APPENDIX 2 Occupational radiation dose distribution at Loviisa and Olkiluoto nuclear power plants in 2007

According to the Radiation Decree, the annual effective dose for a worker from radiation work must not exceed 50 mSv, and the average over any period of five years must remain below 20 mSv.

The highest individual dose incurred at Finnish nuclear power plants was 11.2 mSv. This dose was accumulated from work at both Loviisa and Olkiluoto nuclear power plants. The highest individual dose to a Finnish nuclear power plant worker in the 5 year period 2002–2006 was 64.7 mSv. The dose was accumulated at Loviisa and Olkiluoto, as well as at Swedish nuclear power plants.

dose range (mSv)	Number of persons by dose		
	Loviisa	Olkiluoto	total*
< 0.1	689	980	1619
0.1–0.49	178	499	664
0.5–0.99	106	257	342
1.00–1.99	106	205	294
2.00–2.99	39	97	135
3.00–3.99	37	54	88
4.00–4.99	19	15	47
5.00–5.99	11	6	26
6.00–6.99	5	6	15
7.00–7.99	2	3	8
8.00–8.99	2	1	5
9.00–9.99	2	2	6
10.00–10.99	–	–	5
11.00–11.99	–	–	4
12.00–12.99	–	–	–
13.00–13.99	–	–	–
14.00–14.99	–	–	–
15.00–15.99	–	–	–
16.00–16.99	–	–	–
17.00–17.99	–	–	–
18.00–18.99	–	–	–
19.00–19.99	–	–	–
20.00–20.99	–	–	–
21.00–24.99	–	–	–
25.00–	–	–	–

* The data in this column include Finnish workers who have received doses also at Swedish nuclear power plants. The same person may have worked at both Finnish nuclear power plants and in Sweden.

Source: STUK's dose register

APPENDIX 3 Significant operational events

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Loviisa NPP

Faulty status of the connection between diesel generator DC systems at Loviisa 2

It was observed at Loviisa 2 plant unit on 26 March 2007 that the cable connection between two back-up diesels DC panels was erroneously connected. In addition, the switch between one of the DC panels and its back-up battery was erroneously in the open position. The erroneous connection was fixed on 27 March 2007. The situation had been undetected since the previous annual outage in September 2006. The event caused no power loss for electrical safety equipment, but the observed coupling was non-compliant with the plant unit's Technical Specifications.

The four back-up diesels and their DC panels are normally separated from each other, and each panel is connected to its own battery and rectifier. In fault conditions, two panels can be connected to each other to secure DC supply. The panels are vital, for example, for the diesel automation systems. Voltage loss at the DC panel will prevent the use of the diesel generator.

The power supply connection between the DC panels of the diesel generators had been used during the annual outage of LO2 for various maintenance, testing and modification work. When the work was completed, there was confusion in the distribution of work between the teams, which led in the erroneous connection being left undetected.

The erroneous coupling would not have prevented the diesels from starting and being connected to the network, if need had arisen.

Deficiencies and vagueness in the distribution of work between the teams participating in annual maintenance work concerning the restoration of the normal couplings can be considered the root cause of the event. The detection of erroneous connections was also hindered by the unclear structure of the electrical switches and the missing position indications.

As corrective measures to prevent similar events, the utility has decided to provide more detailed work plans and maintenance instructions. In addition, the indications and position control of important electrical switches will be improved.

Damages to the spring caps of safety valves at the Loviisa power plant

At the Loviisa power plant, damages were detected in the spring caps of some safety valves. Due to the damages, some valve spring caps will be replaced. If the cap breaks, the safety valve will open resulting in a leak in the system.

When this type of safety valve was tested on the testing bench, the valve spring cap broke at the connection of the flange and the shell. A fracture was found in another similar safety valve spring cap. The spring inside the spring cap keeps the safety valve disc closed. The function and opening pressure of safety valves is regularly tested.

There are three valves with a cast iron cap of the same type, provided by the same manufacturer, in the safety classified systems of Loviisa 1 and four in Loviisa 2. The operational pressure of these is below 10 bar. All such safety valves were inspected at Loviisa 2. At Loviisa 1, the valves that could be inspected during reactor operation were inspected. Photographs had been taken during the maintenance outage of the two cast iron spring caps left uninspected. The photographs show that the design of these spring caps is stronger than in the damaged spring caps. STUK required for these spring caps to be inspected during the next outage. The number of inspected safety valves is higher, but the material is more ductile in some of these. No other defective valves were found in the inspection. The utility has decided to replace all cast iron spring caps provided by the manufacturer in question with more ductile material.

Power failure at Loviisa 1 during annual outage

A failure occurred in the power supply system of Loviisa 1 during the annual outage on 22 August, causing a power failure of two diesel backed main switch gears. Due to the failure, the residual heat removal and cooling of the fuel pools were non-compliant with the Technical Specifications. However, Loviisa 1 fuel cooling operated normally according to the functional minimum requirement during the event, and a back-up system independent of the regular systems was available for residual heat removal.

Annual maintenance was in progress at Loviisa 1 on 22 August 2007. Power was supplied to the unit from the external 110 kV network as planned, and all four electrical trains were powered. Of the four back-up generators, three were operational and one under maintenance.

