Conducting preparations for the upcoming international nuclear security advisory service

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Laurea University of Applied Sciences

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Abstract

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Finnish Radiation and Nuclear Safety Authority (STUK) must soon inspect the safe and secure operation of a new nuclear power plant, Olkiluoto 3, that is being constructed in Eurajoki. This new nuclear power plant is about to be taken into operation in 2020, should the schedule be accurate.

To ensure that high standards, requirements and international recommendations of security are met in this new nuclear power plant, international nuclear security advisory service (hereafter referred to as advisory service/IPPAS mission) from the IAEA is going to be conducted to the site. This advisory service will assess the security arrangements in Olkiluoto 3. Advisory service requires certain preparations to be made beforehand to ensure that everything goes smoothly, such as a report containing details about nuclear power plants and relevant laws, gap analysis of nuclear security legislation as well as information gathering on how to improve the IPPAS mission itself. STUK has commissioned a Safety, Security and Risk Management student from Laurea University of Applied Sciences in order to prepare for this advisory service.

Making of gap analysis regarding Finnish nuclear security legislation helps to see how well they fulfil to international nuclear security regulations and recommendations. This gap analysis will be made into easy-to-read table that can be delivered to the IPPAS team members as well. In addition, research will be with the help of a questionnaire to gain practical knowledge on how to improve the IPPAS missions in the future. Report that contains knowledge about the nuclear power plants and relevant legislation was done as well, but was not handled as part of this thesis

Main method on how this thesis was completed was desk research, meaning that much of the information that are used in this thesis was available in public sources in the Internet. Also, a qualitative questionnaire to foreign nuclear security experts was sent to gain their insight about the nuclear security advisory service. This questionnaire was the best way to conduct the research gathering as there were 19 European countries to which the questionnaire was sent.

As a result, a gap analysis and the questionnaire were finished and they both provided important information on how to improve the Finnish nuclear security legislation and overall process of the upcoming nuclear security advisory service. Therefore, STUK is now more prepared for the upcoming nuclear security advisory service than it was before.

Keywords: Compliance, IAEA, IPPAS, nuclear regulation, gap analysis, nuclear security

Laurea-ammattikorkeakoulu **Tiivistelmä**

Turvallisuuden ja riskienhallinnan koulutus (AMK)

Valmistelujen teko tulevaa
kansainvälistä ydinturvallisuuden vertaisarviointia varten

Vuosi 2019 Sivumäärä 57

Säteilyturvakeskuksen (STUK) täytyy pian aloittaa uuden Eurajoelle rakennetun ydinvoimalaitoksen, Olkiluoto 3:n, käyttötoiminnan tarkastamiset sekä turvallisuuden että turvajärjestelyjen osalta. Olkiluoto 3:n sähköntuotanto pitäisi alkaa vuonna 2020, mikäli aikataulut pitävät paikkansa.

Ollakseen varmoja, että korkeat turvallisuuteen ja etenkin turvajärjestelyihin liittyvät vaatimukset täyttyvät uudessa ydinvoimalaitoksessa, kansainvälinen IAEA:n turvajärjestelyjen vertaisarviointi tullaan suorittamaan laitokselle. Tämä vertaisarviointi arvioi ja tukee turvajärjestelyjä Olkiluoto 3:ssa. Jotta tämä vertaisarviointi menisi hyvin, tiettyjä valmisteluja täytyy tehdä, kuten esimerkiksi raportti, joka sisältää tietoja ydinvoimalaitoksista ja lainsäädännöstä, ydinturvallisuuslainsäädännön gap-analyysi sekä tiedonhankintaa siitä, kuinka itse vertaisarviointia voisi parantaa. STUK on palkannut turvallisuuden ja riskienhallinnan opiskelijan Laurea-ammattikorkeakoulusta tekemään näitä valmisteluja.

Gap-analyysin teko auttaa näkemään kuinka hyvin Suomalainen ydinturvallisuuslainsäädäntö vertautuu kansainvälisiin ydinturvajärjestelyihin liittyviin vaatimuksiin ja suosituksiin. Tämä gap-analyysi tullaan tekemään helposti luettavaan taulukkoon, jonka voi näyttää myös vertaisarviointia suorittavan tiimin jäsenille. Tämän lisäksi tietoa tullaan hankkimaan kyselyn avulla, joka lähetetään muille maille, joissa tämä vertaisarviointi on suoritettu. Tällä pyritään saamaan käytännön tietoa, kuinka parantaa vertaisarvioinnin sujuvuutta ja näin ollen sen laatua. Raportti, joka sisältää tietoa ydinvoimalaitoksista ja oleellisista laista tehtiin myös osana valmisteluja, mutta sitä ei tässä opinnäytetyössä käsitellä.

Pääasiallinen työskentelytapa tälle opinnäytetyölle oli ”desk research” – tarkoittaen, että suurin osa materiaaleista oli saatavilla julkisista lähteistä Internetistä. Tiedonhankinta vertaisarvioinnin tehostamiseksi toteutettiin kvalitatiivisen kyselylomakkeen avulla, sillä se oli paras tapa kerätä tietoa ottaen huomioon, että tietoa piti hankkia 19:stä Euroopan maasta.

Tuloksena, gap-analyysi sekä kysely saatiin valmiiksi ja ne molemmat antoivat tärkeätä tietoa, kuinka kehittää Suomen ydinturvallisuuslainsäädäntöä ja yleisesti koko vertaisarvioinnin sujuvuutta ja näin ollen STUK on valmistautuneempi tulevaan turvajärjestelyjen vertaisarviointiin kuin ennen opinnäytetyön tekoa.

Avainsanat: määräystenmukaisuus, IAEA, IPPAS, ydinturvallisuuslainsäädäntö, gap-analyysi, ydinlaitoksen turvajärjestelyt

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1 Introduction

Nuclear power plants are a reliable way to produce great amounts of electricity, while producing only small amounts of carbon dioxide emissions while operating, making it good solution to fight against the climate change. However, history has showed that there is a chance, although rare, a nuclear accident to occur causing harm to the environment and people because of ionizing radiation. This can either happen from human errors, natural disasters or plant malfunction but can also be caused by malicious, unlawful actions (e.g. sabotage of a nuclear facility or nuclear material). Nuclear power plants can be a tempting target for different malicious parties with various motivations varying from terroristic motives with a goal to cause radiological consequences to the environment or to steal nuclear material all the way to environmental protests conducted by different parties that try to disrupt the operations of the nuclear power plant.

There have been nuclear security events around the world where malicious acts have been committed against the nuclear facilities. These acts can be caused either by malicious insiders, outsiders, or both in collusion. The malicious acts can be either physical or cyber-attacks, or both (blended attacks). For these reasons, it's important to regulate the use of nuclear energy to ensure safe and secure use of the nuclear power plants. If the actions taken in the field of nuclear security are not effective enough or are not considered to be important, adversaries would most likely take advantage of the situation and the weaknesses.

Purpose of this thesis is to explain the process of IPPAS mission preparations that are done beforehand to ensure that the IPPAS mission is conducted successfully and to do a research about the benefits of IPPAS missions that was conducted in other countries. This way the future IPPAS missions may be developed and the feedback can be taken into consideration when planning the IPPAS mission that is going to be conducted in Finland in 2020

As part of the preparations, a gap analysis regarding nuclear legislation will be done where the Finnish nuclear security legislation and regulation is benchmarked to the international requirements/recommendations (also referred to as international instruments) to see whether any improvements should be made to the Finnish nuclear security legislation. Gap analysis will be shown to the IPPAS team members so that they can get a clear idea on how well the Finnish nuclear security complies with the international requirements and recommendations.

This thesis was conducted for Finnish Radiation and Nuclear Safety Authority's YTS – Nuclear Security arrangements office, that is part of YTO – nuclear reactor regulation department. YTO's main objective is to ensure that the design and operation of the nuclear power plants meet the requirements set by the legislation and that the operation doesn't unnecessarily expose employees, people or environment to ionizing radiation. It is still the responsibility of

the nuclear power plant's license holder to make sure that the operation is safe and secure and that the requirements of the State are fulfilled.

1.1 Abbreviations and definitions

AIP: Advance Information Package. A report that is made before the IPPAS mission that will then be delivered to the IPPAS team members. This report will contain all the necessary information about the host country, such as relevant legislation, information about the nuclear power plants, information relating to the nuclear security and IPPAS mission schedule and policy.

CPPNM: The Convention on the Physical Protection of Nuclear Material. This convention was signed at Vienna and at New York in 1980 and is the only international legally binding instrument regarding physical protection of nuclear material. In 2005 an amendment was added further improve its provisions.

IAEA: International Atomic Energy Agency. IAEA was established in 1957 and it's an organisation within the United Nations that's purpose is to promote the safe, secure and peaceful use of nuclear technology.

IPPAS: International Physical Protection Advisory Service. An international Advisory Service that is conducted in a Member State of the IAEA upon the State's own request. IPPAS mission provides peer advice on implementing international instruments and assistance about the protection of nuclear and other radioactive material in various facilities and associated activities.

NPP: Nuclear Power Plant.

NSS: Nuclear Security Series. Series of public publications made by IAEA that provide international guidance on all aspects of nuclear security.

NTI: Nuclear Threat Index. A public assessment about the nuclear materials security conditions in 176 countries. In 2018, Finland ranked top place of number 1 country on two categories: preventing sabotage of nuclear material and theft of nuclear material.

Nuclear security event: An event that has potential or actual adverse implications for nuclear security that must be addressed.

Nuclear security regime: A general term that comprises of the legislative, regulatory framework, administrative systems and measures governing the nuclear security. Also, institutions and organisations within the State that is responsible for ensuring the implementation of this legislative/regulatory framework belong to the nuclear security regime. Under this term

belongs also the nuclear security systems and measures that are used to prevent, detect and response to nuclear security events.

STUK: Finnish Radiation and Nuclear Safety Authority. An independent competent and Finnish government agency that operates under the Ministry of Social Affairs and Health. STUK's mandate is to supervise and inspect use of radiation and nuclear energy in Finland. The overall goal is to protect citizens, environment and society from the harmful effects of ionizing radiation.

2 Theoretical background

2.1 History of nuclear power in the world and in Finland

Nuclear power has a long history, dating back to 1938 when Otto Hahn and Fritz Strassman in cooperation with Lisa Meitner discovered fission – changing of uranium nuclei into two pieces during neutron bombardment. (U.S Department of Energy: The Discovery of Fission)
Fission was an important milestone in creating the nuclear power reactor, but it wasn't until late 1942, when an Italian physicist Enrico Fermi had come to a point in his research where the construction of nuclear power reactor could begin. In November 1942, Fermi and group of scientists started constructing world's first nuclear reactor. In December 1942, construction was completed, and a reactor called Chicago Pile-1 was finished in the squash court beneath University of Chicago's athletic stadium. The reactor started operating successfully and it meant that a nuclear era had begun. (U.S Department of Energy: The History of Nuclear Energy)

Commercial use of nuclear energy started in late 1950 and beginning of 1960s when USA, UK, Canada, France and the Soviet Union were the first countries who started to use nuclear energy on a wider scale. (World Nuclear Association)

Finland didn't enter into nuclear era so quickly, only a nuclear research reactor called FiR 1 was constructed in Otaniemi in 1962. Purpose of this reactor was to develop domestic expertise about the subject. (Sandberg 2013, 14)

But in the coming years as Finland's standard of living rose and the industry developed; there was a need for even more electricity. Also, self-sustainability was an important factor as the price of electricity was high, so it started to effect on Finnish industry's competitiveness.

This led to a situation in 1965 where Finnish companies Kotkan Höyryvoima Oy and state company Imatran Voima tried to construct a nuclear power plant in Finland. These plans failed because it only had been thought with business perspective whereas political, safety and security aspects should have been considered as well. Therefore, the Finnish government halted these plans to construct a nuclear power plant.

It wasn't until 1969 when the government started discussions with Soviet Union in order to acquire first nuclear power plant in Finland. It was required that the plant would meet the western safety requirements/ classifications. This combination of eastern and western technologies meant that Imatran Voima needed to acquire own expertise over the topic. Predecessor of STUK, Institute of Radiation physics played a key role in making the safety requirements for the plant.

In 1970 and 1971 the decision was made to acquire the both plants, Loviisa 1 and 2. They were connected to the electrical grid in 1977 and 1980.

Private sector wanted to build a nuclear power plant as well, which led forest industry to establish a company called Teollisuuden Voima Osakeyhtiö (TVO). TVO acquired the nuclear reactor from Sweden in 1974 with an option to acquire another unit. This option was later fulfilled. Two units in Olkiluoto, Eurajoki were connected to the electrical grid in 1978 and 1980. (Sandberg 2013, 15-18.)

