Loviisa Nuclear Power Plant

Our environment 2020

Loviisa power plant – producer of clean energy

Clean energy production and sustainability are at the core of Fortum's strategy. In 2020, the Loviisa power plant generated a total of 7.8 TWh (net) of carbon-free power, corresponding to more than ten per cent of the energy generation in Finland.

As a producer of clean energy, the Loviisa power plant and carbon-free nuclear power play a significant role in mitigating climate change. The greenhouse gas emissions over nuclear power's lifecycle are equivalent to those of wind, hydro and solar power.

As a result of the Loviisa nuclear power plant's electricity production, Finland emits about 6 million tonnes less carbon dioxide emissions compared to the equivalent amount of fossil fuel-based electricity.

After the outbreak of the COVID-19 pandemic, our most important task has been to ensure the health and safety of our own employees and contractor employees and to secure the continuity of operations. We managed very well through what was in many ways a challenging and exceptional year.

The safety condition of the power plant remained good, and both the production and equipment availability was at a very high level. Excellence in plant safety is an absolute prerequisite of safe and efficient operations for employees and the environment, and it is a sign of professionalism.

In 2020 we stayed within all permit limits in terms of environmental impacts.

In August 2020 Fortum initiated an Environmental Impact Assessment procedure (EIA procedure) for the Loviisa nuclear power plant. The procedure will assess the environmental impacts of a potential extension of the operation of the power plant or, alternatively, the decommissioning of the power plant, as well as the environmental impacts of the final disposal facility for low- and intermediate-level waste. The EIA procedure has two phases and will take about eighteen months.
Read more about Loviisa power plant's Environmental Impact Assessment: www.fortum.com/loviisaeia

Radiation safety

The annual collective radiation dose of the Loviisa power plant's own personnel and external contractors in 2020 was the lowest in the plant's operating history compared to similar outage periods. This shows that long-term work in radiation safety produces good results.

Emissions of radioactive effluents into the environment in 2020 were, as in previous years, significantly lower than the limits set for nuclear power plant emissions.

Based on emissions and meteorological data, the estimated radiation dose to the surrounding population was about 0.2% of the set dose limit. The radiation dose to the surrounding population from radioactive substances originating from the Loviisa power plant accounted for only a minor increase compared to the radioactive dose from other sources (like, e.g., radon and medicine).

The radiation monitoring programme carried out in the power plant surroundings occasionally detected radionuclides originating from the plant, but the concentrations detected were very small.

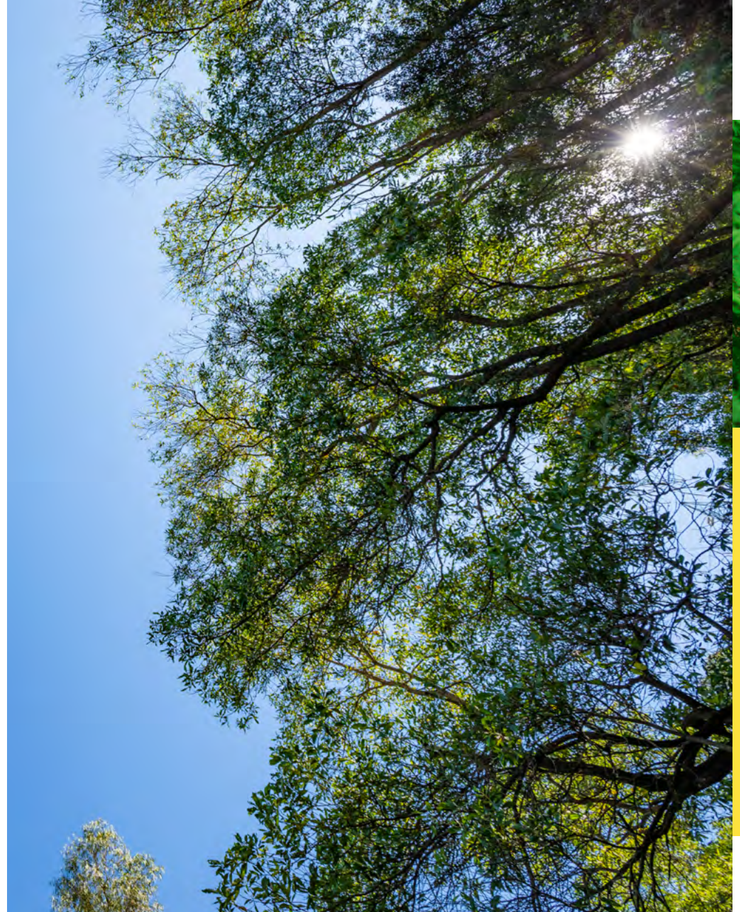
Waste management

Waste management at the Loviisa power plant is comprised of two separate areas: waste management for the non-controlled area and waste management for the controlled area. All waste generated in the controlled area is treated as radioactive. Waste generated outside the controlled area can be treated as waste from a conventional industrial plant.