The power failure originated when the over-current relay of the 6 kV diesel switch gear operated and opened a power feeder switch. As a result, the power supply of one 6 kV and one 400 V substation with diesel back-up, as well as all the electrical equipment fed by these – among others, several important pump motors – was cut off. Due to the voltage failure, the plant protection system started up the back-up diesel, but the over-current relay prevented its connection as designed.

After the detection of the failure, the utility carried out a survey of factors affecting plant safety and began troubleshooting and required repairs. The voltage was restored to the 6 kV substation after a power interruption of 5.5 hours. While restoring the voltage to the 400 V substation, a fault appeared in its main breaker. Due to the repair of the breaker, the interruption lasted approximately 7.5 hours for this system.

The safety significance of the event was minor, since the systems needed for the operation, monitoring and residual heat removal of the plant unit operated normally. Several back-up systems were also available if needed. The protection of the unit's electrical systems operated as planned.

The utility replaced the faulty over-current relay and the main breaker for the 400 V substation. As a follow-up, the utility will inspect the power feed, monitoring and protection of the auxiliary systems for the diesel generator, as well as any possible needs for improvement. On the INES scale, the event is rated at level 0.

Opening of a 400 kV transformer breaker at Loviisa 2 in connection with modifications

A 400 kV transformer breaker opened during modification works at Loviisa 2 on 20 November 2007 due to a human error. As a result, the plant unit's reactor power decreased first to 83% controlled by the adjusting function, and then to 60% while under manual control. One of the two turbines of the plant unit disconnected from the 400 kV network and began house-load operation, producing power output for the unit's own consumption only. The event had no safety significance.

Loviisa 2 has two turbines feeding the national grid through the two transformer breakers located in the Loviisa power plant's 400 kV outdoor switch yard.

Loviisa 2 was in normal power operation on 20 November 2007 when one of the plant unit's transformer breakers opened. As a result, one of the turbines was disconnected from the national grid and began house-load operation as designed. The spurious activation of the breaker was caused by a human error, occurred during wiring modifications in the relay building of Fingrid's 400 kV outdoor switchyard. Once the cause of the failure was detected, the utility began the power increase of the reactor, and the turbine was synchronised back to the power network after an interruption of less than an hour. The event had no safety significance. The systems of the plant unit operated as designed in connection with the event.

The root cause of the event was a human error in connection with the coupling modifications in the relay building of Fingrid's 400 kV outdoor switchyard. An experienced technician had probably accidentally hit an auxiliary relay with his hand and thus caused the transformer breaker to open.

To prevent similar events, the national grid operator Fingrid will carry out the following improvements, among others:

- Work is no longer carried out in operational relay cubicles at the power plant. Instead, work will be carried out during interruptions or using substitute connections.
- Fingrid will intensively monitor that the work within the relay cubicles is completed before the cubicle is reconnected.
- Fingrid will check the implementation processes of all its projects and attempts to minimise the probability of disturbances.

Olkiluoto NPP

A bypass of radioactive release sampling at Olkiluoto 1

On 31 January 2007, TVO observed that the aerosol and iodine measurements of the two parallel sampling lines measuring radioactive gaseous releases at Olkiluoto 1 differed by approximately 30%. At Olkiluoto 2, there was no significant difference between the lines. The difference was observed to be due to the air flow partly passing by the filter in one of the lines (line number one) used to collect a sample of the particles (aerosols) and iodine released into the atmosphere from the plant unit's vent stack. TVO inspected the situation at STUK's request, since a similar by-pass flow had been observed in Sweden at the Forsmark 1 nuclear power plant unit.

The structure of the sampling filter has made it possible for the filter assembly not to fit tightly enough into the filter chamber, allowing a gap to be created on the sealing's surface. Tightness was observed when pushing the filter assembly into the filter chamber of line 1. In connection with the repair work, the cylindrical filter chamber was found not to be round, apparently caused by the weld between the filter chamber and the connected outlet pipe. The out-of-roundness of the filter chamber was corrected by grinding and a sealing ring (O-ring) was installed to the filter assembly. The same modification shall be made to other similar filters as well.

There has been a distinct difference between the results for the sampling lines in 2005 and 2006, 30% at most, and less than 10% in the previous years. The results from line 1 have been used in release reporting, which means that the reported aerosol and iodine releases have been lower than the actual releases. The decreased sampling efficiency has not been detected in the normal operation of the Olkiluoto plant laboratory. When replacing filters, the colour of the filter has been used to check whether the filter has collected impurities from the exhaust air in a normal manner, but the results from lines 1 and 2 have not been compared to each other.

The event had no significance on general radiation safety, as the aerosol and iodine releases from the Olkiluoto power plant are low and the measuring error was minor. The event revealed a deficiency in plant routines: the results from the two sampling lines have not been compared to each other.

TVO has delivered an event report and the corrected release measurements to STUK.

