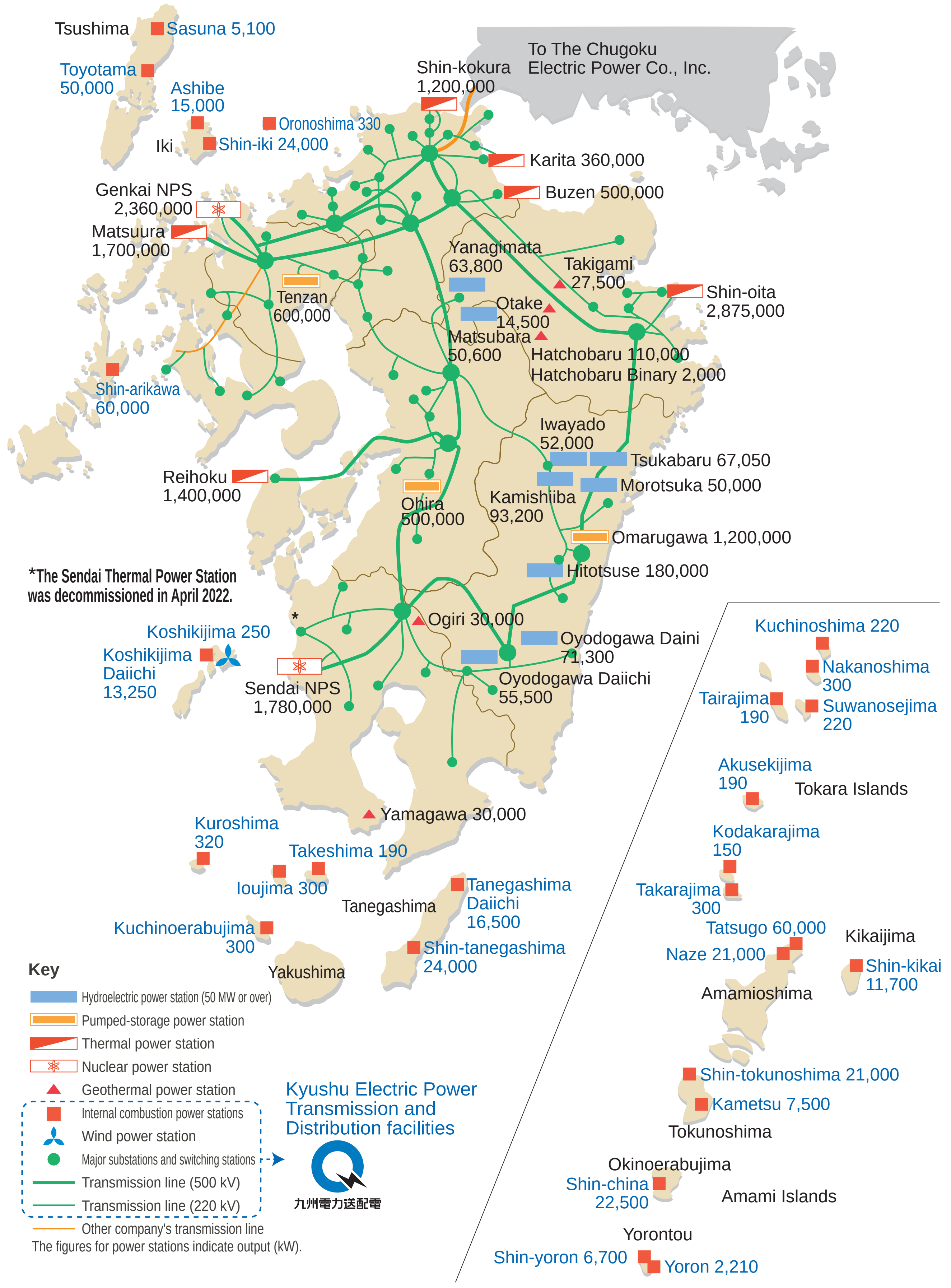
Sendai
Nuclear Power Station

An Introduction to Sendai Nuclear Power Station

KYUSHU ELECTRIC POWER CO.,INC.

Major Supply Facilities (as of March 31, 2023)

[Power Supply Facility Location Map] *Includes Kyushu Electric Power Transmission and Distribution facilities (shown in blue)



Introduction

To ensure our customers a stable supply of electric power today and in the future, Kyushu Electric Power is implementing a policy based on an optimal balance of energy sources, including primarily nuclear power but also renewable energy sources and high-efficiency thermal power plants. This policy was developed to address a wide range of issues including rising energy demand, energy security, the global environment and economy.

In Sendai, we operate Units 1 and 2 of the Sendai Nuclear Power Station, with the cooperation and support of the local community and other involved parties.

Regarding the expansion plan for the Sendai Nuclear Power Station's No. 3 Unit, we are moving forward with appropriate measures which take into account various considerations, such as the 2050 carbon neutrality-focused national energy policy, trends in nuclear power business landscape, competitive changes driven by electricity system reform, and the electricity supply and demand situation.

We will continue to earn the trust of local residents and other involved parties, keeping operational safety our top priority.

Aerial photograph of downtown Satsumasendai

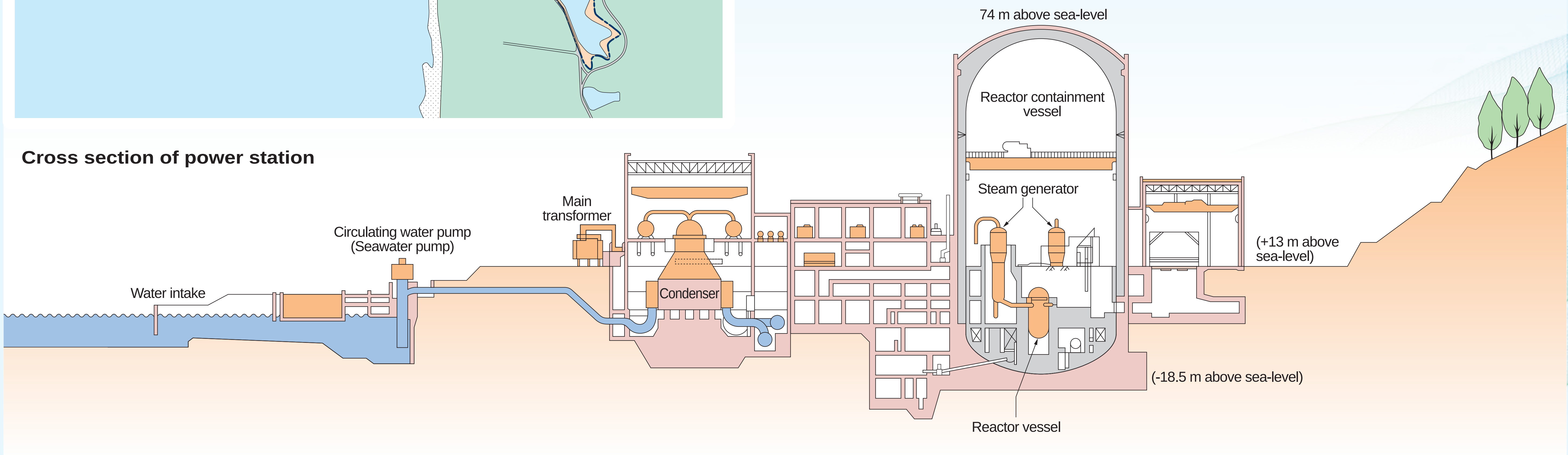
A Guide to the Sendai Site

General Overview of Sendai Site

Overview

Item		Unit 1	Unit 2
Location		1765-3, Gumisaki-cho, Satsumasendai City, Kagoshima Pref.	
Site area		Approx. 1.45 million m² (includes approx. 100,000 m² of reclaimed land)	
Generated output		890 MW	890 MW
Reactor type		Pressurized Water Reactor (PWR)	Pressurized Water Reactor (PWR)
Fuel	Classification	Slightly enriched (Approx. 4 to 5%) uranium dioxide (UO_2)	Slightly enriched (Approx. 4 to 5%) uranium dioxide (UO_2)
	Loaded quantity	74 tons (Approx.)	74 tons (Approx.)
Commercial operation		July 4, 1984	November 28, 1985

Cross section of power station



Major Equipment and Systems

How nuclear power station work

The Sendai nuclear power station is a Pressurized Water Reactor (PWR).

The PWR design circulates the high-temperature, high-pressure water generated in the reactor core through the primary system, which is completely isolated from the secondary system used to supply steam from the steam generator to the turbine via the heat transfer tubes. Because they are independent systems, no steam containing any radioactive substance is transported to the turbine side.

Inside the reactor core, nuclear fuel is fissioned to release enormous amounts of heat. This heat is transferred to the steam generator by the water in the primary system, driven by the primary reactor coolant pump.

The primary system water pumped to the steam generator passes through the heat transfer tubes, separated by the walls, transferring heat to the secondary system water on the outside of the tubes, and it is then circulated back to the reactor.

The transferred heat causes the secondary system water to turn into steam, which is passed to the turbine, rotating the turbine and generator to generate electricity.

The steam used in the turbine and generator is cooled by seawater through the thin tubes of the condenser, turning it back into water and sending it back to the steam generator.

The reactor building consists of an outer shielding wall and a reactor containment vessel.

■Reactor containment vessel

The reactor containment vessel is an airtight enclosure made of steel plate that completely encompasses the reactor, pumps, and other important equipment.

- ●Outer diameter: Approx. 40 m
- ●Height: Approx. 87 m
- ●Thickness: Approx. 4 cm

■Outer shielding wall

The outer shielding wall is made of reinforced concrete.

- ●Outer diameter: Approx. 44 m
- ●Thickness: Approx. 1 m

In the event of an accident, the emergency core cooling system floods the reactor vessel with water. It consists of the following three systems.

