

Genkai

Nuclear Power Station

Introduction to Genkai Nuclear Power Station



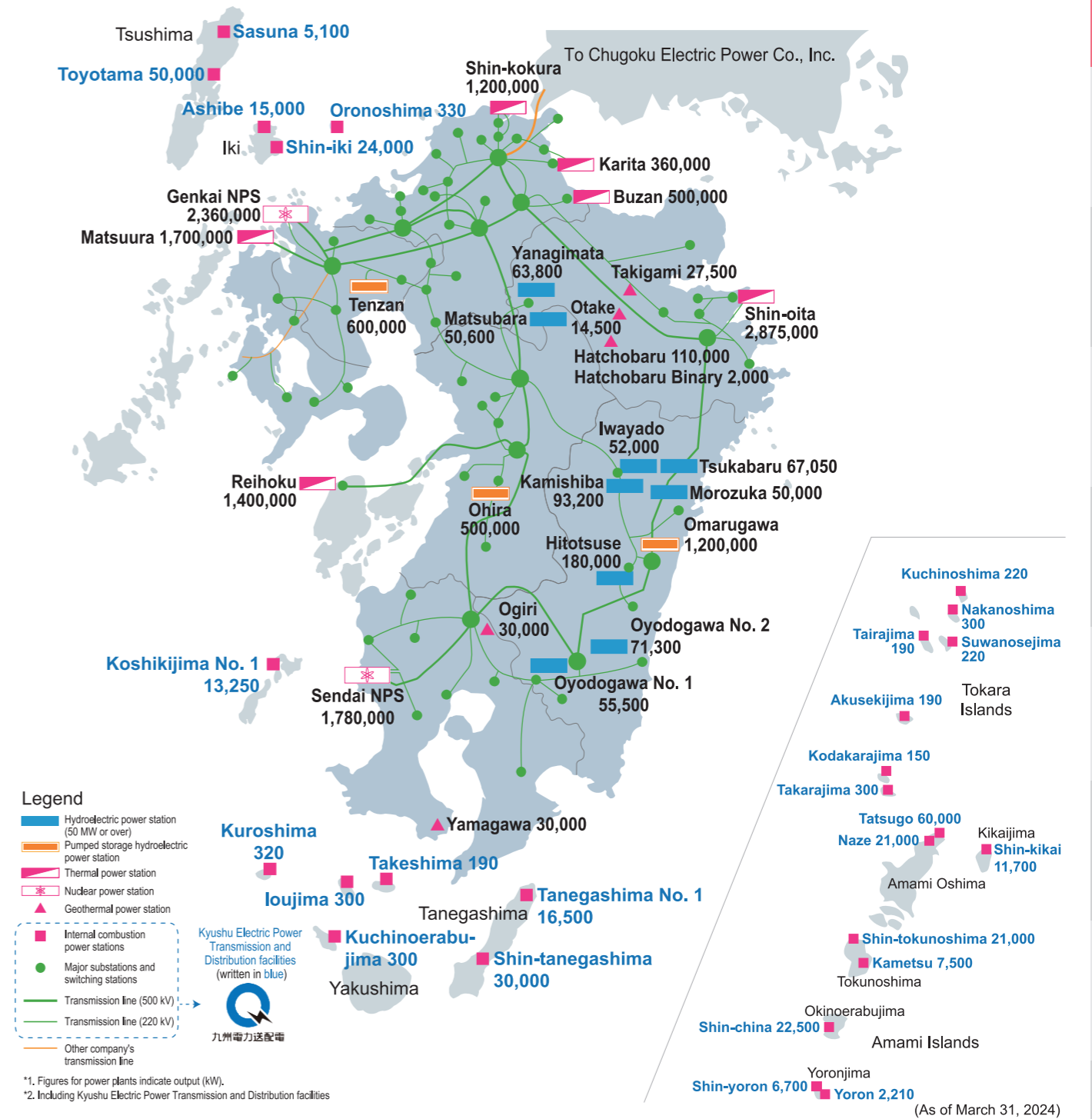
Outline of Genkai Nuclear Power Station



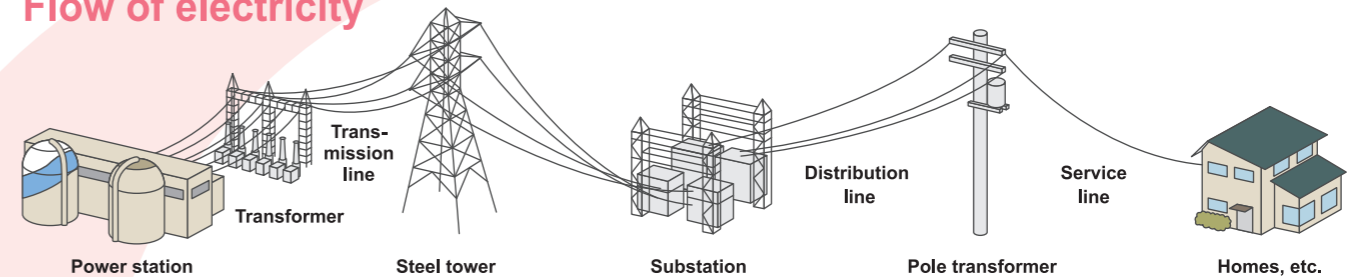
Outline

	Unit 1	Unit 2	Unit 3	Unit 4
Site	Imamura, Genkai-cho, Higashi Matsuura-gun, Saga Pref.			
Site area	approx. 870,000 m ²			
Generated output	559 MW	559 MW	1180 MW	1180 MW
Reactor Type	Pressurized water reactor (PWR)			
Thermal output	1650 MW	1650 MW	3423 MW	3423 MW
Fuel type	—	—	Low-enriched uranium dioxide (approximately 4%), mixed uranium-plutonium oxides	Low-enriched uranium dioxide (approximately 4%)
Fuel capacity	—	—	approx. 89 tons	approx. 89 tons
Start of operation	October 1975	March 1981	March 1994	July 1997
End of operation	April 2015*	April 2019*	—	—

*Decommissioning in progress



Flow of electricity



Outline of Genkai Nuclear Power Station

System

Inside the Power Station

Securing Safety

Serious Incident countermeasures

Response Facilities for Specified Serious Accidents

Decommissioning plan

Monitoring

Waste Treatment

Community Activities

A Guide to the Surrounding Region

System of Nuclear Power Station

System

The type of reactor used at Genkai Nuclear Power Station is called a pressurized water reactor (PWR). One feature of the pressurized water type, shown in the figure below, is the complete separation, through the use of steam generator heat exchanger tubes, of the system that circulates water through the reactor (primary system) from the system that supplies steam to the turbine (secondary system), ensuring that no radioactive substances are transmitted over to the turbine side.