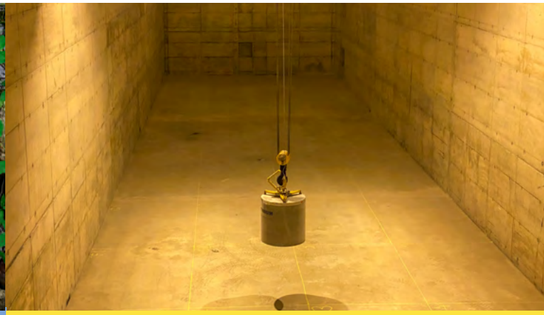
The goal of conventional waste management is to prevent the production of waste and to reduce the amount of landfill waste through effective sorting. In 2020 about 1 296 tonnes of waste was transported from the power plant area. Of this, 158 tonnes was landfilled, 961 tonnes was reused as materials or energy, and 177 tonnes was treated as hazardous waste.

Waste generated in the controlled area is divided into three categories: Low-level waste (maintenance waste), intermediate-level waste (liquid waste), and high-level waste (spent fuel). Maintenance waste is either cleared as non-active and treated as conventional waste or disposed of in the final repository located at a depth of 110 metres in the power plant area. Also the solidified liquid waste was disposed of in the final repository.

Thanks to efficient sorting and packaging, the amount of maintenance waste for final disposal in 2020 accounted for a small share. Liquid waste is purified and released into the sea or stored and solidified in concrete and then disposed of in the final repository. Spent fuel is stored to await final disposal in Eurajoki.



Responsible nuclear waste management



The environmental work of the Loviisa power plant is managed according to an ISO 14001 certified environmental management system.

Total amount of waste

1,350 t

Amount of conventional waste

96%

Conventional waste (non-radioactive)

Waste for recovery

71%

as material 60%
or energy 11%

Waste to landfill

12%

Hazardous waste for further processing

13%

e.g. chemicals and solvents

Nuclear waste

Spent fuel

Interim storage at the power plant premises

2%

Waste for final disposal at the power plant site

Maintenance waste 1%,
liquid waste 5%

6%

Final disposal to Posiva, at Eurajoki

2040's

Final disposal in the final repository

The amount of waste is affected by, among other things, the lengths of the annual outages and the work done in them, especially demolition work.

Cooling water

The power plant's most significant environmental impact is the thermal load on the sea caused by the cooling water, which heats up by about 10 degrees as it passes through the plant. In practice, two-thirds of the thermal energy produced by the reactor ends up in the sea with the cooling water. According to temperature measurements, the discharged water raises the temperature of the sea water during the growing season by about 1-2.5 degrees within a 1-2 kilometre range from the discharge point.

The cooling water discharge area remains unfrozen throughout the winter. The size of the open water and thin ice area depends on winter temperatures. In 2020, the power plant used a total of about 1,328 million m³ of sea water for cooling, and the thermal load on the sea totalled 54,586 terajoules.