■Accumulator injection system (tank)

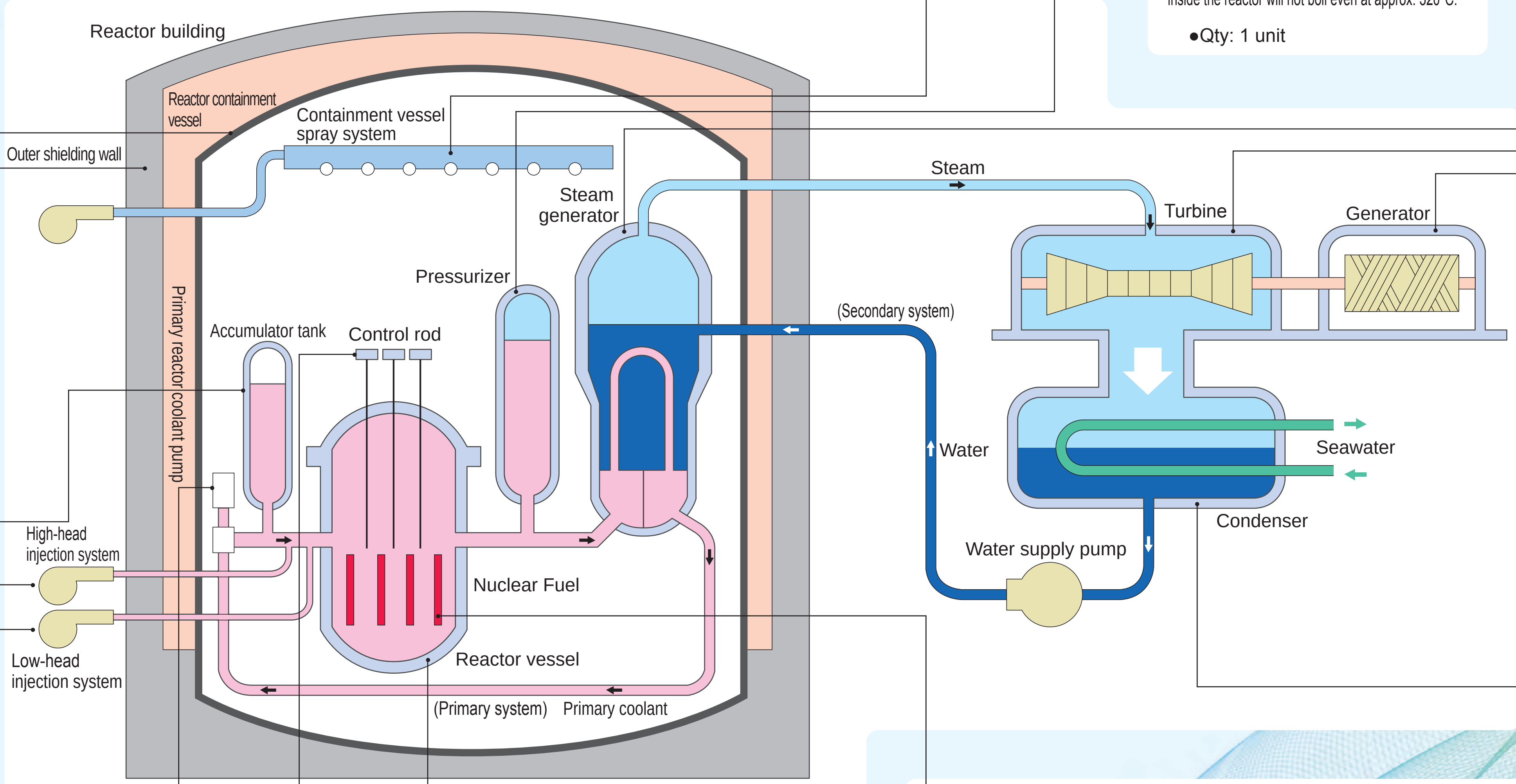
- ●No. of units: 3
- ●Capacity: Approx. 41 m³/unit

■High-head injection system (pump)

- ●No. of units: 3
- ●Capacity: Approx. 147 m³/h/unit

■Low-head injection system (pump)

- ●No. of units: 2
- ●Capacity: Approx. 681 m³/h/unit



■Primary reactor coolant pump

The primary reactor coolant pumps circulate water through the reactor.

- ●No. of units: 3
- ●Capacity: Approx. 20,100 m³/h/unit

■Control rod

These absorb the neutrons causing nuclear fission, stopping the reactor. Furthermore, if any abnormality occurs, the control rods will automatically shut down the reactor.

■Reactor vessel

Made of steel plate, the reactor vessel houses the nuclear fuel, primary coolants, and other major components of the reactor for generation of energy using nuclear fission.

- ●Outer diameter: Approx. 4 m
- ●Height: Approx. 12 m
- ●Thickness: Approx. 20 cm

■Containment vessel spray system

When the pressure inside the reactor containment vessel rises to abnormally high levels, water is sprayed inside to cool it off and limit the rise in pressure.

- ●No. of systems: 2
- ●Pumps: 2
- ●Nozzles: Approx. 500
- ●Capacity: Approx. 940 m³/h/pump

■Pressurizer

Maintains the pressure inside the reactor at approx. 15.4 MPa (about 157 atmospheres). As a result, water inside the reactor will not boil even at approx. 320°C.

- ●Qty: 1 unit

■Steam Generator

High-temperature, pressurized water from the reactor transfers heat to the secondary system water here, creating steam.

- ●No. of units: 3
- ●Steam capacity: Approx. 1,750 t/h/unit

■Turbine

Steam from the steam generator turns the turbine.

- ●Output: 890 MW (rated)
- ●RPMs: 1800

■Generator

Directly linked to the turbines rotations to generate electricity.

- ●Capacity: 990 MVA
- ●Voltage: 23 kV

■Condenser

Steam from the turbine is cooled with seawater, condensing it into liquid, which is pumped back to the steam generator.

■Nuclear Fuel

Neutrons strike the uranium 235 in the fuel, triggering nuclear fission and releasing heat energy. The nuclear fuel (uranium) is sintered into pellets, and used inside sealed metal fuel cladding tube.

- ●Pellet outer diameter x length: Approx. 8 mm x Approx. 10 mm
- ●Fuel rod length: Approx. 3.9 m
- ●No. of pellets contained in one fuel rod: Approx. 400

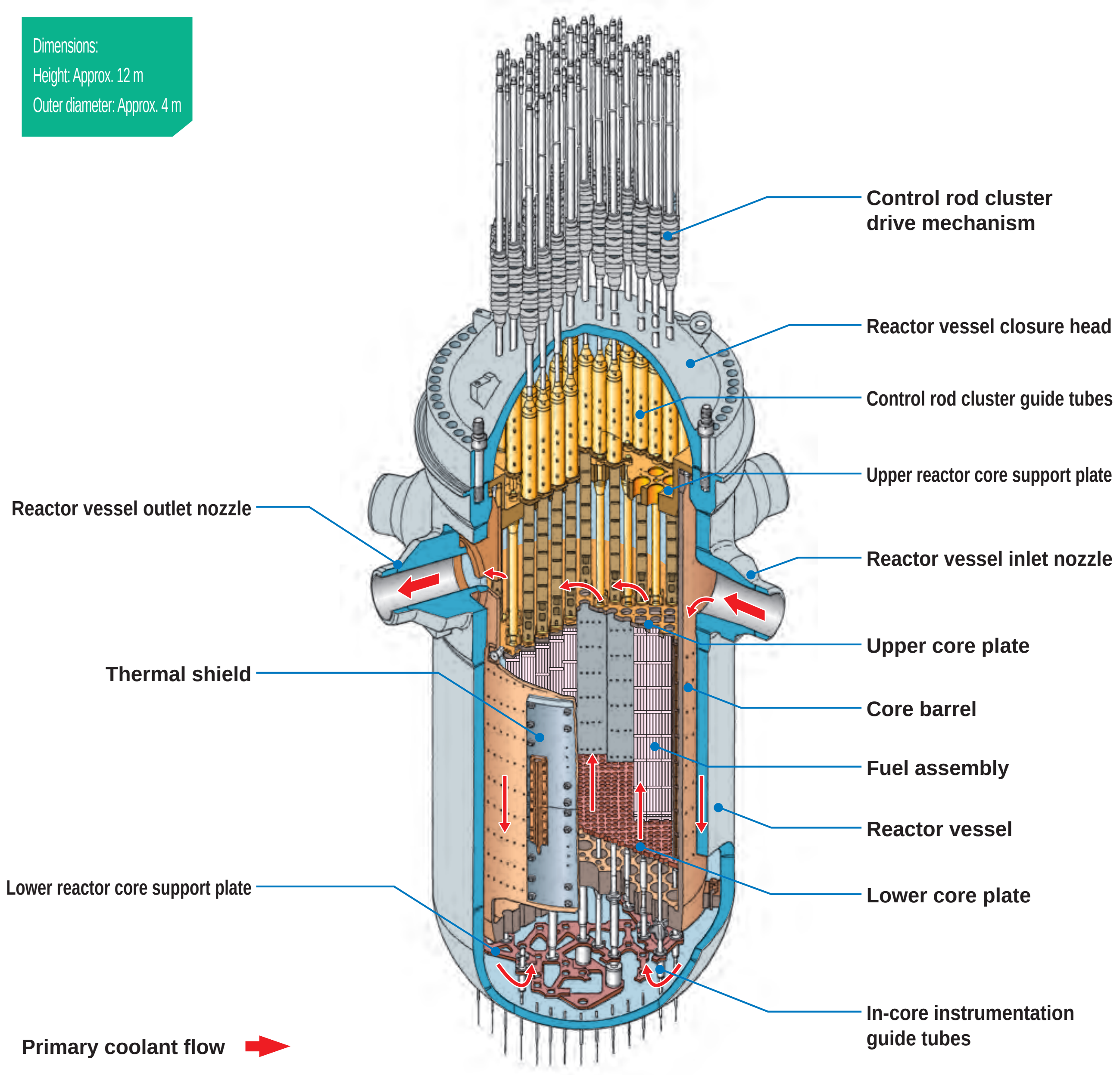
The fuel rods are assembled into squares called fuel assemblies.