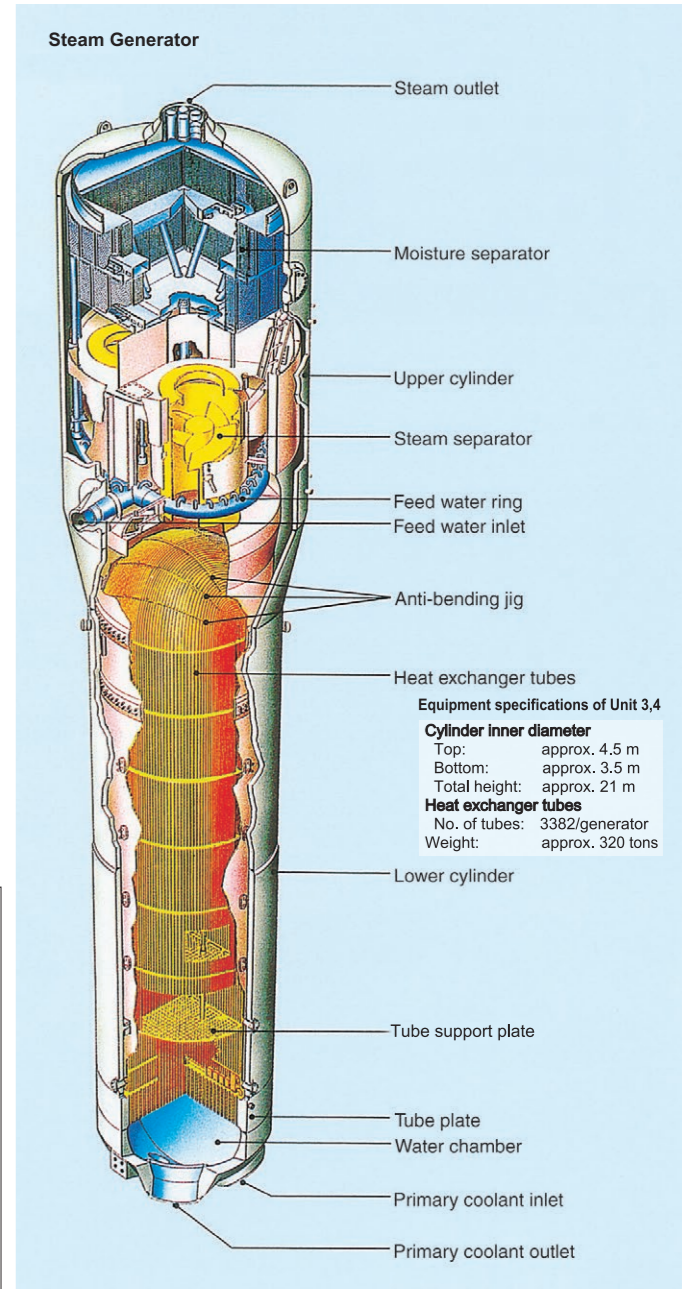
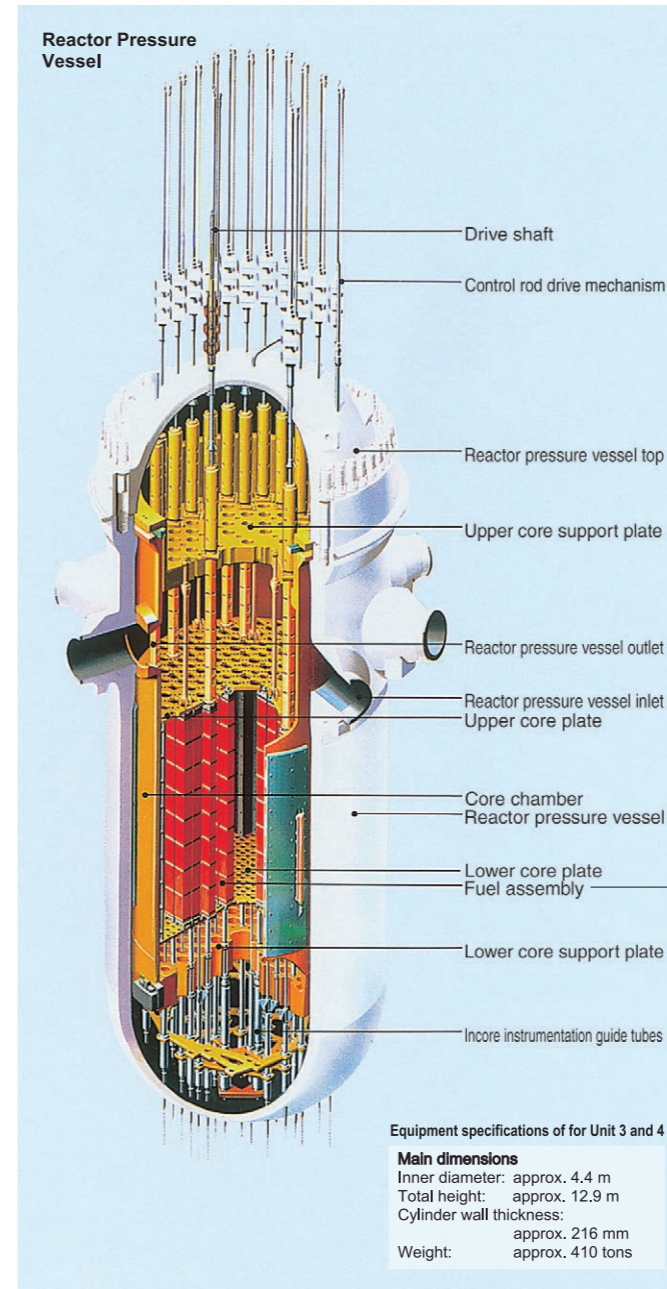
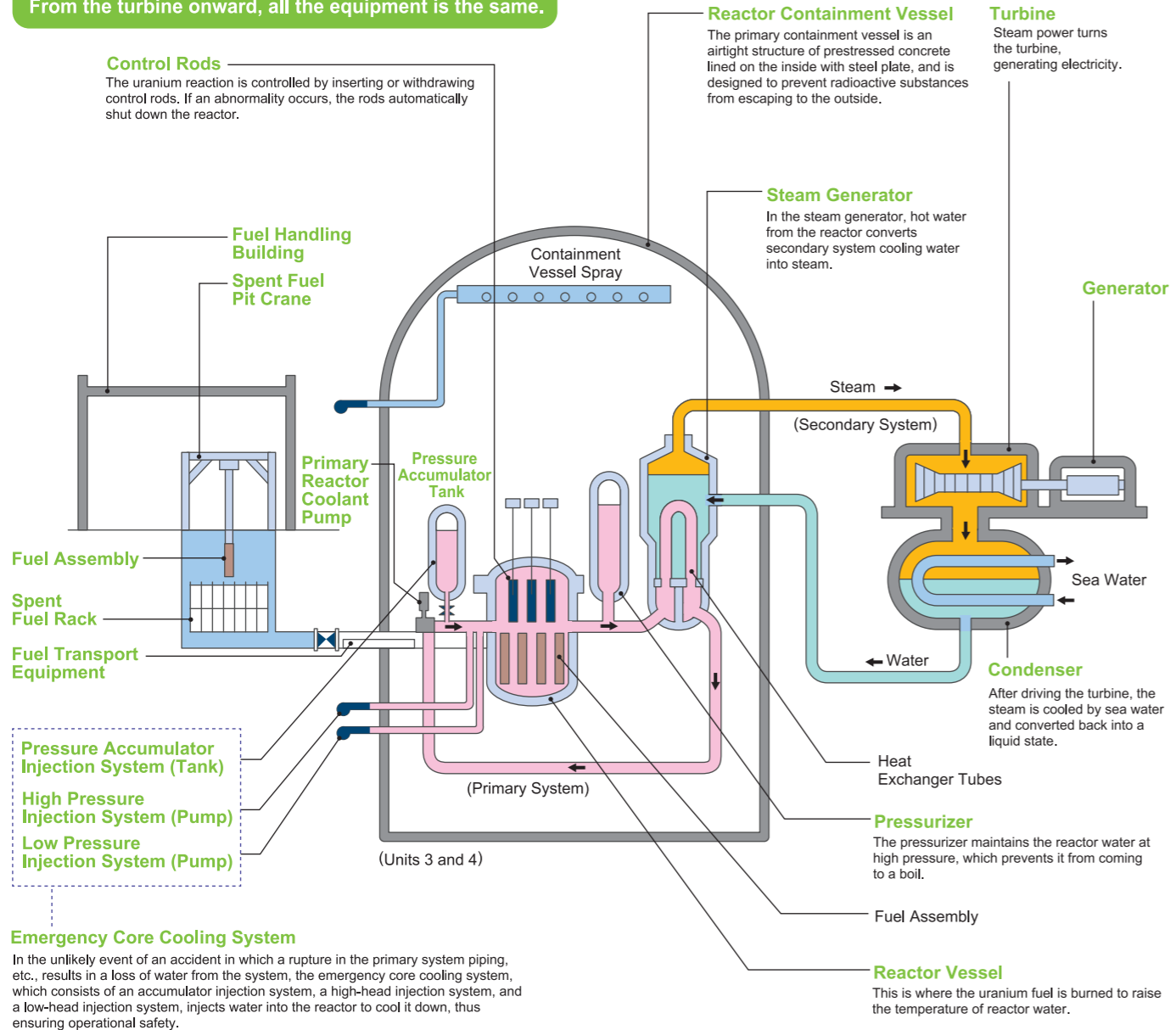
In the reactor, the uranium fuel undergoes nuclear fission, generating large quantities of heat. This heat is transferred to the water of the primary system, which is then transported to the steam generator by the primary reactor coolant pump.