Violation of dryout limits at Olkiluoto 1 as a result of programming error

In Teollisuuden Voima Oy's own inspections on 27 February 2007, it was found that the so-called dryout correlation of the Olkiluoto 1 reactor monitoring system was programmed to use erroneous basic data for one fuel bundle type. When the dryout correlation, which is a measure of the required coolant flow rate with respect to the reactor thermal power, was programmed into the reactor monitoring system in spring 2003, the coolant flow area was given using the value from the assembly inlet, which was approximately 5% higher than the flow area at core mid-level. As a result, the actual amount of coolant in the assembly was overestimated, and the margin for transients affecting the coolant flow was smaller than that indicated by the reactor monitoring system.

After the error was corrected, the core simulations for previous operating cycles were recalculated. The recalculation showed that for the period between 26. September and 10 November 2006, the dryout factor was lower than the lowest allowable limit of 1.30 specified in the Technical Specifications. The lowest value of the dryout factor calculated using the corrected correlation was 1.28. However, the value was still higher than the minimum (1.263) derived directly from the transient analyses used as a basis for the Technical Specifications limit. An extra margin included in the Technical Specifications limit was sufficient to cover the error so that despite the limit violation, fuel integrity would not have been jeopardized even if a dimensioning pressure regulator failure had occurred during that time period.

The utility prepared a special report specifying the reasons leading to the programming error. As corrective measures, the utility suggested, for example, better communication of the correct utilisation of the correlation between the fuel supplier delivering the correlation and the utility responsible for the programming.

A small fire in the Olkiluoto 2 turbine hall

An oil spill occurred at the end of the Olkiluoto 2 annual outage on 2 June 2007 with approximately 600 litres of oil from the bearing oil system spreading into the turbine hall and below it inside the turbine building. The utility immediately began cleaning operations with the objective of preventing the access of oil into the condensate and ensuring fire safety. Despite the cleaning, oil remained in the high pressure turbine insulation. When the plant unit was started up, the equipment heated up and caused the hot oil to begin to flow and finally to ignite.

The control room received a fire alarm from the turbine plant in the morning of 7 June 2007. Reactor power was 90% at the time. The fire was quickly located and extinguished using a handheld extinguisher. The utility brought the plant unit back to shutdown. The oil was removed from the place of fire and the damages caused by the fire were repaired.

The plant unit was synchronised back to the national grid early in the morning of 8 June 2007. The event did not endanger plant safety or environmental radiation safety.

Reactor trip at Olkiluoto 2 as a result of work done on the 400 kV switchyard

A reactor trip occurred at Olkiluoto 2 on 15 May 2007 as a result of a spurious tripping of a busbar breaker's protective relay in the 400 kV switchyard outside the plant area. The unit's internal safety systems operated as designed in connection with the event. However, the failures and design deficiencies in operating systems led to an extensive operating transient.

Normally, Olkiluoto 2 feeds power to an external network through the 400 kV switchyard located outside the plant area. If this connection is lost, the reactor power is decreased to house-load operation that supplies power to the unit's own systems. If the transfer to house-load operation fails, systems are fed from the external 110 kV network. The power supply of safety-critical functions is also secured with diesel generators and batteries.

Modifications were carried out in the 400 kV switchyard during power operation on 15 May 2007 (renewal of relay and control systems). The couplings were being restored back to normal configuration after the modification works when a reactor trip occurred at the plant unit. A protective relay of a busbar breaker of the switchyard tripped erroneously, disconnecting Olkiluoto 2 from the external 400 kV network. Transfer to house-load operation failed due to the erroneous settings of the main generator protection system. After a power failure of 1.5 seconds, the automatic switchover function connected the unit to the external 110 kV network. Both the turbine and the reactor tripped as a result of disturbances caused by the power failure. All of the back-up diesels of the unit started up as designed and were left running at idle.

The unit's actual safety systems operated as designed. According to the unit's design basis, the 400 kV grid fault should not lead to a reactor trip or to safety systems being started up. Failures and design deficiencies in operating systems led to an operating transient.

The event was caused by the erroneous operation of a protective relay of a breaker in the 400 kV switchyard. Incorrect operating values had been defined for the relay. It was also observed that the terminal blocks of the relay's voltage measurement circuit were left open.

The open terminal blocks and the incorrect settings of the protective relay in the 400 kV switchyard were corrected. In addition, the utility has launched a detailed survey in cooperation with Fingrid to prevent similar disturbances in the future. The event has also resulted in some adjustments to the protection and control systems at Olkiluoto 2.

On the International Nuclear Event Scale (INES), the event is rated at level 0.

Reactor trip at Olkiluoto 2 caused by errors in reactor vessel water level measurement

Olkiluoto 2 was being brought to shutdown for annual maintenance in the night between 20 and 21 May 2007, when a reactor trip occurred at the plant unit. The trip was caused by errors in the reactor vessel water level measurement signals. Similar errors had also been detected at Olkiluoto 2 in some previous cases. No definite cause for these errors has been found, even though the utility has investigated the phenomenon in earlier annual outages. The utility will deliver a summary of investigations performed during the annual outage of 2007 to STUK, and will continue to investigate the issue.

The safety significance of the disturbance is minor. The rapid high levels of the measurement signal typical to this phenomenon have not endangered the reactor core emergency cooling systems.

Testing of main steam relief valves in the wrong operational state

It has been observed at the Olkiluoto power plant that the testing of main steam relief valves has been performed in the wrong operational state for several years.