- ●Qty. of fuel assemblies: 157
- ●Qty. of fuel rods per assembly: 264

Major Equipment Specifications

Equipment name	Item	Specifications
Reactor	Type	Pressurized Water Reactor
	Thermal output	2,660 MW
	Reactor outlet temperature	Approx. 321°C
	Reactor intake temperature	Approx. 284°C
	Primary pressure	Approx. 15.4 MPa (Approx.157 atmospheres)
Reactor containment vessel	Type	Upper part hemispherical, lower part shallow-shaped cylindrical
	Dimensions	Outer diameter Approx. 40 m
		Total height Approx. 87 m (Above-ground height Approx. 61 m)
Steam generator	Type	Heat exchange with vertically U-shaped piping
	Steam capacity	Approx. 1750 t/h/unit (3 units installed)
Turbine	Type	Tandem compound 4-chamber, 6-branch exhaust reheat regenerative
	Output	890 MW (rated)
	Intake steam pressure	5.1 MPa (Approx. 52 atmospheres)
	Intake steam temperature	Approx. 266°C
	RPMs	1800
Generator	Type	Laterally rotating magnetic field, 3-phase AC synchronous turbine generator
	Capacity	Approx. 990 MVA
	Voltage	23 kV
Main transformer	Type	Outdoor-use unpressurized sealed
	Capacity	1000 MVA
	Rated voltage	Primary 23 kV
		Secondary 520 kV

Structure of the Pressurized Water Reactor

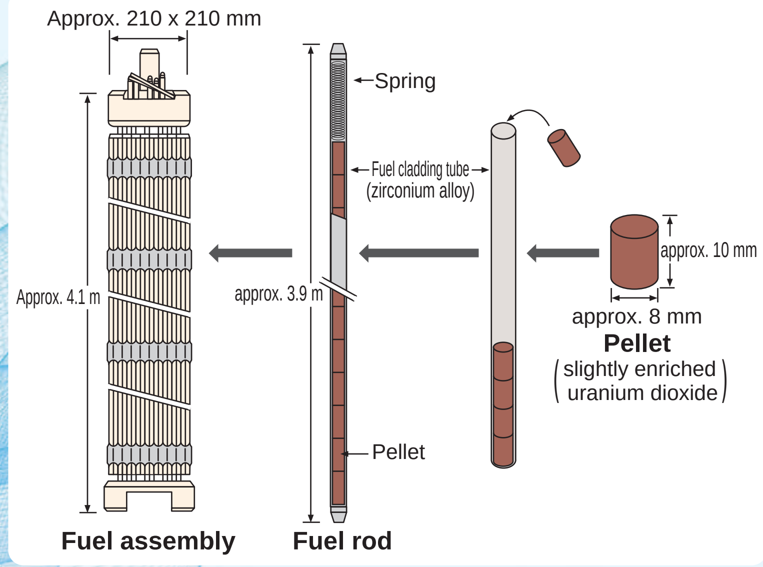


Nuclear Fuel

Nuclear fuel is uranium 235 enriched by about 4–5% to form uranium dioxide (UO_2), which is sintered into hard pellets only the size of your fingertip, but large enough to hold plenty of fissionable substance.

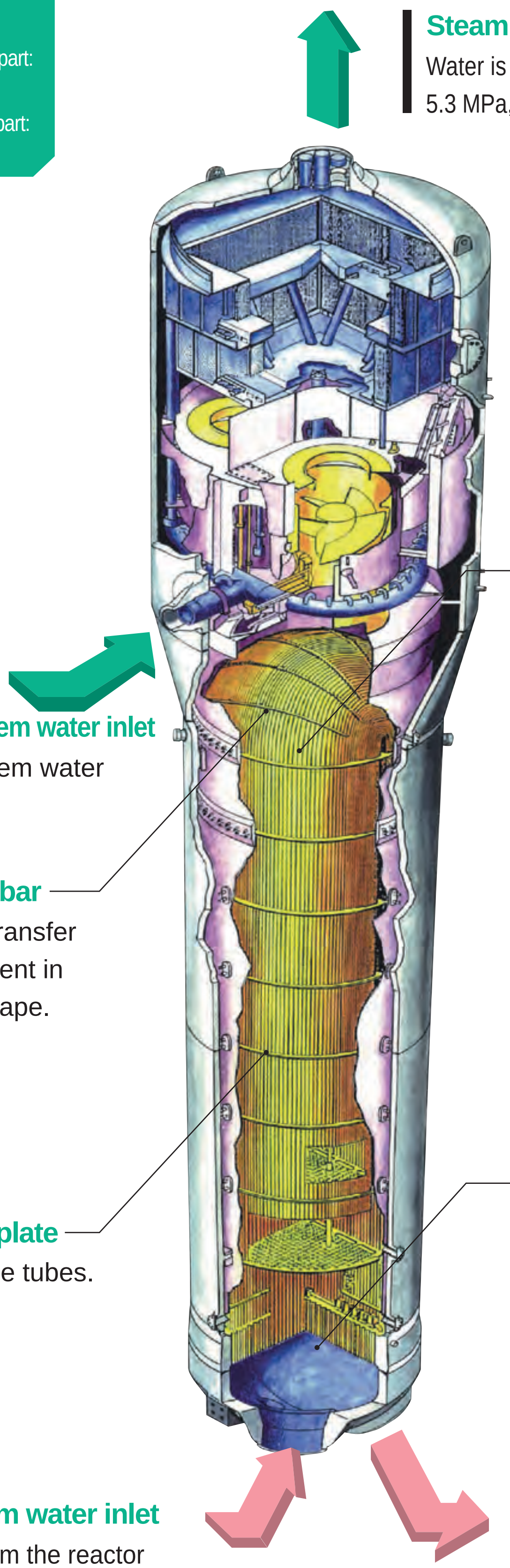
About 400 of these pellets are packed into a fuel rod, which is the name for fuel cladding tube made of zirconium alloy.

An arrangement of 264 of these fuel rods formed into a lattice grid makes up a fuel assembly, and 157 of these fuel assemblies are loaded at one time into the reactor.



Structure of the Steam Generator

Dimensions:
Height: Approx. 21 m
Outer diameter of upper part: Approx. 4.5 m
Outer diameter of lower part: Approx. 3.5 m



Steam outlet
Water is converted to steam (approx. 270°C at about 5.3 MPa, or 55 atmospheres), and sent to the turbine.

Tubes
- A large assemblage of tubes (approx. 3,400 tubes) is used to increase the available surface area, to facilitate the transfer of heat from the primary system water (flowing inside the tubes) to secondary system water (flowing outside the tubes).
- Tubes are made of Inconel alloy, which offers excellent corrosion resistance and strength.
- The inverted U-shape has an outer diameter of about 22 mm and a thickness of about 1.3 mm, and a total length of approx. 20–25 m.

Secondary system water inlet
Secondary system water enters here.

Anti-vibration bar
Supports heat transfer tubes that are bent in an inverse U shape.

Tube plate
- Anchors the bases of the tubes.

Tube support plate
Supports the fine tubes.

Primary system water inlet
Heated water from the reactor (approx. 320°C at about 15.4 MPa, or 157 atmosphere) enters here.

Primary system water outlet
After transferring heat, the water (approx. 280°C) returns to the reactor.

Earthquake Safety Measures of Nuclear Power Stations

1. Thorough preliminary investigation

Extensive site surveys are carried out on prospective sites to ensure that there are no active faults present, as they are prone to earthquakes.

We also investigate the geology of the site, and the history of seismic activity in the region.

2. Nuclear power stations are built on the rock stratum

The rock stratum is a hard solid body that has formed over a very long time. Because the rock stratum inhibits amplification of earthquake-caused vibrations, the softer soil layers above the rock stratum are removed and the safety-critical facilities of the power station are built directly onto the rock stratum.

3. Earthquake-resistant designs reflect the level of safety severity

The facilities of a nuclear power station are classified according to the level of safety severity. Facilities with a high level of safety severity have been designed to withstand strong earthquakes.

4. Computers are used to confirm earthquake resistance

Computers are used to analyze the shaking of buildings (and the shaking of equipment caused by the shaking of the building) when they are subjected to seismic vibration that is set to levels considered by the earthquake resistant design. This process allows us to confirm the facilities have sufficient strength.

5. If a large earthquake is detected the nuclear reactor will be automatically scrammed

Seismic sensors are installed close to the rock stratum inside the power station buildings. These seismic sensors can output a signal that stops the nuclear reactor. If there is a large tremor in the rock stratum, the nuclear reactor scrams automatically to ensure safety is maintained.

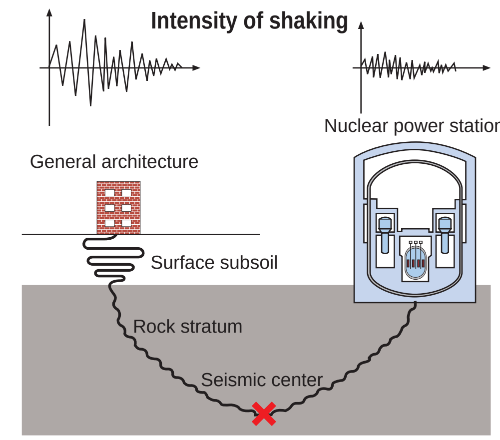
■What is an active fault?

When there is sudden slippage in the earth's crust, it is referred to as fault movement. This is what causes earthquakes.

An active fault is an area of slippage in the earth's crust that has been experiencing repeated slippage sometime in the period from about 1.8 million years ago to the present, or where repeated slippage is expected to occur in the future.

■The difference in tremors in the firm rock stratum and the weaker surface subsoil

In contrast to the firm rock stratum, the weak structure of the subsoil amplifies earthquake tremors. Typically, tremors in the subsoil are 2 to 3 times greater than tremors in the rock stratum. This means that there is a big difference in the intensity of the shaking of a nuclear power station built directly on the rock stratum and the shaking of a building built on the weak-structured surface subsoil even when they are the same distance from the seismic center .

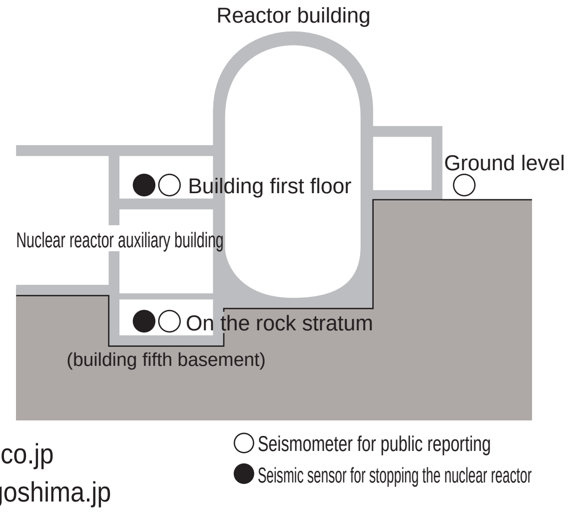


Sendai Nuclear Power Station's Seismometer for Public Reporting

To facilitate the expedient public release of seismic data measured at the power station, three seismometers for public reporting are installed, one on the grounds of the power station, and two close to the location of seismic sensors that automatically stop the nuclear reactor in the event of an earthquake.

These seismic measurement data are sent online to the Kagoshima prefecture and Satsumasendai city governments and can be viewed at Satsumasendai City Hall.

You can also check it on the Kyushu Electric Power website [*1] and the Kagoshima Prefecture website [*2].