2.2 Finnish nuclear industry

Finland has quite a large nuclear industry considering the size of the country; in total there are four operating nuclear power reactors; Olkiluoto 1&2 operated by company called TVO and Loviisa 1&2 operated by Fortum. Also, Olkiluoto 3 which will be operated by TVO, is expected to start operation in 2020.
In addition, decision in principle has been approved by the Government for the new nuclear power plant that shall be built in Pyhäjoki. This nuclear power plant shall be called Hanhikivi 1 and it will be operated by a company called Fennovoima.

Research reactor called FiR1 was also commissioned in the 1962 in Espoo's Otaniemi with the purpose of research and training in nuclear area, but it was later used to produce radionuclides and radiation therapy. The operation of FiR1 was shut down in 2015 and it's now under decommissioning phase.

World's first spent nuclear fuel repository facility, called Onkalo, is being constructed in Olkiluoto next to the nuclear power reactors and with the ability to dispose 2800 spent nuclear fuel containers. When in operation, Onkalo will consist of at least 137 final disposal tunnels dug around 400-500 meters deep that has total length of 47km within an area extending over two to three square kilometers into the Finnish bedrock.

STUK has given a positive statement about the safety and security aspects of multi-metal company Terrafames application to start mining uranium in Sotkamo. Now it's up to Ministry of Economic Affairs and Employment of Finland to decide whether the mining can begin. This would mean that around 135 tons of uranium could be extracted from the soil each year together with other minerals and some of this uranium could be processed into uranium oxide

(also known as yellow cake), a material that can be used as nuclear fuel if further processed. (Terrafame)

Table 1 Info about the Finnish NPPs

NPP name	Loviisa 1 & 2	Olkiluoto 1&2	Olkiluoto 3	Hanhikivi 1
Commissioned	1977 (Loviisa 1) 1980 (Loviisa 2)	1978 (OL1) 1980 (OL2)	2020	Around 2028
Location	Loviisa, Hästholm	Eurajoki, Olkiluoto	Eurajoki, Olkiluoto	Pyhäjoki, Hanhikivi
Licensee	Fortum Power and Heat Oy	Teollisuuden Voima Oy (TVO)	TVO	Fennovoima
Net electrical output (MW) per NPP	507MW (Loviisa 1) 502MW (Loviisa 2)	890MW	1600MW	1200MW
Reactor type	Pressurized Water Reactor (Atomenergoexport)	Boiling Water Reactor (Asea Atom)	Pressurized Water Reactor (EPR) (Areva)	Pressurized Water Reactor (RAOS Project Oy)
Number of fuel assemblies	313	500	241	163

2.3 How nuclear power plants operate

Nuclear power plants operate by heating water to produce steam. This water will be heated with the help of nuclear fission, where atoms are split apart in order to form smaller atoms. This heat created by the nuclear fission inside the reactor core will then create steam that spins large turbines which drives generators producing electricity. Nuclear power plants will then cool down this steam back to water with the help of cooling towers or water from nature. Cooled water can be reused to produce steam.

Fission occurs inside reactor of the nuclear power plant, and in the centre of this reactor is the core, where the uranium fuel is located. Uranium fuel is formed into ceramic pellets which are then placed inside a metallic fuel rod. These metallic fuel rods are bundled together and can have even hundreds of rods. When bundled together, a fuel assembly is formed. Reactor core contains several fuel assemblies. (U.S. Energy Information Administration) To give some dimensions on how energy dense one gram of uranium-235 is, to produce the same amount of energy, around 3000kg of coal would be needed. (Vahvelainen 2002)

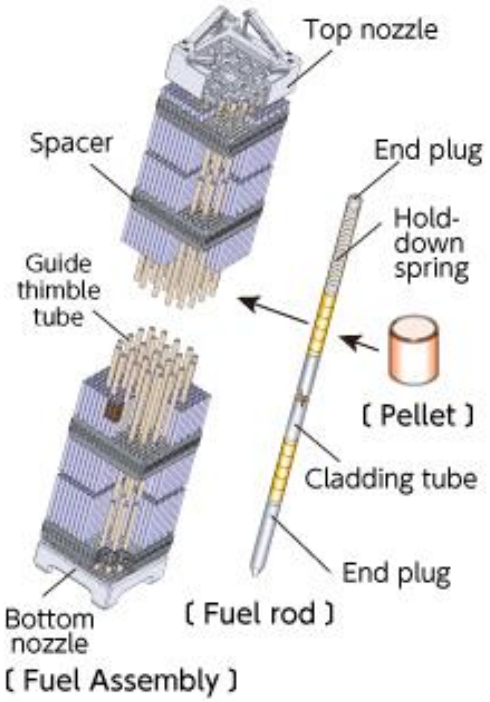


Figure 1 Example figure of Fuel Assembly (Mitsubishi Nuclear Fuel)

2.4 Types of nuclear reactors used in Finland

According to STUK (2015), Finland currently uses two types of nuclear power reactors to produce electricity: pressurized-water nuclear reactors (PWR) and boiling-water nuclear reactors (BWR).

Olkiluoto 1 and 2 plants in Eurajoki are BWR:s and in these plants the heat from the fuel rods is transferred through the core to flowing cooling water, which then heats up and starts to partially create steam. Steam is then separated from water and led to the steam turbine. This expanding steam then spins the turbine and the electrical generator attached to it. Steam that is cooled down in the turbine condenses back to water that can be pumped back to the reactor.

Power of the reactor can be changed with the help of control rods, which contain specific substance such as boron, to absorb the neutrons. To lower the power of the reactor, control rods are pushed inside the reactor, thus absorbing neutrons and containing fission. Another way to adjust the power of this reactor is to change the cooling flow.

Both BWR:s in Finland generated around 14,1 TWh of power in 2018.

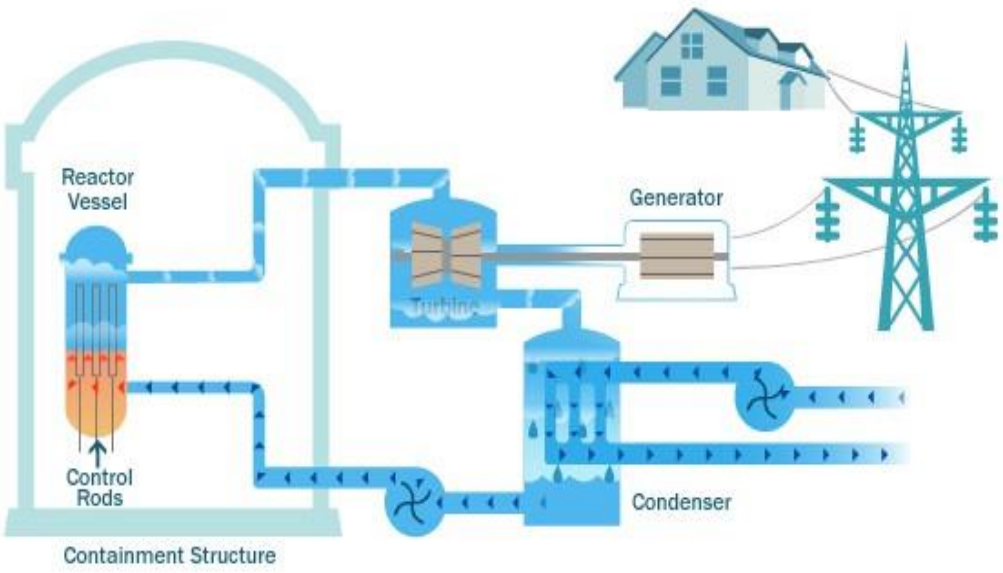


Figure 2 Example of BWR (CLP Group)

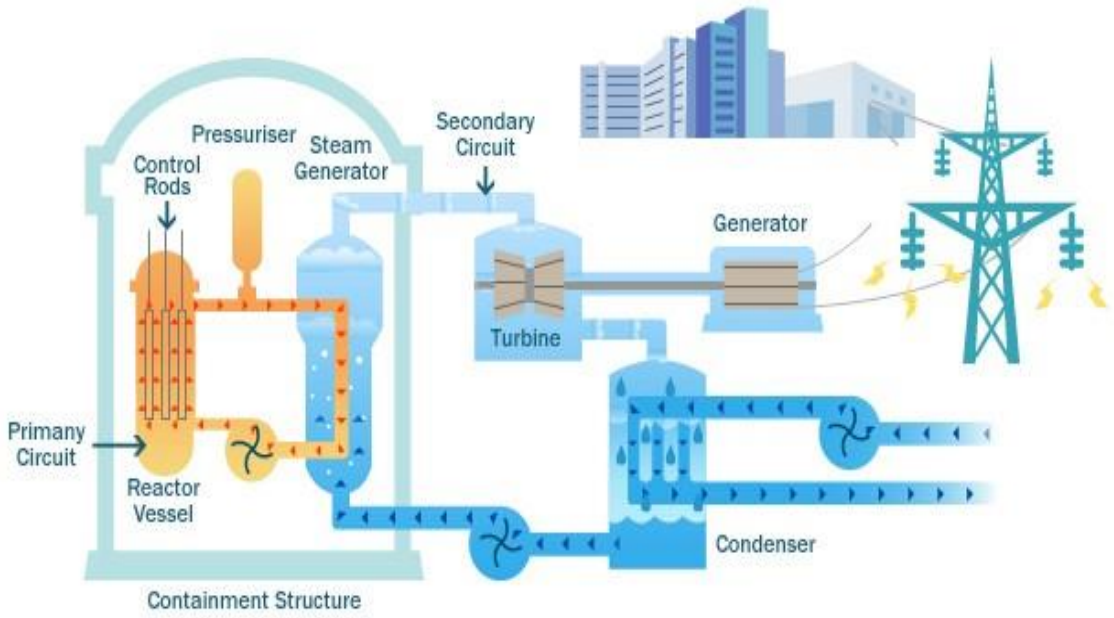


Figure 3 Example of PWR (CLP Group)

PWR:s main difference compared to BWR is that cooling water does not evaporate in the reactor. Instead, steam is produced in steam generator, which lets high-pressured water to run through in thin pipes. Heat from these pipes shifts to the low pressured water located in a separate secondary circuit, which after evaporating, is led to the turbines.
Power of PWR can be modified through the control rods and by changing the boron concentration.

Both the Loviisa 1 and 2 are PWRs that are used in Finland and in total they generated around 7.8 TWh of power in 2018.

2.5 Finnish Radiation and Nuclear Safety Authority

Finnish Radiation and Nuclear Safety Authority (STUK) is an independent competent authority which operates under the Ministry of Social Affairs and Health. Main objective of STUK is to ensure that radiation exposure in Finland is kept as low as reasonably possible and to ensure safe and secured use of nuclear energy. STUK was established in 1958 and in the first years it operated under Medical Administration with a name called Department of Radiation Physics that's purpose was to inspect the radioactive sources in hospitals. When the use of nuclear power became more relevant in Finland in the 1960s, STUK was appointed more duties and authority to supervise the nuclear and radiation safety. During the same time, STUK had also become independent safety authority which was known as Radiation Safety Institute. It was in 1984, when the name was changed to Radiation and Nuclear Safety Authority. (STUK 2015)

STUK conducts regulative inspections on licensee holders' premises to ensure that all the requirements that are given in legislation regarding the use of nuclear energy and radioactive sources are met. Nuclear power plants are not the only place where the safety and security are inspected, also radiation usage in health care, industry and in other research are supervised by STUK. Also, inspecting the transport of radioactive material is part of STUKs operations.