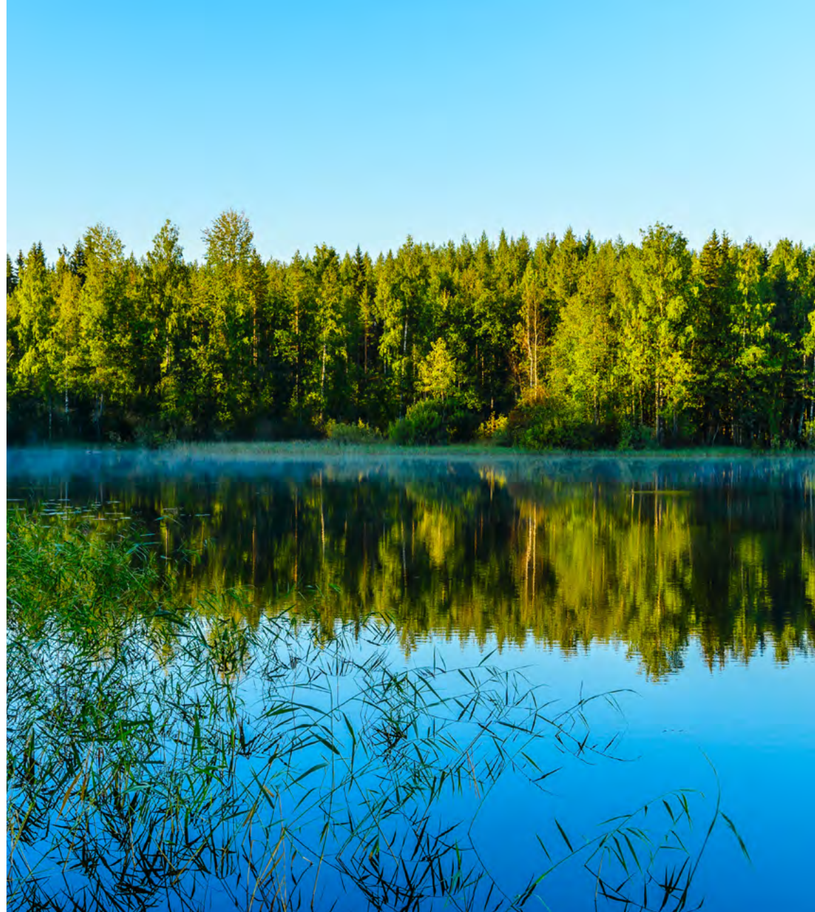
In accordance with the environmental permit, the amount of cooling water released into the sea should not exceed 1,800 million m³ per year or 56 m³/s. The cooling water's thermal load on the sea may not exceed 60,000 terajoules annually. The limits set by the permit were not exceeded in 2020.

Service water

The process and domestic water required by the power plant is sourced from Lake Lappominjärvi, which is located about 5 kilometres north of the power plant.

The water is purified before use at the water plant, and the water used as process water is additionally treated at the demineralisation plant. The total volume of water withdrawn from Lake Lappominjärvi in 2020 was about 155,040 m³.

According to the service water withdrawal permit, the power plant can withdraw up to 180 m³/h of water from the lake for a short period of time and a maximum of 150 m³/h per quarter.



Key figures

IN 2020, LOVIISA NUCLEAR POWER PLANT GENERATED

7.8 TWh ELECTRICITY
without carbon dioxide emissions

The amount of electricity generated at the Loviisa power plant is almost equivalent to the total electricity consumption of the cities Helsinki, Espoo and Vantaa.

Load factor
92.4%

Loviisa 1 **83.8%**
Loviisa 2 **91.7%**

LOVIISA NUCLEAR POWER PLANT'S SHARE OF FINLAND'S TOTAL ELECTRICITY PRODUCTION IS OVER **10%>**

Occupational safety

OCCUPATIONAL INCIDENTS

Loviisa power plant, own personnel

2020 **1** | 2019 **2**

Loviisa power plant, external personnel

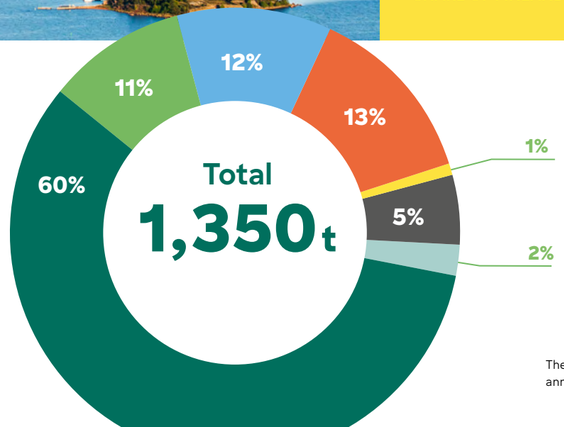
2020 **2** | 2019 **1**

OBSERVATION REPORTS (NO.)

2020 **1,380** | 2019 **1,009**

The power plant uses an observation report procedure to collect information for use at the power plant and for safety-related statistics. Observation reports are also made for "near miss" incidents and possibly hazardous incidents.