*1 Kyushu Electric Power website address https://www.kyuden.co.jp
*2 Kagoshima Prefecture website address http://www.jishin-kagoshima.jp

Safety in Nuclear Power Generation

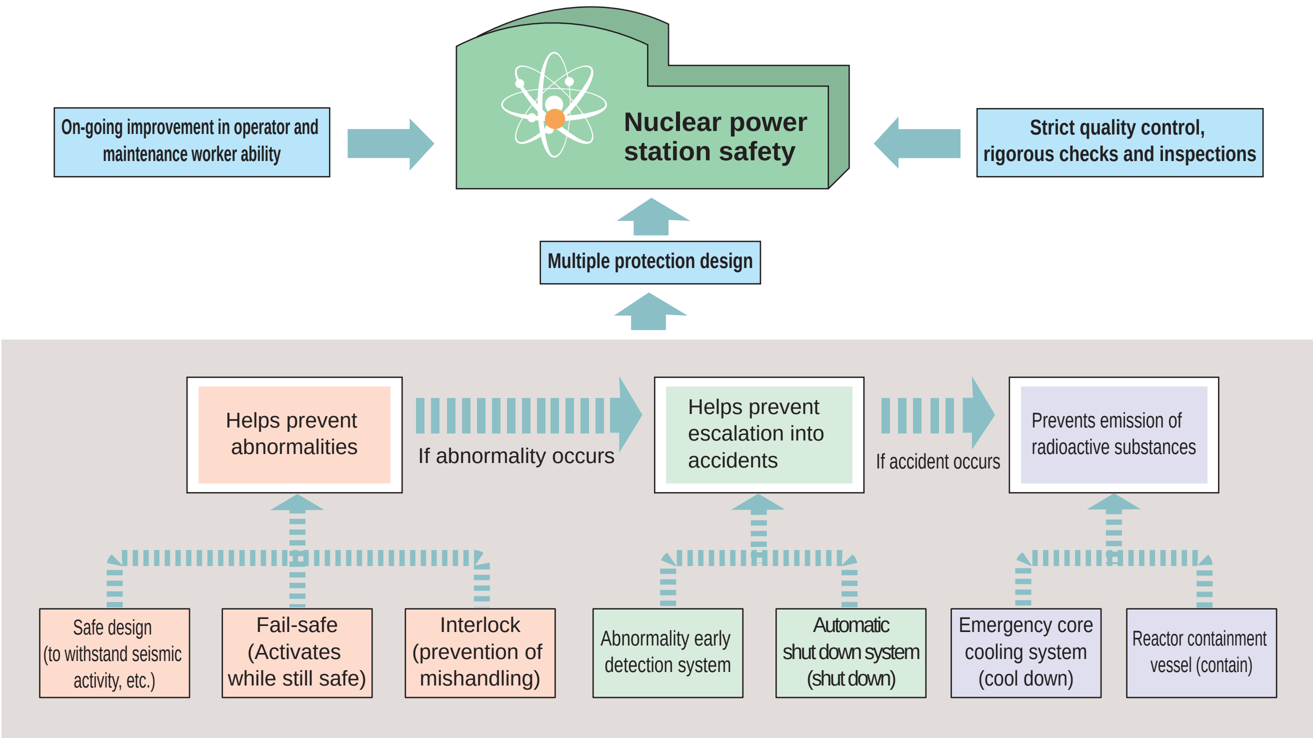
Safety Features of Nuclear Power Station Design

The nuclear power station is designed to ensure safety, using multiple protection in a structure to completely seal away radioactive substance from the outside world.

Under multiple protection, we implement a number of protection strategies in a multi-layered approach that recognizes that machines fail and people make mistakes.

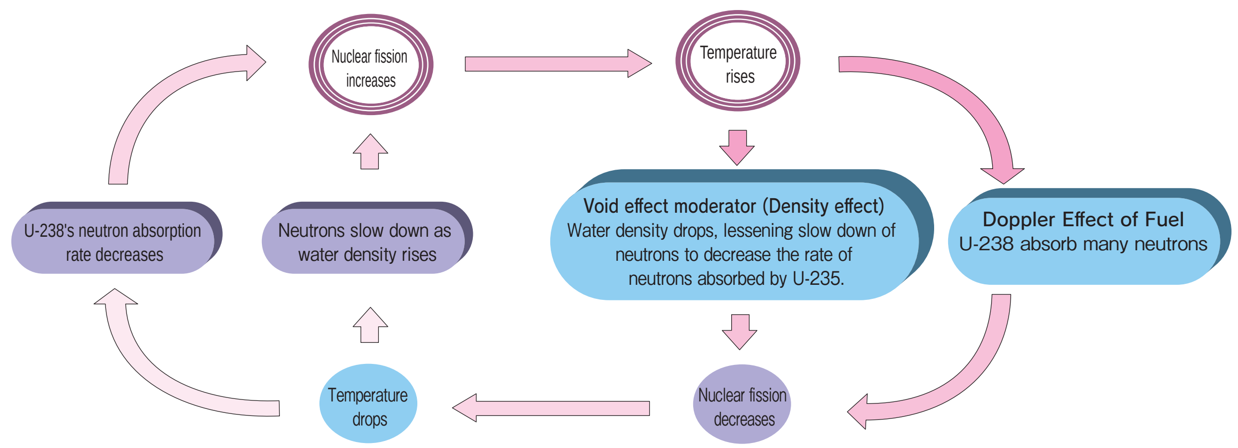
It includes the following safety measures:

- Designs and protocols to help prevent machines from failing, and people from making errors.
- Systems to immediately halt reactor operation in the event of an abnormality.
- Systems to cool the reactor and contain radioactive substance in the event of an accident.



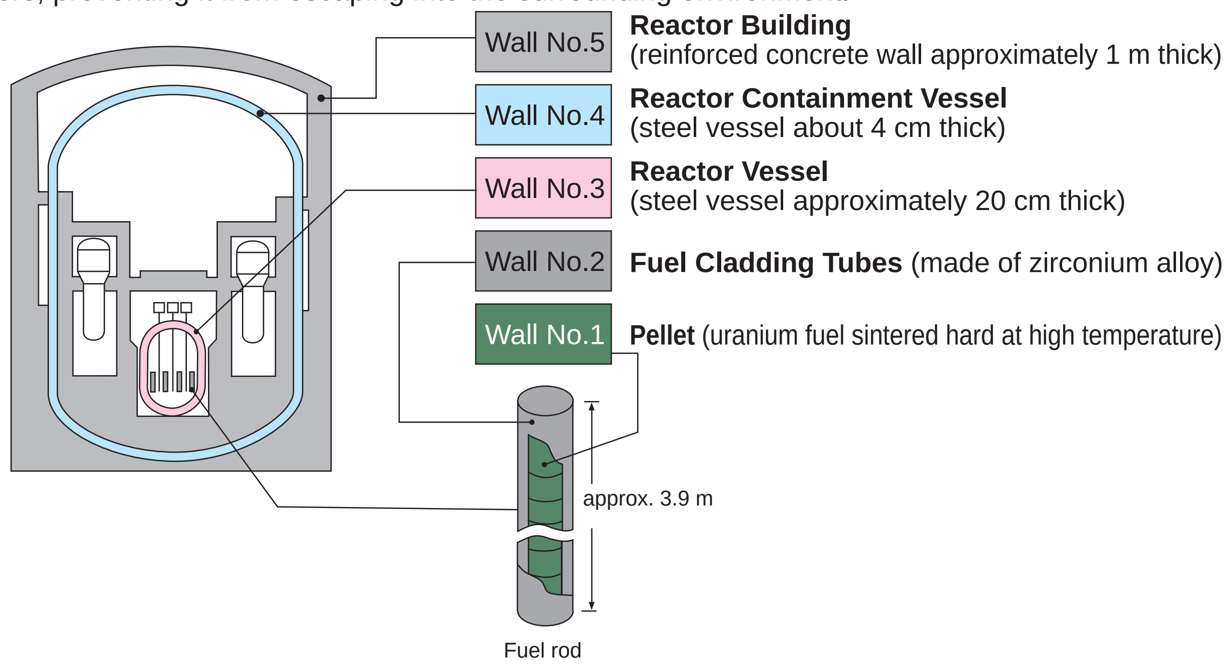
Self-regulation

When the temperature of the reactor core rises sharply for any reason, the nuclear fission chain reaction automatically slackens, causing the temperature to drop again in a self-regulating design that offers excellent operational safety.



Five Walls of Protection

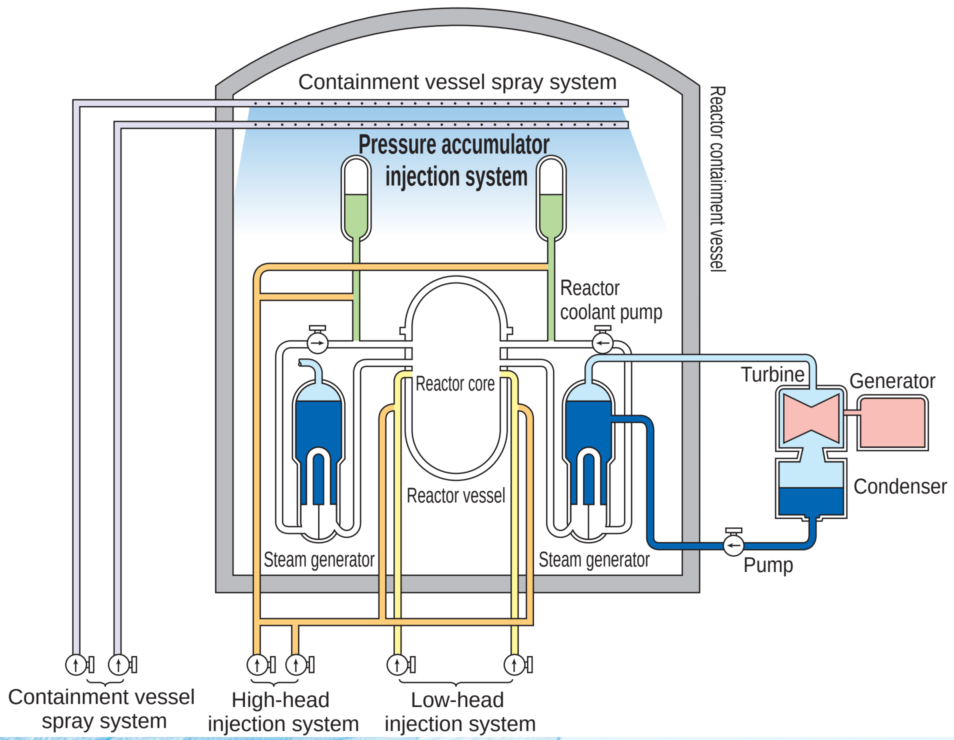
The radioactive substance generated by fission of the uranium 235 fuel is secure behind multiple barriers, preventing it from escaping into the surrounding environment.



Emergency Core Cooling System (ECCS)

The Emergency Core Cooling System (ECCS) is a safety system that immediately injects coolant into the reactor core to cool it down if coolant is lost from the core.

- Even in the event of an accident in which the primary system piping breaks, causing water to leak out and the reactor core to enter a "dry-boil" state, it has been confirmed that there will be no safety issues because the reactor will be cooled by water injected through the emergency core cooling system (ECCS) of the accumulator injection system, high-head injection system, and low-head injection system.