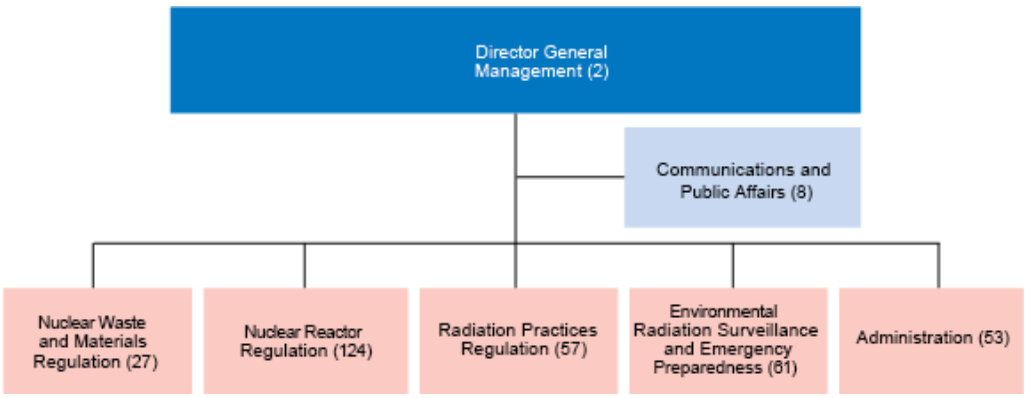


Figure 4 STUK organisation chart from 2018

2.6 Nuclear security arrangements office – YTS

According to STUK (2016), security arrangements in regard to nuclear security means all the activities that's purpose is to protect nuclear facilities, nuclear material and radiation sources against malicious and other unauthorized acts. However, security arrangements do not only protect against intentional actions but also against human errors. Should any above defined act occur, it may have severe social, financial, medical and environmental consequences. Activities of these acts may either be intentional or unintentional aiming to:

- Inflict damage through the use of nuclear or radioactive material, or threatening to use such material
- Compromising the safe and secure use of nuclear facility or radiation
- Compromising the integrity of nuclear material and waste or radiation source
- Creating another direct/indirect threat to nuclear or radiation safety
- Willfully causing damage to nuclear facility, radiation source or nuclear material and waste

In order to prevent these from happening, nuclear security arrangements can be divided into different categories: preventive actions, detection, delay and response, which means stopping the unlawful activity and thus minimizing the consequences. Security arrangements can be: administrative (organizational, safety culture, management system), technical (structures and mechanisms that provide detection, delay, alarm systems), functional (surveillance by the security organization, response by off-site authorities) and information/cyber security. (STUK 2016)

2.7 Requirements & recommendations regarding nuclear security arrangements

All requirements regarding nuclear security arrangements are laid in down in legislation and in regulatory guides. Nuclear Energy Act (990/1987) and Radiation and Nuclear Safety Authority's Regulation on Security in the Use of Nuclear Energy (Y/3/2016) state the general security obligations in the use of nuclear energy. There are certain international obligations as well that Finland has ratified that set requirements for the nuclear security, for example the CPPNM as Amended.

Objective of Nuclear Energy Act (990/1987; amendments up to 862/2018 included) is: "*In order to keep the use of nuclear energy in line with the overall good of society, and in particular to ensure that the use of nuclear energy is safe for man and the environment and does not promote the proliferation of nuclear weapons, this Act lays down provisions on the general principles for the use of nuclear energy, the implementation of nuclear waste*

management, the licensing and control of the use of nuclear energy, and the competent authorities."

Still, the Nuclear Energy Act doesn't contain that much detailed information about the security measures that should be taken. For example, it is said in Chapter 2, Section 7 that: "*Sufficient security and emergency arrangements as well as other arrangements for limiting nuclear damage and for protecting use of nuclear energy against illegal activities shall be a prerequisite for the use of nuclear energy.*"

Purpose of the Y/3/2016 is to supplement the Nuclear Energy Act by setting out more detailed requirements for the security arrangements for the nuclear energy usage. The scope of Y/3/2016 is: "*This regulation applies to security arrangements in the use of nuclear energy. The regulation applies to the security arrangements implemented at nuclear facilities during the different stages of their life cycles in order to ensure that the requirements set for the different stages can be met.*".

Most detailed requirements regarding nuclear safety and security that STUK shall supervise are laid down in STUK's YVL-guidelines. YVL- guidelines that directly relate to security arrangements are YVL A.11, Security of nuclear facility and YVL A.12 Information security management of a nuclear facility. (STUK 2017)

Also, Design Basis Threat (DBT) is used to set more detailed requirements on security arrangements. The DBT is a classified document that defines the threats and adversaries' potential capabilities that a nuclear facility can face. (Bunn, Malin, Roth & Tobey. 2016, 32) These include the motivation, attributes and characteristics of the adversaries, whether insider (person working in the nuclear facility) or outsider, or both in collusion. Intelligence information and other data is crucial for the creation of DBT. (IAEA 2009)
In Finland, the DBT is established by STUK and is based on the threat assessment issued by the Finnish Security and Intelligence Service SUPO.

Most important international treaties regarding nuclear security that Finland has ratified are the CPPNM and the UN Resolution 1540 and they are both important elements for effective nuclear security.

Originally in 1980 when CPPNM was signed, it included requirements for the states to criminalize unauthorized removal of nuclear material and it stipulated broad requirements on how to secure civilian nuclear material during international transport (Bunn et al. 2016, 36). In 2005, amendment to CPPNM was issued to also include physical protection requirements for nuclear materials in domestic use. It also covers the sabotage of nuclear facilities. These requirements aren't detailed but instead it sets the responsibilities of the state and requires establishing nuclear security regime with necessary measures. (Bunn et al. 2016, 36)

Total of 118 countries are part of amendment of CPPNM, including Finland. (IAEA 2019)

United Nations Security Council Resolution 1540 (UNSCR 1540) was approved in 2004 and it requires every UN member state to provide security and accounting for all nuclear materials that are in their possession, criminalize any acts that assist non-state actors to acquire nuclear material, put in place nonproliferation controls and to report to the Council on all the steps that are taken to implement this resolution. In 2011, oversight committee for this UNSCR 1540 was extended for another 10 years and at the same time mandates were extended by identifying effective methods and providing guidance and templates on implementation. (Bunn et al. 2016, 38)

According to IAEA, Nuclear Security Series (NSS) were launched in 2006 by the IAEA and is continuously updated by them as well. These guides provide guidance on nuclear security and can be divided into four different tiers:

- Nuclear security Fundamentals which states the fundamental objective and essential elements that State's should implement.

- Recommendations that set out measures what the States should take in order to maintain and upkeep effective security regime.

- Implementing guides providing guidance on how to implement the Recommendation guides.

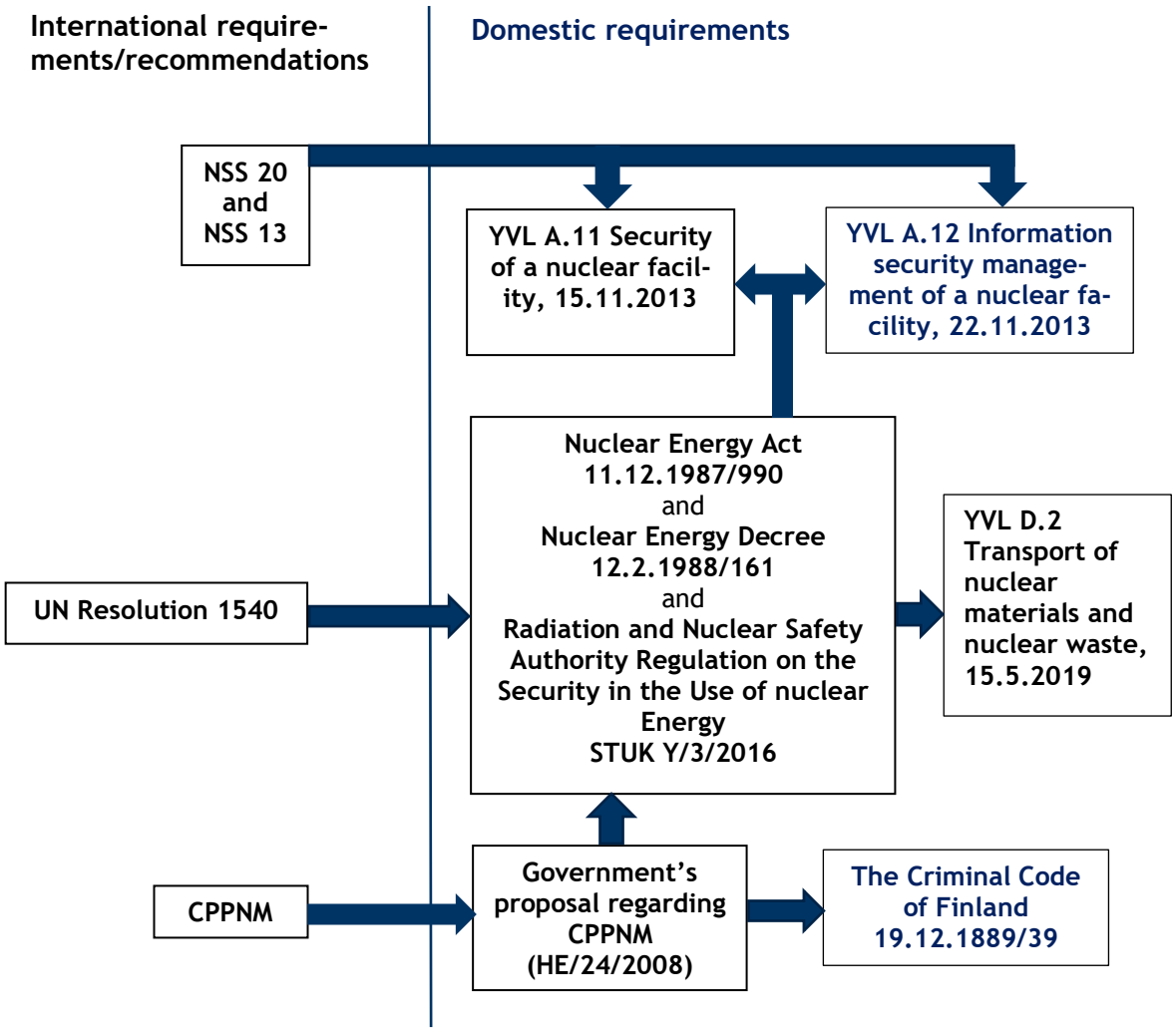
- Technical guides set out detailed guidance on methodologies and techniques on how to implement security measures

In this thesis, Nuclear Security Series No. 13 and 20 were used.

NSS 13, called Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities is made to provide guidance to States and its authorities on how to improve, implement and maintain nuclear security regime for the nuclear facilities and materials with the help of implementing legislative and regulatory programs. Recommendations that are included in NSS 13 have been prepared within wide consensus of the IAEA Member States. (NSS 13 2011)

NSS 20, called Objective and Essential Elements of a State's Nuclear Security Regime belongs to fundamental tier of documents and provides objective and essential elements that can be used to create effective nuclear security regime. NSS 20 is intended for national policy makers, competent authorities, legislative bodies and institutions that are dealing with the State's nuclear security regime. (NSS 20 2013)

Figure 5. Illustration on the influences on how international instruments that were used in the thesis affect Finnish nuclear security legislation and regulation.



2.8 Nuclear security events in nuclear facilities

Assessments have been conducted by intelligence analysts, statespersons and academics to evaluate the threat of nuclear terrorism in the recent years and the conclusion from dozens of countries is that the threat of nuclear terrorism is real, urgent and requires action. (Bunn et al. 2016, 14)

IAEA maintains an Incident and Trafficking Database (ITDB) which maintains record of illicit trafficking and other illegal/unauthorized activities that relate to all sorts of nuclear and other radioactive material. Database was taken into action in 1995 and since December 2018, 138 countries are members of this database. Information for this database is gained straight from the State as they are encouraged to report any event to the database.
As of December 2018, total of 3497 incidents were reported, however only 285 incidents are confirmed to be illegal trafficking or other illegal use. Total of 2247 reported indents are not

related to the any malicious activities and the remaining 965 of the reported incidents doesn't have enough information to say whether they truly are related to trafficking or malicious use. (IAEA 2019)

Another database is Nuclear Facilities Attack Database (NUFAD), which is a global database that records assaults, sabotages and unarmed breaches that nuclear facilities have faced. This database was made by START (Study of Terrorism And Responses to Terrorism) researchers and the information for this database was collected from media archives, academical and public government documents and from RANNSAD (The Radiological and Nuclear Non-State Adversaries Database). (NUFAD)

According to NUFAD, between years 1961 to 2014 there has been 80 reported physical nuclear security events in nuclear facilities. Possible cyber-attacks are not listed in this database. 60% of these attacks are classified as "successful", meaning that the attacker has succeeded in his/her objectives concerning the attack and thus caused harm to the nuclear facility and its operations. (Pomper & Tarini 2017, 8)

Below are some examples of nuclear security events that have taken place in the last decades. (NUFAD)

1. Superphenix Fast-Breeder Reactor in Creys-Malville, in France in 1982 came under fire from anti-tank rockets in midnight that damaged the facility, which was still under construction. Total of five shots were fired from the hills around 550 meters away. All the five rockets hit targets located in the plant area and the perpetrator managed to escape. Later, a member of the Pacifist and Ecologist Committee admitted the crime.

2. Over the period of five months in 1992, a chemical engineer in Luch Scientific Production Association in Podolsk, Russia, smuggled total amount of 1,5kg of highly enriched uranium in small 50-70 g packages out of the facility in order to sell it on black market (protracted theft). He was motivated by a newspaper article that advertised the potential profits gained if selling the nuclear material in black market. Chemical engineer was sentenced to probation.