The relief system regulates and reduces the pressure in the reactor pressure vessel. The system has several valves that are regularly tested to ensure their operational condition. Two of the valves are mainly used for pressure regulation. In series with these control valves, there are the so-called quick opening valves that are rapidly opened by a signal from the protection system.

According to the Technical Specifications, one quick opening valve should be tested before the plant unit begins power operation, and the other during power operation. The utility has tested both valves after the annual outage before power operation.

The safety significance of the event is minor. The operability of both valves has been stated in regular tests. However, the utility had not detected that the testing has been non-compliant to the Technical Specifications since 2001. The utility prepared a special report on the event. On the INES scale, the event is rated at level 0.

Reactor trip at Olkiluoto 2

An operational transient led to a reactor trip at Olkiluoto 2 on September 4, 2007. The unit was shut down for one day for investigation and repair.

The root cause of the event was vibration in the generator water cooling system. The operators decided to stop the coolant pump and switch over to the back-up pump. However, a valve in the second coolant line was erroneously closed, the generator was left without cooling and a turbine trip with partial reactor trip was triggered. This reduced the reactor power to 30 % of nominal and disconnected the plant from the national grid. The turbine bypass valves opened, leading steam from the reactor directly to the condensers through a turbine bypass (dumping) line.

About one hour later, the turbine by-pass valves closed spuriously, and steam dumping to the condensers was prevented. The pressure in the reactor vessel started to rise, and the reactor protection system tripped the reactor. Containment isolation valves in the steam lines were closed, and the steam was directed to the containment wet well condensation pool through the pressure relief system.

The reactor is equipped with 121 control rods, used in normal operation to control the reactor power and reactivity by an electric motor driven system. To enable fast shutdown (reactor trip), the control rods are divided into 14 scram groups, each of which has a nitrogen tank and a water tank. Upon receiving a reactor trip signal, a valve between the nitrogen and water tank opens, allowing the pressurized nitrogen to push the water from the water tank into the control rod drives, forcing the control rods rapidly into the core. One such scram valve failed to open, and consequently the 9 control rods of the scram group in question failed to enter the core. These rods were succesfully inserted with the electrically driven secondary shutdown mechanism.

STUK required that prior to start-up of the unit, Teollisuuden Voima Oy deliver a report on all failures detected during the event and their causes. In addition, TVO was required to specify how the operability of the affected systems is confirmed. After making the necessary inspections and repairs and delivering the required report, TVO started the unit and synchronized it to the national grid in the morning of September 5.

Causes for some of the failures detected during the event remain unknown. Equipment that was replaced due to malfunctions is being examined, and the utility will later on submit a report with a more detailed description of the faults and the corresponding corrective actions.

The utility notified STUK's duty officer of the events in the morning of September 4. STUK reported the event on the Internet on the same day, and published a press release on September 6. The Swedish nuclear safety authority SKI was also informed of the event. On the International Nuclear Event Scale (INES), the report was rated as lNES 1.

Unqualified fuses in the electrical systems of Olkiluoto 1 and Olkiluoto 2

Teollisuuden voima observed on 7 September 2007 that the output and input sides of rectifiers in the 24 V DC grids of Olkiluoto 1 and Olkiluoto 2 had fuses that had not been qualified for safety classified use. The fuses were of a type generally used in industry, and they had been installed to the Olkiluoto plants during 2004–2007.

The plant's DC grid rectifiers convert the current from the 660 V AC grid into a 24 V DC current used to provide power supply to the reactor automation systems and the DC grid batteries, among others. The rectifier fuses protect the rectifiers and the DC-distribution boards in overload and fault situations by disconnecting the failed part. If no rectifier is available, the DC grid's batteries supply the grid. The batteries have a capacity for a minimum of two hours.

Even though the fuses had not been qualified, their electro-technical dimensioning was in order. The purpose of equipment qualification is to ensure that the equipment's properties suit the intended use and that the product's quality management is adequate. Fuses are simple and widely used devices, which makes it very likely that they will work correctly even if they are not qualified for the specific location of use. What made the event serious was the failure of the plant's spare part quality procedures that made it possible to install unqualified parts to safety classified places.

The utility delivered STUK a suitability analysis for the qualification of fuses and prepared a special report of the event.

On the INES scale, the event is rated at level 1.

Wrong fuses in the shut-down secondary cooling system of Olkiluoto 2

Teollisuuden Voima Oy inspected the types of the handle-type fuses of distribution substations of safety class 2 and 3 at Olkiluoto 1 and 2 after the unqualified rectifier fuses were detected. At the inspection it was found that the rated voltage of the fuses of all four shut-down secondary cooling system pumps at Olkiluoto 2 was 500 V, while 690 V fuses should have been used. The current rating of the fuses was correct. Fuses were replaced with fuses with the correct rated voltage. The installation time of the wrong fuses is not known, but they may have been present since the commissioning of the plant.

The purpose of the fuses is to break off power if the cooling pump motor or supply cable fails. If the rated voltage of the fuses is too low, they may not be able to break off the current when required. Breaking off the current in case of failure limits damages to the motor and cables and prevents fires resulting from these damages, as well as prevents the failure from spreading to the supplying distribution centre.