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Safety Measures for Serious Accidents and Other Emergencies

Learning from the lessons of the Fukushima Daiichi Nuclear Power Plant accident, the Sendai Nuclear Power Station implemented all safety measures that are based on the newly framework of these regulations, in both the power plant's facilities (hard infrastructure) and operational management (soft infrastructure), and we have been doing so since immediately after formulated regulatory standards and was the first nuclear power plant in Japan to restart operations. Even now, we continue to work on further safety measures which go beyond the the accident. Going forward, we will strive to inspire peace of mind on the part of area residents by pursuing a voluntary and ongoing program of initiatives to boost safety and reliability.

Progress of Events During the Fukushima Daiichi Nuclear Power Plant Accident

Earthquake

↓

1
- Reactors are automatically shut down.
- External power is lost
- Emergency generators start
- Reactor cooling begins

↓

Tsunami

↓

2
- All power is lost
- The plant loses its ability to cool nuclear fuel.

↓

3
- Nuclear fuel is damaged.

↓

4
- Radioactive substances and hydrogen leak into the reactor buildings from the reactor containment vessels.
- Hydrogen accumulates in the reactor buildings, causing hydrogen explosions.

↓

5
- Radioactive substances are released into the atmosphere.

Compiled with reference to "Comprehensive Nuclear Power Pamphlet 2020" (published by the Japan Atomic Energy Relations Organization).

Overview of New Regulatory Standards

Basic Approach

The new regulatory standards strengthen, as well as newly establish, design standards to prevent serious accidents. Also, they establish new standards for what to do in the unlikely event of a serious accident.

[Existing Regulatory Standards]

Regarding measures against serious accidents, the operator will take measures to ensure safety.

+

- Consideration of natural phenomena
- Consideration of fire
- Power source reliability
- Other equipment performance
- Seismic and tsunami capacity

↓

[New Regulatory Standards]

Preparation of facilities and procedures to deal with any serious accidents that may occur **[New]**:
- Response to an intentional aircraft crash(*)
- Suppression of radioactive substances dispersal
- Measures to prevent damage to reactor containment vessel
- Measures to prevent core damage

Prevention of serious accidents (prevention of simultaneous loss of safety functions due to a common cause) **[Enhancement or new]**:
- Consideration of internal flooding (new)
- Consideration of natural phenomena (newly added: volcanoes, tornadoes and forest fires)
- Consideration of fire
- Power source reliability
- Other equipment performance
- Seismic and tsunami capacity

*Facilities required by the standards to deal with specified serious accidents (e.g., facilities equipped with emergency control rooms to cool the reactor even in the event of large-scale damage to the power plant) must be completed within five years of the approval date of the construction plan for the main facility or other relevant facility.

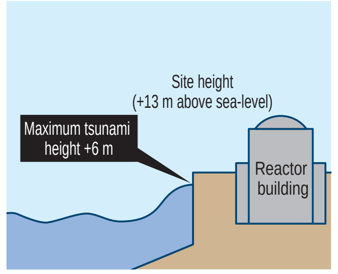
Safety Measures at Kyushu Electric Power Nuclear Power Stations (Safety Measures at the Sendai Nuclear Power Station)

1 Preventing anomalies

Strengthening the plant to prepare for the largest-scale natural disasters that are scientifically possible


Pipe support reinforcement

We've taken steps to boost seismic resistance based on the maximum anticipated standard earthquake ground movement.



It has been confirmed that even the largest estimated tsunami will not affect the safety of the reactor facilities.


Tornado protection measures for outdoor tanks

We've taken steps based on a tornado with a maximum wind speed of 100 meters per second.

2 Preventing an anomaly from expanding


High-capacity air-cooled generators


High-voltage generator trucks

We've prepositioned an array of generators* at the site in order to ensure we can secure the power needed to prevent a serious accident.

*Site elevation: Distributed arrangement from 13 m to 33 m above sea level

3 Preventing damage to nuclear fuel

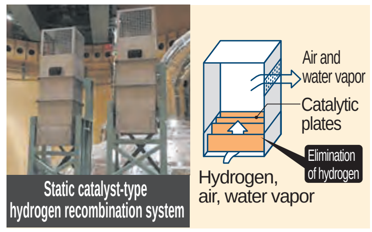

High-capacity pump trucks


Portable diesel filling pumps

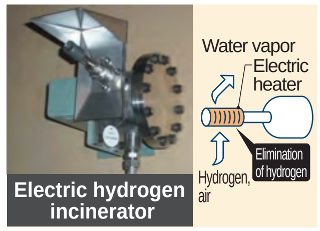
We've prepositioned an array of pumps* at the site in order to ensure the fuel can be cooled.
(also used in measure 4)

*Site elevation: Distributed arrangement from 25 m to 44 m above sea-level

4 Preventing damage to reactor containment vessels



Static catalyst-type hydrogen recombination system



Electric hydrogen incinerator

In addition to adopting more varied means of cooling reactor containment vessels, we've installed hydrogen elimination systems as a way to lower hydrogen concentrations.

5 Preventing the release and dispersal of radioactive substances


Water cannons


Underwater curtains

To prepare for the unlikely event that a reactor containment vessel were to sustain damage, we've prepositioned water cannons and underwater curtains at the site.
(status of installation training)

Training to prepare for a serious accident

In preparation for the unlikely event of a serious accident, we have established a night shift system (52 people per team + facility personnel responsible for dealing with specific serious accidents, etc.) so that we can respond promptly, even outside of working hours, on holidays, and at night, and we conduct continuous training.

Power supply training

Power supply by high-capacity, air-cooled generators

Training to supply coolant

Connecting a high-capacity pump truck

Emergency plant operation training

Operational training using a simulator

Training to prevent the dispersal of radioactive substances

Dispersal of water by a water cannon

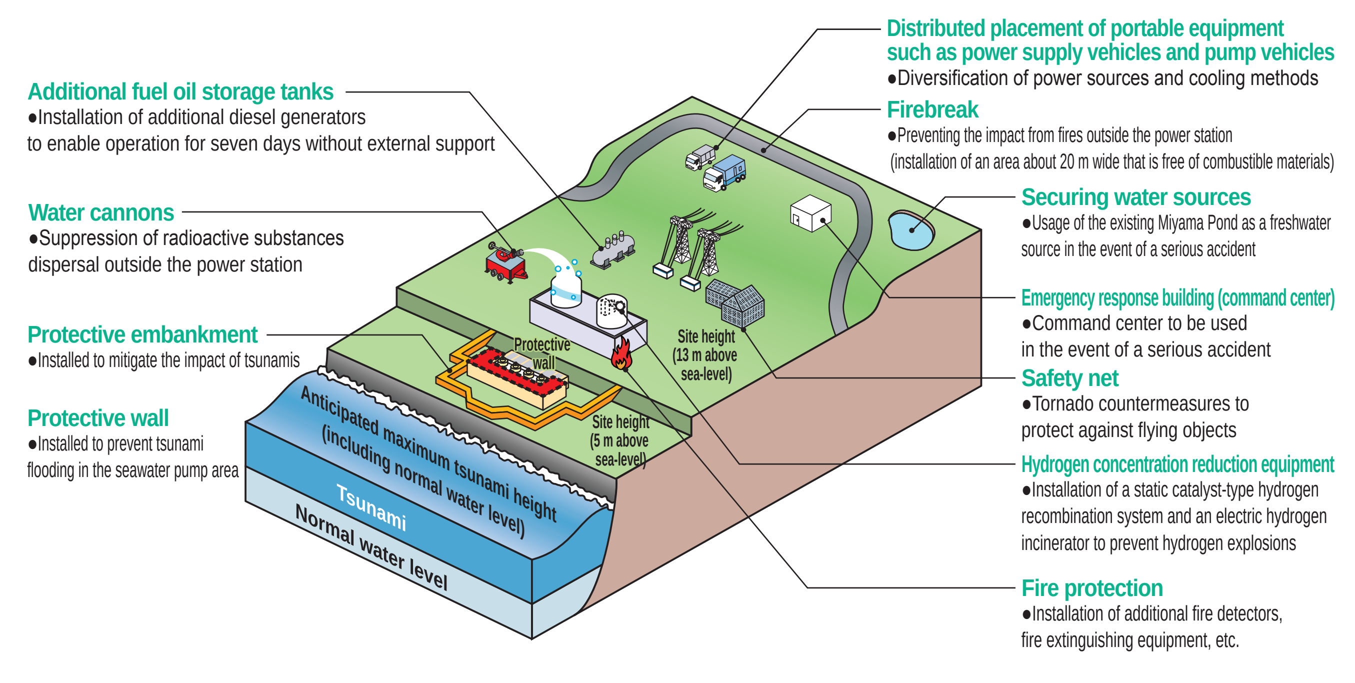
Establishment of an emergency response building (command center)

The emergency response building (command center), which will be used as the on-site response headquarters in the event of a serious accident, is built on solid bedrock.

Exterior of the emergency response building

Training at the emergency response building (command center)

Major facilities newly installed under the new regulatory standards (image)



Response Facilities for Specified Serious Accidents and Other Emergencies

The response facilities for specified serious accidents and other emergencies are designed to prevent damage to the reactor containment vessel in the event that the reactor cooling function is lost and the reactor core is severely damaged due to acts of terrorism, such as the intentional crashing of a large aircraft into a reactor auxiliary building.

1 Water injection equipment for nuclear reactors

The reactor is cooled using dedicated water tanks and pumps. Additionally, pressure reduction equipment is used to reduce the pressure inside the reactor so that water can be injected into the reactor without fail.

2 Spray-type cooling and depressurizing equipment for reactor containment vessels

Using dedicated water tanks and pumps, water is sprayed into the reactor containment vessel to reduce the pressure increase inside the vessel.