The primary system water is transported into the steam generator, where it flows through the inner side of the heat exchanger tubes, transmitting heat through the tube walls to the surrounding secondary system water. The primary system water is then returned to the reactor.

Meanwhile, the secondary system water is transformed into steam within the steam generator, travels to the turbine, and drives the turbine-generator to produce electricity.

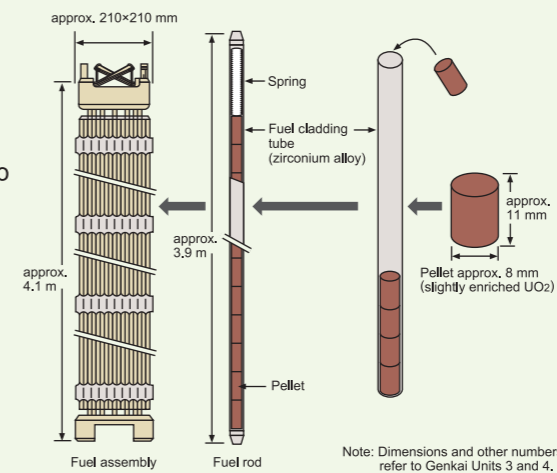
Once the steam has finished its work at the turbine-generator, it is cooled in the condenser by tubes filled with seawater, returned to a liquid state, and transported back to the steam generator.

The only difference between nuclear power and thermal power is the fuel used. From the turbine onward, all the equipment is the same.

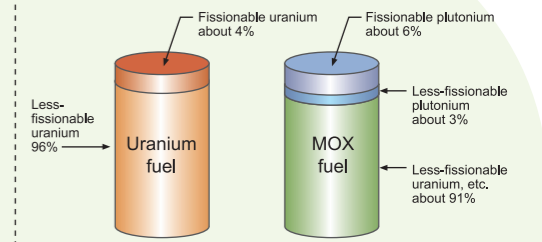


Fuel Assembly Structure

Uranium powder is baked into hard pellets, which are loaded into clad tubes to form fuel rods. These fuel rods are assembled into a lattice grid shape to form the fuel assembly.