3. In 1995 at Elektrostal Plant in Moscow Oblast, Russia, an employee smuggled 1,7kg of 21% enriched uranium out of the facility by hiding the uranium in a shopping bag full of apples (abrupt theft). Portal monitors had a malfunction at that time, so the unauthorized removal was not detected immediately.

4. Blayais Nuclear Power Plant in Blaye, France was attacked by a saboteur who attempted to clog one of the reactors cooling contours with salt. This occurred in 1995.

5. In 2003, a terrorist plot with jihadist motives was uncovered. Target was Cap de la Hague Reprocessing Plant in Cotentin Peninsula, France. Idea was to use suicide bombs against French nuclear power plant as well as to attack several trucks that were carrying powdered plutonium from the reprocessing plant to several sites in Central-Europe. Plot was disclosed by a person receiving training in al-Qaida camp.

6. In 2007 in the Iranian enrichment plant near the village of Natanz, a Dutch contractor employee who had authorized access to the plant, used a USB stick to infect critical plant systems. This malware caused centrifuges that were used to separate and enrich uranium, to speed up and spin wildly, leading to destruction of approximately 20% of the Iran's centrifuges. It's believed that U.S.A. and Israel hired and trained the Dutch contractor worker to conduct this strike. (Giraldi 2019)

7. In 2014 in Doel Nuclear Power Station in Belgium, a malicious insider caused an oil leak in the steam turbine, which led Doel 4 turbine to overheat, thus automatically shutting down. Plant did not produce electricity for 5 months.

8. In 2015 Belgian police found out that terrorists who were involved in terrorist attacks in Paris had taken hours of surveillance video at the home of a Belgium's nuclear research center's senior official. Research center has substantial amounts of highly enriched uranium in it. So far, this event is the most severe indicator that terrorist group ISIS might be interested in acquiring nuclear material. (Bunn et al. 2016, 18)

When comparing these reported nuclear security events to the safety incidents that have occurred in nuclear facilities around the world, it can be seen that the reported safety incidents occur less often, but so far, they are also the only accidents that have caused serious/major harm to the environment and society. Statistics illustrate that between 1950-2014 there have been 216 reported safety incidents in nuclear facilities, on which 104 had an INES value. (Wheatley, Sovacool & Sornette 2016)
An INES (International Nuclear and Radiological Event Scale) is used to determine the severity of the safety incident and it has a rating 1-7, where 1 is an anomaly and 7 is a major accident, such as Chernobyl and Fukushima accident. (IAEA)

Number of nuclear security events clearly indicate that the threat of malicious acts is real and thus every country should take nuclear security seriously and continuous improvement of it is important.

STUK has recognized these security threats and in its strategy for years 2018-2022, especially terrorism and vulnerabilities of information networks are mentioned. (STUK's strategy for 2018-2022)

2.9 IPPAS Mission

The International Physical Protection Advisory Service was originally established in 1995 with the main purpose to assist IAEA's Member States in establishing and maintaining an effective nuclear security regime that helps to protect against unauthorized removal of nuclear material and the sabotage of nuclear facilities and nuclear material. The IPPAS mission compares the measures that are undertaken in the State to the requirements set by CPPNM and Nuclear Security Series Publications. Since 1996, there has been total of 88 IPPAS missions around the world. (Services Series 29 2014)

The whole IPPAS process starts with a formal request that is sent to the IAEA's Division of Nuclear Security. When this formal request is received, IAEA shall designate a staff member that acts as technical officer whose responsibilities include the preparatory work and making the arrangements to conduct an IPPAS mission. With the approval of host country, IAEA shall select an IPPAS team leader that has very broad experience in nuclear security.

A preparatory meeting will be held in the host country around three-four months before the actual IPPAS mission. This allows authorities, governmental organisations and representatives from the nuclear facilities to participate in a meeting where detailed discussions such as the scope and topics of the upcoming IPPAS mission are discussed.

Before the mission is conducted, an Advance Information Package (AIP) shall be prepared to the IPPAS team giving all the necessary information for the mission. Relevant non-confidential information that needs to be covered in the AIP include overview of the nuclear security regime, relevant national legislation dealing with nuclear security, overview of relevant national authorities and general publicly available information about the nuclear facilities. (Service Series 29) Any sensitive information that might come up shall be provided to the team during the IPPAS mission. AIP plays a key role in preparations for the IPPAS mission.

The actual IPPAS mission will last full two weeks and during that time interviews, document reviews and possible facility visits are conducted. Each IPPAS team member shall then take notes about the strengths and weaknesses that they observe so that quality of the assessment is improved.

A draft report shall be prepared by the team about the IPPAS mission that shall compare the national legislation and good practises to the existing guidance and practices and then proposes changes, if necessary. This draft report shall be presented to the host country at the

exit meeting which marks the completion of the IPPAS mission in the host country. Final report shall be sent to the host country within four weeks of the IPPAS mission.

Possible recommendations and suggestions are handled by the State, typically in action plan. In most cases the State requests a follow-up mission to be conducted to verify the implementation of the recommendations. This follow-up is usually conducted 3-4 years after the actual IPPAS mission. (Services Series 29. 2014)

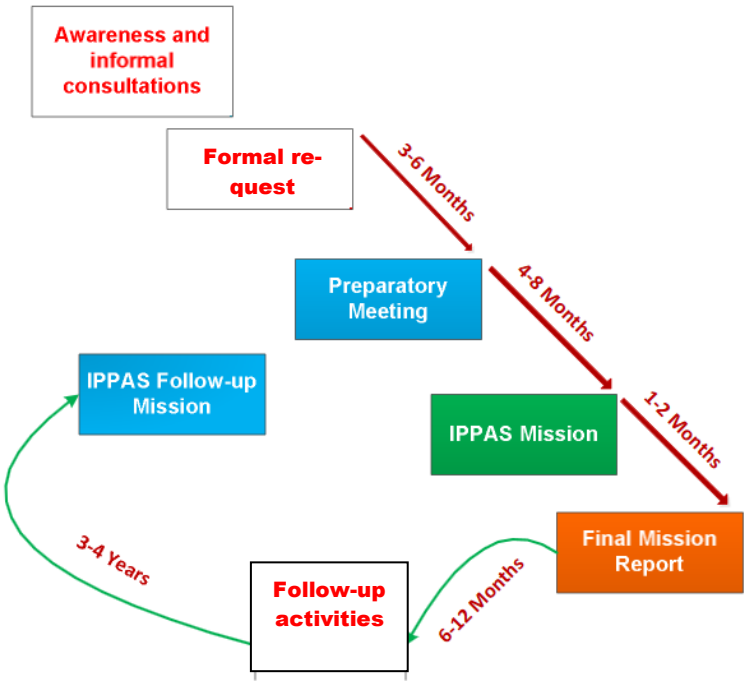


Figure 6 IPPAS mission process

These IPPAS missions are conducted on the request of a State and in Finland, Ministry of Economic Affairs and Employment of Finland shall request these missions. Previous IPPAS mission in Finland was held in 2009 and a follow-up mission was held in 2012. In 2009 IPPAS mission it was concluded that the overall level of security was good and the recommendations that were given had to do with improving nuclear energy legislation so that the confidential information is better protected and that the design basis threat is defined. Also, increase in resources for STUK's nuclear security arrangements supervision was recommended. (STUK 2013)
In order to implement these recommendations into action, sharing of duties was conducted so that each department took responsibility on certain recommendations that belong to their field.
Follow-up that was conducted in 2012 showed that Finland has met the requirements well.

3 Thesis framework

According to Rantanen and Toikko (2009, 7) developing procedures more efficient from individual work tasks all the way up to society's structures is one part of the modern society's key functions. Development aims for a change with a goal of something better or more efficient than the previous procedures/functions.

Gap analysis and questionnaire are both tasks that relate to development of STUK's activities: results of the gap analysis can be used to improve the Finnish nuclear security legislation and the questionnaire can be used to improve the upcoming IPPAS mission to make it go more smoothly and thus improving the overall performance of the mission.

3.1 What is the gap analysis?

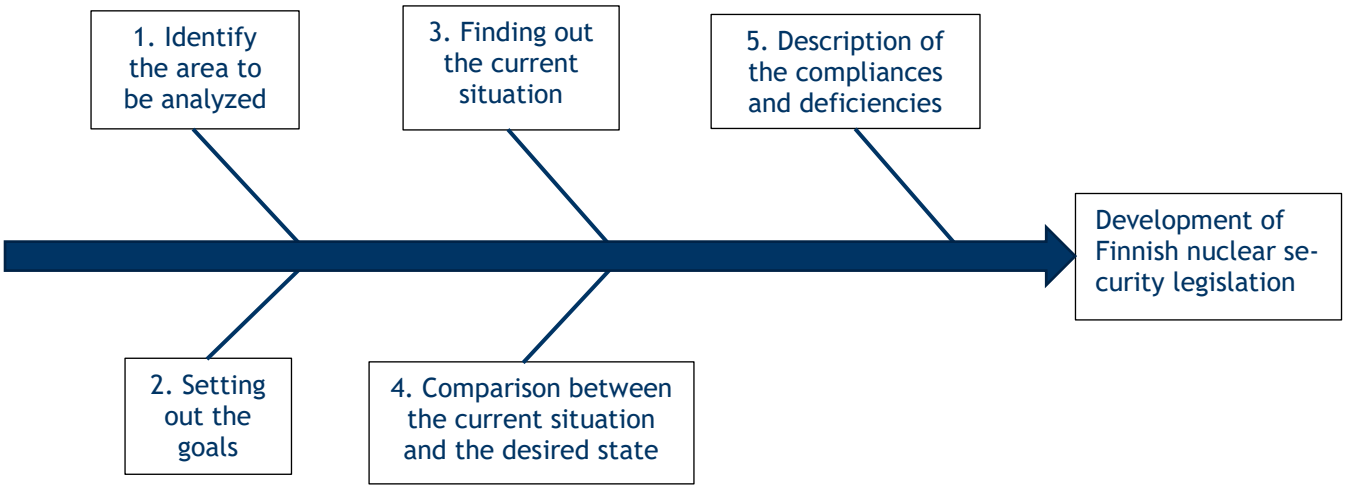
Name gap analysis is used for process that compares the actual performance to that which is expected or desired. This can be used to identify missing processes, practices or structures and then to recommend steps that should be done to meet those goals. There are many benefits to conduct a gap analysis: it gives insight into areas that need improvement, ensures that requirements are met and identifies areas of weaknesses. There are some downsides as well, for example the analysis may be inaccurate because of changing environment or the real root causes might not be analysed if the gap analysis is not in a detailed manner. (SmartSheet)

Gap analysis process starts by identifying the areas to be analysed and setting out the goals. In addition, the ideal future state should be considered; what the situation would be if every goal was met. Analysing the current situation is the next phase in gap analysis; what are the causes and why the required goals are not met.

After having an idea on the current situation, comparison should made to the ideal situation to gain understanding on what the current deficiencies are. Gap between meeting the goals and deficiencies should be described. Also, quantification of the deficiencies can be made to give clearer idea on how broad the issue is.

Finally, the deficiencies that were found should be summarized and procedures should be started on how to fix them.