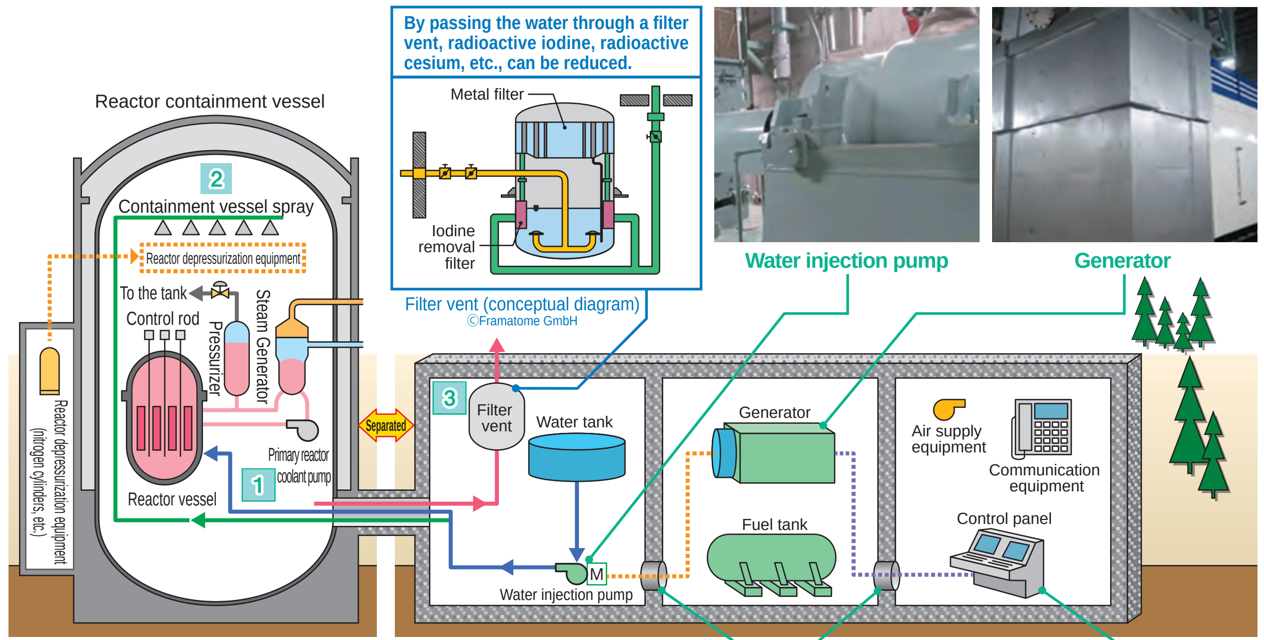
3 Use of filter vents to reduce radioactive substances

When the air inside the reactor containment vessel is released into the atmosphere to prevent damage to the vessel, the amount of radioactive substance is reduced by passing it through a filter.

Operation of Response Facilities for Specified Serious Accidents and Other Emergencies

In the unlikely event of a serious accident which causes the reactor fuel to melt, the portable pumps and power supply equipment that have been installed will be utilized.

The response facilities for specified serious accidents and other emergencies are facilities prepared for terrorism, but manuals have been prepared to ensure that they can be used preferentially in cases of a serious accident where they would prove effective.



●With regard to the response facilities for specified serious accidents and other emergencies, due to the fact that they are designed as counter-terrorism measures, the names, locations, strength, number, etc., of equipment cannot be disclosed for security reasons.

Passage, e.g., for power cables

Control panel installed in emergency control room

Radioactivity and Radiation

Types of Radiation, and Their Properties

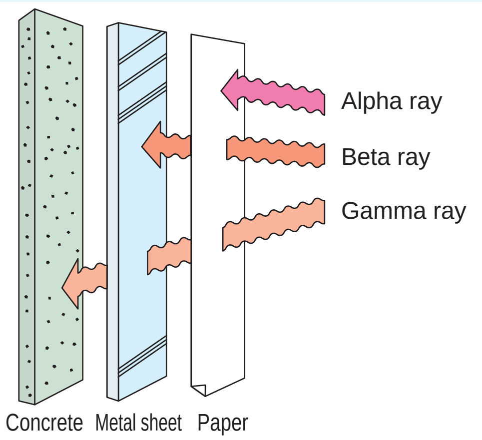
The ability to generate radiation is called radioactivity, while substances that possess this radioactivity are called radioactive substances. Taking the electric light as a familiar example, where the light bulb would be the radioactive substance, the light rays emanating from the light bulb is the radiation, and the ability to generate the light is radioactivity.

Radiation can include alpha rays, beta rays and gamma rays.

●Alpha rays are identical to the nucleus of the helium atom. With little ability to pass through solid objects, they can be stopped by a single sheet of ordinary paper.

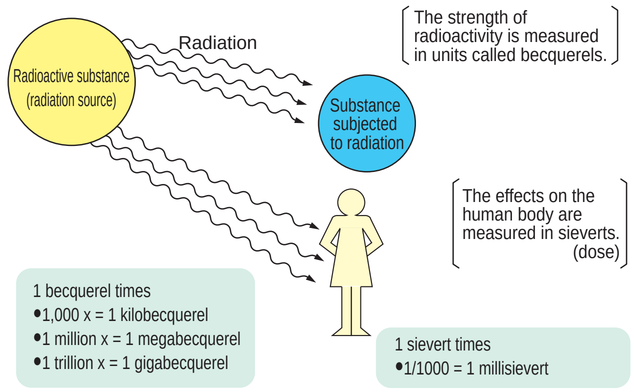
●Beta rays are electrons, and are much more capable than alpha rays of passing through solid objects. Nevertheless, thin metal sheet is enough to stop them.

●Gamma rays are like X-rays, in that both are electromagnetic waves, and pass through solid objects with great ease. Only a thick sheet of lead, or a concrete wall, is barely capable of stopping them.



Radioactivity Weakens Over Time

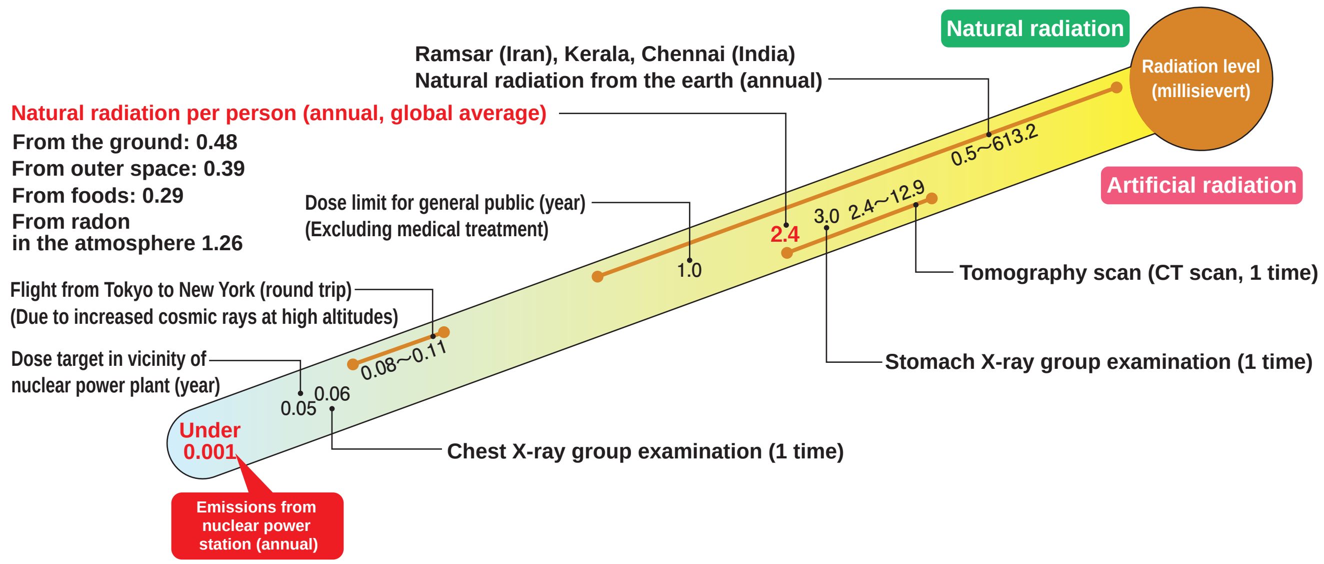
The nucleus of a radioactive substance decays whenever it emits radiation, mutating successively into other substances until it reaches one that is not radioactive. The time required for a substance to give off radiation and change from that substance into a different substance is measured in terms of lives, and is strictly determined for each type of radioactive substance. The time required for the original radioactive level to weaken by one-half is called a half-life, and is the method used for measuring the life of radioactive substances.



■Units of radioactivity and radiation

		Unit	Definition
Unit of radioactivity		Becquerel (Bq)	Amount of radioactive decays per second
Units related to amounts of radiation	Absorbed dose	Gray (Gy)	A unit that expresses how much radiation energy is absorbed by a substance (all substances including the human body). 1 Gy is the dose when 1 joule of energy is absorbed per 1 kg.
	Dose	Sievert (Sv)	A unit that expresses the effect of radiation