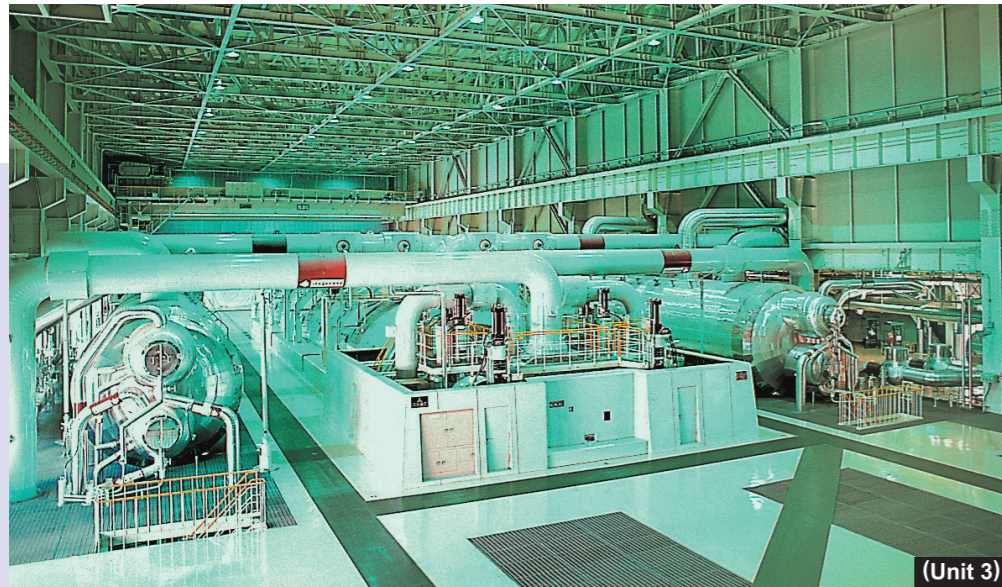


Uranium fuel and mixed-oxide (MOX) fuel

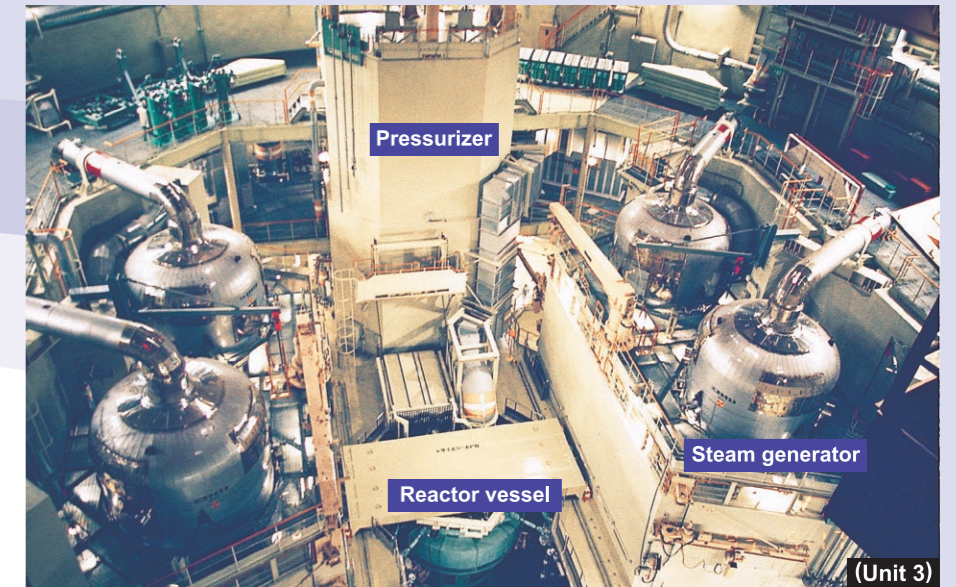


MOX fuel can, in principle, be used as-is in existing generating facilities.

Inside Genkai Nuclear Power Station

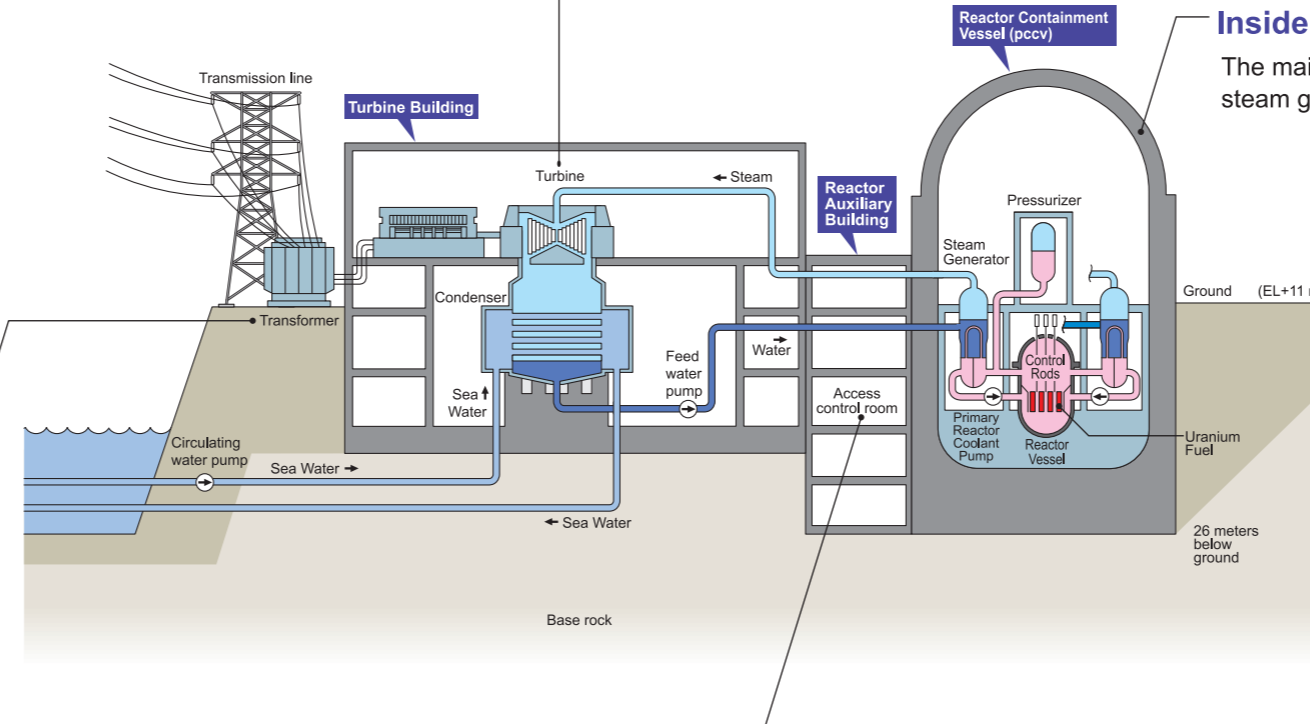


Turbine-Generator
The steam produced by the steam generator turns the turbine. Electricity is produced by the generator which is linked directly to the turbine.



