were verified. The results were archived in the mobile version of the NDA measurement database.

A second measurement campaign was planned in Olkiluoto plant using a new tomographic measurement device, which is expected to be able to detect the removal of a single fuel rod from the assembly. Checks of this accuracy are needed before the assembly can be placed in the final repository for spent nuclear fuel, and the new device has been developed especially for this purpose. However, problems in the final phase of preparing the device meant that the planned campaign had to be postponed to early 2010. The measurement campaign performed at the Olkiluoto NPP did not indicate any inconsistencies in the reporting by the operator.

The construction of the new Olkiluoto 3 reactor (OL3) has proceeded to such a stage 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 and officially reported on 4 January 2009 as the first record of the OL3 safeguards diary. TVO prepared a draft for the Basic Technical Characteristics (BTC) of the new unit in 2008. This draft was reviewed by STUK, the IAEA, and the Commission twice in 2008. Thus, the inspectorates have the possibility to plan the surveillance and containment measures in advance. Future actions were, during 2009, waiting for the advancement of the construction of the fuel handling buildings. The official BTC is due at least 200 days before the first consignment of nuclear material is to be received. The commissioning of the OL3 unit is postponed until 2012.

On the basis of its own assessment as well as IAEA and Commission inspection results, STUK concluded that TVO's Olkiluoto NPP has complied with its nuclear safeguards obligations in 2009.

3.1.4 The VTT FiR1 research reactor site

In 2009, STUK approved the VTT FiR1 research reactor's updated nuclear materials handbook and one new person to be appointed responsible for nuclear safeguards at the facility. In 2009 STUK also granted to VTT a license to import plutonium standards material from the IAEA.

Safeguards inspectors from STUK and the European Commission verified the nuclear material inventory of VTT on 3 June 2009. There were some rounding and timing inconsistencies in reporting but the nuclear material inventory was concluded to be correct. STUK remarked that the operator shall update the nuclear materials handbook to cover the bookkeeping and reporting of nuclear items and equipment.

The IAEA carried out complementary access to the VTT site on 4 June 2009, one day after the physical inventory verification (PIV), to confirm the absence of undeclared activities. Most likely this was to confirm the fact that there were significant changes in the building surrounding the research reactor as indicated on the updated declaration. The university part of the building was fully renovated and the former hot cells located in that part of the building were demolished.

The IAEA or the Commission did not have any clarification requests based on their inspection. The inventory of nuclear materials at the FiR1 research reactor in the end of 2009 is presented in Table 3 (Appendix 1). On the basis of its verification and assessment, STUK could conclude that the VTT FiR1 research reactor facility has complied with its nuclear safeguards obligations in 2009. However, the continuous need to remark on the exact compliance with the safeguards procedures as defined in the manuals is noticed.

3.1.5 Minor nuclear material holders

In 2009 STUK granted an operation license to OMG Kokkola Chemicals for producing, storing and handling natural uranium as a by-product of their cobalt purification process. STUK also approved one new person to be appointed responsible for nuclear safeguards at the facility.

The Nuclear Materials Section of STUK approved a new person and a deputy to be appointed responsible for nuclear safeguards at STUK.

Figure 7. Complementary Access to verify the absence of previously declared activities after the dismantling of nuclear activities.

In 2009 STUK inspected the reports from the minor nuclear material holders. 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 2009.

3.1.6 The final disposal facility

In 2009, STUK approved a person to be appointed responsible for nuclear construction at the facility for final disposal of spent nuclear fuel. This person is also responsible for facilitating the safeguards arrangement at the facility. STUK also approved one new person to be appointed responsible for nuclear safeguards at 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 Posiva's Onkalo facility in 2009. The IAEA and the European Commission participated as observers in one of these on-site inspections. 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. Particular attention was paid to the micro seismic monitoring system verifying the absence on undeclared underground activities in the vicinity of the repository.

STUK has declared the Onkalo project within article 2a(x) of the Additional Protocol to the Safeguards Agreement since 2004. The Commission assigned the Material Balance Area (MBA) code W0LF to Onkalo in January 2008. Moreover, following the development of the Design Information Questionnaire (DIQ) for the encapsulation plant and the geological repository at the IAEA in 2008, the Commission prepared the Annex H-I of the safeguards regulation – adopted for the geological repository – for the Basic Technical Characteristics (BTC) in 2009.

