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Implementing nuclear non-proliferation in Finland

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

Annual report 2015

Olli Okko (ed)

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Executive summary

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

The results of STUK's nuclear safeguards inspection activities in 2015 continued to demonstrate that the 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 stakeholders' declarations.

Safeguards are applied to nuclear materials and activities that can lead to the proliferation of nuclear weapons. These safeguards include nuclear materials accountancy, control, security and the 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 “licence holders” or “operators”– and the state authority. A licence holder shall take good care of its nuclear materials and the state authority shall provide the regulatory control to ensure that the licence holder fulfils the requirements. The control of nuclear expert organisations, technology holders and suppliers, to ensure the non-proliferation of sensitive technology, is also a growing global challenge for all stakeholders. In Finnish legislation, all these stakeholders are dealt with as users of nuclear energy. At the end of 2013, the revised STUK requirements were published as regulatory guides on nuclear safety, security and safeguards, called YVL guides. According to the Guide YVL D.1 Regulatory Control of Nuclear Safeguards all the stakeholders were requested to prepare their safeguards manuals as a part of their quality managements systems. During 2015, in total 19 draft manuals were submitted to STUK, and 14 of those were approved.

Finland has quite significant nuclear power production, but the related nuclear industry is rather limited. Most of the declared nuclear materials (uranium, plutonium and thorium) in Finland reside at the nuclear power plants in Olkiluoto and Loviisa. Additionally, there is the research reactor in Espoo, as well as a dozen minor nuclear material holders in Finland. Nuclear dual-use items and instrumentation for the Olkiluoto 3 reactor under construction are being imported and installed. The import licences are reviewed as applicable to ensure the peaceful use of the technology. The International Atomic Energy Agency (IAEA) and the European Commission made their site visits to the construction site prior to the installation of safeguards instrumentation and fuel delivery.

The planning and design of the Olkiluoto 4 reactor and a new nuclear power plant site, Hanhikivi in Pyhäjoki, were authorised in 2010. The safeguards systems for these new reactors shall be designed together with facility design and development. Similarly to the Olkiluoto 3 reactor that is under construction, the import licences for the new facilities

are reviewed as applicable to ensure the peaceful use of the technology and sensitive information. The operators submitted the preliminary Basic Technical Characteristics to the European Commission and obtained Material Balance Area codes for the future reactors before the vendor companies were selected. During 2015, the construction licence application for the new Hanhikivi plant was submitted to the Government. The authorisation of the Olkiluoto 4 unit expired as the operator did not apply for the construction licence within the 5 year period of validity of the authorisation, i.e. the Decision-in-Principle by the Government, so the material balance area code was also withdrawn. The research reactor was shut down in 2015 and the preparations for decommissioning continue in Espoo. On the other hand, in order to continue research activities, the new VTT Centre for Nuclear Safety was under construction at the research campus in Espoo.

Uranium production as one of the by-products of nickel at the Talvivaara mine was given approval by the Government in accordance with the nuclear energy legislation in March 2012. In 2013, the mining company constructed the uranium extraction plant, but the Supreme Administrative Court rescinded the approval, owing to claims of environmental and economic issues in December 2013 before the commissioning of the plant. The difficulties continued in 2014, and finally in November 2014 Talvivaara Sotkamo Ltd. filed for bankruptcy. During 2015 a new operator, Terrafame Mining Oy took over the mining and milling activities, but no uranium extraction nor safeguards activities took place at Talvivaara. Currently, uranium residuals are extracted from the nickel at Harjavalta Nickel Refinery and at Freeport Cobalt in Kokkola, and reported to STUK and to the European Commission.

STUK maintains a national nuclear materials accountancy system and verifies that nuclear activities in Finland are carried out in accordance with the Finnish Nuclear Energy Act and Decree, European Union Safeguards Regulation and international agreements. These tasks are performed to verify that Finland can assure itself and the international community of the absence of undeclared nuclear activities and materials. In addition to this, the IAEA evaluates the success of the state safeguards system, and the European Commission participates in safeguarding the materials under its jurisdiction.

The application for the construction licence for the disposal facility, which consists of the encapsulation plant and the geological repository, was submitted to the Government in December 2012. During 2013 and 2014, the IAEA and the Commission defined the requirements for the safeguards equipment for the encapsulation plant in an interactive process with STUK and Posiva. These needs were included in the STUK statement and safety evaluation concerning the construction licence application finalised in February 2015. In November 2015 the Government granted the construction licence. In the meanwhile, the detailed design of the facility was updated resulting in the continuation of the planning of the safeguards system.

The number of the routine inspection days of the international inspectorates has been reduced significantly due to the state-level safeguards approach for Finland, which has been in force since 2008. The number of international inspection days per year is approximately 25. Neither the IAEA nor the Commission made any remarks nor did they present any required actions based on their inspections during 2015. By means of their nuclear materials accountancy and control systems, the stakeholders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards. In safeguards, STUK continues with 40 annual inspections and 60 inspection days. In 2014, the number of inspection days was significantly higher owing to the extensive survey campaign to verify the design of the planned geological repository, called Onkalo. In 2015 a concise survey campaign was carried out at Onkalo resulting in an increased number of inspection days since 2013. The number of annual inspection days for nuclear material holders has remained at 20 days per international inspectorate.

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) in the CTBT International Monitoring Network (IMS). The main task of the FiNDC is to inspect data received from the International Monitoring System 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 detection. 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.

The human resources development at the Nuclear Materials Section during 2015 was focused on nuclear material control: in particular, information security issues were addressed. This was partly due to the need to regulate the construction of the disposal facility for spent nuclear fuel at the Olkiluoto repository site.

In addition, STUK contributed to educational workshops and training courses for authorities who represent nuclear newcomers: countries that aim at uranium production or nuclear power in cooperation with the IAEA. STUK and Finnish Customs continued the joint multi-year border monitoring development project. The project covers customs officers training as well as the updating of technical equipment and of operational procedures.
In 2014, the partnerships programme between King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Kingdom of Saudi Arabia, and STUK began supporting the establishment of the Saudi Arabia's regulatory authority in relation to its nuclear energy programme. In the field of safeguards and nuclear security, STUK's safeguards and security experts continued practical cooperation with their colleagues at K.A.CARE.

Contents

1 Nuclear non-proliferation implementation in Finland

The regulatory control of nuclear materials is a prerequisite for the peaceful use of nuclear energy in Finland. In order for Finland to have 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 represent an integral part of nuclear safety and nuclear security and are applied to both 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 monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT).

In Finland, STUK is the regulatory authority with regard to the implementation of nuclear non-proliferation. In November 2012, a new STUK strategy for the period 2013–2017 was announced, and the organisation was renewed to support the implementation of the new strategy. In 2013, STUK was reorganised to implement the strategy, and furthermore in 2015 to achieve effectiveness requirements set by the Government. These changes did not considerably affect the mandatory implementation of non-proliferation control at STUK, but they provide framework for the interaction between nuclear safety, security and safeguards. Parallel to this, STUK requirement documents, the YVL guides were under renewal and were finally issued on 1 December 2013. STUK safeguards requirements concerning nuclear material accountancy, safeguards-based procedures and the implementation of the Additional Protocol are merged in one regulatory guide D.1 Regulatory Control of Nuclear Safeguards. This instructs all stakeholders in the Finnish nuclear field in how to comply with the current national and international safeguards regulations. During 2014, the licence holders were obliged to review their manuals and evaluate how the requirements can be implemented. During 2015, STUK made decisions on the implementation practices for the licence holders. Also, the manuals prepared by other stakeholders were reviewed and approved for the implementation of safeguards.

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 the peaceful use of nuclear energy. When Finland joined the EU, the bilateral agreements with Australia, Canada and the USA were partly substituted with the corresponding Euratom agreements (see Appendix 3 for the relevant legislation).

In 2015, two new agreements on cooperation in peaceful uses of nuclear energy for Finland entered into force, one with Republic of Korea and the other one with the Russian Federation. Both of these agreements cover cooperation in scientific and applied research, exchange of scientific and technological information, transfer of nuclear material, non-nuclear material, equipment and technology as well as provision of relevant technological consultancy and services. In addition, the new agreement with Russian also includes provisions for nuclear liability. That is a new feature which was not included in the old agreement, which expired in 2004. The third agreement was signed with the Kingdom of Saudi Arabia. The ratification of this agreement is in progress.

Finland was the first state where an INFCIRC[1]/153-type comprehensive 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 on 30 April 2004, once 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 the EU as a Member State and thereby subjected itself to the Euratom nuclear safeguards, a comprehensive national safeguards system was still maintained and further developed. The basic motivation for this is the responsibility assumed by Finland for its nuclear safeguards and nuclear security under the obligations of the NPT, and also to ensure fulfilment of the Euratom requirements.

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 and generation of design information for new facilities was introduced from STUK requirements into the Nuclear Energy Decree.

In 2015, the Nuclear Energy Act was amended on 1 July in such a way that the Government Decrees on nuclear safety, nuclear waste management, emergency preparedness and nuclear security were replaced by new STUK Regulations. Parallel to this, a new regulation was issued on mining and milling aiming at the production of uranium or thorium. Some general features such as on radiation doses were introduced from the old Government Decrees into the Nuclear Energy Decree, but most of the detailed requirements were included in the new STUK Regulations that entered into force on 1 January 2016 parallel to the amendment of the Nuclear Energy Decree.

As stipulated by the Act, STUK issues detailed requirements (the YVL Guides) on safety, security and safeguards that apply to the use of nuclear energy. STUK's safeguards requirements for all users of nuclear energy during all phases of the nuclear fuel cycle are set in YVL Guide D.1 Regulatory Control of Nuclear Safeguards. Areas covered in the new comprehensive guide include the obligations and measures stemming from the Additional Protocol for the Safeguards Agreement and from recent developments. All stakeholders must describe their own safeguards system in written form (as a nuclear materials handbook or safeguards manual), in order to ease their task of fulfilling their obligations and to guarantee the effective and comprehensive operation of the national safeguards system. In the new guide, there are also specific national requirements for the disposal of spent nuclear fuel in a geological repository. In general, nuclear safeguards control applies to:

- nuclear material (special fissionable material and source material)
- nuclear dual-use items (non-nuclear materials, components, equipment and technology suitable for producing nuclear energy or nuclear weapons as specified in INFCIRC/254, Part 1)
- licence holders' activities, expertise, preparedness and competence including information security
- R&D and other activities related to the nuclear fuel cycle as defined in the Additional Protocol
- design and construction of new nuclear facilities.

[1] INFCIRC = IAEA Information Circulars

1.2 Parties of the Finnish nuclear safeguards system

The main parties involved in the Finnish nuclear safeguards system are the authorities and the stakeholders. Undistributed responsibility for the safety, security and safeguards of the use of nuclear energy rests with the stakeholder. It is the responsibility of STUK as the regulatory state authority to ensure that the licence holders and all other stakeholders in the nuclear field comply with the requirements of the law and the nuclear safeguards agreements. To complement the national effort, international control is necessary in order to demonstrate credibility and the proper functioning of the national safeguards system.

1.2.1 Ministries

The Ministry for Foreign Affairs (MFA) is responsible for national non-proliferation policy and international agreements. The MFA is responsible for the export control of nuclear materials and other nuclear dual-use items, including sensitive nuclear technology. The Ministry of Employment and the Economy (MEE) is responsible for the supreme command and control of nuclear matters. MEE is responsible for the legislation related to nuclear energy and is also the competent authority mentioned in the Euratom Treaty. Other ministries as well, 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

As per the Finnish nuclear legislation, STUK is responsible for maintaining the national nuclear safeguards system in order to prevent the proliferation of nuclear weapons. STUK regulates the stakeholders' activities and ensures that the obligations of international agreements concerning the 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 materials and nuclear dual-use items. STUK is in charge of Finland's approval and consultation process for inspectors from the IAEA and the European Commission.