Figure 7 An example of how the gap analysis was conducted (SmartSheet)



3.2 Research question

Research question aims to explore uncertainty in certain area and that's why it's considered to be vital to define research question before starting any research. Some indicators of good research question are that it should detail the problem, guide the data collection and set context for the research. (Ratan, Anand & Ratan 2019)

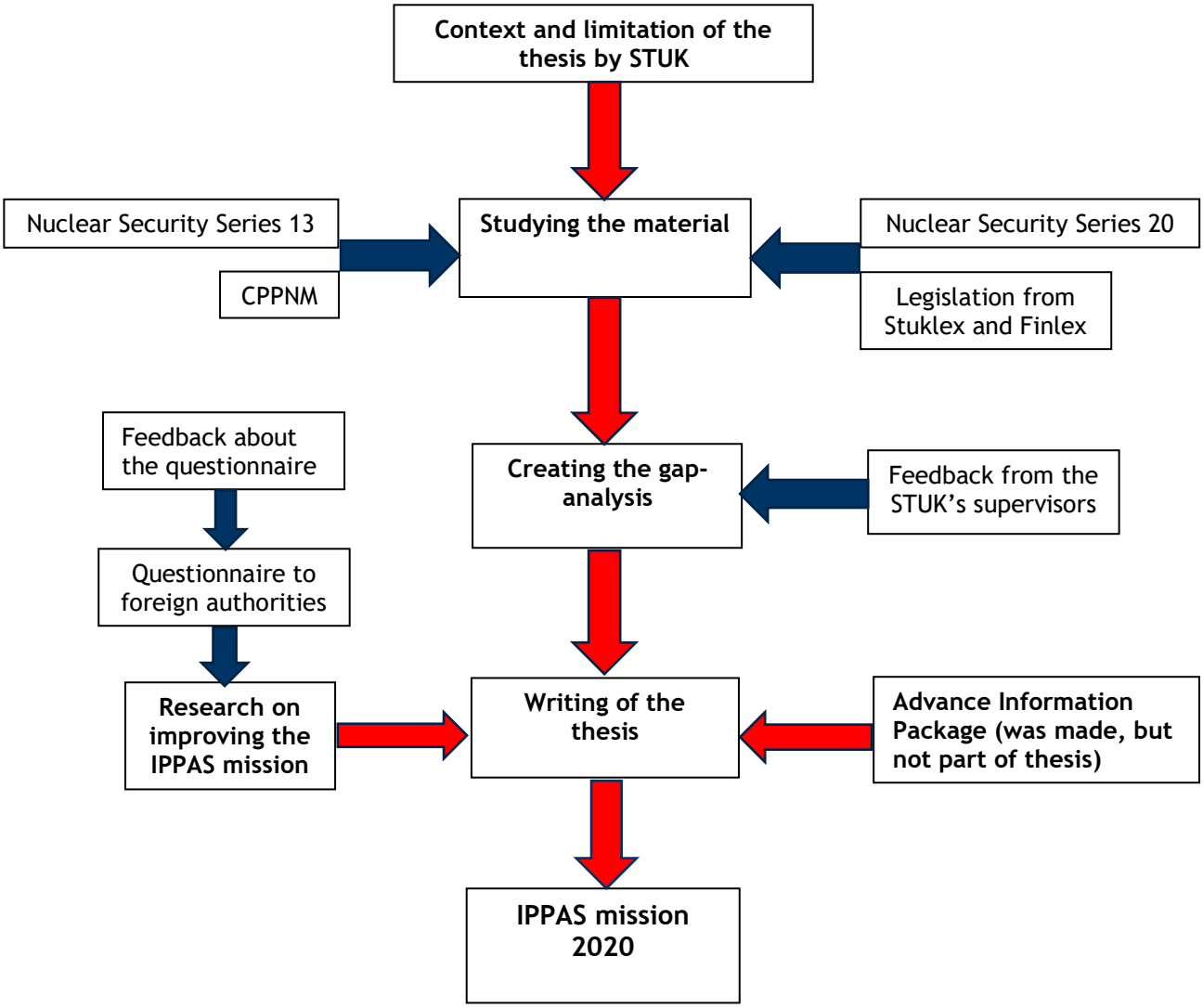
Research question for this thesis was selected to be: How compliant Finnish nuclear security legislation is when compared to international instruments?

As for the information gathering, it was also included as part of the IPPAS mission preparations due to the writing of the thesis, but still doesn't really belong under the main research question, thus a sub-question was made: What can be done to improve future IPPAS missions?

There were couple of reasons why these were chosen as the research questions. First of all, the IPPAS mission is going to be conducted here in Finland in 2020, thus requiring preparations to be made. Secondly, the gap-analysis shows directly whether the nuclear security legislation is compliant compared to the international instruments (NSS 13, 20, CPPNM and UN Reso 1540). If the nuclear security legislation meets the requirements well, Finland is more prepared for the IPPAS. Thirdly, the information gathering allows to get knowledge needed to help STUK conduct the IPPAS more efficiently.

Research goal for the thesis was to find answers for these research questions, which would then provide new information that STUK could benefit from.

Figure 8 Process of the whole thesis



Because this thesis had two objectives: conducting the gap analysis regarding nuclear security legislation and the questionnaire on how to develop IPPAS missions, each part below has its own section for both tasks.

3.3 Limitations

Objective of this thesis was to compare the current state of nuclear security legislation to the international requirements and recommendations. Results of the assessment will then support the nuclear security supervision that is conducted in nuclear facilities across Finland.
Most of the legislation that STUK supervises has to do with safety, which according to Eirik Albrechtsen (2003, 2) can be defined as a: "The condition of being protected from or unlikely to cause danger, risk or injury".

Only a small part of nuclear legislation has to do with security arrangements: YVL A.11 Security of a nuclear facility and YVL A.12 Information security of a nuclear facility are the main guidelines that are used when supervising the security arrangements in nuclear facilities. In addition, there is YVL D.2, Transport of nuclear materials and nuclear waste, which sets certain security requirements for the nuclear material and nuclear waste. Nuclear Energy Act lays down the requirement that STUK needs to set up detailed safety/security requirements that meets the Nuclear Energy Act's requirement for the safe/secure use of nuclear energy.

For the questionnaire, limitation was on the IPPAS mission itself and how the experienced team members have experienced the previous IPPAS missions. Idea was not to get any ideas about the advisory service topics themselves: they are already selected beforehand. Instead, the questionnaire focuses more on practical and organizational issues to get an insight of problems that previous IPPPAS missions have faced.

3.4 Literature review

Literature review's aim is to find, read and analyse the literature that shall be used in the particular topic, in this case the thesis. (Grossman 2010) However, literature reviews purpose is not to be a listing of all the sources used to gather information or neither a book-review. Relevant sources on where to find information for the literature review are scientific magazines, public corporations such as ministries and agencies, international organisations publications as well other expert organisations research. (Salminen 2011, 31)
Therefore, creating a literature review helps researcher to get up-to-date overview about the literature used in the thesis. (Wee B.V & Banister 2015)

3.4.1 Gap analysis

Literature review was an important part in creating this gap analysis as the material is so deeply connected to the nuclear industry that the foreknowledge in this topic was quite limited. The material that was used to create this thesis was mostly the nuclear security legislation found on STUKLex (YVL-guidelines, Nuclear Energy Act etc.) and then the international requirements or recommendations (CPPNM, UN Resolution 1540, Nuclear Security Series 13 and 20).

Studying these materials formed the basis for the whole thesis as the self-assessment is basically only about legislative matters. Before starting to make the gap analysis, supervisor from STUK informed about the materials that should be used so that only the relevant regulations are used. As can be seen, the material used in gap analysis was not related to actual literature like books or articled, but instead to legislation and documents that set out requirements. This meant that the literature was reliable and mostly up-to-date. Only with the Finnish nuclear legislation there were few cases where the law text was not either translated to

English or it was an old version which meant that it misses out some relevant points. Therefore, unofficial translations from Finnish law text had to be made in certain parts.

3.4.2 Questionnaire

As for the questionnaire, it was important to learn how to make good questionnaires, so therefore material was acquired to gather knowledge about the topic. However, most of the questionnaire was done in cooperation with HRD-specialist or department secretary who both are professionals in functions that are used to develop or support the STUK's procedures.

3.5 Research methods

Research methods are the strategies, processes or techniques that are used in the collection of data or evidence for analysis in order to discover new information or to create a better understanding about a topic. There are different methods that can be used for this data collection for example, questionnaires, document analysis, interviews or observation.

Research itself can be divided into qualitative research, quantitative research or mixed methods research. Qualitative research is gathering of data about lived experiences, behaviours and the meaning individual attach to them. This is used to gain better understanding of complex concepts, social interactions or cultural phenomena.

Quantitative research gathers numerical data that can be ranked, measured or categorised through statistical analysis, thus assisting uncover patterns and making generalisations.

Mixed method research is a combination of both the quantitative and qualitative research that provides holistic approach in combining the statistical data with deeper insights. (Booth, Ogle & Talbot-Stokes 2019)

For this thesis, research methods were questionnaire (a quantitative research method) and document analysis (qualitative research method). Combination of these methods indicates mixed method research was used.

3.5.1 Gap analysis

Gap analysis was conducted in Excel, where all the requirements from the various sources (NSS 13, NSS 20, CPPNM and UN Resolution 1540) had their own sheet to make it look clearer. To speed up the work and to ensure integrity of the requirements they were copied straight from the source. After all the requirements from every source were inserted into the Excel file, assessment of each requirement was started by going through them one by one. If there was a counterpart for that certain requirement in the Finnish legislation, the law text was copied next to the requirement and the cell was marked green to indicate that requirement was met, and no further actions are needed. If the Finnish legislation only partially met the

requirement, the law text's cell was marked yellow and the requirements cell text was painted red on that part what needs to be evaluated again. Should there be no counterpart in the Finnish legislation, the cell was marked red. At the early stages of creating this gap analysis, meeting was held with the workplace supervisor to gain feedback.

Some of the requirements can be met by the text that is included in the appendix A, which is classified information according to Act on the Openness of Government Activities (621/1999), paragraph 24.1 §7 and thus cannot be published in the thesis and in the self-assessment. In addition, some of the requirements/recommendations are covered in the DBT, which is also a classified document.

It should be noted that the gap analysis only took into account legislation, not the actual procedures in the nuclear facilities, so therefore even though certain parts did not fully meet the international requirements/recommendations, it doesn't mean that there wouldn't be procedures in place that fulfil at least the requirements.

When making of the gap analysis had come to a point where the comparison had been almost fully completed, a meeting with the YTS Section Head was done to go through the findings and to give preliminary comments about the results. During this meeting, the parts that were only available in the classified Annex A and DBT were given.

	A	B	C	D
2	This file lists the requirements/recommendations set by NSS 13, NSS 20, CPPNM and UN Resolution 1540 and they are then compared to the Finnish nuclear security legislation to see how well the Finnish legislation complies to international requirements/recommendations.			
3				
4	IAEA:s Nuclear Security Series 13 focuses on physical protection of nuclear material, that includes its physical protection during transport, and of nuclear facilities against malicious acts.			
5			**Self-assessment criteria:**	
6	https://www-pub.iaea.org/MTCD/publications/PDF/Pub1481_web.pdf		Fulfills the requirement	
7			Partially fulfills the requirement	
8			Does not fulfill the requirement	
9				
10	**Requirements set by NSS 13:**		**Requirements set by Finnish legislation:**	
11				
12	**1.13.** Three types of risks should be taken into consideration: Risk of unauthorized removal with the intent of constructing nuclear explosive device, Risk of unathorized removal, which could lead to subsequent dispersal and Risk of sabotage		**Chapter 3, Section 8 paragraph 3 of STUK Y/3/2016 Radiation and Nuclear Safety Authority Regulation on the Security in the Use of Nuclear Energy** states: "3. The nuclear facility shall have in place appropriate methods for the detection and prevention of unauthorised removal of nuclear materials, nuclear waste, radioactive substances and confidential information."	
13				
14	**1.15.** When facility contains nuclear material and other radioactive material, two sets of protection requirements should be considered and implemented in a manner such that the more stringent requirements for physical protection are applied		**Y/3/2016 Chapter 2, Section 4, paragraph 2** states: " Security shall be based on the utilisation of several security zones placed within each other so that systems and components important to safety, and nuclear material and nuclear waste, are afforded particular protection and access control and the control of goods traffic can be arranged." Also, **Nuclear Energy Act Chapter 2, Section 7 b** states: "The safety of a nuclear facility shall be ensured by means of successive levels of protection independent of each other (safety principle of defence-in-depth). This principle shall extend to the operational and structural safety of the plant." **YVL A.11 Chapter 3, Paragraph 321** states: "Under Section 4 of Government Decree (734/2008), security shall be based on the utilisation of several security zones placed within each other so that systems and components important to safety, and nuclear material and nuclear waste, are afforded particular protection and access control and the control of goods traffic can be arranged [2]. Technical, administrative and operative procedures shall be used to protect the aforementioned items."	
15				
	2.1 The overall objective of State's nuclear security regime is to protect persons, property, society and the environment from malicious acts involving nuclear material and other radioactive material - Protect against unauthorized removal: protecting against theft and other unlawful		**Decree about Finnish Radiation and Nuclear Safety Authority (STUK), Chapter 1, Paragraph 1** tells that STUK must supervise the safety, security and preparedness procedures regarding the use of nuclear energy and nuclear material. Also, **Safety in radiation practices ST 1.1 Chapter 2** states: " The purpose of radiation protection is to protect human beings, society, the environment and future generations from the harmful effects of radiation without unnecessarily restricting acceptable uses of radiation or	

NSS 13 | NSS 20 | CPPNM | UN Resolution 1540 | Yellow parts gathered | Red parts gathered

Figure 9 Picture of gap analysis

3.5.2 Questionnaire

Questionnaire is a widely used tool that allows to gather information as well as numerical data without the presence of the researcher that is also quite straightforward to analyse. However, in order to make a good questionnaire, time is required to develop and refine a good questionnaire. (Cohen, Manion & Morrison 2007, 317)

Due to the fact that this questionnaire was submitted to the foreign regulatory authorities, an online questionnaire was used. It was made with the help of Webropol online survey platform that allows the creation of wide variety of surveys with good customization options. Also, the results of surveys can easily be transferred into an PDF, excel or word format for easier analysis. Benefits of the questionnaire is that it allows more honest answers compared to interviewing people (for example, in this case with Skype call) because of the anonymity, thus increasing reliability. In this questionnaire it was voluntary to put up contact information. It's also less time consuming than doing actual interviews. Disadvantages of this questionnaire is that there might be low response rate and risk of misinterpreting the questions exists. (Cohen et al. 2007, 158)
As implicated by Cohen, Manion & Morrison (2007, 340), to improve the response rates, a pre-notification about the questionnaire should be sent before sending in the actual questionnaire and notification about the questionnaire's deadline during the answering period should be sent as well. Both of these steps were taken to improve the quality of the results and it was also emphasised to ask, should there be any questions.