The rated current of the fuses was correct, so there was no danger of erroneous burning of the fuses. The wrong fuses also had no effect on the availability of the pumps. If a fault current had occurred and the fuse had not been able to break it off, the failure would have spread from the motor circuit, but only within one subsystem.

The wrong fuses were replaced with the correct ones. In inspections carried out by the utility, other fuses deviating from the fuse types defined in plant documentation were found, but the safety significance of these was lower than that of the secondary cooling system's pump fuses.

On the INES scale, the event is rated at level 0.

Pressure doors of Olkiluoto 1 and Olkiluoto 2 did not meet the requirements

Modifications have been made to the pressure-tight doors of Olkiluoto 1 and Olkiluoto 2 reactor buildings without the required approvals. Door sills have been removed from the doors and access doors have been added. Most of the changes have been made already in the early stages of plant operation, some probably in recent years. Reactor building doors belong to safety class 3, and some of them are compartmentalising fire doors. Modifications performed on such doors require both an internal approval from the utility and an approval from the authorities. No approvals of the modifications have been applied for.

The purpose of modifications has been to facilitate the easier passage of people and equipment through the doors. The modifications have been made without the knowledge of the original design specifications, safety class 3 requirements or requirements set for type approved fire doors, or without the ability to connect these requirements to the doors in question. However, the effect of

the door modifications for nuclear safety has been minor; the main point is the wrong practices used when carrying out the modifications.

All reactor building pressure doors and fire doors have been inspected and repaired. Pressure-tight doors have been repaired by installing new door sills, or the doors have been replaced according to the licensee's door replacement plan. The pressure-resistance of some doors has been inspected by calculations. The fire doors of other buildings, particularly those along common access routes, will be also inspected in connection with the door maintenance programme in 2008.

To avoid similar incidents in the future, training will be organised for the maintenance foremen on the requirements that must be observed when making modifications to safety classified structures and fire separating structures of compartments. Persons responsible for modifications will be told that the original design specifications must be found out before carrying out modifications.

Reactor trip at Olkiluoto 2 due to spurious closing of a high pressure turbine control valve

A reactor trip occurred at Olkiluoto 2 as a result of a valve failure at the turbine plant. The plant unit was disconnected from the national grid for approximately 18 hours.

The steam created in the reactor is led through four steam lines to the high pressure turbines and then further to the four low pressure turbines. The turbines turn the generator that produces power for the national grid. Steam lines have control valves to regulate the steam flow.

The reactor power of Olkiluoto 2 was being increased early in the evening of 29 December 2007, when one of the four steam line control valves opened too much and then immediately closed. The fast decrease in the steam flow caused the steam pressure and the reactor power to increase, which resulted in a reactor trip. Before the event, the reactor power was approximately 80% of rated power. The defective actuator that caused the erroneous operation of the control valve was replaced before the plant unit was started up again.

On the International Nuclear Event Scale (INES) with seven levels, the event was rated at level 0.

The plant unit had experienced several disturbances before the event, and had been disconnected from the national grid two times during 28 and 29 December 2007. In connection with periodic testing requiring reduced reactor power on 28 December, a failed phase unit had been replaced in the frequency converter of a main circulation pump. When increasing the reactor power after the periodic testing, it was observed that the main circulation pump in question was rotating backwards. The plant unit was shut down to be able to restart the pump. The restart of the pump was successful, but minor steam leaks in the turbine plant hindered the startup so that the plant unit wasn't synchronised to the national grid until the afternoon of 29 December 2007. Approximately 15 minutes after the synchronisation, the plant unit was disconnected again, this time due to a turbine trip caused by bearing vibrator. The next synchronisation to the national grid was performed about one hour after the disconnection. The reactor trip described above occurred for about four hours after this.

Unlocked containment isolation valves at Olkiluoto 1 and Olkiluoto 2 non-compliant with the Technical Specifications

It was observed at the Olkiluoto power plant on 18 December 2007 that both plant units have 24 manually controlled containment isolation valves that have not been locked as specified in the Technical Specifications. The locking ensures that the valve position cannot be changed accidentally. Despite the unlocked position, the status of the valves was correct (closed).

Valve positions are inspected at least once a year at the end of the annual outage using the so-called list of normal states. The cause of the event was that in the instructions used for inspections, there was no mention in the lists of normal states that the valves should be locked.

The event was classified at INES Level 0. The utility prepared a special report on the event.