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), together with many other activities. STUK reviews the stakeholders' reports (operational notifications, inventory reports), inspects their accountancy, facilities and transport arrangements on site, and performs system audits. 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, physical protection

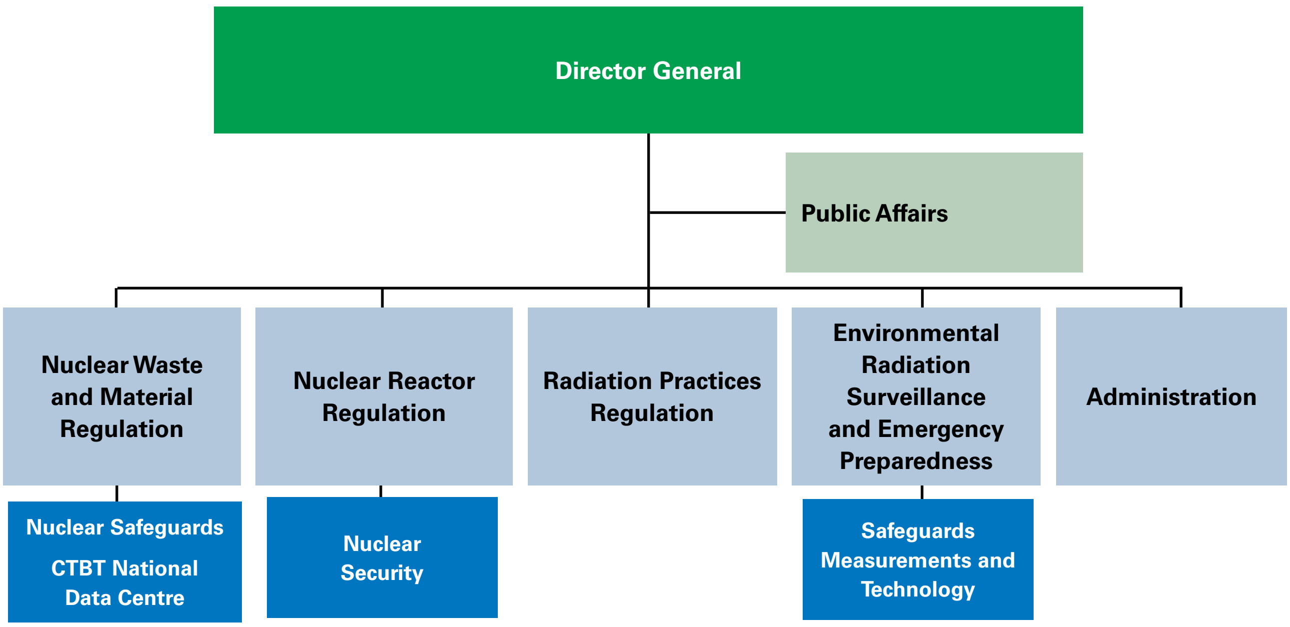

Figure 1. Non-proliferation framework in STUK's organisation.

Table 1. Status of regulatory documents for material balance areas in Finland at the end of 2015.

MBA, location	BTC, last upd.	Site (AP), founded	PSP, in force	FA, in force	Licence/DiP, in force (from/until)	SG Manual, approved
WLOV, Loviisa	3.2.2015	S SF LOV1, 8.7.2004	Yes, 4.5.1998	No	Operation, LO1 until 31.12.2027 LO2 until 31.12.2030	Yes, 30.11.2012
WOL1, Olkiluoto	9.4.2014	S SF OLK1, 8.7.2004	Yes, 7.6.2007	No	Operation, until 31.12.2018	24.8.2015
WOL2, Olkiluoto	9.4.2014	S SF OLK1, 8.7.2004	Yes, 7.6.2007	No	Operation, until 31.12.2018	24.8.2015
WOLS, Olkiluoto	20.3.2015	S SF OLK1, 8.7.2004	Yes, 7.6.2007	No	Operation, until 31.12.2018	24.8.2015
WOL3, Olkiluoto	19.3.2015	S SF OLK1, 8.7.2004	No	No	Construction, granted 17.2.2005	24.8.2015
WOL4, Olkiluoto	12.11.2012 to be withdrawn	S SF OLK1, 8.7.2004 (add. 2013)	No	No	DiP, 1.7.2010, expired	No
WOLE, Olkiluoto	21.5.2015	S SF POS1, 31.3.2010	No	No	Construction, 12.11.2015	No, included in WOLF manual
WOLF, Olkiluoto	21.5.2015	S SF POS1, 31.3.2010	No	No	Construction, 12.11.2015	6.11.2015
WFV1, Pyhäjoki	6.7.2015 (prel. DI)	No	No	No	DiP, 1.7.2010	No
WRRF, Espoo	31.12.2014	S SF VTT1, 8.7.2004	Yes, 9.7.1998	No	Operation, until 31.12.2023	31.3.2011 update requested
WNSC, Espoo	31.12.2014	No	No	No	Under construction	to be prepared
WFRS, Helsinki	10.4.2014	S SF STUK, 8.7.2004	No	No	Not required (as an authority)	29.10.2015
WHEL, Helsinki	8.11.2006	S SF HYRL, 8.7.2004	No	No	Operation, until 31.12.2017	30.6.2015
WKKO, Kokkola	30.5.2013	No	No	No	Operation, until 31.12.2019	18.6.2015
WNNH, Harjavalta	16.11.2010	No	No	No	Operation, until 31.12.2019	18.6.2015
WTAL, Talvivaara	29.11.2010	No	No	No	No	No, drafted in 2013
WDPJ, Jyväskylä	14.5.2012	No	No	No	Operation, until 31.12.2024	24.2.2015

Finnish material balance areas and their status as 31.12.2015. MBA (material balance code), BTC (Basic Technical Characteristics, i.e. Design Information), AP (the Additional Protocol), PSP (Particular Safeguards Provisions set by the European Commission), FA (Facility Attachment prepared by the IAEA), DiP (Decision-in-Principle, date of Parliament approval, in force 5 years).

of nuclear materials, and monitoring compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Nuclear safety and particularly nuclear security objectives are closely complemented by safeguards objectives. For this reason, the research, development and regulatory units in the fields of safety, security and safeguards at STUK cooperate under the non-proliferation framework. The scope of non-proliferation work is linked to many organisational units of STUK (Fig. 1). During the reorganisations in 2013 and 2015, the competences in non-proliferation control were split into several organisational units. Only the core competences were maintained in the Nuclear Materials Section of the Nuclear Waste and Material Regulation. Consequently, interaction and cooperation between the reorganised units have been activated. The roles of the different units are described in detail in Chapter 4.

1.2.3 Licence holders and other users of nuclear energy

The essential parts of the national nuclear safeguards system are the licence holders and other users of nuclear energy – in nuclear terminology, often called the operators and other stakeholders. In the Finnish legislation, the term 'use of nuclear energy' comprises a wide range of nuclear-related activities, such as those defined in the Addition Protocol. These stakeholders, in particular the licence holders, perform key functions in the national safeguards system: control of the authentic source data of their nuclear materials in addition to accountancy for nuclear materials at the facility level for each of their material balance areas (MBA). Each licence holder or other user of nuclear energy must operate its safeguards system in accordance with its own nuclear materials handbook or safeguards manual. The requirements of the Additional Protocol are integrated in the handbook to facilitate implementation of safeguards at the site, including the material balance areas. Other stakeholders too, as users of nuclear energy, are requested to have a safeguards manual to facilitate safeguards implementation. The nuclear materials handbook or safeguards manual is a part of the operator's quality system and is reviewed and approved by STUK.

With the basic technical characteristics (BTC) submitted by a licence holder or by other stakeholder as groundwork, the European Commission adopts particular safeguards provisions (PSP) for that licence holder. PSPs are drawn taking operational and technical constraints into account in close consultation with both the person or undertaking concerned and the relevant member state. Until PSPs are adopted, the person or undertaking shall apply the general provisions of the Commission regulation No 302/2005. A facility attachment (FA) is prepared in cooperation with the IAEA for each facility to describe arrangements specific to that facility. The status of the regulatory documents for the Finnish material balance areas is shown in Table 1.

A total of 99.8% of all nuclear materials in Finland reside at the nuclear power plants (NPP). The amounts of nuclear materials (uranium, plutonium) in Finland in 1990–2015 are presented in Figures 2 and 3.

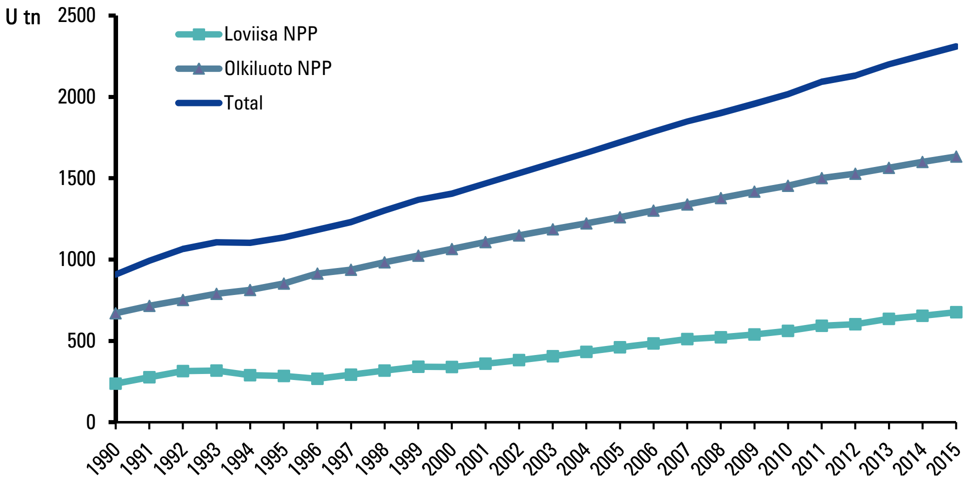

Figure 2. Uranium accumulation in Finland in 1990–2015.

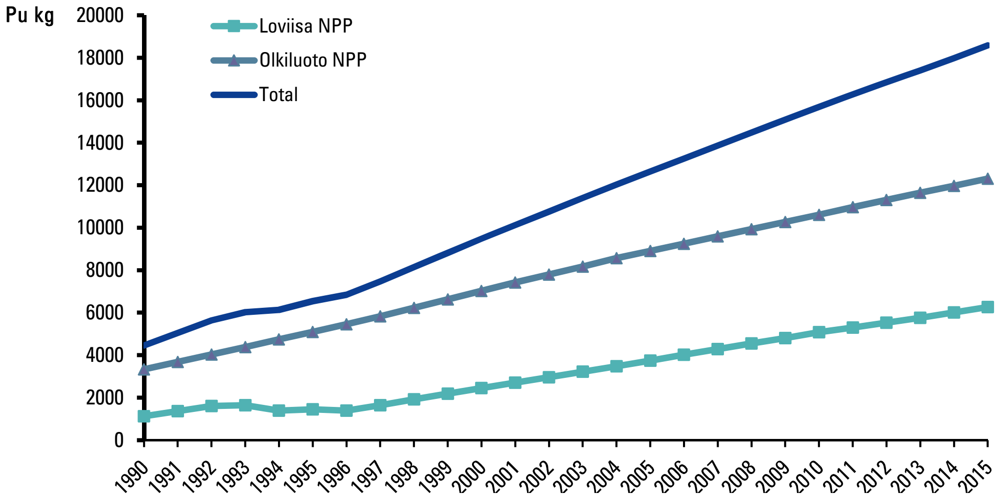

Figure 3. Plutonium in spent nuclear fuel in Finland in 1990–2015.

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 including nuclear.

The nuclear power plant operated by Fortum Power and Heat is located on Hästholmen Island in Loviisa on the southeast coast of Finland. This first NPP to have been built in Finland hosts two VVER-440 type power reactor units, with a current net electrical output of 496 MW for each of the units, Loviisa 1 and Loviisa 2. Loviisa 1 started its electricity production in 1977 and Loviisa 2 in 1980. These two units share common fresh and spent fuel storages. For nuclear safeguards accountancy purposes, the entire NPP is counted as one material balance area (MBA code WL0V). The electricity generated by the Loviisa NPP constitutes about 10% of electrical production in Finland as a whole.

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 has been stored in the interim storage due to a change in Finnish nuclear legislation, which forbids the import and export of nuclear waste in general, including spent fuel.

As per the requirements of the Additional Protocol, the Loviisa NPP site (SSFLOV1) comprises Hästholmen Island as a whole and extends to the main gate on the mainland. 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 Facility Attachment of the Safeguards Agreement INFCIRC/193 has not been prepared by the IAEA for the Loviisa NPP.

Teollisuuden Voima (MBAs W0L1, W0L2, W0LS, W0L3 and W0L4)

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. These units have been upgraded to the current output of 880 MW. The Olkiluoto NPP is responsible for about 17% of all electricity production in Finland. There are three active material balance areas (MBA codes W0L1, W0L2, W0LS) at the Olkiluoto NPP.

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 to prevent the proliferation of nuclear weapons was approved by STUK. The construction and assembly work of the reactor unit is under way. The European Commission has assigned the MBA code W0L3 for Olkiluoto 3.

The decisions for new nuclear facilities were granted by the Government on 6 May 2010. One of these was the Olkiluoto 4 reactor. Although the reactor type was not specified yet, TVO submitted the preliminary basic technical characteristics (BTC) in November 2012 in order to obtain the MBA code W0L4 for future correspondence. However, in June 2015 TVO decided that no construction licence for Olkiluoto 4 will be applied for during the 5-year period of validity of the Decision-in-Principle ratified by the Parliament on 1 July 2010. Consequently, the Decision-in-Principle expired at the end June 2015; and consequently, the MBA code was withdrawn in 2015 as confirmed by the Commission in a letter in January 2016.