Posiva updated its non-proliferation handbook in March 2009 to clarify and update the descriptions of some of Posiva's practices. However, this update did not consider the need to prepare the early Design Information as indicated by the IAEA and the Commission. Therefore, the update was not accepted by STUK. As a consequence, STUK carried out a system inspection on 13 October 2009 and remarked Posiva upon a few organisational and technical descriptions, to be re-written in the handbook. Besides, several meetings were arranged between the Finnish and Swedish parties and the Commission and the IAEA during the year 2009 in order to clarify and facilitate safeguards measures for the final disposal of spent nuclear fuel. Finally in December, STUK forwarded the Basic Technical Characteristics prepared by Posiva to the Commission in order to facilitate the implementation of the IAEA safeguards approaches.

3.1.7 Nuclear dual use items, export licenses

In 2009 the Ministry for Foreign Affairs issued two licences for exporting nuclear software to the Russian Federation and one to Algeria, one for transferring nuclear material to the IAEA and the other to transferring nuclear technology (nuclear information) to Germany.

3.1.8 Transport of nuclear materials

In 2009, fresh nuclear fuel was imported to Finland from Spain, Sweden, Germany and the Russian Federation (Table 1). In relation to these imports, STUK approved four transport plans and inspected two transports of fresh nuclear fuel. A small amount of spent nuclear fuel was transported in Finland in 2009 and for that operation STUK granted a licence and approved a transport plan. The transport was also inspected. Furthermore, STUK approved three package designs for packages to be used in transports of fissile material.

3.1.9 International transfers of nuclear material

In 2009, TVO reported to STUK about its international fuel contracts, fuel transfers and fuel shipments. STUK carried out an on-site inspection where TVO's nuclear material accountancy on the fresh fuel imported in 2009 was verified against the original shipment documents covering the international transfers. The accountancy of the natural uranium in TVO's possession but storied outside of the Olkiluoto NPP site was also inspected. Based on the findings, STUK concluded that TVO has complied with its safeguards obligations in purchasing the nuclear fuel and managing its international transfers.

Figure 8. Presidents of ESARDA at the annual meeting: Göran Dahlin (Past-President), Elina Martikka (President), Kristof Horvath (Vice-President), Jerome Joly (Past-President).

3.2 International developments in safeguards

In the international nuclear safeguards development fora, one major topic during the year 2009 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 2009 by having a member in SAGSI. Safeguards implementation issues considered by SAGSI during the year included Integrated Safeguards issues, furthering the state level safeguards concept, cooperation with State Systems of Accounting for and Control (SSAC), strategic planning, future Safeguards Implementation Report, and a safeguards R&D plan.

In 2009 STUK continued its participation in the European Safeguards Research and Development Association's (ESARDA) working groups and the steering committee meeting. STUK contributed to the 31st Annual Meeting of ESARDA in Vilnius, Lithuania with a large delegation and several presentations. STUK also participated in the ESARDA Executive Board meetings in 2009. At the beginning of 2009 STUK's representative started her two-year term as the President of ESARDA (see Fig. 8). Based on the concepts of Short Notice, Unannounced Inspections and Complementary Access, the term "SNUICA" inspector for the on-alert safeguards inspector was introduced at the Integrated Safeguards Working Group meeting in Stockholm, Sweden 21–22 April 2009 by STUK.

In 2009, the group of experts for Application of Safeguards to Geological Repositories (ASTOR) met at the IAEA in Vienna in June. 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 nuclear fuel. Novel technologies to be applied for safeguards purposes at this new type of facility were presented and discussed during the meeting. Two trilateral meetings between the IAEA, the European Commission, Finland, and Sweden on the implementation of safeguards for geological repositories were held in Vienna on 24 June and on 5 November 2009.

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 2009. The focus in 2009 was on the cooperation with the Russian nuclear security and safeguards authorities, mainly through peer-to-peer exchanges. Collaboration with Ukraine in mutually beneficial areas was re-established in 2008 and an agreement about a programme was made between the State Nuclear Regulatory Committee of Ukraine (SNRCU) and STUK. The focus in 2009 was on the construction of the Mobile Measurement Laboratory to be used by SNRCU.

STUK also participated in the tasks of the cooperation programme between the Swedish Radiation Safety Authority (SSM) and the Ukraine authorities including the SNRCU. Experts from STUK participated in the review and development of the national system of nuclear material accountancy and control and in the non-proliferation education programme in Ukraine.