APPENDIX 4 Licences and approvals in accordance with the Nuclear Energy Act in 2007

Teollisuuden Voima Oy

- C214/279, 5 January 2007
  Import of nuclear fuel with uranium content of Australian origin from Spain. 95 assemblies, a total of 16,800 kg (maximum) of low enriched uranium. Valid until 31 December 2007.
- C214/280, 5 January 2007
  Import of nuclear fuel from Sweden. 45 assemblies, a total of 7,650 kg (maximum) of low enriched uranium. Valid until 31 December 2007.
- C214/281, 5 January 2007
  Import of nuclear fuel from Sweden. 73 assemblies, a total of 12,450 kg (maximum) of low enriched uranium. Valid until 31 December 2007.
- C214/283, 12 January 2007
  Import of model assemblies containing zirconium tubes from Spain. Two assemblies, a maximum total of 110 kg zirconium. Valid until 30 June 2007.
- C214/285, 12 March 2007
  Export of model assemblies containing zirconium tubes to Spain. Two assemblies, a maximum total of 110 kg zirconium. Valid until 31 May 2007.
- C214/287, 3 April 2007
  Import of spare part control rods from Sweden. 4 rods weighing approximately 130 kg each. Valid until 31 December 2007.
- C821/88, 28 September 2007
  Transfer of waste oil (8.6 m^3) released from supervision to Ekokem Oy for burning. Valid until 31 December 2008.
- C214/290, 1 November 2007
  Import from Sweden of rods manufactured of zirconium alloy. Two rods, a maximum total of 4 kg zirconium. Valid until 31 March 2008.
- C214/291, 1 November 2007
  Import of nuclear fuel with uranium content of Australian origin from Spain. 110 assemblies, a total of 19,600 kg (maximum) of low enriched uranium. Valid until 31 December 2008.
- G214/2, 1 November 2007
  Import of equipment, devices and software needed in the construction and operation of Olkiluoto 3 nuclear power plant unit from France, Germany and Japan. The licence covers components such as the reactor pressure vessel with head and internal components, reactor coolant pumps, steam generators, control rods and their control equipment, the refuelling machine and the reactor control and surveillance software, and is valid until 31 December 2010.
- C821/89, 20 November 2007
  Transfer of waste oil (approximately 400 kg) released from supervision to Ekokem Oy for burning. Valid until 31 December 2007.
- C214/292, 17 December 2007
  Import of nuclear fuel with uranium content of Canadian origin from Sweden. 64 assemblies, a total of 11,200 kg (maximum) of low enriched uranium. Valid until 31 December 2008.
- C214/293, 17. December 2007
  Import of nuclear fuel from Sweden. 62 assemblies, a total of 10,800 kg (maximum) of low enriched uranium. Valid until 31 December 2008.

Fortum Power and Heat Oy

- A214/94, 5 January 2007
  Import from Germany of equipment related to the Loviisa I&C renewal. Valid until 31 December 2007.
- A214/98, 19 April 2007
  Transportation in Finland of fresh nuclear fuel imported from Spain. 99 assemblies, a total of 12,500 kg (maximum) of low enriched uranium. Valid until 31 December 2007.
- A214/99, 3 May 2007
  Modification to licence A214/98, 19 April 2007 concerning the uranium enrichment factor. Valid until 31 December 2007.
- A214/100, 24 July 2007
  Import of boron measurement equipment from Germany. 9 neutron detector and measuring devices. Valid until 31 December 2007.
- A214/106, 17 December 2007
  Import from Germany of equipment related to the Loviisa I&C renewal. Extension of the validity of the licence A214/94, 5 January 2007 until 31 December 2008.

Others

- F214/18, 28 August 2007 VTT
  Import of the APROS simulation software to Germany. Valid until 31 December 2008.
- Y214/164, 1 November 2007 VTT
  Export of uranium samples to Germany and Sweden for research purposes. A total of 43 g of uranium. Valid until 31 December 2007.
- A214/105, 6 November 2007
  Fortum Nuclear Services Oy
  Export of the APROS simulation software to Sweden. Valid until 30 April 2008.
- Y214/169, 19 December 2007
  University of Helsinki,
  Laboratory of Radiochemistry
  Licence for operations with nuclear materials (licence for the possession, handling, use and storage of nuclear materials for research purposes in the Laboratory of Radiochemistry). A maximum of 3 kg of thorium, 25 kg of depleted uranium, 60 kg of natural uranium, 1500 g of enriched uranium (the maximum combined ^{235}U and ^{233}U content 75 g) and 5 g of plutonium. Valid until 31 December 2017.

APPENDIX 5 Periodic inspection programme

Inspections contained in the periodic inspection programme focus on safety management, operational main processes and procedures, as well as the technical acceptability of systems. The compliance of safety assessments, operations, maintenance and protection activities (radiation protection, fire protection and physical protection) with the requirements of nuclear safety regulations are verified by the inspections. The annual inspection programme is brought to the attention of the licensee at the beginning of each year, and inspection dates are agreed upon with the licensee's representatives.

	Inspections in 2007	
Basic programme	**Loviisan NPP**	**Olkiluoto NPP**
A. Safety management		
A.1. Management of safety	x	x
B. Main functions		
B.1. Assessment and improvement of safety		
B.2. Operation		
B.3. Plant maintenance and ageing management		
C. Inspections by functional unit and field of competence		
C.1. Plant safety functions	x	x
C.2. Electrical and I&C systems	x	
C.3. Mechanical engineering *		
C.4. Structures and buildings		
C.5. PSA and safety management	x	
C.6. Document and information management		
C.7. Chemistry	x	x
C.8. Nuclear waste *	x	x
C.9. Radiation protection	x	x
C.10. Fire protection	x	x
C.11. Emergency preparedness	x	x
C.12. Physical protection	x	
C.13. Training / Human resources and training	x	x
C.14. Quality assurance	x	x
C.15. LARA **	x	
C.16. International operating experience feedback	x	x
C.18. Operation	x	x
C.19. Management of organisational restructuring		x
C.20. Human resources at the reactor physics' office		x

* Inspection consists of several subinspections.