Overall idea of the survey was to gain ideas and feedback from experienced IPPAS team members on how the mission could be conducted better. The IPPAS mission is known to be quite hectic as there's a lot to do but only two weeks to finish the whole mission. This leads to a situation where the working days that start in the morning can last late in the evening. Long working hours and busy schedule may eventually lead to decreased work quality.

When creating the questions for this survey, the plan was to make them simple to understand but also informative so that relevant information could be acquired when analysing the results. This was especially important as not everyone speaks fluent English. The design of the of the questionnaire can also influence on the response rates. Therefore, it was important to design the questions so that the answers are not only answered with one or two words. Another aspect that needed to be taken into consideration was the response burden. Response burden can be defined as the effort required by a person to answer the questionnaire. (Rolstad, Adler & Rydén 2011)
The fact that affects the response burden is length of the questionnaire, thus making too many questions should be avoided as this might lower the response rate or decrease the quality of the answers due to lack of motivation to fill too lengthy questionnaires. Therefore, it

was crucial to balance between the reasonable amount of questions to gain the information but still not to make it too lengthy.

Finally, in order to make sure that everything works as intended, questionnaire testing was conducted was partially filled and submitted. No problems occurred during the testing and thus it was ready to be submitted.

The questionnaire was originally sent to the regulators on 5.7.2019, but no deadline was given because of the ongoing holiday season. Instead, in September 6th an notification was given about the deadline that had been agreed to be September 20th, so everyone's holiday was finished. Two weeks seemed to be reasonable amount of time to answer this survey as it must be considered that the questionnaire was originally sent in July.

In the end there were total of 15 questions and to minimise the response burden, few multiple-choice questions were added. This helps also in the data analysing phase as the answers can be seen directly from the table, instead of reading every single answer individually.

Questions that were asked in this survey were:

- 1. Contact info (voluntary)
- 2. Organisation
- 3. When was the following missions conducted in your country?
- 4. How often do you try to organize IPPAS mission to be conducted in your country? What is your basis for this decision?
- 5. What benefits were gained from the IPPAS mission?
- 6.What could be done to improve the IPPAS mission? (for example, to make it more efficient or smoother to organize…) based on your experience?
- 7. Was there something, regarding to IPPAS, that you would do in different way next time?
- 8. Is it possible that the NTI index (https://ntiindex.org/data-results/) for your country would rise in the future assessment, because of the help gained through IPPAS mission?

- 9. Do you consider that the team members, who participated in IPPAS mission, were professional and cooperation with
- 10. Were you able to influence on the selection of the team leader, team members and/or other experts for your IPPAS
- 11. Did any problems occur between IPPAS team members and the host country representatives?
- 12. Additional feedback/improvement ideas regarding IPPAS missions
- 13. Have you published your IPPAS mission report for the public?
- 14. Do you consider that the good practices (GP) database, managed by the IAEA, is valuable for you (learning from other good practices)
- 15. On a scale 1-10 (10 being the best), what grade would you give to IPPAS mission that was conducted in your country, in your country, in overall?

3.6 Scheduling

Because of the different tasks that needed to be done for this thesis and the limited timing, making a good schedule was an important part. Schedule allows the prioritisation of the tasks and guidelines on how much time should be allocated on certain task.
The task was started on 2.5.2019, when the public-service employment relationship began in STUK and the deadline was given to the end of the year 2019.

Table 2 Schedule of the thesis

	Start date	**Finish date**
Research plan	1.3.2019	15.4.2019
Gap analysis	1.5.2019	20.6.2019
Making of questionnaire	21.6.2019	5.7.2019
Analysis of the gap analysis results	29.8.2019	30.9.2019

Analysis of the questionnaire results	1.9.2019	30.9.2019
Writing of thesis	1.8.2019	Before the end of the year

These were the tasks that directly related to the making of thesis, but in addition writing the AIP was done mainly during summer and improvements gained via feedback during autumn were then later added to the AIP.

4 Results

4.1 Gap analysis

Originally the gap analysis found out more incompliances than there actually would have been. This is because all the incompliances were later checked together with the workplace supervisor and it was found out that some of the Finnish counterparts that comply with the international requirements can be found in the classified Annex A or DBT. Because they contain detailed requirements for the security arrangements, they are not published in public and thus were not taken into consideration when creating the gap analysis. This led to a situation where some of the findings were actually met even though they were listed in the yellow or the red section.

In the end, there was 9 yellow sections for the NSS 13, 0 for the NSS 0 and 0 for the CPPNM. There were 2 red sections that both related to NSS 13.

Now that the incompliances are recognised, corrective measures can be started. Correction cannot be made immediately into the legislation, instead changes can be adopted when there is a larger revision process going on. Examples on what incompliances were found are given below.

1. NSS 13, Section 1.13 states that: "*Three types of risks should be taken into consideration: Risk of unauthorized removal with the intent of constructing nuclear explosive device, Risk of unathorized removal, which could lead to subsequent dispersal and Risk of sabotage*". Currently in the Finnish nuclear security legislation there is no mention about the word "sabotage".
   Closest Finnish legislation's counterpart for this requirement was: Chapter 3, Section 8 paragraph 3 of STUK Y/3/2016 Radiation and Nuclear Safety Authority Regulation on the Security in the Use of Nuclear Energy that states: "The nuclear facility shall have in place appropriate methods for the detection and prevention of unauthorised removal of nuclear materials, nuclear waste, radioactive substances and confidential information."

Thus, a proposal for changing the legislation is going to be made where the term sabotage is going to be included in nuclear security legislation to make it look more clear for everyone that every aspect of malicious activity is taken into consideration in the design and operation of nuclear security arrangements.

2. In NSS 13, Section 3.28 it's stated: "*For a new nuclear facility, the site selection and design should take physical protection into account as early as possible and also address the interface between physical protection, safety and nuclear material accountancy and control to avoid any conflicts and to ensure that all three elements support each other*".
   Currently in the Finnish legislation there is no direct requirement for the interface between physical protection, safety and especially the nuclear material accountancy and control. In Radiation and Nuclear Safety Authority Regulation on the Safety of a Nuclear Power Plant, Y/1/2018, Chapter 3 Section 8 interface between physical protection and safety is considered, but not the material accountancy. Therefore, requirement shall be edited so that nuclear material accountancy will be taken into consideration.

3. Section 3.47 in NSS 13, it's stated that: "*Defence in depth should take into account the capability of the physical protection system and the system for nuclear material accountancy and control to protect against insiders and external threats*."
   Best counterpart in Finnish legislation was Nuclear Energy Act Chapter 2, Section 7b, which states: "*The safety of a nuclear facility shall be ensured by means of successive levels of protection independent of each other (safety principle of defence-in-depth). This principle shall extend to the operational and structural safety of the plant"*. Thus, change into legislation shall be made that takes the nuclear material accountancy into account.

4. NSS 13, Section 3.57 states that:" Operators*, shippers and carriers should establish sustainability programmes for their physical protection system. Sustainability programmes should encompass: …Equipment updating, maintenance, repair and calibration…, …Configuration management (the process of identifying and documenting the characteristics of a facility's physical protection system — including computer systems and software — and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated in to the facility documentation)*
   Counterparts for this part of the requirement is not found in the public part of Finnish YVL-guidelines, but in the confidential Annex A part. The confidential requirement will be changed to meet the configuration management and maintenances better.

5. In NSS 13, Section 4.33, it's said that: "*A 24 hour guarding service and response forces should be provided to counter effectively any attempted unauthorized removal. The central alarm station personnel and off-site response forces should communicate at scheduled intervals. The guards and response forces should be trained and adequately equipped for their functions in accordance with national laws and regulations*".
   Finnish counterpart for this is YVL A.11 Chapter 3, paragraph 354: "*A nuclear facility shall have, around the clock, the number of security personnel defined in the security standing order, who are appropriately equipped and trained and have undergone drills to act under various threats*". Also, decree on nuclear security Y/3/2016 Chapter §, section 11 gives certain requirements on this topic.
   Still, proposal is going to be made that the decree's part is going to be changed to meet the requirement better concerning the communication interval between central alarm station personnel and off-site response forces.

6. In NSS 13, section 4.29 it's stated that: "*On-site movements between two protected areas should be treated in compliance with the requirements for nuclear material during transport, after taking into account existing physical protection measures at the facility*".
   In the Finnish legislation there was no direct counterpart for this, so therefore a proposal is going to be made to add a new requirement into the Finnish YVL A.11 guideline.

7. It's said in NSS 13 Section 4.44 that: "*Private vehicles should be prohibited access to inner areas*". It was found out that there is no counterpart in the Finnish legislation for this part, therefore a new requirement will be added when the legislation is revised.

8. In NSS 13, Section 5.34 it's stated that: "*During a shutdown/maintenance period, strict access control to vital areas should be maintained. Prior to reactor start-up, searches and testing should be conducted to detect any tampering that may have been committed during shutdown/maintenance*". There was an Finnish counterpart in the confidential YVL A.11 Annex A regarding this, but it's going to be modified to take inspection procedures in the reactor start-up better into consideration.

These were just part of the findings, but it can be seen that despite the fact that some of the listed findings were found in Annex A and thus complied with the international requirements/recommendations, there were still parts that needed to be updated.

4.2 Questionnaire

Questionnaire was sent to total of 19 other European nuclear security regulators and there were total of 13 answers, which is quite a good amount of answers. One of the answers was received in a Word file as the deadline was missed.
All of the respondents are nuclear security professionals with years of experience.
Due to privacy reasons, no organisations or persons names that answered the questionnaire are given in this thesis, even though voluntary contact details were given in the questionnaire. Privacy and anonymity are said to be key part in ethical research. (Crow & Wiles 2008)

Certain answers are given below. It should be noted that if the answer contains information that can be used to identify organisation or person, that information will be left out from the thesis.

1. When was the following missions conducted in your country and how often IPPAS mission is going to conducted?

   According to the answers, most of the previous IPPAS missions were held within 10 years' time and most recent one was held in 2018. Longest time when a previous IPPAS mission had been conducted was in 1996 and 1998. When looking at the answers, it can be seen that the frequency on how often the IPPAS missions are conducted in each country varies quite a lot within countries; some have no determined frequency where as other countries try to do it every 5, 10 or 12-year period. Thus, it is totally up to country's own decision whether the mission is conducted more often or not. Things that showed from the answers is that frequency of the missions are affected by the (lack of) human and financial resources or even recommendation from AHGNS (Ad Hoc Group on Nuclear Security) 2012 – a report made after the Fukushima incident to further improve security of nuclear facilities. All in all, basis for the IPPAS is on voluntary basis, and many countries try to organise it on regular basis.

   "*We would like to organise at least every 10 years, but our resources (human and financial) are very limited. It is very important to receive insights on a regular basis from international experts regarding current physical protection regime and to identify areas for the improvements.*" (Respondent)

   "*Every 5 years. Basis = enough time to take necessary steps (ex. legal initiatives) and changing environment (emerging threats)*" (Respondent)

2. What benefits were gained from the IPPAS mission?

   Answers indicated wide variety of the benefits that were gained from the IPPAS missions. Especially the broadness and comprehensiveness of the IPPAS mission were seen as benefits as this meant that whole nuclear security could evolve, not just a certain part of it. Recommendations and suggestions that were gained during the IPPAS mission were seen very helpful by the respondents as they played a crucial role to improve the nuclear security. Also, awareness raising was one mentioned in the answers; other organisations/ authorities became more aware of the importance of nuclear security.

   "*Good wrapup of last 5 years 2. Comparison with other countries regarding initiatives and lessons learned 3. Support in future decision making within our country (through recommendations) 4. Presence of IPPAS is an extra element to make other organisations aware of the importance of nuclear security.*" (Respondent)

   "*The IPPAS missions conducted in (…) were very positive. They helped to strengthen the importance given to nuclear security by the different (…) stakeholders and authorities and they developed a shared vision. It was a leverage to make our nuclear security regime evolve, especially the regulation.*" (Respondent, identification removed with (...))