Transformers/Switch Yard

The electricity produced by the generator is stepped up to a higher voltage by transformers and sent out over the transmission lines. The Switch Yard plays the role of switch between the power station and transmission lines.



Inside the Containment Vessel

The main equipment of the primary system, such as the reactor and steam generator, is installed inside the reactor containment vessel.



Central Control Room

The Central Control Room, with its wide variety of meters, warning and monitoring devices, operating switches and other equipment is the brain of the power station. Operators monitor the reactors, turbines, generators, and other equipment 24 hours a day.

Radiation Controlled Area Access Control Room

Monitoring devices such as a registration system for entry and a body surface contamination monitor are installed to control access to the radiation-controlled area.



Registration system for entry



Body surface contamination monitor

Safety of Nuclear Power Station

Multiple Layers of Safety Protect Against Expanding Harm

The major premise of safety measures for nuclear power stations is to ensure the safety of persons in the surrounding area from danger due to radioactive substances.

As a result, we use multiple layers of safety measures based on acceptance of the idea that machinery will break down, and people will make mistakes.

We have a full range of systems for ensuring safety.

Safety Assurance

1. Prevent abnormalities before they occur

We implement designs that ensure ample safety margins, and use equipment and materials of the highest performance and quality. In addition, we utilize systems that are capable of automatically evading dangerous situations even should the machinery break down, and that can prevent the equipment from receiving operating commands issued in error.

2. Prevent abnormalities that do occur from burgeoning into accidents

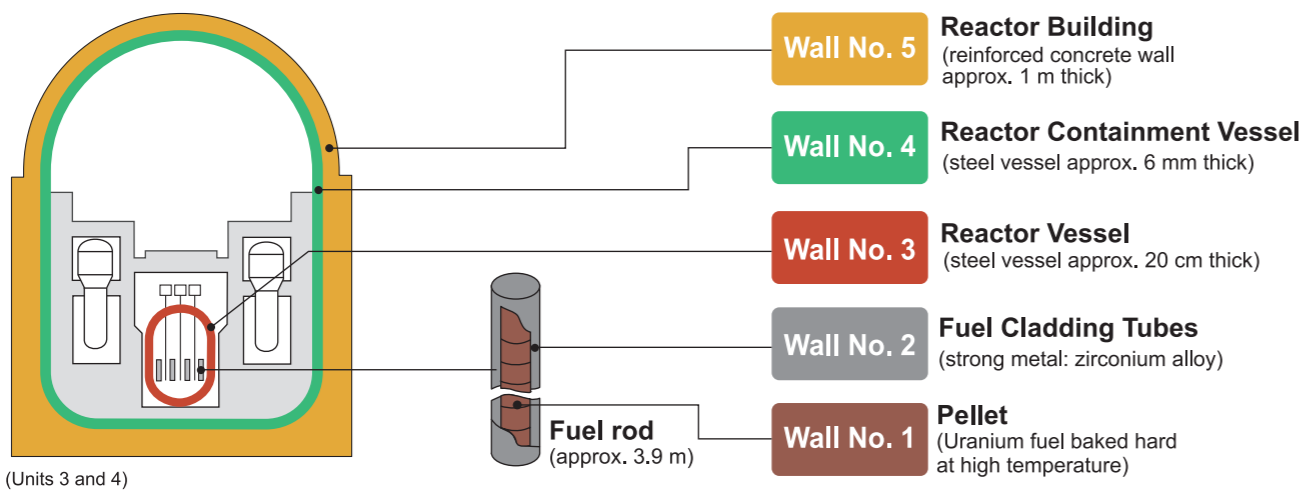
We have established a monitoring system for instant notification of abnormalities, to ensure that the abnormalities do not lead to accidents. Moreover, the system can automatically shut down the reactor should the need arise.

3. Prevent the release of radioactive substances in the unlikely occurrence of an accident

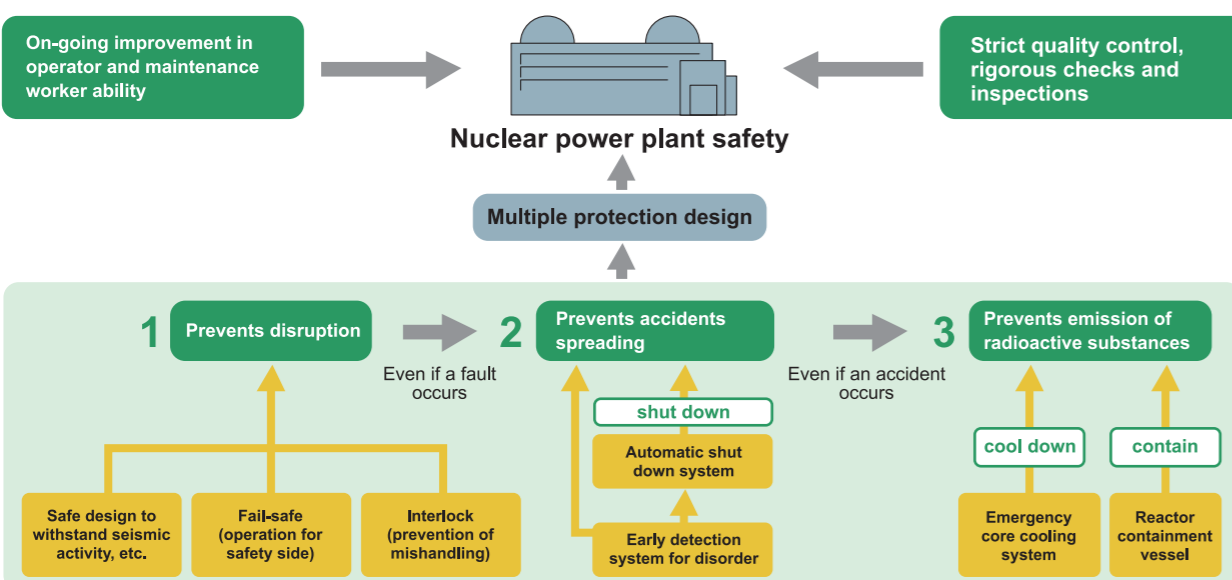
To prevent the abnormal release of radioactive substances in the unlikely occurrence of an accident, the reactor shall immediately be cooled down and all radioactive substances be sealed in.