Total amount of waste handled at the Loviisa power plant in 2020



- as material
- as energy

Waste to recycling **71%**

- **Waste to landfill**
- **Hazardous waste** (e.g. chemicals and solvents)
- **Radioactive maintenance waste** (to final repository)
- **Radioactive liquid waste** (to final repository)
- **Spent fuel**

The amount of waste is affected by, among other things, the lengths of the annual outages and the work done in them, especially demolition work.

Personnel

Own personnel
525
Temporary employees **3%**

Men **85%**
Women **15%**

External personnel
Fortum's technical support in Espoo, ca. **170**
Permanent contractors, ca. **100**
Summer workers **81**
During annual outages, ca. **800**

Emissions into air

	2020	2019	Permitted annual emissions
Noble gases, TBq (Kr-87 equivalent)	5.1	5.0	14,000
Iodine, TBq (I-131 equivalent)	0.0000005	0.0000006	0.22

Emissions into water

	2020	2019	Permitted annual emissions
Cooling water, million m³	1,328	1,380	1,800
Thermal load into the sea, TJ	54,586	57,005	60,000
Tritium, TBq	16.1	14.5	150
Other radioactive nuclides, TBq	0.0002	0.0008	0.89

Annual load caused by domestic water

	2020	2019
Biological oxygen demand, kg	66	66
Chemical oxygen demand, kg	655	464
Phosphorus, kg	3.1	4.2
Nitrogen, kg	932	905
Solids, kg	180	308
Domestic wastewater volumeme, m³	19,443	22,642

Annual load caused by process wastewater

	2020	2019
Phosphorus, kg	2.3	3.0
Nitrogen, kg	929	411
Solids, kg	74	90
Process wastewater volume, m³	218,580	234,537

Wastewater

The domestic wastewater generated is treated at the power plant area's biological-chemical wastewater treatment plant, to which about 19,443 m³ of wastewater was piped in 2020.

In accordance with the environmental permit, domestic wastewater must be treated so that the biological oxygen demand (BOD7ATU) of wastewater discharged into the sea does not exceed 15 mg/l and the total phosphorus concentration does not exceed 0.7 mg/l, calculated as annual averages. The efficiency of the treatment process must be at least 90% for both variables.

According to the monitoring results, the treatment plant reached results compliant with the conditions of the permit: the biological oxygen demand of treated wastewater in 2020 was 3.1 mg/l on average and total phosphorus concentration 0.16 mg/l. The load caused by domestic wastewater in 2020 was 3.1 kg of phosphorus, 932 kg of nitrogen and 180 kg of solids.

The environmental permit of the power plant does not set any limits for the process wastewater load. However, the nutrient load caused by the process wastewater is monitored through samples taken in accordance with the monitoring programme.

The load caused by process wastewater in 2020 was 2.3 kg of phosphorus, 929 kg of nitrogen and 74 kg of solids. The power plant's share of the total load in the Hästholmen sea area in 2020 was about 0.7% phosphorus and about 4.7% nitrogen.

Environmental incidents

No permit limits were exceeded at the Loviisa power plant in 2020 nor were there any breaches of permit conditions.

One chemical leak was reported at the Loviisa power plant in 2020. In the commissioning phase of the new storage for concentrated chemicals, concentrated lye (48% NaOH) was being transferred from the chemical storage tank into the new storage tank. Because of an incorrectly closed valve, the lye flowed through the overflow line into a water tank instead of into the storage tank; the lye filled the water tank and, via the pressure relief line, leaked onto the top of the tank and to the floor of the room. About 300 litres of 30% lye ended up on the floor of the room and flowed through the floor drain to the power plant's cooling water channel, and from there through the cooling water discharge outlet into the sea. Based on the criteria in effect, sodium hydroxide is not classified as hazardous. Before the chemical was discharged into the sea, the chemical was diluted considerably in the plant's cooling water channel.

The most important task of our nuclear power operations is to produce electricity safely, reliably and competitively, in the short term and long term, while complying with the principles of nuclear and radiation safety, waste management safety, and nuclear material control.

Our operations are based on a high-level safety culture and quality and on continuous improvement.

Our own world-class expertise is a prerequisite for safety and competitiveness. Our Nuclear Services business is built upon this strong competence base, and our customers are in the centre of the solutions we provide.

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