TVO owns most of the area of the Olkiluoto Island, but the NPP site (SSFOLK1) as per the requirements of the Additional Protocol currently comprises the fenced areas around the reactor units, the spent fuel storage and the storage for low and intermediate level waste, and the Olkiluoto 3 construction site. Particular Safeguards Provisions for the Olkiluoto NPP have been in force since 2007. The Facility Attachment of the Safeguards Agreement INFCIRC/193 has not been prepared by the IAEA for the Olkiluoto NPP.

Fennovoima (MBA WFV1)

Fennovoima was founded in 2007 to be a new nuclear power operator in Finland. Fennovoima started preparatory works with several vendor candidates for this purpose and submitted its application for a nuclear power plant in 2009. The Government approved a Decision-in-Principle in 2010 for the new operator Fennovoima to construct a new nuclear power plant at a new site, either at Karsikkoniemi in Simo or at Hanhikivi in Pyhäjoki. The applicant was requested to submit its nuclear construction licence application within five years and to submit a plan for its nuclear waste management within six years. The preliminary Basic Technical Characteristics (BTC) was submitted to the European Commission in summer 2013, and the MBA code WFV1 was assigned to the future material balance area once the selection of the future Hanhikivi site at Pyhäjoki was decided. However, after negotiations with the original vendors and a new candidate, Fennovoima announced in December 2013 that the plant supplier would be Rusatom Overseas. Owing to the changes in ownership and reactor type described in the ratified application, a reassessment of the Decision-in-Principle was initiated in 2013. The reassessment was completed on 5 December 2014 when the Parliament endorsed the Decision-in-Principle of 2010 for the different reactor type. Fennovoima submitted the construction licence application to the Government on 30 June 2015. In September 2015 the Ministry of Employment and the Economy launched the process to evaluate the application with the desired timeline at the end of 2017. The Hanhikivi site (according to the Additional Protocol) will be declared stepwise as the project proceeds from a virgin green site to the preparatory work site and finally to the nuclear power plant. The current estimate is that the first Hanhikivi site declaration will be submitted in 2017.

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), located in Otaniemi, Espoo. The research reactor was the first nuclear reactor built in Finland at the Technical Research Centre of Finland (VTT). It reached criticality on 27 March 1962. On 12 July 2012, the Ministry of Employment and the Economy and VTT announced the plan to close down the reactor and to launch the decommissioning process. The reactor was shut down in June; and, finally on 7 December 2015 the reactor was made subcritical.

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 Facility Attachment of the Safeguards Agreement INFCIRC/193 has not been prepared by the IAEA for the research reactor.

In contrast to this, a new building, the VTT Centre for Nuclear Safety, for experimental nuclear research will be built at the Espoo premises of VTT. The preliminary BTC for the new building, already under construction, was submitted to the Commission by the end of 2014; and, consequently the MBA code WNSC was assigned for the future material balance area in 2015. In the new building some of the experimental research carried currently out in the building containing the research reactor will be continued. Both these decisions will have long-lasting effects, due to the need for licences, permits, contracts and environmental impact assessment. This also affects safeguards, as the nuclear materials must be kept under the control of competent personnel at both material balance areas.

The VTT FiR1 site (SSFVTT1), as per the requirements of the Additional Protocol, currently consists of the whole building around the research reactor, though there are non-nuclear companies and university premises in the same building.

STUK (MBA WFRS)

Small quantities of nuclear materials are stored by the Radiation and Nuclear Safety Authority (STUK) – mainly materials no longer in use and hence taken into STUK's custody. STUK was founded in 1958 and has been 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 (SSFSTUK), as per the requirements of the Additional Protocol, consists of the premises of STUK's headquarters located in Helsinki. 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 (SSFHYRL), as per the requirements of the Additional Protocol, comprises the whole building that hosts the laboratory.

Freeport Cobalt Oy (MBA WKK0)

The by-products of the Kokkola Chemicals facility's cobalt purification process contain uranium, which qualifies these by-products as nuclear material. Thus, the Kokkola Chemicals has an operating licence to produce, store and handle nuclear material. In 2013, Freeport-McMoRan Copper & Gold Inc acquired the ownership of the OM Group. The operator is Freeport Cobalt Oy, and the facility is located in Kokkola on the west coast of Finland.

Norilsk Nickel Harjavalta Oy (MBA WNNH)

Norilsk Nickel Harjavalta Oy operates the nickel refining plant at Harjavalta in western Finland. The plant was commissioned in 1959, expanded in 1995 and again in 2002. Norilsk Nickel Finland became a part of the Russian-based Norilsk Nickel as a result of the OM Group's nickel business acquisition in 2007. The refinery of Norilsk Nickel Harjavalta employs a technique of sulphuric acid leaching of nickel products. Uranium residuals will be extracted from the nickel products, e.g., from the Talvivaara mine. In March 2010, STUK granted a licence to extract less than 10 tonnes of uranium per year. The Norilsk Nickel Harjavalta company submitted the basic technical characteristics (BTC) to the European Commission in December 2010.

Terrafame Oy (MBA WTAL)

On 9 February 2010, the Talvivaara Sotkamo Ltd mining company announced its interest in investigating the recovery of uranium as a separate product from its sulphide ore body. The environmental impact assessment was carried out in 2010 and, according to nuclear energy legislation; the licence to recover uranium was granted by the Government in March 2012. The Basic Technical Characteristics (BTC) were submitted to the European Commission in 2010, and the MBA code WTAL is assigned to the future uranium extraction plant that is constructed as a separate part of the mineral processing plant. The production of uranium was expected to commence in 2013. However, the claims concerning the uranium extraction licence were approved by the Supreme Administrative Court in December 2013, and the processing of the licence application to extract uranium was returned to the Government. Moreover, Talvivaara Sotkamo Ltd filed for bankruptcy in November 2014. During 2015 a new state-owned company Terrafame took over the mining operations at Talvivaara. Currently, the use of the uranium extraction plant is not included in the mining and mineral processing. However, the MBA code WTAL is still kept available for possible future nuclear activities.

Other nuclear material holders

There are about ten minor nuclear material holders in Finland. One of them is an actual material balance area: the University of Jyväskylä, Department of Physics (JYFL, MBA code WDPJ), but in fact the nuclear material at 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 the purposes of international nuclear safeguards. Most of these have depleted uranium as radiation-shielding material.

Posiva (MBAs W0LE and W0LF)

Posiva Oy is the company responsible for the 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 at Eurajoki since 2004, and thus preparing for the construction of the disposal facility. 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. For this reason, Posiva was required to develop a non-proliferation handbook, such as a nuclear materials handbook, to describe its safeguards procedures and reporting system already before becoming a nuclear material holder. By the end of 2012, Posiva submitted an application to the Government to construct the disposal facility, which will consist of the encapsulation plant and the geological repository. The licence to construct the disposal facility was granted by the Government in November 2015. Based on the drawings presented in the application, the preliminary BTCs were prepared for both facilities separately and submitted to the Commission in June 2013. The MBA codes assigned for the future facilities are W0LE for the encapsulation plant and W0LF for the geological repository. As the geological repository will be under continuous development, it has been suggested that the BTC for the underground part will be updated annually. However, neither Particular Safeguard Provisions nor the Facility Attachments of the Safeguards Agreement INFCIRC/193 have been prepared for these new facilities. The installation without nuclear materials but having the two BTCs for these future Material Balance Areas constitutes a site according to the Additional Protocol. The Posiva site (SSFPOS1) covers the fenced area around the buildings supporting the construction of the facilities.

Other stakeholders

Nuclear expert organisations, technology holders and suppliers that serve nuclear and other industry are obliged to take care that non-proliferation sensitive technology does not get into the hands of unauthorised actors and thereby contribute to nuclear proliferation. The introduction of the Additional Protocol (1996) extended the scope of safeguards to the non-proliferation control of nuclear programmes and fuel cycle-related activities. These also include research and development activities not involving nuclear materials, but are related to process or system development of fuel cycle aspects defined in the Protocol. Additionally, the United Nations Security Council Resolution 1540 (April 2004) requires every state to ensure that export controls, border controls, material accountancy and physical protection are efficiently addressed, and calls all states to develop appropriate ways to work with and inform industry and the public regarding their obligations. The control of nuclear expert organisations to ensure the non-proliferation and peaceful use of sensitive technology and dual-use items is a growing global challenge for all stakeholders.

Nuclear safeguards are commonly seen as the traditional nuclear material accountancy and reporting system, the main stakeholders of which are the international, regional and local authorities and the operators. In accordance with the extended non-proliferation regime and the amendments to the Finnish legislation, the stakeholders, universities, research organisations or companies that have activities defined in the Additional Protocol are under reporting requirements and export control. These stakeholders as users of nuclear energy are required to prepare the nuclear safeguards manual and to nominate responsible persons for nuclear safeguards arrangements.

IAEA regular inspections:

Facilities at nuclear power plants (NPP):

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

Spent fuel storages at NPPs

- *PIV/DIV 1/year*
- *RII at 48 h notification (at least 1/year)*

Research reactor and locations outside facilities (LOF)

- *PIV/DIV 1/4–6 years*

New reactors, under construction

- *DIV and PIV later like at the NPPs*

Repository (Onkalo), under construction

- *PIV/DIV most likely 1 per year*

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

1.3 IAEA and Euratom safeguards in Finland

The IAEA and the EuropeanThe IAEA and the European Commission (Euratom safeguards) both have independent mandates to operate in Finland. These two international inspectorates have agreed on cooperation, which aims to reduce undue duplication of effort. The operators report to the Commission as required by Commission Safeguards regulation No 302/2005. It is the Commission's task to audit the licence holders' accounting and reporting systems. The Commission shall draw up the particular safeguard provisions (PSP) to agree on the means of safeguards implementation taking account of the operational and technical constraints of the licence holder.

The IAEA 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 additionally performs 1–3 short-notice inspections per year in a state that has a number and type of nuclear installations similar to the situation in Finland. The IAEA has annually drawn conclusions confirming its confidence that all nuclear activities and materials are accounted for and are in peaceful use in Finland.

The number of IAEA and Euratom routine inspections decreased significantly in 2009, as defined in the state-level safeguards approach for Finland, which was negotiated during 2007 and 2008. At the trilateral meeting (IAEA/EC/STUK) in September 2013, it was agreed that no unannounced inspections with two hours' notice time would be performed in Finland after the beginning of 2014. Thus, currently all short notice inspections are expected to take place with 48 hours' advance notice (see infobox). STUK continues with annual routines consisting of approximately 40 field inspections, which enables the reduction in the effort of the international inspectorates. At the trilateral meeting (IAEA/EC/STUK) in September 2014, STUK requested the IAEA to finalise the Subsidiary Arrangements and Facility Attachments of the Safeguards Agreement. This is considered to be urgent for the specification of inspections procedures. However, the main achievement concerning inspection procedures in 2015 was the agreement to replace the inspection announcements sent traditionally by fax by announcements sent by e-mail.

According to the Finnish Nuclear Energy Act, STUK must be present when the IAEA and Euratom are having inspections in Finnish facilities. Thus STUK has increased preparedness for short-notice and unannounced inspections and complementary access (abbreviated SNUICA). Every weekday, one of STUK's inspectors is prepared to attend a possible IAEA inspection.

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 in timely fashion to the Commission and the IAEA.

In Finland, there are currently six sites in the sense of the Additional Protocol: the two nuclear power plant (NPP) sites in Loviisa and Olkiluoto respectively, the geological repository site in Olkiluoto, and three minor sites: the Technical Research Centre of Finland (VTT), the Radiation and Nuclear Safety Authority (STUK) and the Laboratory of Radiochemistry at the University of Helsinki (HYRL). STUK reviews and verifies the correctness and completeness of the information about the sites provided by the stakeholders.

STUK annually reviews 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 an 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, for example, the enrichment of uranium as well as the burn-up and cooling time of nuclear fuel. The technical analysis methods in use are non-destructive assay (NDA), environmental sampling and satellite imagery.

STUK employs three NDA methods to verify spent nuclear fuel. One method lends itself to 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. On the other hand, the other two methods allow confirming the correctness of the declared burn-up and the cooling time with greater confidence. 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 information for 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 in accordance with the Additional Protocol. Timely imagery is used to monitor different kinds of activities at the sites or elsewhere in Finland. STUK contributes to the work of the satellite image analysts of the IAEA and the Commission.

1.5 Licensing and export/import control of dual-use goods

As per the Finnish Nuclear Energy Act, other nuclear fuel cycle-related activities in addition to nuclear materials are under regulatory control. A licence is required for the possession, transfer and import of non-nuclear materials, components, equipment and technology suitable for producing nuclear energy (nuclear dual-use items). The list of these other items is based on the Nuclear Suppliers' Group (NSG) Guidelines (INFCIRC/254 Part 1). The licensing authority is STUK. The Ministry for Foreign Affairs is responsible for granting NSG Government–to–Government Assurances (GTGA) when necessary. The ministry usually consults with STUK before giving the assurances. The licence holder is required to provide STUK with a list of the above-mentioned items annually. Moreover, the export, import and transfer of such items must be confirmed to STUK after the action.