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.



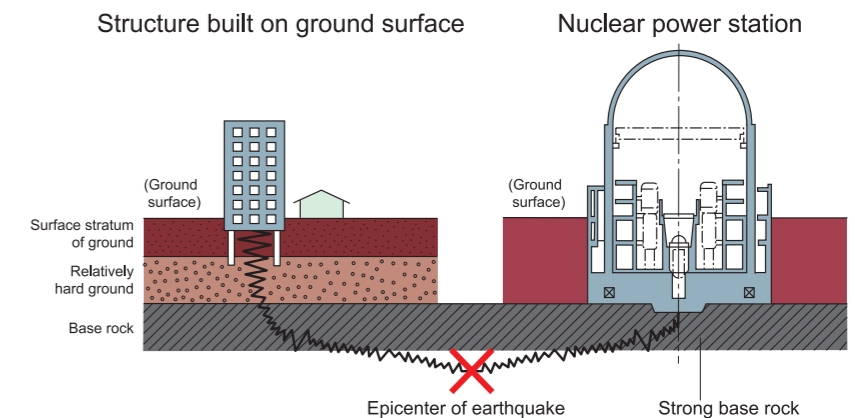
Safety Features of Nuclear Plant Design



Earthquake countermeasures at nuclear power station

When an earthquake occurs, the seismic waves are amplified as they travel from the epicenter to the ground surface. This causes violent shaking in structures which are built on the ground surface.

In contrast, earthquakes have far less effect on structures such as nuclear power station which are built directly on strong base rock, because the base rock does not amplify the motion of the quake.



Daily Inspection

In order to confirm the operating condition of the equipment, patrol personnel make inspections every day.



Periodic Inspection

In addition to thorough implementation of multiple safety measures for the equipment, every effort is made to ensure safety by rigorous training of operators and maintenance personnel, which is conducted periodically at the site and the Training Center.



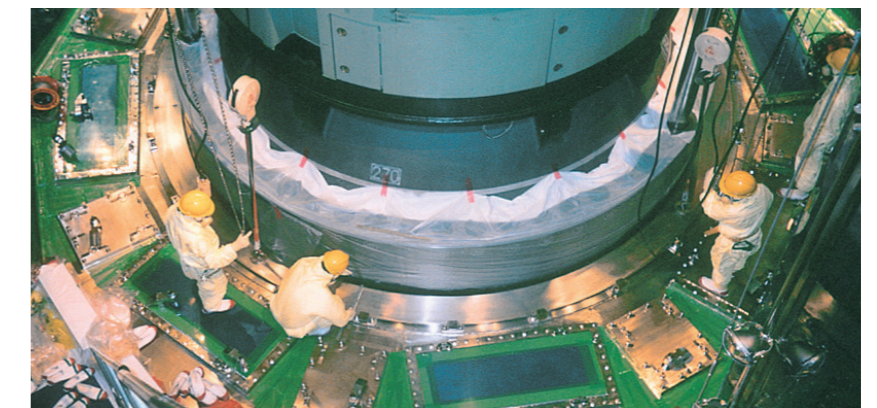
Exterior view of the Nuclear Power Training Center



Simulator room (for units 3 and 4)

Periodic Inspection

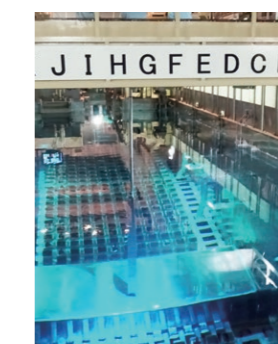
As required by law, equipment is periodically disassembled, inspected, and tested.