3.3.1 Cooperation with the Rostechnadzor, Russia

The cooperation programme with the Russian Federation includes the review of Russian norms and guidelines, technical visits to exchange experiences in the implementation of the new norms and the provision of measurement and information technology.

The scope of the work covered physical inventory taking, the evaluation of the results and the assessment of the effectiveness of the nuclear regulatory authority of Russia Rostechnadzor's supervision. In addition, the measurement programmes of the I Rosenergoatom for radioactive substances and waste, as well as the associated quality control programmes were reviewed. The reviewed documents, except the one dealing with the assessment of the effectiveness of supervision, are by now finalized.

The demonstration of the spent fuel attribute tester (SFAT) measurement device for the Rostechnadzor was successfully carried out in November 2008 at the Kola nuclear power plant. The device was returned, as planned, to the Security Technology Laboratory at STUK and is now being tested and prepared for shipment to the Ozersk Office of the Rostechnadzor to be used at the Mayak reprocessing facility.

STUK, together with Rostechnadzor, visited the RADON radioactive waste management and storage complex near Moscow. The safety, security as well as material accountancy and control measures at such a large industrial processing and storage facility were of particular interest during the visit. Similar visit in Finland will be organized in the coming year.

STUK participated in the 4th Russian International Conference on Nuclear Material Protection, Control and Accountancy in Obninsk in October 2009. The conference was convened to review the progress achieved during US-Russia co-operation programme, which is approaching its completion. There was, however, a shared understanding that international cooperation must continue to ensure the sustainability of past work and the mutually beneficial cooperation in the future.

3.3.2 The programme with Ukraine: delivery of mobile laboratory

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.

During 2009 the focus was on manufacturing and delivering a Mobile Laboratory vehicle for the use of the State Nuclear Regulatory Committee of Ukraine (SNRCU). Subsequently, by the end of the year, the experts from the IAEA, Ukraine, Sweden, and the European Commission were getting acquainted with its technical, functional and operative features at STUK. The Mobile Laboratory is by now ready and will be provided to the Authorities in Ukraine via IAEA during the year 2010.

Within the information technology support task, the Electronic Performance Support System (EPSS) for inspectors was developed and demonstrated to the representatives of SNRCU. The required technical documentation was created and the task was completed by December 2009. The system can also be applied in management of future work with training, maintenance and the use of the mobile laboratory in Ukraine.

Additionally, STUK participated in the tasks of the cooperation programme between Sweden's SSM and the Ukraine authorities, including SNRCU. Experts from STUK participated in the review and development of the national system of nuclear material accountancy and control and in the non-proliferation education programme activities in Odessa in July and in Sevastopol in September 2009.

3.3.3 Baltic Sea regional workshop on illicit nuclear trafficking

The first regional workshop on illicit nuclear trafficking was organized by IAEA and STUK in Hyvinkää, Finland, 8–11 June 2009. The participants represented police, border and customs authorities from the Baltic Sea countries and from Belarus, Ukraine, Moldova and Turkey. Representatives of the European Commission and the Council of the Baltic Sea States (CBSS) participated as well. During the workshop, IAEA disseminated information about its services that are aimed at strengthening the measures used to combat illicit trafficking. The participants exchanged experiences in implementing security functions, with the particular focus being on cooperation between different law enforcement authorities. The Rostechnadzor, the nuclear regulatory authority of Russia, also participated in the workshop.

The workshop proved a success and may well result in more concrete collaboration of different law enforcement authorities in the region, particularly in the areas of infrastructure development, regulatory system enhancement, detection technology procurement and application, training exercises, and securing financial support. The results have been presented to the CBSS Secretariat in Stockholm and will be provided to the relevant parties, including the Expert Groups, for their consideration and decisions. The results of the Workshop were also reviewed at the IAEA in November 2009 and will be used in the planning a similar workshop in the Black Sea area.

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

3.4.1 International cooperation is the foundation of CTBT verification

During 2009 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), the FiNDC can provide technical expertise to the CTBTO, while also attending to the Finnish national interests.

3.4.2 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 58 at the end of 2009 (at the final stage there will be 80). The operational stations generated approximately 700 gamma 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 21 at the end of 2009. 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, often leaks also from underground tests, which seldom release particulate matter.