Mining and mineral processing operations aiming to produce uranium or thorium are also under nuclear safeguards and regulatory nuclear safety control. In order to carry out these activities, a licence and an accounting system to keep track of the amounts of uranium and thorium are required. A national licence is also required to export and import uranium or thorium ore and ore concentrates. These activities are also controlled by the Euratom Supply Agency and the European Commission. Mining and milling activities as well as the production of uranium and thorium must be reported to STUK, the Commission and the IAEA.

Finland's export control system is based on EU Council Regulation (EC) No 428/2009 of 5 May 2009, which sets up a Community regime for the control of exports, transfer, brokering and transit of dual-use items. This regulation was amended in 2014. 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. An authorisation is required to export dual-use items outside the European Union as well as for EU internal transfers of NSG Part 1 items, excluding non-sensitive nuclear materials. The licensing authority is the Ministry for Foreign Affairs. Before granting an export licence, it takes also care of NSG Government–to–Government Assurances. The ministry asks STUK's opinion on all applications concerning NSG Part 1 items.

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, SSR-6, and their purpose is to protect people, the 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 and nuclear waste: generally 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 transport security plan approved by STUK are mandatory for each transport of nuclear material or nuclear waste. A certificate of nuclear liability insurance must also be delivered to STUK before transportation. 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. The practices obtained at the current construction projects in Olkiluoto have emphasised the need to bring in the safeguards requirements at an early stage of facility design. In order to improve and facilitate the future implementation of safeguards at new facilities, STUK initiated negotiations with all stakeholders to have the 3S (safety, security, safeguards) concept included in the design requirements of new facilities. The experience has been shared with the IAEA, several international fora and also in bilateral cooperation with several countries.

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 in several working groups.

Upon request by the IAEA, STUK's experts have contributed to the IAEA's international missions. The current experience obtained from the planning, design and construction of new nuclear facilities in Finland has increased the number of requests to participate in different kinds of international cooperation.

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

The Finnish Safeguards Support Programme to the IAEA Safeguards, FINSP, was established in 1988. The aim of FINSP is to provide the IAEA with educational and technical support in the field of non-proliferation of nuclear weapons. FINSP is funded by the Ministry for Foreign Affairs and implemented by STUK.

In 2014 the partnership programme between King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Kingdom of Saudi Arabia, and STUK was launched. The initiative is to give expert support to the establishment of the nuclear regulatory authority in Saudi Arabia. In the field of safeguards and nuclear security, STUK's safeguards and security experts carry out practical cooperation with their colleagues at K.A.CARE.

1.8 The Comprehensive Nuclear-Test-Ban Treaty

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 test explosions in any environment. This ban is aimed at constraining the development and the qualitative improvement of nuclear weapons, including the development of advanced new types of nuclear weapons.

The CTBT was adopted by the United Nations General Assembly, and was opened for signature in New York on 24 September 1996. It 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. The IMS is almost 90% ready, and is providing data from almost 300 measuring stations all over the world to more than 1,200 organisations in more than 120 countries. In addition to monitoring compliance with the treaty, the data from the IMS is used in disaster mitigation. The Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) is actively providing data to the global Tsunami Warning System and, since 2012, the CTBTO has been a member of the Inter-Agency Committee on Radiological and Nuclear Emergencies (IACRNE) and a co-sponsor of the Joint Radiation Emergency Management Plan of the International Organisations (JPLAN) led by the IAEA. Within this framework, the CTBTO is

Comprehensive Nuclear-Test-Ban Treaty (CTBT) Status (31 December 2015)

- *CTBT Member States* 183
- *Total Ratifications* 164
- *Annex 2 Ratifications* 36

responsible for gathering and providing close to real-time radionuclide monitoring data to the IAEA and other participating organisations.

Finland signed the CTBT on its day of opening in 1996 and ratified it less than three years later. In addition to complying with the basic requirement of the CTBT of not carrying out any nuclear weapons tests, Finland actively 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: it operates the Finnish National Data Centre (FiNDC) and one of the 16 radionuclide laboratories in the IMS (RL07). The most important task of the FiNDC is to inspect data received from IMS and inform the national authority about any indications of a nuclear test explosion. 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 Interfaces between nuclear safeguards and security

STUK is the national authority for the regulatory control of nuclear and radiological safety, security and safeguards (3S). All these three regimes have a common goal: the protection of people, society, the environment and future generations from the harmful effects of ionising radiation. As nuclear security aims to protect nuclear facilities, nuclear material and other radioactive material from unlawful activities, 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. Physical and information security measures at nuclear facilities and for nuclear materials including technology, sensitive information and knowledge also contribute to non-proliferation by providing detection and delay of and response to security events. On the other hand, nuclear material accountancy and control measures may supplement security measures through a deterrence effect.

The Finnish regulatory system for nuclear security was audited by an IPPAS mission in 2009, followed by an IPPAS follow-up mission in 2012. One of the recommendations arising from the audit – namely, the need for more detailed security requirements for minor holders of nuclear materials – was part of the Nuclear Materials Section's area of responsibility. As a result, the new STUK requirements set in the Guide YVL D.1 on regulatory control of nuclear safeguards contain more

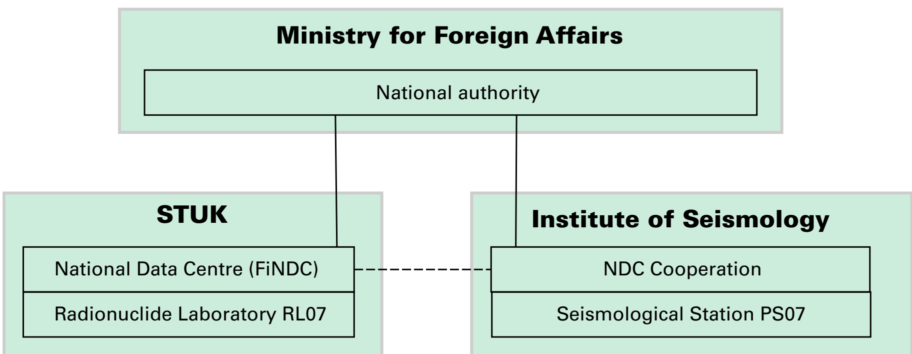

Figure 4. The Finnish CTBT organisation.

detailed security requirements for these minor holders. The Guide YVL D.1 complements Guides YVL A.11 Security of a Nuclear Facility and A.12 Information Security Management of a Nuclear Facility. STUK safeguards and security sections are working in close cooperation to set detailed requirements for all the users of nuclear energy and to verify that requirements are complied. This ensures that both safeguards and security in all use of nuclear energy are taken care of as well as possible and national and international requirements can be fulfilled. In 2014, STUK created a new assessment type for 3S approach, called site walk, where inspectors for safety, security and safeguards jointly review licence holder's processes and practices. Furthermore, in 2015 STUK launched the GOSSER (Geological Disposal Safeguards and Security) project for the harmonisation of safety, information security and other security arrangements and the safeguards for the implementation of 3S in an appropriate manner.

2 Themes of 2015

2.1 Enforcement of STUK requirements

The need for the revision of STUK requirements was recognised when applying the existing regulations to the construction of the new reactor, Olkiluoto 3. During the reformation work, the international reviews and stress tests performed after the Fukushima accidents were also taken into account. The nuclear safeguards requirements were addressed, mainly stemming from the Olkiluoto 3 and later also from the Olkiluoto 4 and Hanhikivi 1 experiences, by fitting the safeguards, security and safety interfaces of a new nuclear facility into the bidding phase. The revised STUK requirements were published as new YVL Guides in 2013. In general the publication of an YVL guide shall not, as such, alter any previous decisions made by STUK. However, after hearing of the parties concerned STUK issues separate implementation decisions as to how a new or revised YVL guide is to be applied to operating nuclear facilities or those under construction, and to the licence holder's operational activities. In particular, the regulatory guide YVL D.1 for nuclear safeguards shall apply as it stands to new nuclear facilities and to other use of nuclear energy.

The main safeguards requirement is to describe the operator's nuclear material accountancy and control system in nuclear materials manual and also to describe the necessary security measures (including information security) in a separate document (security plan) annexed to the safeguards manual. This nuclear material manual and security plan shall be submitted to STUK for approval. This requirement was also adapted to those users of nuclear energy who are performing research and development activities referred to in the Additional Protocol. During 2015 STUK assessed these safeguards manuals and security plans. The aim that all users of nuclear energy are acting in accordance with an approved manual by the end of the year 2015 was almost achieved. At the end of the year, one manual of a new stakeholder was in the approval process and one manual was under updating.

Moreover, operators of the operating nuclear facilities were requested to carry out a self-assessment on how the STUK requirement published in the YVL guides can be fulfilled. In this context also the YVL D.1 requirements were self-assessed during 2014–2015. None of the facility operators applied for a deviation from the requirements. STUK reviewed and assessed the operators applications and made implementation decisions on the implementation practices at TVO's Olkiluoto 1 and 2 reactors, spent fuel storage and low and intermediate level waste repository, to the Fortum's Loviisa NPP, and on the VTT FiR1 research reactor. In the implementation decision for TVO, STUK approved that TVO can comply YVL D.1 requirements also at the Olkiluoto 3 reactor which is under construction although separate implementation decision will be made accordingly later. In all these decisions some updates for the nuclear materials manual were required. The implementation of the new Guide YVL D.1 as such began in March 2015 for TVO, in October 2015 for Fortum, and in January 2016 for VTT.

2.2 Safeguards-by-Design for the encapsulation plant

After the submission of the nuclear construction licence application for the disposal facility for spent nuclear fuel in 2012, several meetings were arranged between Posiva, STUK, the Commission and the IAEA, in order to clarify and facilitate safeguards measures for the permanent disposal of spent nuclear fuel. The meetings in 2013–2015 focused on the verification issues prior to spent fuel encapsulation and the on the technical safeguards measures for the encapsulation process.

The requirement document for the IAEA/EC equipment to be installed in the encapsulation plant was prepared and finalised in 2014. This requirement document was indicated in the STUK assessment of the licence application in February 2015. The construction licence for the new facility was granted by the Government on 12 November 2015. The licence gives Posiva authorisation to construct the encapsulation plant, deposition tunnels, deposition holes and other necessary installations for the geological repository. According to the licence conditions construction shall start within two years. STUK's oversight of the encapsulation plant and geological repository is continuous through the construction phase and operation of the facility. Posiva is expected to apply for an operating licence for the facility in the early 2020's.

Parallel to this, a task force consisting of the IAEA, the Commission and Finnish and Swedish authorities and operators was established in November 2012. The first Lower Level Liaison Committee (LLLC) Encapsulation Plant and Geological Repository (EPGR) Liaison Group meeting was arranged in January 2013 to discuss the draft versions for Basic Technical Characteristics of the encapsulation plant and for the geological repository. The Committee did not meet officially during 2015, but the IAEA and the Commission representatives commented on the preparation of the BTC documents for the disposal facility during 2013–2015. In the meanwhile, Posiva updated the BTC's both for the encapsulation plant and the geological repository in May 2015. In particular, the layout of the planned encapsulation plant was updated. As a consequence, the requirement document for the safeguards equipment to be installed at the encapsulation plant has to be updated by the IAEA and the Commission as an interactive "Safeguards-by-Design" process.

During 2015, two videoconferences and one technical meeting at Posiva premises in Vuojoki were held between the inspectorates and the Finnish operators and regulators. In these meetings the equipment infrastructure requirements specification for the encapsulation plant operator in Finland was discussed and adjusted, to facilitate effective safeguards with minimal impact on the design and operation of the encapsulation plant. Another major discussion point was the plans for the NDA measurements needed to verify the spent fuel before permanent deposition and the impact of such measurements on the operation of the current spent fuel storages at the NPP's. In spite of the fact that the encapsulation plant will not be in operation before 2022, a draft safeguards approach document should be created by the IAEA and the Commission in the near future. At the same time work on the Particular Safeguard Provisions and Facility Attachment should commence. The first official draft Facility Attachment was provided by the IAEA to the Commission in October 2015. The Commission will start negotiations with the Agency after review. The work on developing a similar safeguards infrastructure specification for the geological repository will continue in the coming years.

2.3 GOSSER – 3S for disposal of spent fuel

The disposal of spent fuel requires that safety, data security and other security arrangements and the safeguards required to prevent the proliferation of nuclear weapons are properly implemented. This requires the reconciliation of all areas resulting in the implementation of 3S in an appropriate manner. This, in turn, requires actions from the operators producing, encapsulating or disposing of spent nuclear fuel (TVO, Fortum, Posiva) as well as the authorities (STUK).