**Loviisa I&C upgrading

APPENDIX 6 Periodic inspection programme during construction

The objective of the Olkiluoto 3 construction-time inspection programme is to verify that the operations required by the construction of the plant ensure a high quality implementation according to the approved plans and compliant with official regulations, without endangering the plant units operational within the plant site. The inspection programme assesses and monitors the licensee's operations to build the plant unit, implementation procedures in various technical areas, the licensee's expertise and use of the expertise, the handling of safety issues and the quality management and control. STUK prepares an inspection plan for Olkiluoto 3 every six months.

	Inspections in 2007
Main functions	
Project quality management (two inspections in 2007) • 20–21 June 2007 • 3–4 December 2007	 x x
Project management, resources and safety issues 31 May–1 June 2007	x
Work processes	
Training of operating personnel 4–5 October 2007	x
Quality assurance (two inspections in 2007) • Purchases management process 28 February 2007 • Nuclear safety 15–16 October 2007	 x x
Utilisation of PRA 18 September 2007	x
Inspection procedures (two inspections in 2007)	x
Inspection of technical areas	
• Mechanical components 11–12 June 2007	x
• Electrical and I&C systems 28–29 August 2007	x
TVO inspection procedures 15–16 March 2007	
Radiation safety 1 March 2007	
Inspection outside the programme, site supervision 23 August 2007 and 5 September 2007	
To be inspected in connection with the periodic inspection programme	
Emergency preparedness	x
Physical protection	x
Fire protection	x
Nuclear waste	

APPENDIX 7. STUK-financed technical support projects completed in 2007

Nuclear power plants

Technical support for regulatory decision-making

Olkiluoto 3

Assessing fire safety of FRNC-cables for Olkiluoto 3, 22.1.2007; VTT

Oversight of the containment concreting; concreting readiness inspection UJA-X04 and -X15. Olkiluoto 5.–9.2.2007; VTT

Review of the specification of rubber lining for the PEB cooling water pipes; Fortum Power and Heat Oy, Turbines

Pool liners of the containment; 30FAE01, 30FAF01, 30FAF02 and 30FAF03 inspection of the updated construction plan documents of the pool liners. Pontek Consulting Oy

Pool liners of the containment; 30FAE01, 30FAF01, 30FAF02 and 30FAF03 inspection of the updated construction plan documents of the pool liners. Pontek Consulting Oy

Application of TONUS V2006 and FLUENT 6.2.16 CFD codes to ENACCEF hydrogen combustion tests;VTT

Safety Class 3 buildings; Statement on the design specification NGPM2/2004/en/0221, Pontek Consulting Oy

Access Building; Review of design documents. Pontek Consulting Oy.

Oversight of the containment concreting; concreting of UJA-X16 and -X17. Olkiluoto 29.–30.5.2007; VTT

Source Term Analysis of Olkiluoto 3; VTT

Coatings; Inspection of coating plans and inspection of painting combinations; Fortum Power and Heat Oy, Turbines

Fuel Building (UFA); Review of design documents from level –9.600 to level –6.200; Pontek Consulting Oy

Containment liner; Oversight of the coating work and conditions in Poland, Energomontaz Polnoc Gdynia 27.–29.6.2007; Fortum Power and Heat Oy, Turbines

Safeguard Buildings; Detail design documents of the buildings 1–4, Global static analysis; Pontek Consulting Oy

Preliminary Evaluation of the Combustible Gas Control System JMT for the Finnish OL 3; Institute for Safety and Reliability (ISaR)

Safeguard Buildings 1 and 4; Review of design documents from level –9.600 to level –5.000; Pontek Consulting Oy

Safeguard Buildings 2 and 3; Review of design documents from level –9.600 to level –5.000; Pontek Consulting Oy

Fuel Building (UFA); Review of design documents from level –6.200 to level –3.400; Pontek Consulting Oy

Review of the paint and varnish protection procedure for the reactor pressure vessel support ring coating; Fortum Power and Heat Oy, Turbines

Essential Water Pump Building 31-32UQB;review of design documents; Pontek Consulting Oy

In-containment refueling water storage tank (IRWST) liner;review of design documents; Pontek Consulting Oy

Review of design documents; Emergency Diesel Generator; buildings 31–34. Pontek Consulting Oy

Safeguard Buildings 1 and 4; Review of design documents from level –5.000 to level +0.000; Pontek Consulting Oy

Circulating Water Seal Pit (30UQJ); Review of design documents; Pontek Consulting Oy

Fuel Building; Review of design documents from level –3.400 to level +0.000; Pontek Consulting Oy

In-containment refueling water storage tank (IRWST) liner; review of updated design documents; Pontek Consulting Oy

Safeguard buildings; Review of global static analysis of the safeguard buildings 2 and 3, updating of the documents and review of design documents from level –5.000 to level +0.000; Pontek Consulting OySafeguard Buildings; Design documents of the safeguard buildings 1–4, Review of global static analysis updating; Pontek Consulting Oy