3.4.3 The DPRK Test 2010

The underground nuclear test performed by the Democratic People's Republic of Korea (DPRK) on 25 May 2010 was readily detected by the CTBT network of seismic stations. However, seismic data alone cannot give unquestionable proof of the nuclear nature of an explosion. This test was well contained and did not release radionuclide particles or even gases in such amounts that these would have been detected at any IMS station. Nor has any other party reported publicly about any such detection. Thus the nuclear nature of this explosion can only be deduced from the self declaration of the DPRK and the enormous difficulties in achieving an explosion of this magnitude using chemical explosives. If the treaty had been in force, the exact nature of the test would almost certainly have been revealed during an on-site inspection.

For just over a week after the test FiNDC delivered daily status reports generated by the CTBTO and the FiNDC to our collaborators. This was done while key staff was travelling abroad, and succeeded due to fully utilizing the global communications networks and our automated analysis tools.

3.4.4 CTBT OSI equipment testing at Onkalo

The On Site Inspection (OSI) division of the Provisional Technical Secretariat (PTS) of the CTBTO arranged an equipment test exercise at Posiva's Onkalo site and in its vicinity. During the exercise, which lasted almost two weeks in July-August, the PTS was able to test their seismic and other ground sensing equipments against the explosions of the tunnel construction blasts, which resemble the aftershocks of a nuclear test deep in the underground. The test was successful and the PTS gained valuable experience of their equipment and procedures. STUK played an active part in establishing contact between the PTS and Posiva and thus facilitating the exercise within the CTBT framework.

4 Human resources development

Nuclear safeguards by the Nuclear Materials Section of STUK cover all typical measures of a State System of Accounting for and Control of Nuclear Materials (SSAC), and many other activities besides. The nuclear fuel cycle related activities, e.g. research and development activities not involving nuclear material and manufacture of certain equipment as defined it the Additional Protocol have enlarged the scope of traditional safeguards. 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). Continuous analysis of the developments in the involved fields of both technology and politics is a daily, multidisciplinary task at the STUK Nuclear Materials Section.

The personnel's competence is systematically developed taking into account the needs of the organisation and the wishes of the individuals (see Figure 9). Those aiming at an expert's career are valued as highly as those interested in managerial duties. At the Nuclear Materials Section, the management participated in the general course for managers at government organisations provided by the Finnish Institute of Public Management. The internal training programme of the section continued, and experts participated in a few international courses. During 2009 the main focus was in nuclear forensics and security related training courses.

The internal training programme of safeguards inspectors at STUK continued in 2009. There were a total of eight seminar lectures arranged at STUK, where a variety of topics such as nuclear security, nuclear material transports and the final disposal of spent nuclear fuel were addressed. The safeguards inspectors also gave safeguards related training to the other STUK inspectors, who work mainly with nuclear safety. Moreover, one seminar concentrated on the current issues of nuclear non-proliferation and was held in cooperation with the Ministry for Foreign Affairs.

STUK participated in the workshop on Human Capital Development in Ispra, Italy in September 2009. The purpose of the meeting was to collect information and coordinate training on safeguards and non-proliferation issues in the world. This joint workshop was organised by the European Commission (EC) Joint Research Centre (JRC) Ispra and the Department of Energy in the USA. JRC and USA have cooperated for a long time to combine safeguards and security training for all those who need this type of training. In the meeting there were about 50 participants from USA, China, Japan, Republic of Korea, Belgium, Lithuania, Russia, Israel, France, Germany, Italy, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC), the EC and the IAEA. In September STUK participated also in the "Training session on the detection of illicit trafficking of radioactive and nuclear materials" at JRC Ispra. The purpose of the meeting was to map the Member States needs for nuclear security training, for example training for the Customs and Border Control officers. The RADAR project to educate and train Finnish Custom officers benefits from the co-operation established with the Joint Research Centre.

Three experts from the Nuclear Materials Section participated in a three day training exercise on detecting and analysing nuclear materials using gamma spectrometric tools at the Institute for Transuranium Elements (ITU) of the EC Joint Research Centre (JRC) in Karlsruhe. The training was shared with the Security Technology Laboratory of STUK and arranged so that the trainees could train with their own equipment. This way, the training did not only heighten the theoretical knowledge of the group, but greatly enhanced the practical ability of the team to respond in real situations.

Later in the year one expert participated in a workshop on nuclear forensics at the same institute. This workshop heightened our awareness of tools and methods available for nuclear forensics and was a part of setting up the collaboration between ITU and STUK.

Two STUK experts participated in the IAEA International Training Course ITC-21, Physical Protection of Nuclear Material and Facilities, at the Sandia National Laboratories, Albuquerque, NM. The 3-week long training concentrated on the systematic performance-based approach to the definition, design and evaluation of the requirements for physical protections.