Removal of upper head of the reactor vessel



Overhaul inspection of turbine



Fuel exchange



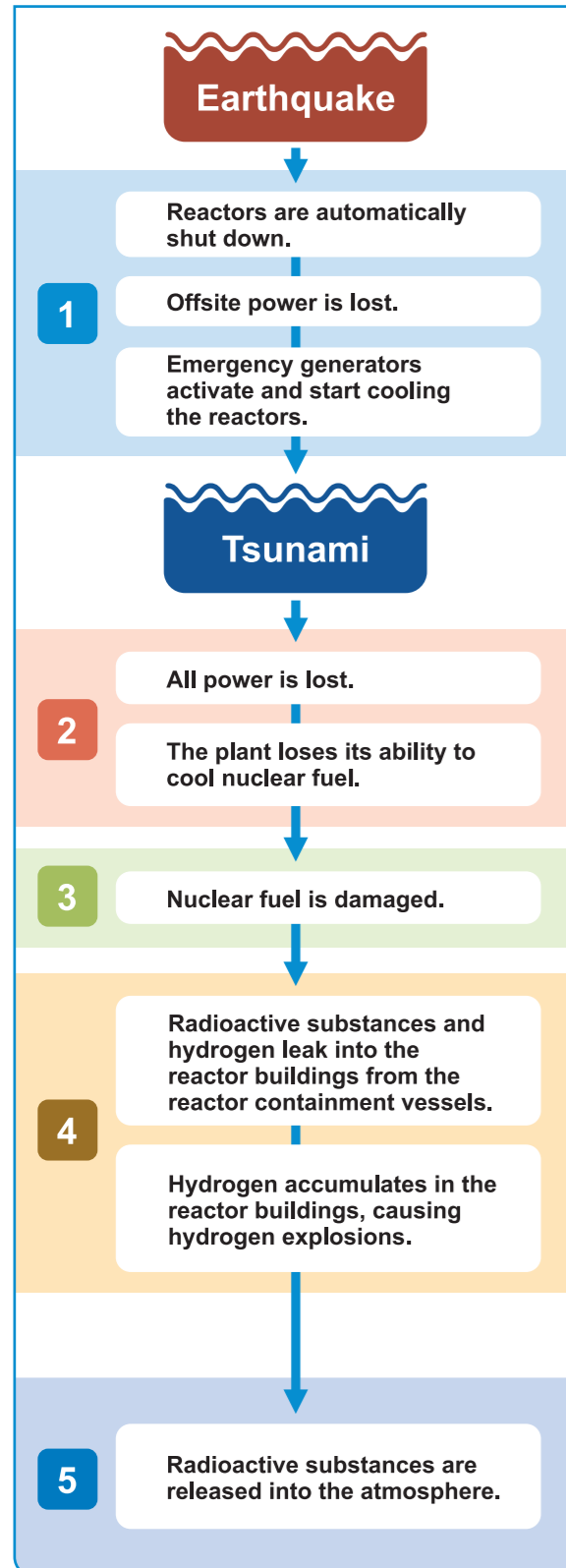
Fuel inspection by monitor television

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Measures to ensure safety in the event of a serious accident

Genkai Nuclear Power Station has learned from the lessons of the Fukushima Daiichi Nuclear Power Plant and implemented a facility equipment and operational management in the immediate aftermath of an accident. Going forward, we will strive to pursuing a voluntary and ongoing program of initiatives to boost safety and reliability.

Progress of events during the accident at the Fukushima Daiichi Nuclear Power Plant

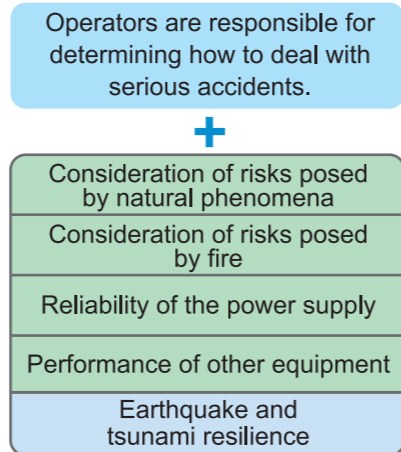


Overview of new regulatory standards

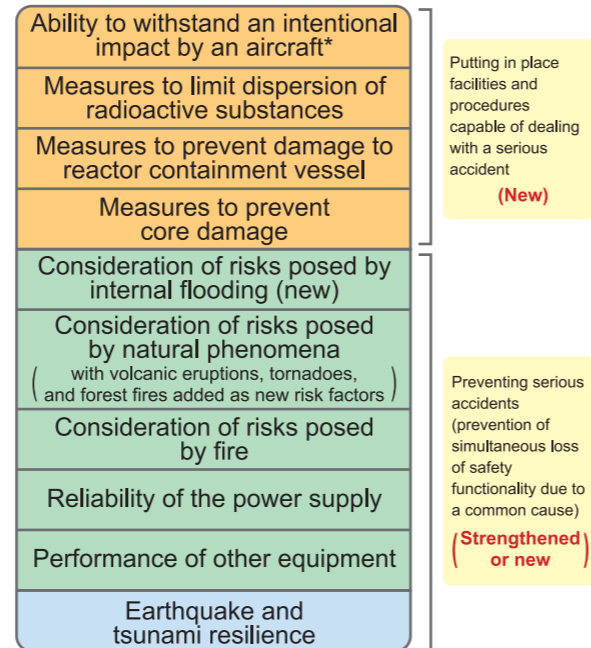
Basic approach

Japan's new regulatory standards for preventing serious accidents strengthen legacy standards that were in place prior to the adoption of the new regime, add new standards, and incorporate new requirements designed to deal with serious accidents in the event they occur.

Previous regulatory standards



New regulatory standards



*Designated facilities required by regulatory standards to implement readiness measures in anticipation of serious accidents and other incidents (facilities with equipment such as emergency control rooms for ensuring that reactors continue to be cooled even in the event of large-scale destruction of the power station) must implement measures no later than 5 years after the construction plan for the facility is approved.

number of safety-enhancing measures to address both inspire peace of mind on the part of area residents by

Principal safety measures in place at the Genkai Nuclear Power Station (example initiatives)

1 Preventing anomalies

Example: Increasing the seismic resistance of tank support structures

Before reinforcement | After reinforcement

Maximum tsunami height: 6 m above sea level

Site height 11 m above sea level

Reactor building

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

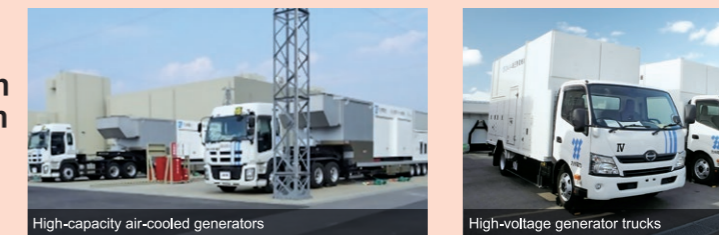
We've taken steps to boost seismic resistance based on the maximum anticipated standard earthquake ground movement.

The site is situated 11 meters above sea level, and we have verified that even the maximum anticipated tsunami would not have an adverse effect on the safety of the reactor facility.



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

2 Preventing an anomaly from expanding



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.

*Equipment has been dispersed throughout the site at elevations of about 11 to 28 m above sea level.

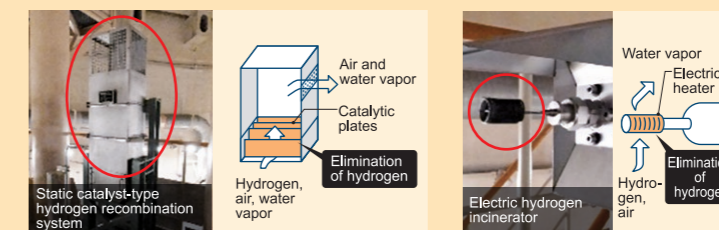
3 Preventing damage to nuclear fuel



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

*Equipment has been dispersed throughout the site at elevations of about 11 to 28 m above sea level.

4 Preventing damage to reactor containment vessels



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.