Reinforced Concrete Channels; 31-34 UQZ/UBZ/UMZ; Review of design documents; Pontek Consulting Oy

Olkiluoto NPP

Study on Human-Induced Maintenance Failures on the Basis of Maintenance History 2005 at Olkiluoto NPP, VTT

Loviisa NPP

KLUPA - Reference analyses related to the renewal of the Loviisa operating licence; VTT

Study on Human-Induced Maintenance Failures on the Basis of Maintenance History 2005 at Loviisa NPP, VTT

Others

Review of information security of nuclear power plants; VTT

Evaluation of Human Resources Development of Nuclear Power Plants; Aamu Consulting Oy

The release limit for a severe reactor accident and off-site long-term constraints on land use; VTT

Weather mast – GUI, real time processing and visualisation on NPP weather mast instrument data;Finnish Meteorological Institute

Evaluation of automation systems of nuclear power plants; 2006; VTT

Nuclear waste management

Technical support for regulatory decision-making

Posiva, TVO and FPH – TKS-2006, Nuclear waste management of the Olkiluoto and Loviisa power plants, Programme for research, development and technical design for 2007-2009; Review Group (Michael Apted, Randolph Arthur, Adrian Bath, Auli Niemi, David Read, Peter Robinson, Ove Stephansson, Sevn Tiren, Chin-Fu Tsang)

Posiva – Expected Evolution of a Spent Nuclear Fuel Repository at Olkiluoto (POSIVA 2006-05); Review Group (Michael Apted, Randolph Arthur, Adrian Bath, Martin Mazurek, Auli Niemi, Matti Saarnisto, Timo Saario, Ove Stephansson, Sven Tirén, Chin-Fu Tsang)

Posiva – Olkiluoto Site Description (POSIVA 2007-03); SONEX Review Group (Adrian Bath, Martin Mazurek, Auli Niemi, Ove Stephansson, Sven Tirén)

Posiva – Facility Description 2006; Ove Stephansson

Posiva – Geological Mapping of the Region Surrounding the Olkiluoto Site (WR 2007-30); Sven Tiren

Posiva – Safety issues concerning the Engineered Barrier Systems; AEGIS Review Group (Michael Apted, Randolph Arthur, Hannu Hänninen)

Posiva – Safety issues concerning the site investigations; SONEX Review Group (Adrian Bath, Martin Mazurek, Auli Niemi, Ove Stephansson, Sven Tirén)

Posiva – Review of the technical plans and construction of ONKALO; Ortogeo Oy

Posiva – Review of SR Can Safety assessment by SKB; VTT

TVO – Review of the Olkiluoto VLJ-repository safety assessment; VTT

APPENDIX 8 Glossary and abbreviations

BWR
boiling water reactor

Euratom
for nuclear material safeguards, Euratom refers to the European Commission units responsible for nuclear material safeguards: Directorate General for Energy and Transport, Directorates H and I

FSAR
Final Safety Analysis Report

IAEA
International Atomic Energy Agency

INSAG
International Nuclear Safety Group; organisation called by the Director General of IAEA

IRS
Incident Reporting System; nuclear power plant operating experience reporting system maintained by IAEA and NEA

KYT
publicly funded national nuclear waste management research programme

MDEP
Multinational Design Evaluation Programme; a multinational cooperation programme evaluating the practices and requirements of authorities related to the licensing of new nuclear power plants

NKS, Nordisk kärnsäkerhetsforskning
Nordic safety research programme

OECD/NEA
OECD Nuclear Energy Association

Onkalo
underground rock characterisation facility for the final disposal of spent nuclear fuel

PRA
Probabilistic Risk Analysis

PWR
pressurised water reactor

SAFIR
Safety of nuclear power plants; Finnish publicly funded national nuclear power plant research programme

SAGSI
Standing Advisory Group on Safeguards Implementation; an international team of nuclear material safeguard experts called by the Director General of IAEA

STUK-YVL Guides
The Regulatory Guides on nuclear safety (YVL) will be updated by the end of 2011 and published as STUK-YVL Guides.

TechSpec
Technical Specifications

WANO
World Association of Nuclear Operators

WENRA
Western European Nuclear Regulators' Association

VVER, Vodo-Vodyanoi Energetichesky Reactor

Russian pressurised water reactor; Loviisa 1 and Loviisa 2 are VVER-440 reactors

nuclear material

special fissionable material and source material such as uranium, thorium or plutonium, suited for obtaining nuclear energy,

nuclear commodity

nuclear commodity means nuclear material, device, equipment, and agreement referred to in Section 2, paragraph 4 and 5 of the Finnish Nuclear Energy Act (Section 1, paragraph 8 of the Nuclear Energy Decree).

nuclear material accounting and control manual

manual to be used by an organisation in possession of nuclear commodities, describing the nuclear material safeguards and accounting system

nuclear non-proliferation manual

manual to be used by a future possessor of nuclear commodities, describing the measures of securing the requirements of nuclear safeguards

regulatory control of nuclear non-proliferation

regulatory control to prevent the proliferation of nuclear weapons; operations consist of nuclear safeguards and the monitoring of the nuclear test ban

YVL Guides

STUK guides containing detailed requirements set for the safety of nuclear power plants