In view of the possible emergency response duties, one expert took part in the Empire 2009 exercise in Albany, NY as an observer. This exercise gave insight into the demands on radiation authorities and requirements for working environments in a large scale radiological emergency.

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

Figure 9. The staff of STUK's Nuclear Materials Section.

5 Conclusions

The implementation of the International Atomic Energy Agency (IAEA) integrated safeguards began in Finland on 15 October 2008. Thus, the year 2009 was the first whole year with the new approach. The number of IAEA inspection days was reduced from the approximately 25 person days per year of the past to 13. Similarly, the European Commission reduced its inspection activities to 14. STUK continued with national safeguards measures and activities with 64 inspection days and 40 inspections. In order to be present at the short notice IAEA inspections, agreed to compensate for the reduced number of routine inspections, STUK raised preparedness to have a daily on-the-alert inspector.

In 2009 STUK performed 15 safeguards inspections at the Finnish nuclear power plants (NPP), six at the Loviisa NPP and nine at the Olkiluoto NPP. The Commission and the IAEA took part in seven of these inspections. STUK performed three non-destructive assay 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 took part in the physical inventory verification at the VTT research reactor. At the underground research premises for the geological repository of spent nuclear fuel, STUK performed three safeguards inspections, of which the IAEA and the Euratom took part in one inspection. The IAEA carried out complementary access to the Olkiluoto nuclear power plant site and the VTT research reactor nuclear site to verify declared activities and the absence of undeclared activities. 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 2009.

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 one of the licence holders in 2009, requiring them to update the descriptions of their nuclear material accountancy procedures and control systems for the nuclear technology and dual use equipment. The main concern was about the compliance with the reporting timelines at the research reactor facility. Neither the IAEA nor the 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 Commission – were able to considerably reduce their inspection efforts in Finland.

The purpose of the Finnish chemical, biological, radiological, and nuclear (CBRN) 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. The International Physical Protection Advisory Service (IPPAS) mission provided by the IAEA to

Finland made suggestion to improve some practices. As a consequence of the mission's recommendations, a new Nuclear Security Section was established at the Nuclear Reactor Regulation Department of STUK.

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. 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. While still incomplete, the verification system has already demonstrated its potential for detecting nuclear tests. During the year 2009 the performance of the system was validated after the DPKR test on 25 May 2009.

6 Publications

Honkamaa T. Response to IAEA "Vision 20/20" – What the SSAC could do to support IAEA to achieve its mission. ESARDA 31th Annual Meeting, Vilnius Lithuania, 26–28 May 2009, Paper 077, 4 p.

Honkamaa T. Border radioactivity monitoring upgrading project in Finland. In: Proceedings of the 50th Annual Meeting of the Institute of Nuclear Material Management (INMM). 2009, July 13–16; Tucson, Arizona USA.

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Kuusi A, Honkamaa T, Moring M. Spent fuel verification and continuity of knowledge through centuries. ESARDA 31th Annual Meeting, Vilnius Lithuania, 26–28 May 2009, Paper 067, 7 p.

Martikka E. 40 Years of ESARDA: Safeguards made to order. ESARDA 31th Annual Meeting, Vilnius Lithuania, 26–28 May 2009, Invited Paper.

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Rautjärvi, J. "International safeguards – Basic values, institutional performance and future expectations" ESARDA 31th Annual Meeting, Vilnius Lithuania, 26–28 May 2009, Paper 024, 5 p.

Smolander P, Toivonen H, Pelikan A, Karhunen T, Salonen T. Mobile radiation measurement system with remote data handling and analysis. In: Maatela P, Korpela S (eds.). Symposium Proceedings. NBC 2009. 7th Symposium on CBRNE threats. 8–11 June, 2009, Jyväskylä, Finland. Defence Forces Technical Research Centre, Publications 18. Helsinki: Defence Forces Technical Research Centre; 2009. p. 135–138.

Turunen J., Ihantola S., Peräjärvi K., Pöllänen R., Toivonen H. Non-destructive characterization of radioactive particles in safeguard samples ESARDA 31th Annual Meeting, Vilnius Lithuania, 26–28 May 2009, Paper 025, 4 p.

7 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

SNRCU
State Nuclear Regulatory Commission of Ukraine

SNRI
Short Notice Random Inspection

SNUICA
Short notice, unannounced inspection, complementary access on-alert inspector

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 2009

Table 1. Summary of nuclear material receipts and shipments in 2009.