The GOSSER (Geological Disposal Safeguards and Security) project is STUK's development project, which main objective is the finalisation of the Finnish concept for safeguarding the geological disposal of the spent nuclear fuel. The GOSSER gathers together the needed actions that have been done and that still need to be done to develop the cost effective and functional safeguards concepts for the encapsulation plant and for the geological repository. The project coordinates the activities between the IAEA Safeguards Support Programme, the safeguards implementation plans of the IAEA, the European Commission and STUK, and maintains the cooperation between STUK's safety, security and safeguards sections.

GOSSER contains two important sub-projects. First and more toilsome is LOVE (verification of the spent fuel for the disposal), which activities are aimed to develop the robust, reliable and accurate method and device that enables creation of the necessary assurance that spent fuel to be disposed is what it is stated to be. Second and more far-reaching is JOY (continuity, observation, co-operation and synergies), which concentrates to ensure completeness and correctness of information in a manner that continuity-of-knowledge (C-o-K) are preserved also after the closure of the geological repository. In JOY, the technologies and methods for observation of activities are assessed and if found necessary developed. It's aim is also to utilise findings of safety and security to fulfil safeguards objectives as well as create surplus value that increase confidence that disposal of spent fuel is possible to be done safe and secured, i.e. one task is to seek and exploit synergies between different regimes by strengthening the co-operation and exchange of information.

The GOSSER project was approved in December 2015 and it is expected to be finished by the end of the 2018.

2.4 GICNT – Global Initiative to Combat Nuclear Terrorism in Helsinki 2015

The Global Initiative to Combat Nuclear Terrorism, founded in 2006, is a voluntary partnership of 86 nations, 5 official observers, and co-chaired by the Russian Federation and the United States. A structure of the GICNT is presented in Figure 5. The GICNT mission is to strengthen the global capacity to prevent, detect, and respond to nuclear terrorism by conducting multilateral activities that strengthen the plans, policies, procedures, and interoperability of partner nations. The GICNT plenary meetings are organised every two years. In these meetings the work programme for the coming two years is agreed. The previous plenary meeting was organised at Helsinki in June 2015. During the Helsinki plenary meeting also new chairmen for the Implementation and Assessment Group (IAG) and for the NDWG were endorsed. The Netherlands was assigned to chair the IAG and Finland to chair the NDWG. In January 2015 the Nuclear Detection Working Group (NDW

The Leadership Team of GICNT includes co-chairs, chairmen of different groups and a couple of distinguished experts. During the autumn 2015 Leadership Team has converted the general work plan agreed in the plenary meeting to a more concrete plan. During 2015 in addition to GICNT events organised in Finland, Finnish experts have also participated in Leadership Team meetings abroad and in exercises in Karlsruhe, the Hague and London.

2.5 IPNDV – International Partnership for Nuclear Disarmament Verification

International Partnership for Nuclear Disarmament Verification (IPNDV) was established on the initiative of United States in 2014. IPNDV's first plenary meeting was organised in Washington DC in March 2015. The main outcome of the meeting was the establishment of three working groups:

1) Monitoring and Verification Objectives
2) On-site Inspections
3) Technical Challenges and Solutions.

Finland participates in the work of all groups. In November 2015 the second plenary meeting was organised in Oslo, Norway. It was agreed that during the next 18 months IPNDV will concentrate on the verification of the disassembly of nuclear weapons. Some countries criticised this decision since in their opinion the disassembly of a weapon does not remove it from the arsenal permanently.

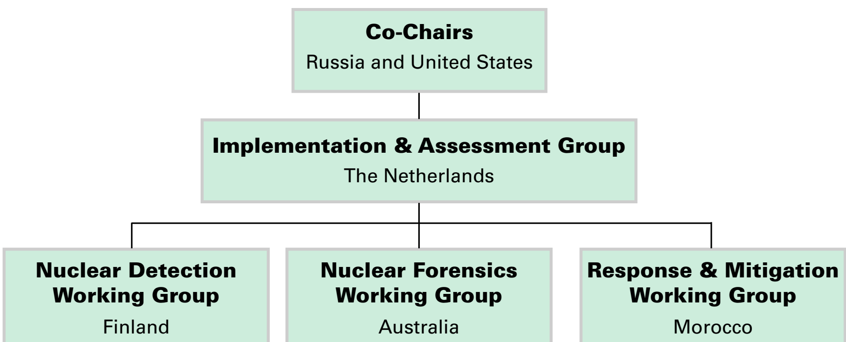

Figure 5. The organisational structure of GICNT.

This critique was responded to by saying that later on IPNDV will also include other parts of the nuclear weapons' life cycle. The first concrete results are expected before the end of the 18 month period. This should be a realistic expectation due to the tight focus of the work.

Before IPNDV nuclear disarmament activities have mainly been bilateral. Only Russian Federation and the United States have actual past experience on this topic. In IPNDV special emphasises needs to be given to the non-proliferation issues due to the participation of multiple non-nuclear weapon states. Two different technological approaches are investigated: Template and Attribute methods. During the Oslo meeting it was agreed that participants should first publish their results and only after that introduce them to the IPNDV forum.

3 Safeguards activities in 2015

3.1 The regulatory control of nuclear materials

STUK continued with national safeguards measures as in the past. Nuclear material inventories at the end of 2015 are shown in Tables A2 and A3 in Appendix 1. The development of inspections and inspection person days per Material Balance Area (MBA) is presented in Figures 6 and 7. Inspections by STUK, the International Atomic Energy Agency (IAEA) and the European Commission in 2015 are presented in Appendix 2.

The application of integrated safeguards began in Finland on 15 October 2008. Thus, in 2009 the number of IAEA inspections was reduced from approximately 30 person days to 15. Similarly, the Commission reduced its inspection activities significantly. In 2010, the number of inspection days rose somewhat, due to the first inspections at the geological repository site, additional inspection days at the Loviisa Nuclear Power Plant (NPP), and the increased number of random inspections in Finland. Since 2010, the number of regular in-

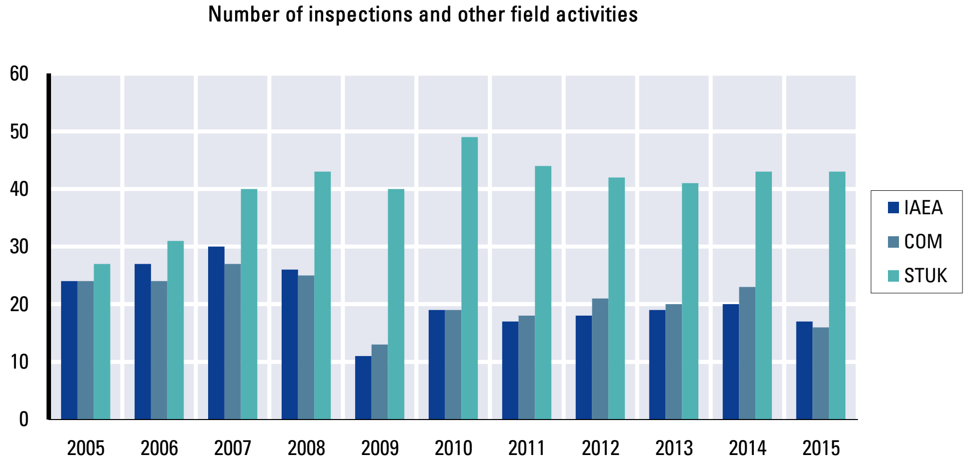

Figure 6. The number of inspections from 2005 to 2015.

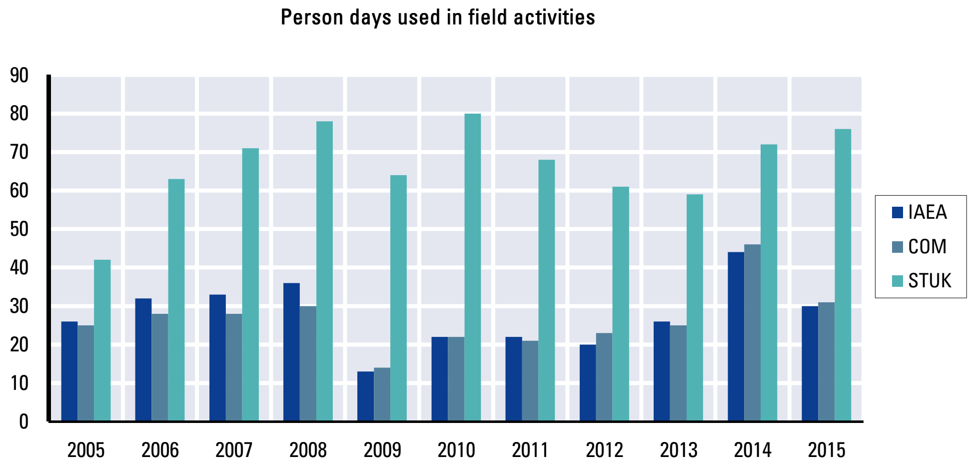

Figure 7. Inspection person days from 2005 to 2015.

spections has remained at the same level, i.e. the current number of annual IAEA inspection days is about 25 person days in Finland. In 2014, the IAEA and the Commission carried out an extensive inspection in the planned geological repository. During the one-week long survey campaign in Onkalo, 65 person days ware spent by the inspectors, technicians and supporting JRC staff. A similar inspection was performed also in 2015; and, 24 person days were spent to inspect the planned facility. Only the inspector days are estimated in the figures.

3.1.1 Declarations and approvals of new international inspectors

All the relevant licence holders sent their updated information for the national declaration, which is compiled by STUK, in time by 1 April. STUK submitted Finland's annual declaration updates to the IAEA on 13 May 2015 as required. Additionally, STUK submitted the quarterly declarations on exports in February, May, August and November.

In 2015, altogether 37 IAEA and 7 Commission inspectors, newly appointed, were approved to perform inspections at nuclear facilities in Finland.

3.1.2 The Loviisa nuclear power plant site

During 2015 the operator Fortum self-assessed how the STUK requirements in Guide YVL D.1are and can be fulfilled at the Loviisa NPP, and applied for the implementation decision. STUK made the implementation decision on YVL D.1 for Loviisa NPP on 25 September 2015. The regulatory guide YVL D.1 is in force for the Loviisa NPP since 1 October 2015.

In total, STUK performed 12 safeguards inspections at the Loviisa NPP in 2015. The routine refuelling outage of the Loviisa 1 reactor unit took place during the period 9–26 August 2015 and the outage of the Loviisa 2 reactor unit during the period 29 August – 15 September 2015. STUK, the IAEA and the Commission performed a Physical Inventory Taking (pre-PIT) inspection before the outages, on 5–6 July 2015. Due to working remote data transmission, no extra cameras were needed during the outages. The Physical Inventory Verification (PIV) was carried out after the outage, on 22–23 September 2015. STUK identified the fuel assemblies in the reactor cores and itemcounted the fuel assemblies in the loading ponds. The Loviisa 1 core was inspected on 16 August 2015 and the Loviisa 2 core on 5 September 2015. In addition to the PIV and the core controls, STUK carried out two routine inspections on its own. Two additional inspections, together with the IAEA and the Commission were carried out to perform activities, that the international inspectors did not perform on the pre- and post PIV inspections, these two inspections could be scheduled with minimal resource use, while the inspectors were present at the NPP for other reasons.

On the basis of its own assessment as well as that of the IAEA and the Commission inspection results, STUK concluded that Fortum's Loviisa NPP complied with its nuclear safeguards obligations in 2015.

3.1.3 The Olkiluoto nuclear power plant site

In 2015, STUK granted two import licences to TVO for importing fresh nuclear fuel.

The operator TVO self-assessed in 2014 the YVL D.1 requirements and how these can be fulfilled at the facilities, and applied for the implementation decision. STUK made the implementation decision on YVL D.1 on 13 March 2015 for Olkiluoto operating nuclear facilities. In the decision STUK also approved that in Olkiluoto 3 facility under construction YVL D.1 can be used as a substitutive procedure until the actual implementation decision will be made. The regulatory guide YVL D.1 is in force for the Olkiluoto operating facilities since 15 March 2015.

The refuelling and maintenance outage of the Olkiluoto 1 reactor unit took place during the period 30 April – 12 May 2015, and that of the Olkiluoto 2 reactor unit during the period 15 May – 2 June 2015. The PIV was carried out after the outage on 23–24 June 2015 in the two reactor units and the spent fuel storage.

During the refuelling and maintenance outage, STUK identified the fuel assemblies in the reactor cores and inspected the loading ponds before the reactors were closed. The Olkiluoto 1 reactor was inspected on 10 May 2015 and the Olkiluoto 2 reactor on 1 June 2015.

STUK carried out two additional routine inspections at the Olkiluoto site and the material balance areas (MBA) at the Olkiluoto NPP. In the spent fuel storage, the ponds are covered with shielding plates preventing regular verification activities for the fuel elements in the ponds.