   "(1) A good and independent audit peer review of the (…) system for physical protection based on CPPNMA and the IAEA NSS. We got a number of recommendations and suggestions that challenge our own thoughts and contribute to continuous improvement of the national physical protection regime.
   (2) Valuable exchange and sharing of experience and good international practices between national counterparts and international team of experts, aimed at strengthening the State's nuclear security regime.
   (3) Contributes to the credibility of the national physical protection regime by building stakeholder confidence and showing regulatory transparency.
   (4) Several of the recommendations and proposals submitted have been a dressed in the (…) development of work with physical protection.
   (5) We have just (spring 2019) been given a government assignment to develop an report on the action plan to deal with remaining recommendations and proposals and report on compliance with CPPNM/A in preparation for the 2021 review meeting of the convention." (Respondent, identification removed with (…))

3. What could be done to improve the IPPAS mission (for example, to make it more efficient or smoother to organize…) based on your experience?

   In the answers for this question, it was found out that many improvement ideas related to the mission time and its management as well as workload. Plenty of time should be reserved for preparing the IPPAS mission.

Improvement ideas for the actual mission were also given. It was said that certain topics might not be interesting for the whole group, thus it would be good to have common, but small briefing to the whole team. In-depth discussion would be nice to be have only with topic related experts.
Another thing that showed up in the answers was that host country could embed an person to the IPPAS team as this would help situations where the IPPAS team might not necessarily understood. Host country representative could then clarify the situation during the writing of the report. Legal expert assistance would also be nice during the IPPPAS mission.

"*Some topics were not interesting for the whole team, so for those topics it is better to have a common, but small briefing to the whole team. For questions and more in-depth discussion split up the group with only the topic related experts in that specific group. This was partially done, by using that option in the second week, but is also useful in the first week.*" (Respondent)

"*Separate IPPAS assignments can be compiled and form a basis for assessing whether the work of all the individual states combined leads to the overall purpose of the ACPPNM convention – a worldwide effective physical protection of nuclear materials and nuclear facilities. It should be emphazised that an IPPAS mission consists of two parts, the self assessment and the international review. The peer review and exchange with international experts is important, but most important is the self assessment and resulting action plan of the host country. An honest and frank self-assessment make it possible for the review team to give an added value and likely verify the most important findings and give the recommendations that most effectively contribute to strengthening the national physical protection regime*." (Respondent)

"*Having a person from the host country embedded in the IPPAS team proved most useful, as certain aspects of the regulatory framework that were not understood by the IPPAS team could be clearified while the report was written, this saved a lot of time and should be considered as a useful idea for future IPPAS missions. A better integration of the legal experts on the host country side would have been helpful, as when we gave them the first draft of the report we discovered that lawyers and physicists read the same text completely different...*" (Respondent)

4. Was there something, regarding to IPPAS, that you would do in different way next time:
    a. For preparation?
    This question didn't raise too many thoughts in the answers. Many answers regarded only to start preparing for the missions earlier so that there wouldn't be any hurry.

    "*Verify briefings being given by operators demonstrated a clear understanding of CPPNM, NSS 20 and NSS 13. Have the government, as the requester of the mission, own the mission and its organization. Better communication within the competent authority so nuclear safety experts understand the difference between IPPAS and IRRS*." (Respondent)

    b. During the mission?

Again, this question didn't have that many relevant answers, but lawyer and IT support was mentioned; there should be assistance available if needed.

"*IT Support (wifi, transfer or data between mission experts etc) was not smooth.*"

c. After the mission (e.g. action plan etc.)

Most of the answers said "no" on this part. However, there were a couple of improvement ideas regarding publication of the IPPAS mission report and about the responsibility of implementing recommendations and suggestions (Government vs competent authority vs operator).

"*Earlier and more effective approach towards the action plan; also considering (with IAEA) on the report's confidentiality and publishing of some non-confidential parts.*" (Respondent)

5. Is it possible that the NTI index for your country would rise in the future assessments, because of the help gained through IPPAS mission?

a. Regarding theft

Answers for this question were quite negative; most of the answers said that the IPPAS mission has no effect on the NTI regarding sabotage. Three answer said that the NTI index can rise because of the IPPAS mission.

b. Regarding sabotage

Answers are quite the same as for the theft; most of the respondents say that NTI index wouldn't rise despite the IPPAS mission. Three of the respondents said that NTI index might rise.

c. Regarding cyber/computer security

Yet again, majority of answers say that IPPAS mission had no impact on improving the NTI index. There were four answers that said it's possible that the index would rise.

Despite the overall good feedback on the IPPAS mission and its benefits, contradiction is that only few respondents said it's going to help the NTI index, despite the fact that the NTI is used to measure nuclear security arrangements. One respondent said that it might improve the index in certain categories, but when thinking about the developed countries nuclear installations, IPPAS is more of a tool to verify performance in identifying strengths and weaknesses of the security regime. Thus, staying on quite general level rather than getting into details.

6. Do you consider that the team members, who participated in IPPAS mission, were professional and cooperation with them was fluent?

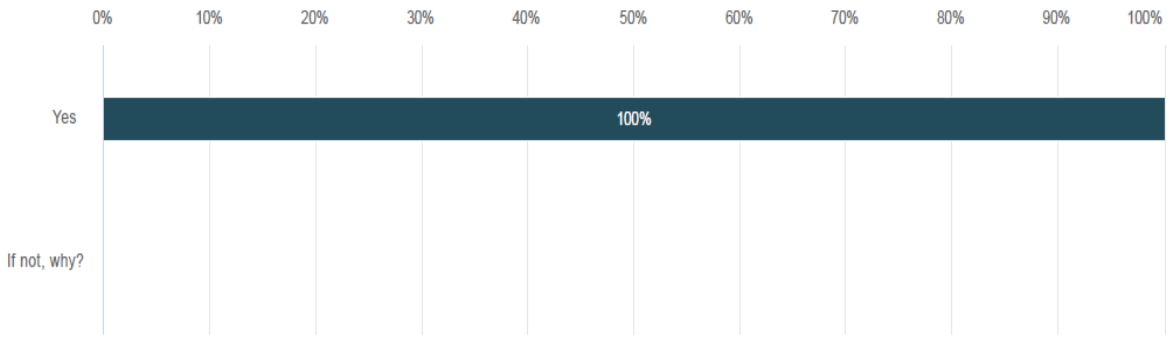


Figure 10 Statistic about question 6

All the respondents said that IPPAS team members were professional in their tasks and cooperation was fluent. One reason that might explain this good result is that in order to be part of an IPPAS team, one must be professional in their field with lots of experience. Also, selection process is held for every applicant that must be passed should one want to be part of IPPAS team.

7. Were you able to influence on the selection of the team leader, team members and/or other experts for your IPPAS mission?

    a. Team leader

       Total of 7 answers said yes.

    b. Team members
       There were 8 answers that said yes.

    c. Other experts

       There were only four answers that said yes

Most of the countries can influence on the selection of the team leader and team members. This ensures that that the country has better chances to get the persons with right skills to conduct the inspections.

8. Did any problems occur between IPPAS team members and the host country representatives?

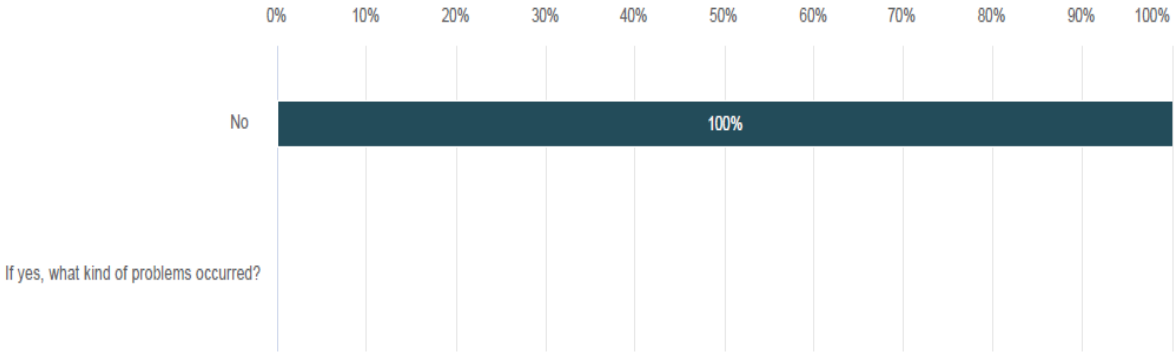


Figure 11 Statistic about question 8

Once again, results show that the cooperation was done well and no problems occurred. One reason for this can be the good preparations done before the actual mission.

9. Additional feedback/improvement ideas regarding IPPAS missions

   Answers for this question gave even more suggestions on improving the IPPAS mission. Suggestions relate to having sufficient financial and human resources as well as having enough time to prepare for the IPPAS mission. Another suggestion that showed up was that the IPPAS report could atleast partially be shown to public as this can help to create support and understanding for nuclear security.

   "*It would be good for more nuclear security professionals (not regulators) to take part in Missions. Missions also tend to focus on NSS13 or NSS14. Perhaps there should be Missions focussed on NSS15. There might also be scope for IPPAS missions focussed exclusively on cyber security.*" (Respondent)

   "*IPPAS Guidelines (IAEA Services Series no. 29, from 2014) have been a comprehensive and advantageous "tool" – also to be considered by national stakeholders (i.e. before the mission) – for full benefits. IAEA has introduced in the last couple of years some additional themes or "modules" and the countries can "pick" them up. However, the process needs to be clearly understood by all counterparts, and also IPPAS peer reviewers should be sufficiently trained (competent) to ask and assess those additional modules thoroughly on one hand and address, identify and collate (those, "trailblazing") good practices, on the other hand*" (Respondent)

   "*Publishing a public version of the IPPAS report helps in creating support and understanding for nuclear security. In 2012, the (…) published the part of the IPPAS report on government policy regarding nuclear security.*" (Respondent, identification removed with (…))

10. Have you published your IPPAS mission report for the public?

    Total of 10 respondents said that they haven't published the report for public and there were only two answers that told that the report is partially published and one report is completely published. This is a clear indicator that regulators wish to keep

security arrangements as confidential and are not willing the public to know about the security measures and procedures. This is a slight contradiction to question 9 in which the improvement ideas suggested on publishing the report atleast partially.

11. Do you consider that the good practices (GP) database, managed by the IAEA, is valuable for you (learning from other good practices)?

    a. Have you used the GP database for enhancement of nuclear security?

       Almost all of the answers said no on this question. Only three respondents said that they have used good practices database to further improve the security measures which raises questions on why the GP database is not more widely used.

    b. How could the GP database be enchanced?

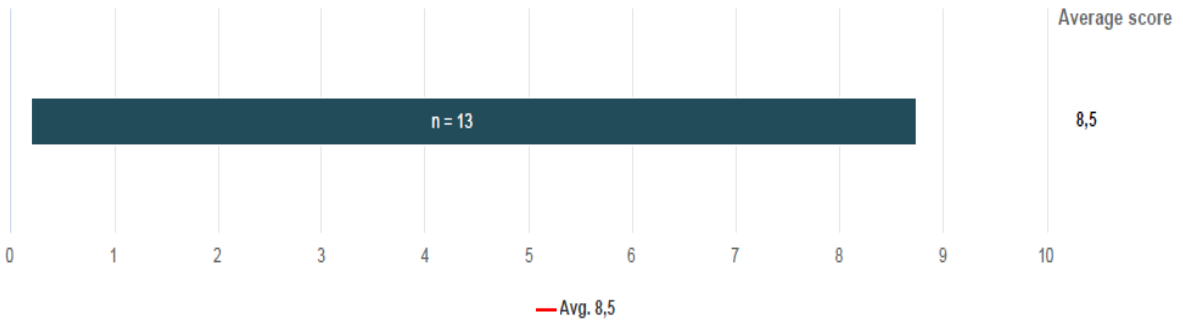
       This question didn't raise that many answers, but some comments that were given was that it needs to be more detailed and it should be promoted more.

    c. Have you agreed your mission's good practices to be listed in the GP database?

       Total of 10 respondents said that they have listed good practices gained from the IPPAS mission to be inserted into GP database.

12. On a scale 1-10 (10 being the best), what grade would you give to IPPAS mission?

    Total grade for the IPPAS mission was quite good, with an average grade of 8,54 and median of 8. Lowest grade was 7, which was given by one respondent and the highest grade was 10, which was given by two respondents.



1	2	3	4	5	6	7	8	9	10	Average	Median
0%	0%	0%	0%	0%	0%	7,69%	46,15%	30,77%	15,39%	8,54	8

Figure 12 Statistic about question 12

5 Conclusion about the questionnaire results

Questionnaire which was sent to 19 European nuclear security regulators had total of 13 answers.
From the answers it can be seen that IPPAS missions are mostly conducted on regular basis as it's the responsibility of the State to ask the mission. Availability of resources was one factor that influenced on how often the missions were conducted. There were couple of cases where the last IPPAS mission was conducted in the late 90s.