To	From	FA	LEU (kg)	Pu (kg)
WOL1	Spain	116	20 526	–
WOL1	Germany	8	1 389	–
WOL2 (1/2)	Sweden	60	10 373	–
WOL2 (2/2)	Sweden	56	9 682	–
WOLS	WOL1	41	6 777	59
WOLS	WOL1	41	6 775	59
WOLS	WOL1	41	6 773	59
WOLS	WOL2	41	6 887	61
WOLS	WOL2	41	6 869	61
WOLS	WOL2	41	6 859	61
WLOV	Russian Federation	72	9 070	–

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 2009.

MBA	FA/SFA *)	LEU (kg)	Pu (kg)
WLOV	4 671/3 973	540 476	4 809
WOL1	1 083/501	185 473	745
WOL2	1 133/559	189 554	818
WOLS	6 150/6 150	1042 712	8 709

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)
WLOV	–	540 477	–	4 809	–
WOL1	–	185 521	–	745	–
WOL2	–	189 593	–	818	–
WOLS	–	1042 712	–	8 709	–
WRRF	1 511	60.1	0.002	–	–
WFRS	44.7	1.4	1023	0.003	2.5
WKKO	2 250	–	–	–	–
WHEL	41.2	0.3	20.0	0.003	3.0
Minor holders	0.2	0.00116	997	< 0.01	0.142

MBA = material balance area, WRRF = VTT FiR-1/VTT Processes, WFRS = STUK, WKKO = 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.

APPENDIX 2 IAEA, European Commission and STUK safeguards field activities in 2009 in Finland

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, Loviisa site	3 March	Routine inspection + site (verification of declaration)	0	0	1	0	0	3
ONKALO	3 March	As built DIV	0	0	1	0	0	2
WOL1,WOL2, WOLS, Olkiluoto site	4 March	Routine inspection + site (verification of declaration)	0	0	3	0	0	6
WOLS	18 March	SNRI	1	1	1	1	1	1
VTT site	19 March	Site (verification of declaration)	0	0	1	0	0	1
HYRL site	24 March	Site (verification of declaration)	0	0	1	0	0	1
STUK site	25 March	Site (verification of declaration)	0	0	1	0	0	1
WOL1,WOL2	28–29 April	Pre-PIV WOL1, WOL2	2	2	2	2	2	2
Olkiluoto site	29 April	Complementary Access (CA)	1	1	1	1	1	1
WOL1	9 May	CV	0	0	1	0	0	1
WOL2	27 May	CV	0	0	1	0	0	1
WOL1, WOL2, WOLS	2–4 June	Post-PIV (WOL1, WOL2) and PIV (WOLS)	3	3	3	3	3	3
WFRS	2 June	PIV	0	1	1	0	1	1
WRRF	3 June	PIV	0	1	1	0	1	1
VTT site	4 June	Complementary Access (CA)	1	1	1	2	1	1
ONKALO	12 June	As built DIV	0	0	1	0	0	2
WLOV	23 June	Routine inspection	0	0	1	0	0	1
WLOV	18 August	Pre-PIV	1	1	1	1	1	1
WLOV	31 August.	CV of LO1	0	0	1	0	0	1
WLOV	21 September	CV of LO2	0	0	1	0	0	1
TVO Helsinki Office	25 September	TVO's international transfers NMAC inspection	0	0	1	0	0	2
WLOV	6–7 October	Post-PIV	1	1	1	2	2	2
WOL1, WOL2, WOLS	12 October	Routine inspection	0	0	3	0	0	3
ONKALO	13 October	As built DIV + system inspection	0	0	2	0	0	3
WOL2	18 November	SNRI	1	1	1	1	1	1
TRANPORT INSPECTIONS								
TVO Olkiluoto	2 March	Transport inspection	0	0	1	0	0	2
TVO Olkiluoto	17 December	Transport inspection	0	0	1	0	0	1
NDA MEASUREMENTS								
WLOV	24 March	FORK	0	0	1	0	0	2
WOL2	15–17 April	GBUV	0	0	1	0	0	9
WLOV	19–20 August	SFAT + ES	0	0	2	0	0	6
TOTAL			**11**	**13**	**40**	**13**	**14**	**64**

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 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 2009 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 428/2009 setting up a Community regime for the control of exports, transfer, brokering, and transit of dual use items.

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.