The annual design information verification inspection in the Olkiluoto 3 unit was carried out on 10 November 2015. The MBA code W0L4 was assigned to Olkiluoto 4 unit already in 2013. However, TVO decided in June 2015 that no construction licence for Olkiluoto 4 will be applied for during the 5-year period of validity of the Decision-in-Principle. Consequently, the Decision-in-Principle expired in June 2015. TVO informed the European Commission about the changed situation by sending an update of the preliminary basic technical characteristics. The IAEA was informed as well, by STUK letter explaining the situation so that the IAEA has the required information to refrain from planning any safeguards activities for Olkiluoto 4.

On the basis of its own assessment and on the IAEA and the Commission inspection results, STUK concluded that TVO's Olkiluoto NPP complied with its nuclear safeguards obligations in 2015.

3.1.4 The Hanhikivi nuclear power plant project

The Government granted a Decision-in-Principle in 2010 for the new operator Fennovoima to construct a new nuclear power plant at a new site. STUK initiated negotiations with the operators and the Commission as well as with the IAEA in 2011 to prepare for the implementation of safeguards in good time, simultaneously with the facility development. As a consequence, the company could request the vendor organisations to facilitate safeguards implementation; for example, to improve proliferation resistance and facilitate nuclear material verification and surveillance at the future plant. In the meantime, Fennovoima created an organisation for safeguards and prepared for the implementation of safeguards.

The re-assessment of the already approved application began in 2013 for technical and organisational changes since the Decision-in-Principle because the option of having Rosatom as a vendor candidate was not included in the application ratified in 2010. On 5 December 2014, the Parliament endorsed the Decision-in-Principle of 2010 for the new reactor type with a requirement for reasonable domestic ownership. Owing to this, the nuclear construction licence application was submitted on 30 June 2015 in accordance with the 5-year timeline set in 2010. In addition to the licence application documents, Fennovoima submitted to STUK the material identified in the § 35 of the Nuclear Energy Decree. This included 'A plan for arranging the safeguards control that is necessary to prevent the proliferation of nuclear weapons' as stated in the Decree. The process of reviewing and assessing the application documents for the statements was launched by the Ministry of Employment and the Economy in September 2015 with the aim to have STUK statement and safety assessment finalised by the end of 2017, if possible. The procedures to complete the statement on Fennovoima's plan for arranging the safeguards were discussed between STUK and Fennovoima in October 2015.

One of the first steps in the construction process is the control of nuclear technology, such as sensitive information obtained from the bidding companies. It was obvious that the first version of the nuclear materials handbook should focus on the current needs to control the nuclear technology and dual-use equipment. Thus, STUK approved Fennovoima's safeguards manual "Fennovoima Managements System: Nuclear Materials Manual" in July 2014. Fennovoima submitted an annual safeguards report to STUK and the programme of activities for 2015–2016 to STUK and the Commission. The preliminary design information was updated in July 2015.

Based on the meetings on the implementation of safeguards and the control of nuclear technology with Fennovoima's staff, STUK concludes that awareness and preparedness for safeguards procedures are at an adequate level in the new organisation preparing for the new NPP project and Fennovoima fulfilled its safeguards obligations in 2015.

3.1.5 The VTT FiR1 research reactor site

In 2015, the preparations for decommissioning the research reactor and those for the construction of the new nuclear safety research building continued at the Technical Research Centre of Finland, VTT. STUK reviewed the decommissioning plans and made its assessment to VTT in May. The reactor was shut down permanently on 30 June 2015 and made subcritical on 7 December 2015. The operating licence amendment application for decommissioning will be prepared during 2016. In 2015, STUK approved one person as a deputy for the safeguards responsible person. An internal coordinative project was launched at STUK for the control of the decommission projects at the building containing the laboratories and the research rector as well as for the commissioning of the new experimental premises.

STUK and VTT responsible persons met twice and discussed future actions to ensure appropriate safeguards procedures. The update of the BTC for the reactor and the preliminary BTC for the new building of the VTT Centre for Nuclear Safety under construction were submitted to the Commission at the end of 2014. The small amounts of nuclear material used in the laboratories located in the reactor building will be moved to the new building once it is commissioned. The current target is at the beginning of 2016. In the beginning of 2015, the Commission assigned the Material Balance Area code WNSC for the new building. The aim is to have separate MBAs for the two separate VTT buildings with different activities. The site delimited according to the Additional Protocol covers only the reactor building. The VTT site will updated as the materials and activities are moved to new locations in the near future. In addition, VTT prepared a separate safeguards manual to cover the responsibilities to report and control the research and development activities defined in the Additional Protocol. These activities are carried out in several buildings in the research campus area in Espoo. In 2015 STUK approved this safeguards manual.

During 2015 STUK made decisions on the implementation practices of the regulatory guides on nuclear safety. In this context the applicability of the regulatory guide YVL D.1 on nuclear safeguards was assessed for the operator of the research reactor. As the outcome, the requirement to revise and update the safeguards handbook was set. The requirements of the regulatory guide YVL D.1 enter in force in 1 January 2016 for the operator of the research reactor.

In 2015, STUK carried out one interim inspection at the research reactor site of VTT. On 27 March, the site declaration and, in particular, the progress in construction activities and plans to move materials and activities to the new building, were checked. STUK and the Commission verified the nuclear material inventory of VTT on 24 September 2015. The construction site for the VTT Centre for Nuclear Safety was also visited during the inspection.

On the basis of its assessment and inspection results, STUK concluded that VTT complied with its nuclear safeguards obligations in 2015.

3.1.6 STUK site

STUK Nuclear Materials Section verified the physical inventory, and inspected the site declaration and basic technical characteristics during the inspection on 11 June 2015. Also, the new safeguards manual was addressed and finally it was approved with a few remarks concerning the responsibilities and the need to update the quality management system in general. Anyhow, it can be concluded that the operating unit at STUK fulfils the requirements for national safeguards arrangements.

3.1.7 University of Helsinki site

STUK carried out its inspection to the University of Helsinki site on 21 April 2015 to verify the site declaration and the inventory. The inspections was accompanied also by inspectors from the Radiation Practices and Nuclear Security of STUK to verify the 3S practices at the University as described in the nuclear material handbook prepared in June 2014. The manual covers the control and reporting procedures for nuclear materials. Also the procedures for reporting the research and development activities as defined in the Additional Protocol were added to the handbook. The handbook was finally approved in June 2015.

On the basis of its assessment and inspection results, STUK concluded that the University of Helsinki complied with its nuclear safeguards obligations in 2015.

3.1.8 Minor nuclear material holders

In 2015, STUK inspected the reports from the minor nuclear material holders. In addition, STUK granted the licence to the Geological Survey of Finland to possess, handle, use and store nuclear materials in order to continue their activities. One minor holder reported termination of possession of nuclear material.

The minor holders were requested to prepare their nuclear materials handbooks as required in the new STUK requirements, i.e. in the Guide

YVL D.1. These handbooks or manuals were prepared during 2014, but the approval process continued in 2015. In total 13 handbooks were submitted to STUK by the minor holders, but some activities and materials were withdrawn after the submission of preliminary handbooks. In total, 8 handbooks prepared by the minor holders were approved in 2015.

On the basis of its assessment, STUK concluded that the minor nuclear material holders complied with their nuclear safeguards obligations in 2015.

3.1.9 Front-end fuel cycle operators

The operators at Harjavalta and Kokkola report monthly to the Commission and STUK. The extraction of uranium from industrial purification processes is considered to be a pre-safeguard activity and therefore not subject to IAEA safeguards. With the entry into force of Guide YVL D.1 imminent, the operators are preparing their procedures to fulfil the new requirements. In particular, the nuclear safeguards manual are to be incorporated into the quality managements systems. During 2015, STUK approved the manuals prepared by Norilsk Nickel Harjavalta and Freeport Kokkola. On the basis of its assessment, STUK concluded that these operators complied with their nuclear safeguards obligations in 2015.

During early 2011, STUK evaluated the licence application of Talvivaara Sotkamo Ltd to begin uranium production as a by-product at the Talvivaara nickel mine. On 1 March 2012, the Finnish Government granted a licence in accordance with the Finnish nuclear legislation to Talvivaara Sotkamo Ltd for the extraction of uranium from the Talvivaara mine. According to the licence conditions, STUK must ensure that all relevant arrangements are in place, including the nuclear safeguards manual and responsible persons for nuclear materials accountancy before the plant is commissioned. During 2011–2013, the uranium extraction plant was built as a new unit in the mineral processing complex. Progress in uranium extraction was halted on 5 December 2013 when the Supreme Administrative Court revoked the licence of 1 March 2012 to extract uranium for reassessment by the Finnish Government. Moreover, during 2014 the Talvivaara Sotkamo Ltd. continued for restructuring and finally filed for bankruptcy on 6 November 2014. On 12 March 2015 the Ministry of Employment and the Economy announced new financing and new ownership for the mine. Furthermore, in August 2015 the state-owned company Terrafame Mining Oy took over the mining and milling operations of Talvivaara Sotkamo Ltd. There were no safeguards activities at Talvivaara in 2015.

3.1.10 The disposal facility site for spent nuclear fuel

The operator Posiva applied for the nuclear construction application for the disposal facility in 2012. STUK assessed the application during 2013–2015 together with the Commission and the IAEA in order to clarify and facilitate safeguards measures for the permanent disposal of spent nuclear fuel. The requirement document for the IAEA/EC equipment to be installed in the encapsulation plant was prepared and finalised in 2014. This requirement document was referenced in the STUK assessment of the licence application on 12 February 2015. The construction licence for the new facility was granted by the Government on 12 November 2015.

In May 2015 Posiva updated the BTCs both for the encapsulation plant and the geological repository. In particular, the layout of the encapsulation plant was updated. In the geological repository there where no actual changes in the underground premises, but the planned shaft connections were presented more precisely to assist the planning of safeguards measures. As a consequence, the requirement document for the safeguards equipment to be installed at the encapsulation plant had to be updated by the IAEA and the Commission. This “Safeguards-by-Design” process can be expected to continue during the progress of the facility.

During 10–12 November 2015 two survey teams consisting of the Commission, JRC/Ispra and the IAEA inspector and technicians independently inspected the underground premises using laser scanning devices. All teams were escorted by operator’s staff. In their on-site assessment, the underground premises were confirmed to correspond to the drawings that were available at the construction site. Owing to the security-relevant nature of the detailed information, all the data collected and drawings inspected were left in several sealed copies at the site.

Posiva updated its safeguards manual in spring

2015 mainly to correspond to organisational changes and current safeguards practices. The number of appendices was increased to cover safeguards-related activities and also the name was changed from safeguards manual to nuclear materials handbook owing to the to foreseen control of nuclear materials. During 2015, STUK approved the manual update. As a consequence of the construction licence application, STUK approved the responsible manager and his deputy for the construction of the disposal facility.

In 2015 STUK carried out two interim inspections at the site. As the there were almost no underground excavation works going on during the processing of the licence application, the STUK inspections were focused on the site declaration, 3S site walk concepts and research activities. On the basis of its assessment and inspection results, STUK concluded that Posiva complied with its nuclear safeguards obligations in 2015.

3.1.11 Verification of spent fuel

In August 2015 STUK performed a Gamma burn-up verification (GBUV) measurement campaign at the Olkiluoto NPP unit 2. During the campaign, 50 fuel elements were measured and verified as spent fuel. In November STUK performed FORK measurements at the Loviisa spent fuel pond. The neutron detection unit of the fork device did not function, but 20 fuel units and one dummy element were verified using gross gamma measurements only. The dummy element was a skeleton element that had been inserted in the reactor between 2011 and 2013. Because of its high activation and short cooling period the skeleton device could not be distinguished from long cooled fuel elements by gross gamma measurements only, but it was clearly distinguishable from fuel elements of similar age.

3.1.12 Nuclear dual-use items, export licences

In 2015, the Ministry for Foreign Affairs issued 12 export licences for NSG Part 1 items: one individual licence for nuclear material and three for components to the EU countries, three individual licences and for exporting nuclear technology (nuclear information) for a nuclear power plant to the EU countries, four licences to export software to Sweden (3) and the Russian Federation and training of nuclear software to the representatives of the Kingdom of Saudi-Arabia.

3.1.13 Transport of nuclear materials and nuclear waste

In 2015, fresh nuclear fuel was imported to Finland from Germany, Sweden and the Russian Federation (Appendix 1, Table A1). In relation to these imports, STUK approved four transport plans and two transport packaging designs.

STUK inspected fresh nuclear fuel transports in accordance with the inspection plan, i.e. one inspection was carried out in 2015.

3.1.14 International transfers of nuclear material

In 2015, TVO reported to STUK about its international fuel contracts, fuel transfers and fuel shipments. Based on the document inspection findings, STUK concluded that TVO has complied with its safeguards obligations when purchasing the nuclear fuel and managing its international nuclear material transfers. The other operators purchase fuel as an end-product, and thus their accountancy does not need to cover the purchase chain abroad.

3.1.15 Other stakeholders

In 2015, STUK granted two licences to expert organisations to possess and transfer nuclear technology (nuclear information) related to the Fennovoima project.