IPPAS mission has given many benefits to the countries; because of the broadness of the mission, the whole nuclear security benefits from the mission, not just some detailed part. IPPAS mission plays key part in awareness raising as well because several organizations/authorities take part in the IPPAS mission. Every country said that the team members were professional.

Despite the overall positive feedback, there are still some issues that showed up from the answers. Mission timing and its management as well as workload were the issues that showed up from the answers. Splitting the IPPAS team so that relevant persons handle areas that are their expertise was offered as one solution. In addition, host country representatives that are embedded in the IPPAS team could help the process. IT-support as well as legal expert support was mentioned to be important part in improving the overall process. Regarding the NTI-index, it’s not believed that the ranking would rise because of the IPPAS mission, despite the fact of overall good feedback about the mission. One reason for this could be that the country is already at the top of the index.

Overall, according to the answers, the grade that IPPAS mission received was 8 out of 10.

6 Self-evaluation

The tasks that were completed were quite large; the gap analysis contained hundreds of requirements that needed to be checked and the questionnaire contained lot of open-field answers that needed more time to analyse. Both timing and scheduling played an important factor when doing the thesis; total of 7 months of time was given and it really helped as the tasks wouldn’t be needed to do in a hurry. This also allowed me to participate in YTS-office other duties such as inspections and meetings, which was an important thing improving the personal professional knowledge in the area. Whenever there was a need for more information, the colleagues in STUK, especially in the YTS office, were able to help if something needed to be clarified.

Fortunately, there were not that many problems that occurred during this whole process. Main problems that occurred related to making of questionnaire as it was made together with experts due to them having the rights to use the Webropol, who at the same time happened

to be busy with other work tasks and holidays. It was important to send the questionnaire during July as most of the European regulators keep their holidays on August and thus chances are it wouldn't have given that many answers considering that the deadline should be in early September.

Another problem was that some of the Finnish requirements were held in the classified Annex A, which was ruled out from the writing of thesis due to its publicity. This led to situations where I searched the counterpart in the Finnish legislation even though it was not even available there, thus wasting time. These parts were later fulfilled with the help of workplace supervisor.

All the tasks that I did during the writing of thesis helped me to gain new knowledge in the nuclear security field, which as a field, is really unique and thus proved to be interesting experience. Nuclear industry is a highly regulated field and it was nice to see how the STUK operates in this challenging environment.

7 Conclusions

Nuclear security is a vital part of keeping the use of nuclear power plants safe and secured against malicious activities that may threaten its normal operations. Nuclear security events have taken place before and several experts have said that the threat is real and requires actions. Therefore, continuous improvement of nuclear security is vital for the safe use of nuclear energy and the IPPAS mission is one way to ensure the nuclear security regime can be maintained even more effective.

As part of the IPPAS preparations, gap analysis found out certain parts from the Finnish nuclear security legislation that did not fully meet the requirements/recommendations given from the international instruments. These parts will be modified so that requirements are better met, but this whole process can take some time as the change will not happen instantly; careful rephrasing of the guidance must be done, and authorities need to approve the changes.

Questionnaire had a good response rate that gave lot of useful information on how to improve the IPPAS mission. Despite this information gathering, making of the gap analysis and writing of the AIP, there's still lot of other preparations that needs to be conducted, like the scheduling and cooperation between different parties. But these had to be left out from the context of the thesis as they need to be agreed on a closer date.
Considering the research questions, which were: "How compliant Finnish nuclear security legislation is when compared to international instruments?" and "What can be done to improve future IPPAS missions?", it can be said that STUK is now much better prepared than it was before the writing of thesis.

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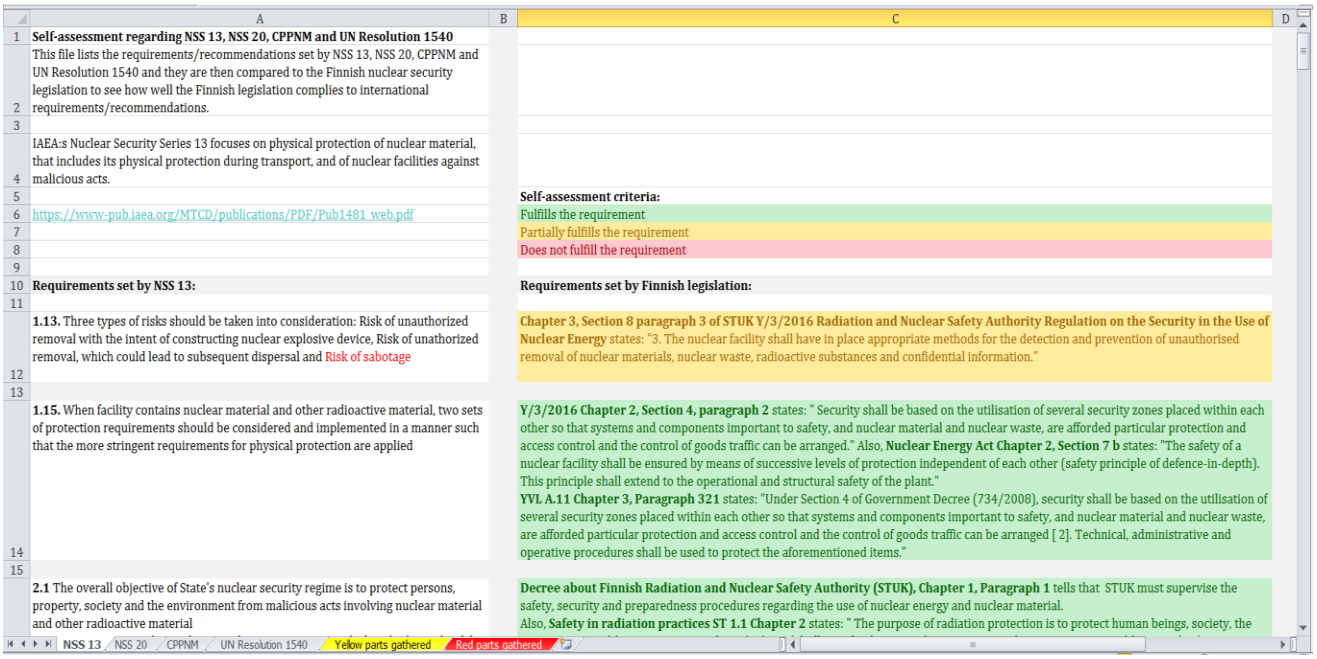
Appendix 1: Gap analysis



	A	B	C	D
1	**Self-assessment regarding NSS 13, NSS 20, CPPNM and UN Resolution 1540**			
2	This file lists the requirements/recommendations set by NSS 13, NSS 20, CPPNM and UN Resolution 1540 and they are then compared to the Finnish nuclear security legislation to see how well the Finnish legislation complies to international requirements/recommendations.			
3				
4	IAEA:s Nuclear Security Series 13 focuses on physical protection of nuclear material, that includes its physical protection during transport, and of nuclear facilities against malicious acts.			
5			**Self-assessment criteria:**	
6	https://www-pub.iaea.org/MTCD/publications/PDF/Pub1481_web.pdf		Fulfills the requirement	
7			Partially fulfills the requirement	
8			Does not fulfill the requirement	
9				
10	**Requirements set by NSS 13:**		**Requirements set by Finnish legislation:**	
11				
12	**1.13.** Three types of risks should be taken into consideration: Risk of unauthorized removal with the intent of constructing nuclear explosive device, Risk of unathorized removal, which could lead to subsequent dispersal and Risk of sabotage		**Chapter 3, Section 8 paragraph 3 of STUK Y/3/2016 Radiation and Nuclear Safety Authority Regulation on the Security in the Use of Nuclear Energy** states: "3. The nuclear facility shall have in place appropriate methods for the detection and prevention of unauthorised removal of nuclear materials, nuclear waste, radioactive substances and confidential information."	
13				
14	**1.15.** When facility contains nuclear material and other radioactive material, two sets of protection requirements should be considered and implemented in a manner such that the more stringent requirements for physical protection are applied		**Y/3/2016 Chapter 2, Section 4, paragraph 2** states: " Security shall be based on the utilisation of several security zones placed within each other so that systems and components important to safety, and nuclear material and nuclear waste, are afforded particular protection and access control and the control of goods traffic can be arranged." Also, **Nuclear Energy Act Chapter 2, Section 7 b** states: "The safety of a nuclear facility shall be ensured by means of successive levels of protection independent of each other (safety principle of defence-in-depth). This principle shall extend to the operational and structural safety of the plant." **YVL A.11 Chapter 3, Paragraph 321** states: "Under Section 4 of Government Decree (734/2008), security shall be based on the utilisation of several security zones placed within each other so that systems and components important to safety, and nuclear material and nuclear waste, are afforded particular protection and access control and the control of goods traffic can be arranged [2]. Technical, administrative and operative procedures shall be used to protect the aforementioned items."	
15				
	2.1 The overall objective of State's nuclear security regime is to protect persons, property, society and the environment from malicious acts involving nuclear material and other radioactive material		**Decree about Finnish Radiation and Nuclear Safety Authority (STUK), Chapter 1, Paragraph 1** tells that STUK must supervise the safety, security and preparedness procedures regarding the use of nuclear energy and nuclear material. Also, **Safety in radiation practices ST 1.1 Chapter 2** states: " The purpose of radiation protection is to protect human beings, society, the	

NSS 13 | NSS 20 | CPPNM | UN Resolution 1540 | Yellow parts gathered | Red parts gathered

Appendix 2: Notification about the questionnaire

Hello all,

Here is the link for the questionnaire that Mr. Tapani Hack mentioned about.

https://link.webropolsurveys.com/S/44AC4D52A4F2BEC6

Questionnaire focuses on feedback regarding previous IPPAS missions and how they could be improved in the future.
Answering will take around 30 min and I hope that as many countries as possible will have person(s) who will give the answers.
Because of the holiday season, there will be no deadline for this, but I hope that most of you have answered at latest in September.

If you have any questions, please contact me via email.

Have a happy summer!

Best regards,
Joonas Pekkala

Appendix 3: Questionnaire

IPPAS Survey

1. Contact info (voluntary)

First name

Last name

Email

Country

Organisation

2. Organisation

Select

Save & continue later

Next

stuk

IPPAS Survey

3. When was the following missions conducted in your country?

a. IPPAS mission

b. Follow-up mission

4. How often do you try to organize IPPAS mission to be conducted in your country? What is your basis for this decision?

5. What benefits were gained from the IPPAS mission?

6. What could be done to improve the IPPAS mission? (for example, to make it more efficient or smoother to organize…) based on your experience?

7. Was there something, regarding to IPPAS, that you would do in different way next time?

a. For preparation

b. For actual mission (during the mission)

c. After the mission (e.g. action plan, etc.)

8. Is it possible that the NTI index (https://ntiindex.org/data-results/) for your country would rise in the future assessment, because of the help gained through IPPAS mission?

a. Regarding theft

b. Regarding sabotage

c. Regarding cyber/computer security

9. Do you consider that the team members, who participated in IPPAS mission, were professional and cooperation with them was fluent?

◯ Yes

◯ If not, why?

10. Were you able to influence on the selection of the team leader, team members and/or other experts for your IPPAS mission?

a. Team leader

b. Team members

c. Other experts

11. Did any problems occur between IPPAS team members and the host country representatives?

◯ No

◯ If yes, what kind of problems occurred?

Save & continue later

Previous Next

IPPAS Survey

12. Additional feedback/improvement ideas regarding IPPAS missions

13. Have you published your IPPAS mission report for the public?

- ◯ No, we haven't
- ◯ Partially
- ◯ The whole report. If possible, please provide a link to the report

14. Do you consider that the good practices (GP) database, managed by the IAEA, is valuable for you (learning from other good practices)

a. Have you used the GP database for you enhancement of nuclear security?

b. How could the GP database be enhanced?

c. Have you agreed your mission's good practices to be listed in the GP database?

15. On a scale 1-10 (10 being the best), what grade would you give to IPPAS mission that was conducted in your country, in overall?

1	2	3	4	5	6	7	8	9	10
◯	◯	◯	◯	◉	◯	◯	◯	◯	◯

Save & continue later

Appendix 4 Advance Information Package

ADVANCE INFORMATION PACKAGE
International Physical Protection Advisory Service

Helsinki – Finland

Finnish Radiation and Nuclear Safety Authority
Laippatie 4
00880 Helsinki
Telephone +358 9 759 881
Telefax +358 9 759 88 500

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