Everyday Life and Radiation

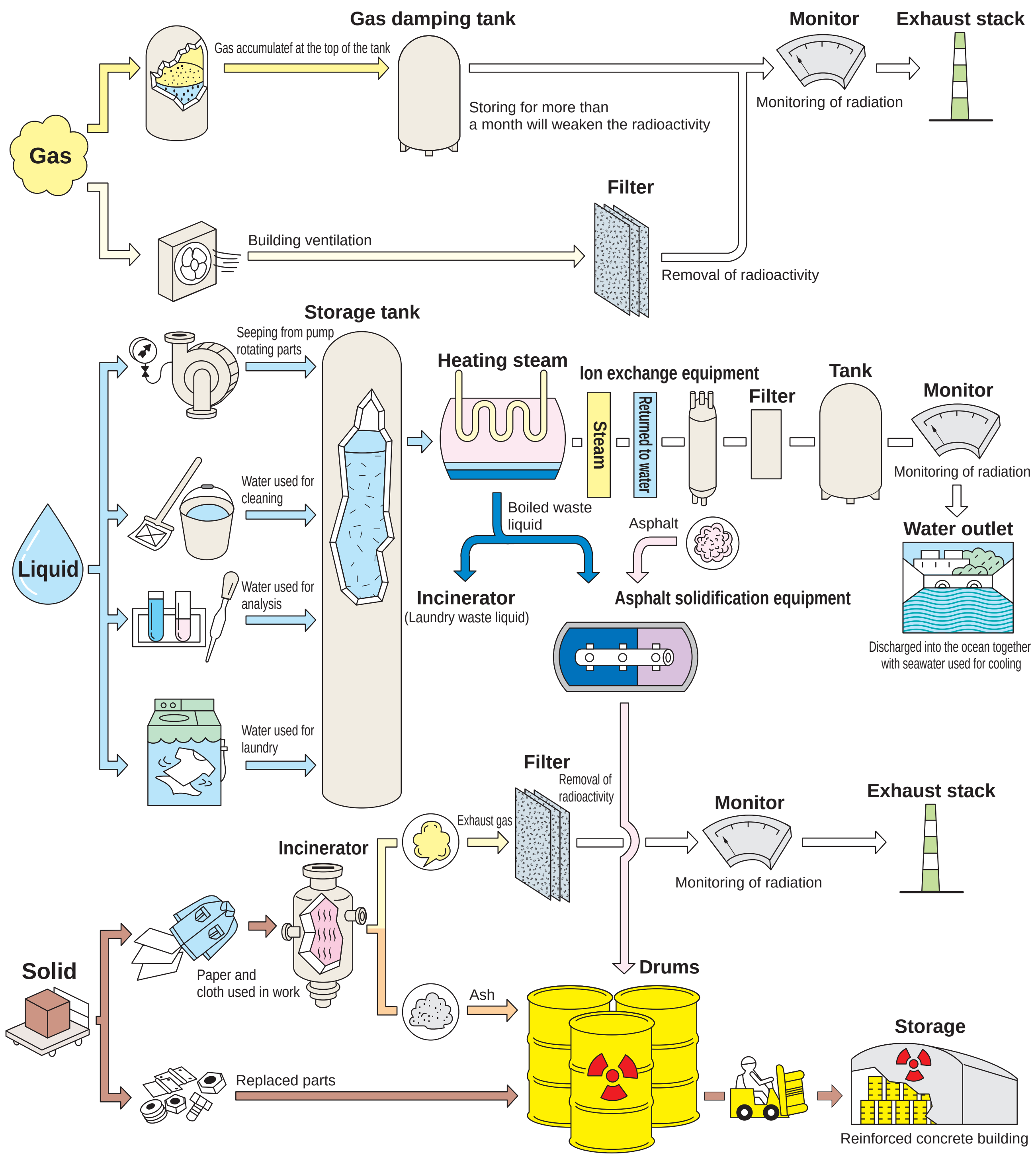


Radioactive Waste Disposal

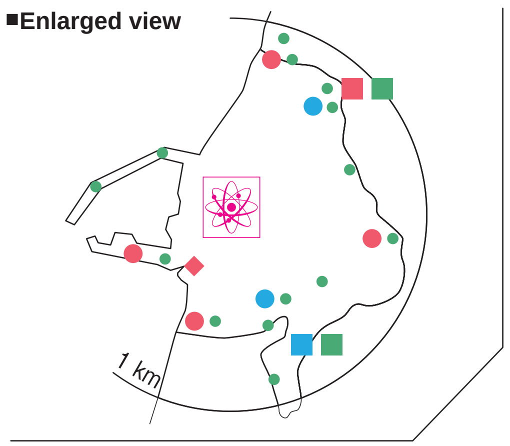
The operation of nuclear power plants produces radioactive gaseous, liquid and solid waste. These are called "low-level radioactive wastes," and they have low levels of radioactivity.

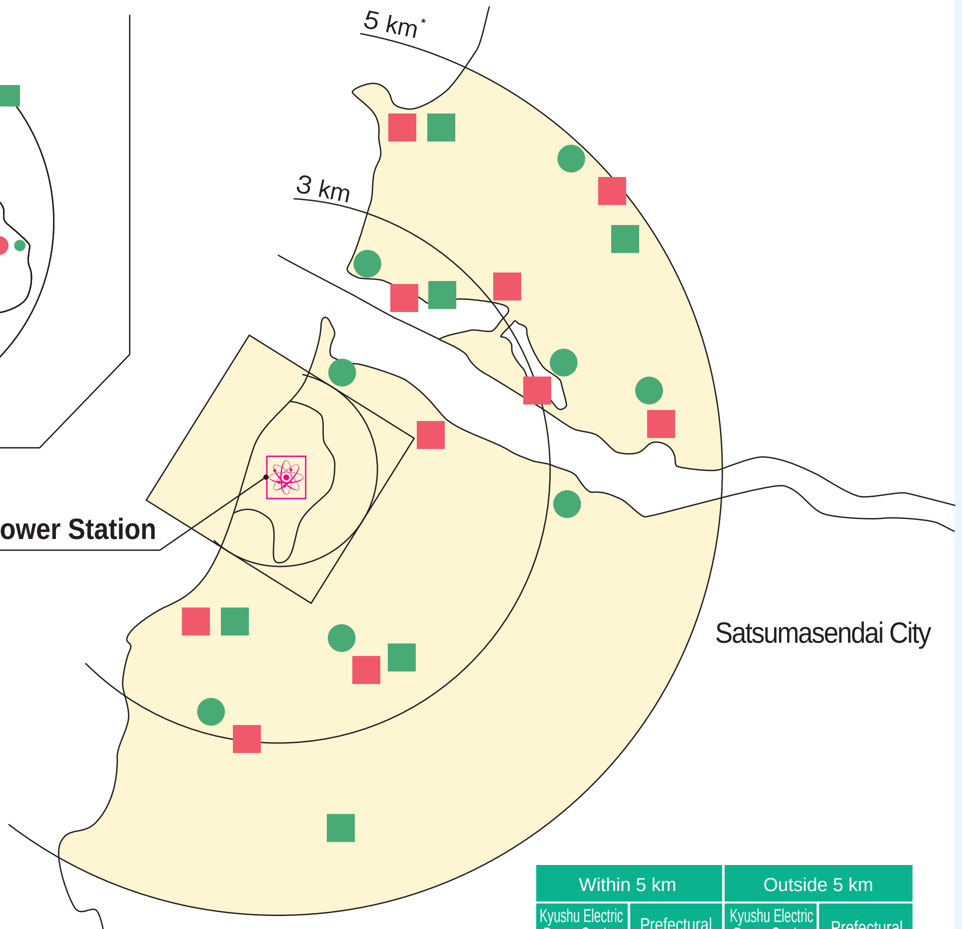
Gaseous and liquid waste is properly treated in the waste treatment equipment within the power plant, and the concentration of radioactive substances is measured to confirm that it is safe before it is released into the atmosphere or ocean. The impact of this release on the environment around the power plant is kept below natural radiation levels. In addition, after solid waste is incinerated, compressed, or otherwise processed, it is packed into drums and temporarily stored in storage facilities on the power plant site.

■Treatment of waste generated during nuclear power station operation



Environmental Monitoring





In order to confirm that there is no change in environmental radiation after a nuclear power station goes into operation, various types of radiation measuring instruments are installed in the area surrounding the power station, and crops, vegetation, soil, drinking water, fish, seaweed, seawater, and other items from around the site are sampled periodically and measured for radiation or concentrations of radioactivity.

These activities are termed environmental monitoring. The measurement results are published by Kagoshima Prefecture.

	Within 5 km		Outside 5 km	
	Kyushu Electric Power Co.,Inc.	Prefectural	Kyushu Electric Power Co.,Inc.	Prefectural
Monitoring station	● 2 sites	■ 1 site	—	—
Monitoring post	● 4 sites	■ 11 sites	—	88 sites (not shown)
Water outlet post	◆ 1 site	—	—	—
Monitoring point	● 22 sites	■ 8 sites	3 sites (not shown)	16 sites (not shown)

*Within approx. 5 km of the nuclear power station (PAZ)

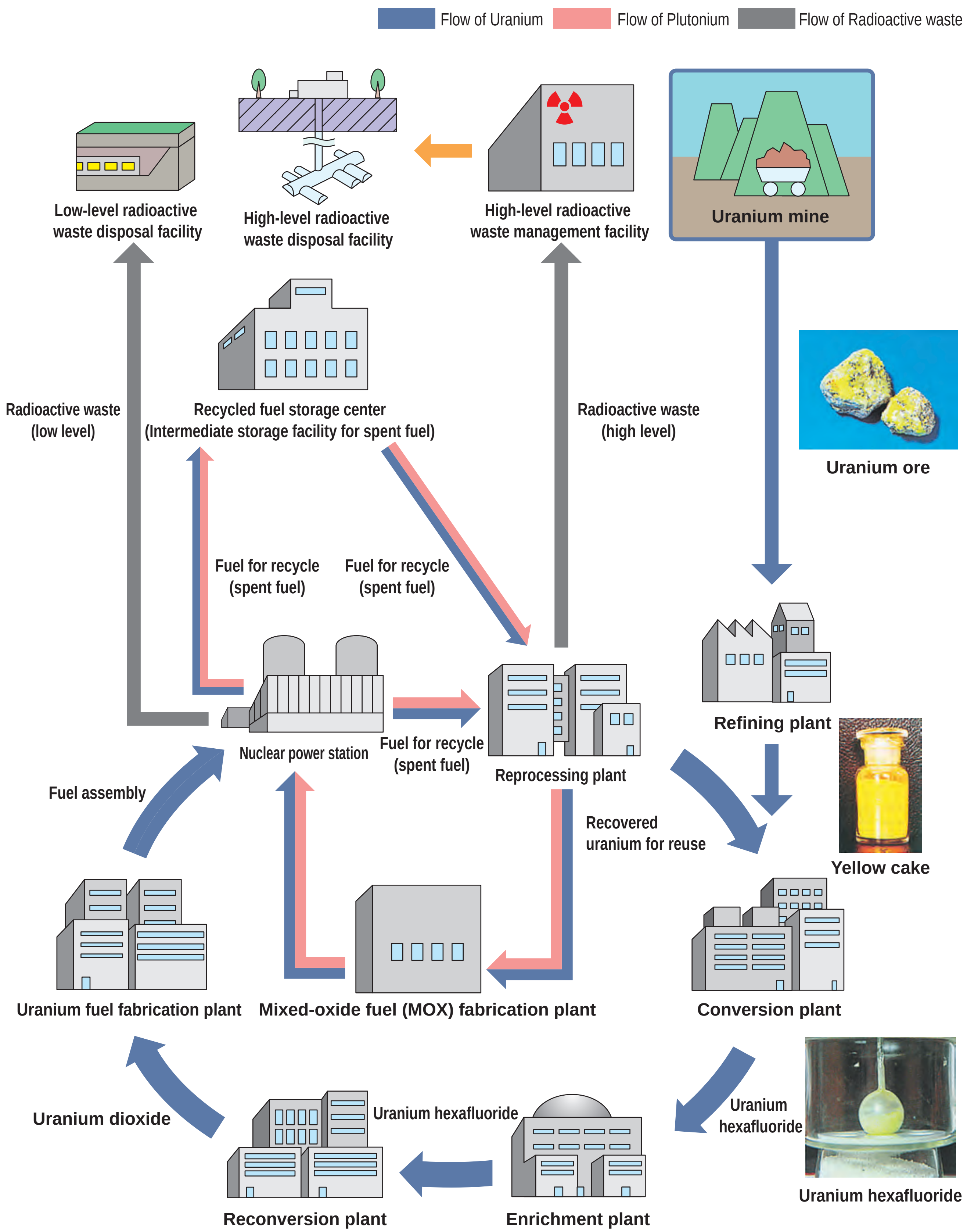
In the event of an emergency caused by a nuclear power station accident, this is the area where evacuation will begin as a precaution before radioactive substances are released.

Monitoring station

Taking specimens for environmental tests (soil)

Nuclear Fuel Recycling

After mined uranium has been processed and used for electricity generation, it passes through a series of processes until it is used again as fuel. This is called nuclear fuel recycling.