Research organisations and universities that perform research and development work defined in the Additional Protocol were requested to nominate their responsible persons and prepare a safeguards manual in 2014. Since the work does not need a licence, these contact persons were not officially approved by STUK. The approval of the manuals of four stakeholders took place in the beginning of 2015.

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

3.2.1 International cooperation is the foundation of CTBT verification

During 2015, 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 Finnish national interests.

3.2.2 The analysis pipeline is a well established daily routine

The FiNDC routinely analyses all radionuclide measurement data generated at the IMS radionuclide stations across the world. 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 IMS network is still developing, and the number of installed air filter stations was 66 at the end of 2015 (in the final stage there will be 80).

The number of IMS stations equipped with radioxenon measurement capabilities was 30 at the end of 2015. 24 IMS radioxenon systems were certified by the CTBTO at the end of 2015. Radioxenon measurements are especially important for CTBT verification, because xenon, as a noble gas, may also leak from underground tests, which seldom release particulate matter. The operational stations generated more than 1,000 gamma and beta-gamma spectra per day for the FiNDC analysis pipeline to handle. The particulate pipeline is well-established and has been running stably for many years. During 2015 the FiNDC tested and evaluated the radionuclide part of the "NDC-in-a-Box" analysis software provided by the CTBTO to all interested member states. The xenon analysis software in "NDC-in-a-Box" has been integrated in the FiNDC operations as an optional tool for additional analysis of interesting events.

In 2015, there were no indications of nuclear testing in the data provided by the CTBTO; neither were there any alarms by the Finnish Institute of Seismology or any other indications of possible nuclear tests that would have required the special attention of the FiNDC. Xenon radioisotopes released from medical isotope production facilities and NPP:s are regularly measured all around the globe. Anthropogenic nuclides with CTBT relevance, mainly ^{99}Tc, ^{131}I from medical isotope production and ^{137}Cs from Chernobyl and Fukushima fallout are regularly measured at some particulate stations.

3.3 International cooperation

The implementation of safeguards in Finland was addressed at several meetings with the IAEA and the European Commission. In addition, STUK continued its participation in the ESARDA working groups, executive board and the steering committee meetings. A STUK expert finished his term as the chairperson of the ESARDA Novel Approaches/Novel Technologies Working Group; whereas, another STUK safeguards expert, continued with the vice-chairmanship of the Verification Technologies and Methodologies (VTM) Working Group. STUK experts also provided a few presentations at the INMM annual meeting and at the INMM/ESARDA joint workshop.

The progress at the Olkiluoto 3 unit, which has been under construction since 2003, and the more current authorisation of the planning and design of new nuclear facilities Olkiluoto 4, Hanhikivi 1 and the enlargement of the spent fuel storage at Olkiluoto in 2010; and, moreover the licensing of the encapsulation plant and the geological repository in 2015, have given STUK practical experience in implementing safety, security and safeguards for

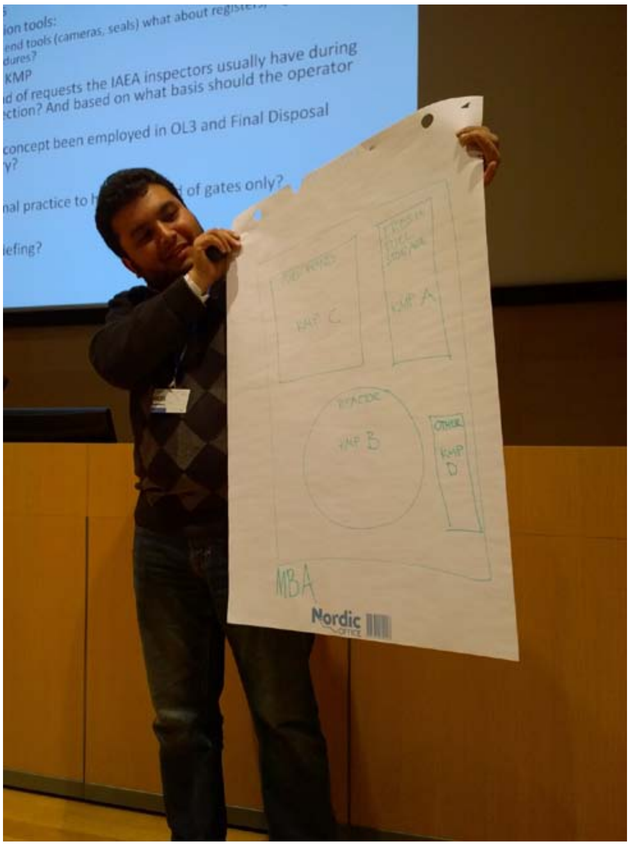

Figure 8. Introduction of nuclear material accountancy for a power reactor.

new nuclear facilities. Owing to this, STUK experts have been invited on several occasions to provide guidance and share their experiences.

Some of this cooperation has been facilitated via the Finnish Support Programme to the IAEA, but there have also been other mechanisms available to contribute to the worldwide cooperation. In 2014, the partnership programme between King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Kingdom of Saudi Arabia, and STUK began supporting Saudi Arabia's nuclear energy programme. In the field of safeguards and nuclear security, STUK's safeguards and security experts continued practical cooperation with their colleagues at K.A.CARE (Fig. 8.). In 2015, STUK assisted the U.S. DoE International Nuclear Safeguards Engagement Program (INSEP) by contributing to the safeguards-by-design workshop held in Jakarta, Indonesia. The experiences from developing STUK requirement documents for new installations in particular in Olkiluoto with the aim to have safeguards to be included in the design and construction phases were demonstrated to the participants. In addition, the new facilities at the front- and back-ends of the fuel cycle – i.e. the extraction of uranium in mining and milling and the development of the geological repository – have widened the capabilities and scope of the Finnish national safeguards system.

3.3.1 Support programme to the IAEA

The Finnish Support Programme to the IAEA Safeguards (FINSP) is financed by the Ministry for Foreign Affairs and coordinated by STUK. The FINSP was established in May 1988. In 2015 FINSP was active in the areas of verification method development, development of safeguards guidance to the IAEA Member States and in inspector training.

A NDA verification method, Passive Gamma Emission Tomography (PGET), has been under development by support programmes of USA, Sweden and the European Commission. The long lasting task JNT 1510 "Development of PGET prototype" started in 2004 was completed in 2015. FINSP is now providing support to the IAEA in the development of the prototype further under task FIN A 1997" Passive Gamma Emission Tomography System Implementation Support". The goal of the task is an approved NDA verification tool. At the end of 2015 the prototype is under electronics upgrade, which will speed up the measurements.

FINSP actively participates to the development of IAEA safeguards guidance to the Member States under the task: "Member State Contributions to IAEA Topical Guidance on Safeguards Implementations, JNT C 1959". The IAEA published a guide "Safeguards Implementation Practices Guide on Facilitating IAEA Verification Activities" in December 2014 a guide "Establishing and Maintaining State Safeguards Infrastructure" in February 2015. During the course of the year 2015 IAEA planned outreach events to make these guides known in the Member States. FINSP participated in the planning of and will contribute to these events, scheduled for the first half of 2016.

FINSP has also organised NDA training for the IAEA inspectors. A Spent Fuel Verification Training Course was held at the Loviisa NPP on 16–19 November 2015, with the support and cooperation of the NPP operator Fortum.

3.3.2 Final disposal programme and the ASTOR group

The programmes for a geological repository for spent nuclear fuel in Sweden and Finland have reached the licensing phase, and the safeguards measures must be agreed to by all parties: facility designers, operators and the inspectorates. Thus, the IAEA and the presented their safeguards approaches at the last Application of Safeguards to Geological Repositories (ASTOR) group's meetings. In 2015, the group of experts met in Gyeongju, Republic of Korea on 20–22 April. There were about 30 participants attending the meeting and excursions to the underground low and intermediate radioactive waste disposal facility and the spent fuel dry storage facility at the Wolsong NPP. The next ASTOR meeting will be hosted by US in 2016. The aim is to report and summarise the achievements obtained during the 10 year period of the ASTOR group.

3.4 Radiation monitoring at border crossing stations

STUK and Finnish Customs have a joint project for the radiation border monitoring of Finnish border-crossing stations. The upgrading project, RADAR, is now changing its form and the work continues as a maintenance process, which continues for the time being. Major investments were made in 2015, but the delivery of the detectors will take place in early 2016. Long term maintenance contracts needed for sustaining the systems will be signed in the near future. In 2015, lots of effort was put in development of IT infrastructure and analysis methods, which will make it possible to implement national nuclear detection architecture. Data analysis of spectrometric detectors from different locations is now carried out automatically at the headquarters of STUK. Moreover, STUK experts have necessary tools at their disposal to provide support to the frontline officers in real time and based on accurate information from the radiation measurements. The architecture serves both fixed installations and mobile devices.

Border monitoring has several aims: it helps to find material out of regulatory control (MORC), and it is also a part of the detection architecture combating the illicit trafficking of radioactive and nuclear materials, the proliferation of weapons of mass destruction, and nuclear terrorism. In December 2015 a training event was organised for Finnish Customs officers in EU Nuclear Security Training Centre (SECTRA) in Karlsruhe, Germany. Altogether 12 Customs officers were trained in actual work scenarios, involving radioactive and nuclear materials. In Figures 9 and 10 there are examples of identification of a target in a vehicle for further investigations and laboratory analysis.

Figure 9. Training at fictive border crossing station.

Figure 10. Demonstration of measurement technologies at SECTRA.

4 Human resources development

Nuclear materials safeguards implemented 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 such as research and development activities not involving nuclear material or the manufacture of certain equipment as defined in the Additional Protocol have extended the scope of traditional safeguards. Nuclear safeguards on the national level are closely linked with the 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). The continuous analysis of the developments in the involved fields of both technology and politics is a daily, multidisciplinary task in the STUK Nuclear Materials Section. Most of the experts working in Nuclear Materials Sections have also been reserved to work for STUK's Emergency Preparedness as experts and in case of emergency. That is a good overall view of the whole scale work of STUK, and continuous training keeps experts in touch.

The personnel's competence is systematically developed, taking into account the needs of the organisation and the wishes of individuals. Those aiming at an expert's career are valued as highly as those interested in managerial duties. One of the inspectors attended the national training course for nuclear waste management.

Because of the restrictions of the State budget and its consequences for STUK's resources, STUK undertook a reorganisation in accordance with its primary tasks and initiated the implementation of the consequent matrix organisation in 2013. Thus, when implementing the new strategy, it became important to launch a new kind of cooperation with other STUK units to optimise the use of skills and resources. Moreover, in 2014 cooperation with universities was initiated in order to re-locate budgetary funded research. Also, other actions to reduce costs took place, e.g. STUK regional laboratory in Rovaniemi was closed down and the traditional library services were concluded in 2015. The changes did not substantially affect the oversight of the use of radiation or that of nuclear energy.

In the new organisation, the cooperation with other units continues, and it is based on exchange of information, and consequent motivation and training. For example, the spent fuel verification measurements are carried out by the staff of Environmental Radiation Surveillance. In addition, STUK Radiation Practices Regulation carries out regular inspections of organisations that use radioactive sources and small amounts of nuclear materials. During such inspections, it is possible to perform nuclear safeguards inspection in accordance with the training and check-list previewed by the Nuclear Materials Section. Nuclear security and safeguards may have varied aspects to the control of nuclear materials. Therefore, it is necessary to have close cooperation between these two units. Cooperation and good communication between different departments and units improve nuclear safety, security and safeguards in general. Information security is a joint concern of all units.

The distribution of the working days of the Nuclear Materials Section in the different duty areas is presented in Figure 11. Most of the working days are invoiced to the stakeholders. As seen in Figure 11, the duty areas are divided into those of direct oversight and inspections (basic operations), support functions including maintenance, development work for the regulatory functions and consultancy, including, e.g. international cooperation financed by the Ministry for Foreign Affairs or the EU. However, the state budgetary funding constitutes only about 2% of the total funding of the Nuclear Materials Section.

The experts working for nuclear materials control. All staff members participate in the core safeguards tasks. Additionally, each person has some special areas of expertise to focus on.

Ms. Elina Martikka	Section Head	Management, international cooperation
Ms. Ritva Kylmälä	Assistant	Day-to-day business, archiving
Mr. Timo Ansaranta	Senior Inspector	Control of operators' competence at facilities, inspections, declarations
Mr. Marko Hämäläinen	Senior Inspector	Safeguards regulation, Inspection coordination, Additional Protocol-related matters
Mr. Tapani Honkamaa	Senior Inspector	FINSP to the IAEA safeguards, measurements and verification methods
Mr. Mikael Moring	Senior Inspector	Finnish National Data Centre for the CTBT, safeguards for disposal of spent fuel
Mr. Olli Okko	Senior Inspector	Safeguards for geological repository, Additional Protocol-related oversight of R&D activities
Mr. Timo Wiander	Senior Inspector	Safeguards inspections and information security, until October 2015

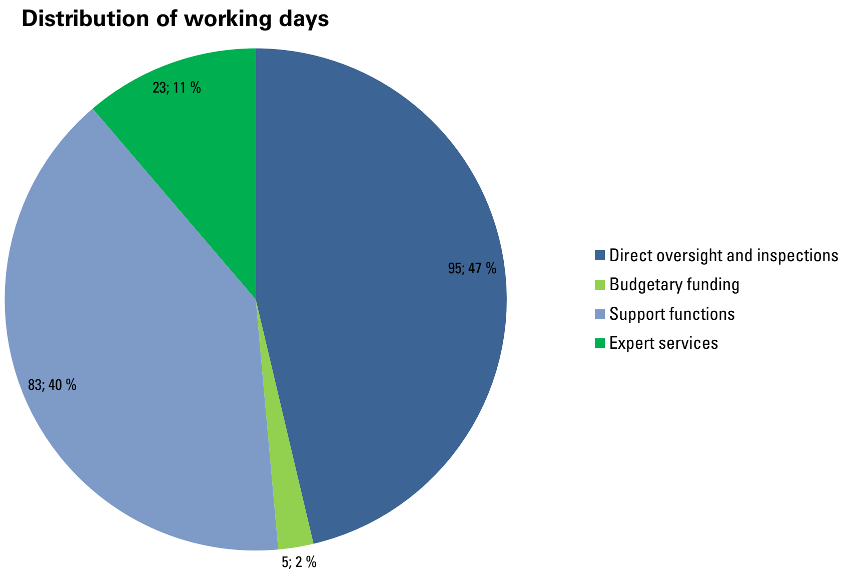

Figure 11. The distribution of working days of the Nuclear Materials Section in the various duty areas.

5 Conclusions

STUK continued with national safeguards measures and activities with 76 inspection days and 43 inspections. The implementation of the International Atomic Energy Agency (IAEA) integrated safeguards began in Finland on 15 October 2008. Since 2010, the number of IAEA and European Commission inspections annually has been close to 20. The implementation of the IAEA integrated safeguards reduces the total number of annual routine inspections days of the international inspectorates, but includes short-notice random inspections. In order to be present at all of the short-notice IAEA inspections, STUK has had a daily on-call inspector.

In 2015, STUK performed 31 safeguards inspections to the material balance areas of the Finnish nuclear power plants (NPP), 12 to the Loviisa NPP and 19 to the Olkiluoto NPP. The Commission took part in 14 and the IAEA in 17 of these inspections. The relative high number of IAEA inspections was higher than usual, due to the installation of new cameras that are suitable for remote data transfer. Since November 2015 the remote data transfer is applied to the safeguards surveillance at both NPPs. STUK performed one non-destructive assay measurement campaign at both NPPs. At other facilities, the Commission took part in the accountancy inspection and physical inventory verification at the VTT research reactor and the BTC verification at the VTT Centre for Nuclear Safety, and together with the IAEA in the BTC and design information verification of the planned geological repository at the disposal site at Olkiluoto. The verification was carried out during a three-day long survey campaign by a joint team assisted by technicians from both inspectorates and the JRC. The total number of safeguards inspections in 2015 was 43 for STUK, 16 for the Commission, and 17 for the IAEA. 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 with STUK's own findings; there were no outstanding questions by the IAEA or the Commission at the end of 2015.

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 stakeholders' declarations. Neither the IAEA nor the Commission made any remarks, nor did they present any required actions based on their inspections. By means of their nuclear materials accountancy and control systems, the stakeholders enabled STUK to fulfil its own obligations under the international agreements relevant to nuclear safeguards and non-proliferation. The main open concern at the IAEA was about the initiation of remote data transmission at the Olkiluoto NPP. In contrast to this, STUK pointed out the need to have safeguards requirements clarified for the geological repository before the licensing of the disposal facility. In general, the subsidiary arrangements and facility attachments should be updated for old facilities, and prepared for new ones.

In 2015, STUK's Nuclear Materials Section cooperated closely with the IAEA in order to share experiences and train authorities' staff in countries that are aiming at nuclear programmes, i.e. uranium production or nuclear energy. STUK cooperated with Finnish Customs to offer expert advice in the development of radiation monitoring at borders, including training for Customs officers.

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 detection. 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 ability to detect nuclear tests.

6 Publications

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Okko O (ed). Implementing nuclear non-proliferation in Finland. Regulatory control, international cooperation and the Comprehensive Nuclear-Test-Ban Treaty. Annual report 2014. STUK-B 186. Helsinki: Radiation and Nuclear Safety Authority; 2015.

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Okko O, Martikka E. Building Confidence through Transparency, Public Opinion, and Integration of Existing and Emerging Technologies. 8th INMM/ESARDA Joint Workshop, Building International Capacity, October 4–7, 2015, Grand Teton, WY USA, www.inmm.org.

STUK, 2015. STUK's statement and safety assessment on the construction of the Olkiluoto encapsulation plant and disposal facility for spent nuclear fuel. STUK-B 196.

White T, Jacobsson Svärd S, Smith E, Mozin V, Jansson P, Davour A, Grape S, Trellue H, Deshmukh N, Wittman R, Honkamaa T, Vaccaro S, Ely J. Passive Tomography for Spent Fuel Verification: Analysis Framework and Instrument Design Study. Proceedings of 37th ESARDA Symposium on Safeguards and Nuclear Non-Proliferation, Manchester, UK, 19–21 May 2015, pp .949–960.

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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, 20 % or more of U-235

HPGe
High-Purity Germanium

IAEA
International Atomic Energy Agency

IMS
International Monitoring System (of the CTBTO)

ITU
Institute of Transuranium Elements in Karlsruhe

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

INMM
Institute of Nuclear Materials Management

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

JRC
The Joint Research Centre

KMP
Key Measurement Point

LEU
Low-enriched uranium, less than 20 % of U-235

LINSSI
an SQL database for gamma-ray spectrometry

MBA
Material Balance Area

MEE
Ministry of Employment and the Economy

MFA
Ministry for Foreign Affairs

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

NRC
U.S. Nuclear Regulatory Commission

OECD/NEA
Organisation for Economic Co-operation and Development /Nuclear Energy Agency

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

PGET
Passive Gamma Emission Tomography

PIT
Physical Inventory Taking

PIV
Physical Inventory Verification

PSP
Particular Safeguards Provisions

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

Pu
Plutonium

RL07
Radionuclide Laboratory in the CTBT IMS network hosted by STUK (FIL07)

SA
Subsidiary Arrangements

SFAT
Spent Fuel Attribute Tester

SNRI
Short Notice Random Inspection

SNUICA
Short notice, unannounced inspection, complementary access, on-call 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)

YVL Guide
Regulatory Guide on Nuclear Safety (STUK requirements on safety, security and safeguards, in Finnish Ydinvoimalaitosohje)

APPENDIX 1 Nuclear materials in Finland in 2015

Table A1. Summary of nuclear fuel receipts in 2015.

To	From	FA	LEU (kg)
Olkiluoto 1, WOL1	Germany	110	19 178
Olkiluoto 2, WOL2 (1/2)	Sweden	96	16 607
Loviisa NPP, WLOV	Russian Federation	180	22 638

FA = fuel assembly; LEU = low-enriched uranium.

Table A2. Fuel assemblies at 31 December 2015.

MBA	FA/SFA *)	LEU (kg)	Pu (kg)
Olkiluoto 1, WOL1	1 128/540	192 990	851
Olkiluoto 2, WOL2	1 338/766	222 844	1 159
Olkiluoto, spent fuel storage, WOLS	7 212/7 212	1 217 893	10 303
Loviisa NPP, WLOV	5 811/5 029	676 197	6 265

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

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

Table A3. Total amounts of nuclear material at 31 December 2015.

MBA	Natural U (kg)	Enriched U* (kg)	Depleted U (kg)	Plutonium (kg)	Thorium (kg)
WOL1	–	193 039	–	852	–
WOL2	–	222 890	–	1 160	–
WOLS	–	1 217 893	–	10 303	–
WLOV	–	676 197	–	6 265	–
WRRF	1 509	60.096	0.001	< 0.001	0.044
WFRS	1.842	0.537	374.1	~0	0.346
WKKO	2 709.7	–	–	–	–
WNNH	3 588.070	–	–	–	–
WHEL	53.297	0.294	20.010	0.003	3.018
Minor holders	0.907	0.00116	1 158.6	~ 0	0.291

MBA = material balance area, WRRF = VTT Research Reactor, WFRS = STUK, WKKO = Freeport Cobalt Oy, in Kokkola, WNNH = Norilsk Nickel Harjavalta, WHEL = Laboratory of Radiochemistry at the University of Helsinki, U = uranium. *) Less than 150 g of high-enriched uranium, mainly used in detectors.

APPENDIX 2 Safeguards field activities in 2015

General information			Inspections			Inspection person days		
MBA	**Date**	**Inspection type**	**IAEA**	**COM**	**STUK**	**IAEA**	**COM**	**STUK**
WOLS	21 January	DSOS maintenance (XCAM mem. cards removed)	1	1	1	1	1	1
WOL1	28 January	SNRI (48 h notice)	1	1	1	1	1	1
WOLF	17 March	Interim Inspection+ Site check	0	0	1	0	0	2
WFRS	17 March	Site check	0	0	1	0	0	1
WOL1,WOL2, WOLS	18 March	Interim Inspection + Site check	0	0	4	0	0	8
WRRF	27 March	Site check	0	0	1	0	0	1
WNSC	27 March	DIV	0	0	1	0	0	1
WLOV	1 April	Interim Inspection + Site check	0	0	2	0	0	4
WHEL	21 April	PIV + Site check	0	0	2	0	0	4
WOL1,WOL2	28–29 April	PIV, Pre-PIT	2	2	2	2	2	2
WOL1	10 May	Core verification	0	0	1	0	0	1
WOLS	20 May	SNRI	1	1	1	1	1	1
WOL2	1 June	Core verification	0	0	1	0	0	1
WLOV	2 June	Interim Inspection	0	0	1	0	0	1
WLOF	8 June	Interim Inspection	0	0	1	0	0	2
WFRS	11 June	PIV	0	0	1	0	0	1
WOL1,WOL2, WOLS	23–24 June	PIV, Post-PIT	3	3	3	3	3	3
WLOV	5-6 August	PIV, Pre-PIT	1	1	1	2	2	2
WLOV	7 August	Pre-PIT (additional act.)	1	0	1	1	0	1
WLOV	16 August	Lo 1 Core verification	0	0	1	0	0	1
WLOV	25 August	XCAM and XSOS maintenance (LO2)	1	0	1	1	0	1
WLOV	5 September	Lo 2 Core verification	0	0	1	0	0	1
WLOV	22 23 September	PIV (Post-PIT)	1	1	1	2	2	2
WNSC	24 September	DIV	0	1	1	0	1	1
WRRF	24 September	PIV	0	1	1	0	1	1
WOL1, WOL2, WOLS	20 October	Interim inspection	0	0	3	0	0	3
WOLF	10–12 November	DIV	1	1	1	12	12	5
WOL3	10 November	DIV	1	1	1	1	2	1
WOL1, WOL2, WOLS	11–12 November	RDT equipment installation	1	0	1	2	0	1
WLOV	16 November	FF verification, containment (seals) maintenance	1	1	1	1	1	1
WLOV	17 November	Containment (seals) maintenance	1	1	1	1	1	1
NDA MEASUREMENTS								
WOL2	18–21 August	GBUV	0	0	1	0	0	13
WLOV	2–3 November	FORK	0	0	1	0	0	6
TOTAL			**17**	**16**	**43**	**31**	**30**	**76**

Note: At the Olkiluoto NPP, inspections are counted per MBA. MBA = material balance area, PIV = Physical Inventory Verification, CV = Core Verification, CA = Complementary Access, ES = Environmental Sampling, NM = nuclear material, SFAT/eFORK/GBUV = methods of non-destructive assay. RDT equipment installation at TVO Olkiluoto NPP are accounted as one activity.

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 2015 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 as amended by the Commission Delegated Regulation (EU) No 2420/2015.

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 Agreement between the Government of the Republic of Korea and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy entered into force on 1.1.2015 (FTS 5/2015).

18. The Agreement with the Government of the Russian Federation and the Government of the Republic of Finland for Co-operation in the Peaceful Uses of Atomic Energy entered into force on 6.4.2015 (FTS 32/2015).

19. The Agreement on Cooperation in the Field of Peaceful Uses of Atomic Energy Between The Government of the Kingdom of Saudi-Arabia And The Government of the Republic of Finland, signed on 8.9.2015.

20. The Comprehensive Nuclear-Test-Ban Treaty (FTS 15/2001). This treaty was ratified by Finland on January 15, 1999, but will not enter into force before it is ratified by all 44 states listed in Annex II of the treaty.