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Structure of the Steam Generator / Earthquake Safety Measures of Nuclear Power Stations
Safety in Nuclear Power Generation
Safety Measures for Serious Accidents and Other Emergencies
Response Facilities for Specified Serious Accidents and Other Emergencies
Radioactivity and Radiation / Radioactive Waste Disposal
Environmental Monitoring / Nuclear Fuel Recycling
Inside the Containment Vessel
A Photo History of the Construction
Sendai Nuclear Power Station Exhibition Hall

Inside the Containment Vessel

The vessel holds 157 fuel assemblies.

A Photo History of the Construction

Major Events

Item	Unit 1	Unit 2
Construction plan announced	April 21, 1970	March 29, 1977
Electric Power Development Coordination Council	March 12, 1976 (68th session)	July 14, 1978 (75th session)
Construction permit granted	December 17, 1977	December 22, 1980
Start of construction (Start of foundation excavation)	January 24. 1979	May 7, 1981
Major equipment installation completed	April 8, 1983	November 14, 1984
Commercial operation	July 4, 1984	November 28, 1985

Foundation excavation work

The foundations for containment vessel were laid directly on the firm bedrock stratum, at a depth of approx. 30 meters below ground level.

About 900,000 cubic meters of earth and rock was removed for this excavation operation.

Excavations for Unit 2 went much faster than the earlier excavations for Unit 1, due to refinements in the excavation method, and in the use of larger earth-moving machinery.

Construction of main buildings

The main buildings consist of five structures, including the Reactor Building, the Reactor Auxiliary Building, an intermediate building, the Control Building, and the Turbine Building, and stretch from the bedrock foundations approx. 30 meters below ground to the highest point at approx. 60 meters above ground, for a complex that is nearly 100 meters high.

Containment vessel installation

Approx. 170 steel plates, each 38 millimeters thick, 7 meters wide, and 10 meters long, was linked together to assemble the containment vessel.

Inspections were conducted at every stage of the construction process, with the final inspection consisting of raising the air pressure inside the containment vessel to 0.27 MPa (2.8 kg/cm^2) as a check for possible leaks.

Turbine and generator installation

The turbine was assembled from one high-pressure turbine and three low-pressure turbines, arranged skewer-like in a line. The rotor weighs approx. 350 tons and extends approx. 40 meters.

The generator consists of a stator, weighing approx. 420 tons, and a 177 ton rotator, for a total weight of approx. 600 tons.

The turbine, generator, and exciter are arranged in a straight line extending approx. 60 meters, and rotate as one unit.

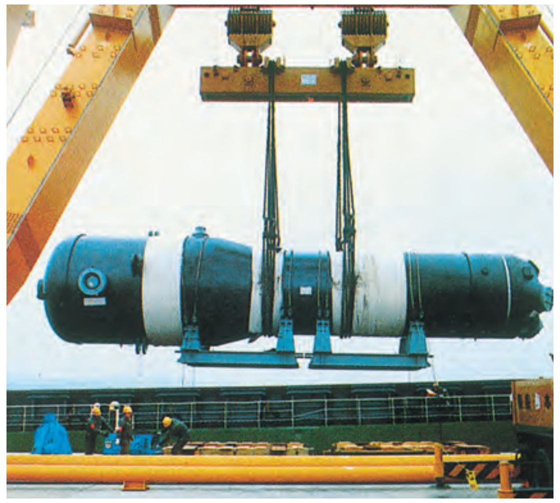
*Turbine replacement
(Mitsubishi Heavy Industries' unit replaced with Siemens' unit)
No. 1 Unit: 2006, No.2 Unit: 2010

Reactor installation

The reactor vessel is a cylindrical low alloy steel container weighing approx. 320 tons, and with a outer diameter of approx. 4 meters, length of approx. 12 meters, and thickness of approx. 20 centimeters.

The reactor vessel was brought ashore from an unloading wharf built specially for the power station, and then transported on rollers to the containment vessel site and lowered into the center of the lowest excavated point for installation.

Steam generator installation



The steam generator is a cylindrical vessel weighing 315 tons with a length of 20.6 meters. As with the reactor vessel, it was unloaded at the specially built wharf, transported on rollers to the site, and installed near the reactor inside the containment vessel.

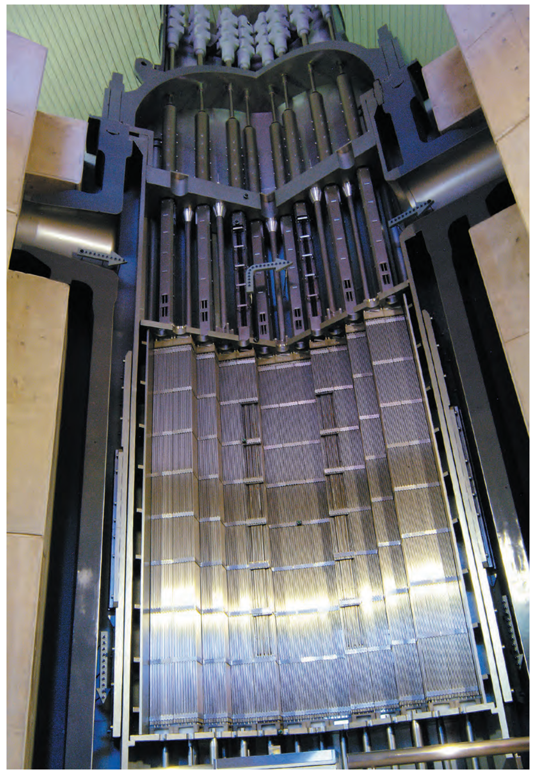
*Steam generator replacement
No. 1 Unit: 2008, No.2 Unit: 2018

Central control room (in operation)

The core facility for all operations in the power station is the control room.

The control room houses approx. 1,800 switches, approx. 1,800 alarms, and approx. 1,200 instruments for Units 1 and 2, and operators are always on station monitoring conditions.

Sendai Nuclear Power Station Exhibition Hall



Life-size mock-up of a reactor in the Exhibition Hall

Guide to the Exhibition Hall

■ Access

• By Bus: Take the Satsumasendai City community bus Takae/Tsuchikawa Line from Sendai Station, and get off at the Tenjikanmae stop (Exhibition Hall stop). Takes about 30 minutes.

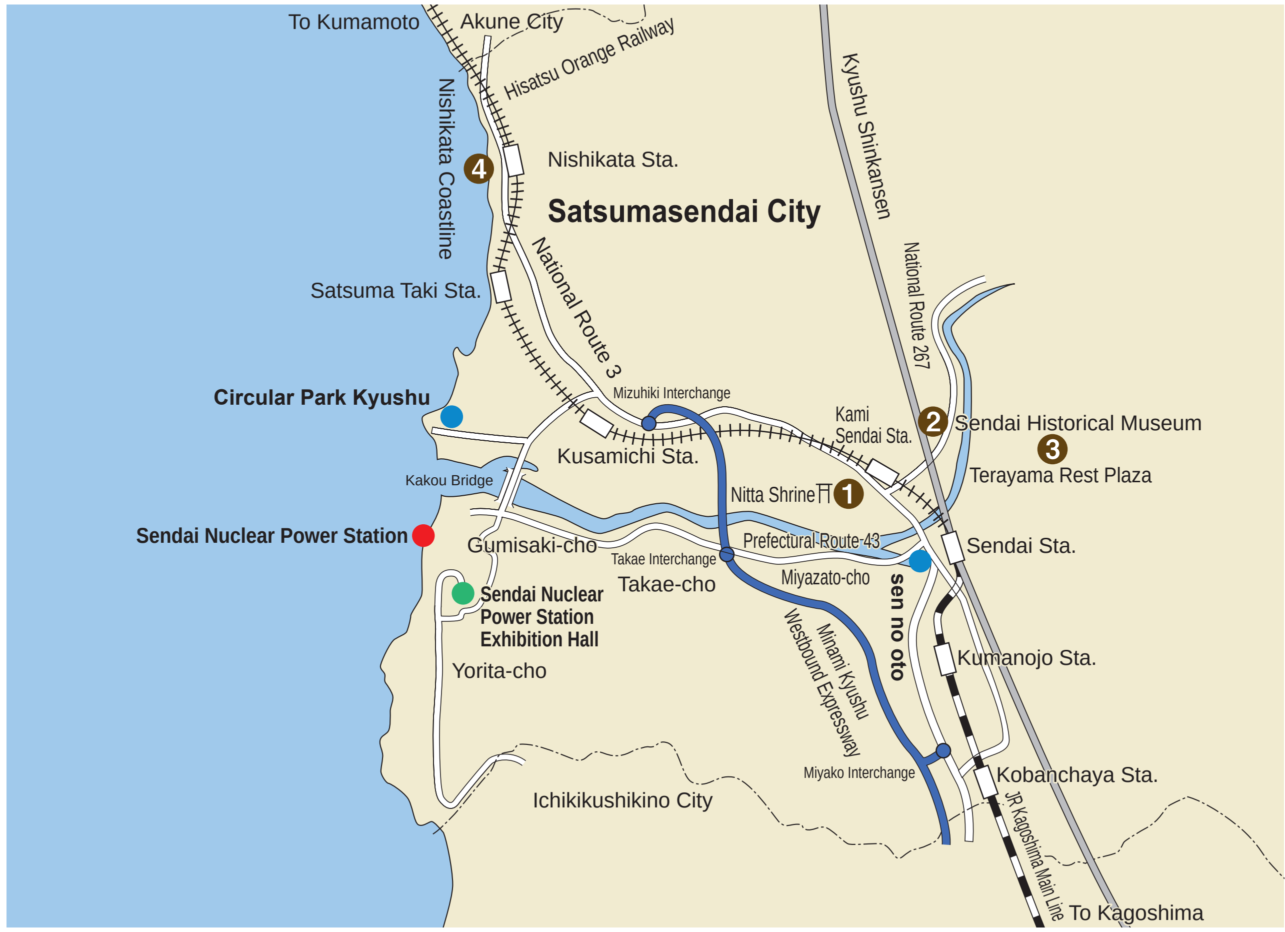
• By Taxi: About 25 minutes from Sendai Station.

■ Hours 9 a.m. to 5 p.m. (free admission)

■ Closed New Year's holidays (December 29 to January 1)

■ Group tours are requested to apply in advance.

Exhibition Hall Reception Tel (0996) 27-3506



Sites of Interest Near the Power Station

❶ **Nitta Shrine** [Miyauchi-cho, Satsumasendai City]

❷ **Sendai Historical Museum** [Chugo-cho, Satsumasendai City]

❸ **Terayama Rest Plaza** [Amatatsu-cho, Satsumasendai City]

❹ **Nishikata Coastline (Ningyo-Iwa)** [Nishikata-cho, Satsumasendai City]

An Introduction to Sendai Nuclear Power Station

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For more information on the Sendai Nuclear Power Station, visit our website.
https://www.kyuden.co.jp/sendai_index.html

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