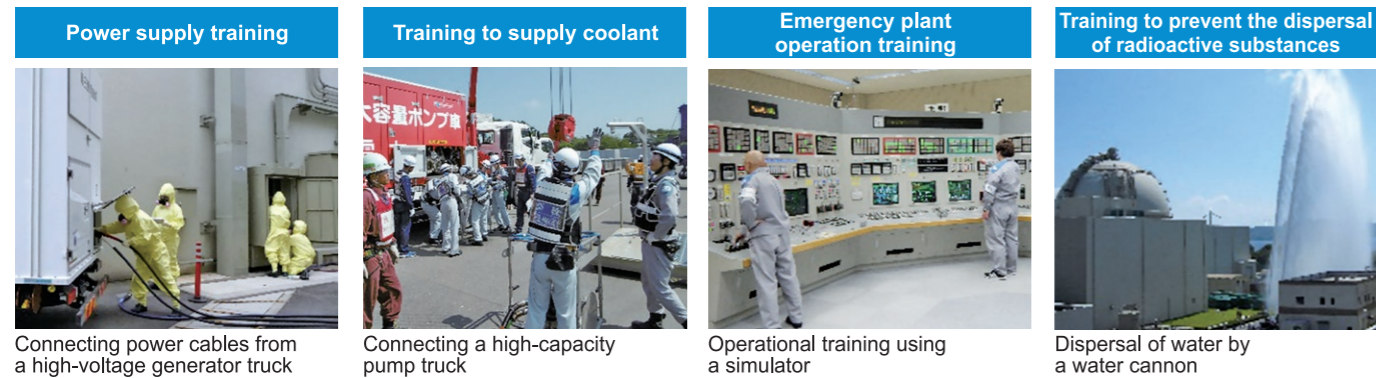
5 Preventing the release and dispersal of radioactive substances



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.

Training to prepare for a serious accident

In preparation for the unlikely event of a serious accident, we have established a 52-member response team so that we can respond promptly, even outside of working hours, on holidays, and at night.



Connecting power cables from a high-voltage generator truck

Connecting a high-capacity pump truck

Operational training using a simulator

Dispersal of water by a water cannon

Establishment of an emergency response building (command center)

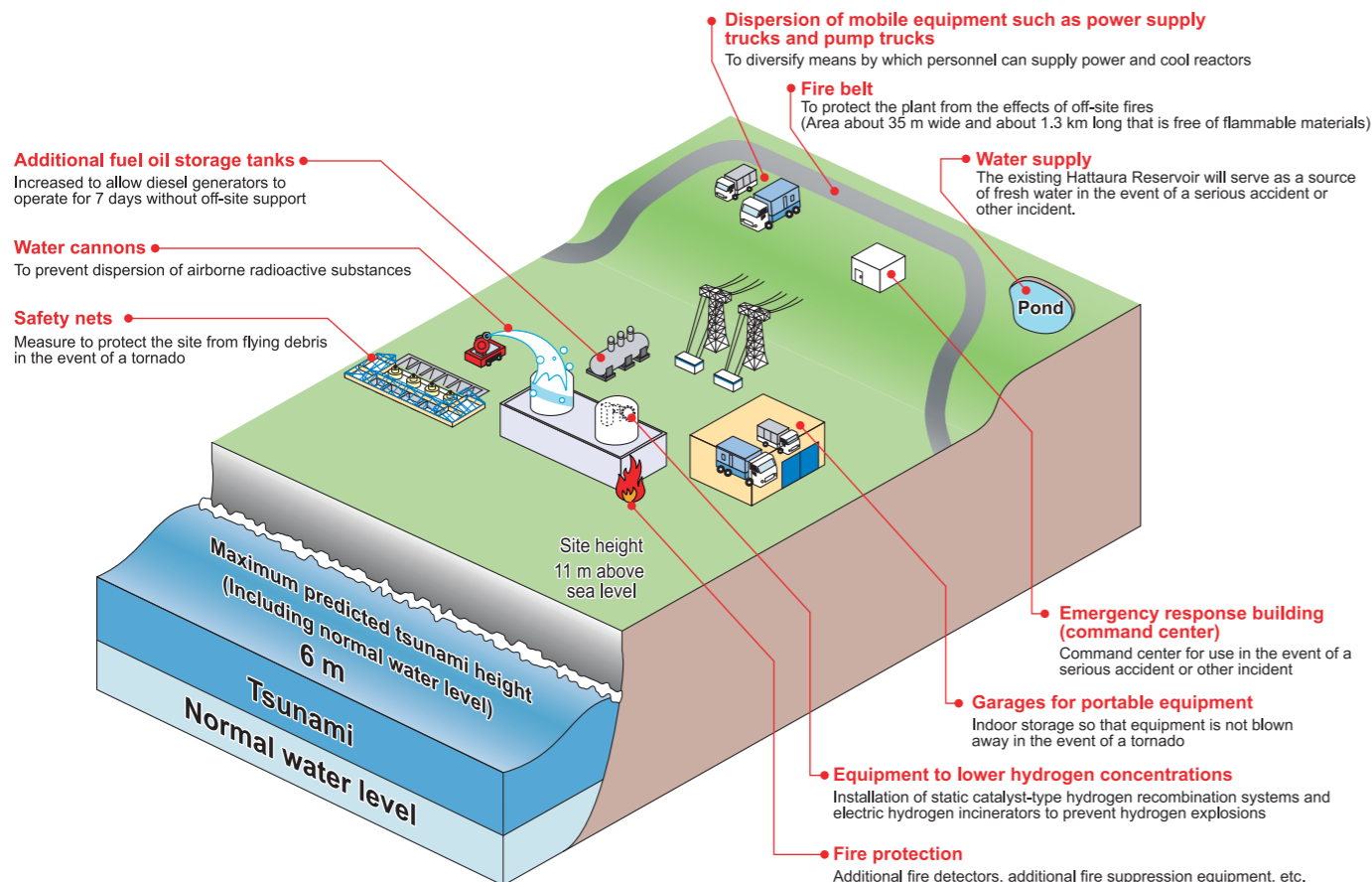
The emergency response building (command center), which will be used as the on-site response headquarters in the event of a serious accident, is built on solid bedrock.



Exterior of the emergency response building

Training at the emergency response building (command center)

Major equipment installed under Japan's new regulatory standards (illustration)



Response Facilities for Specified Serious Accidents

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.

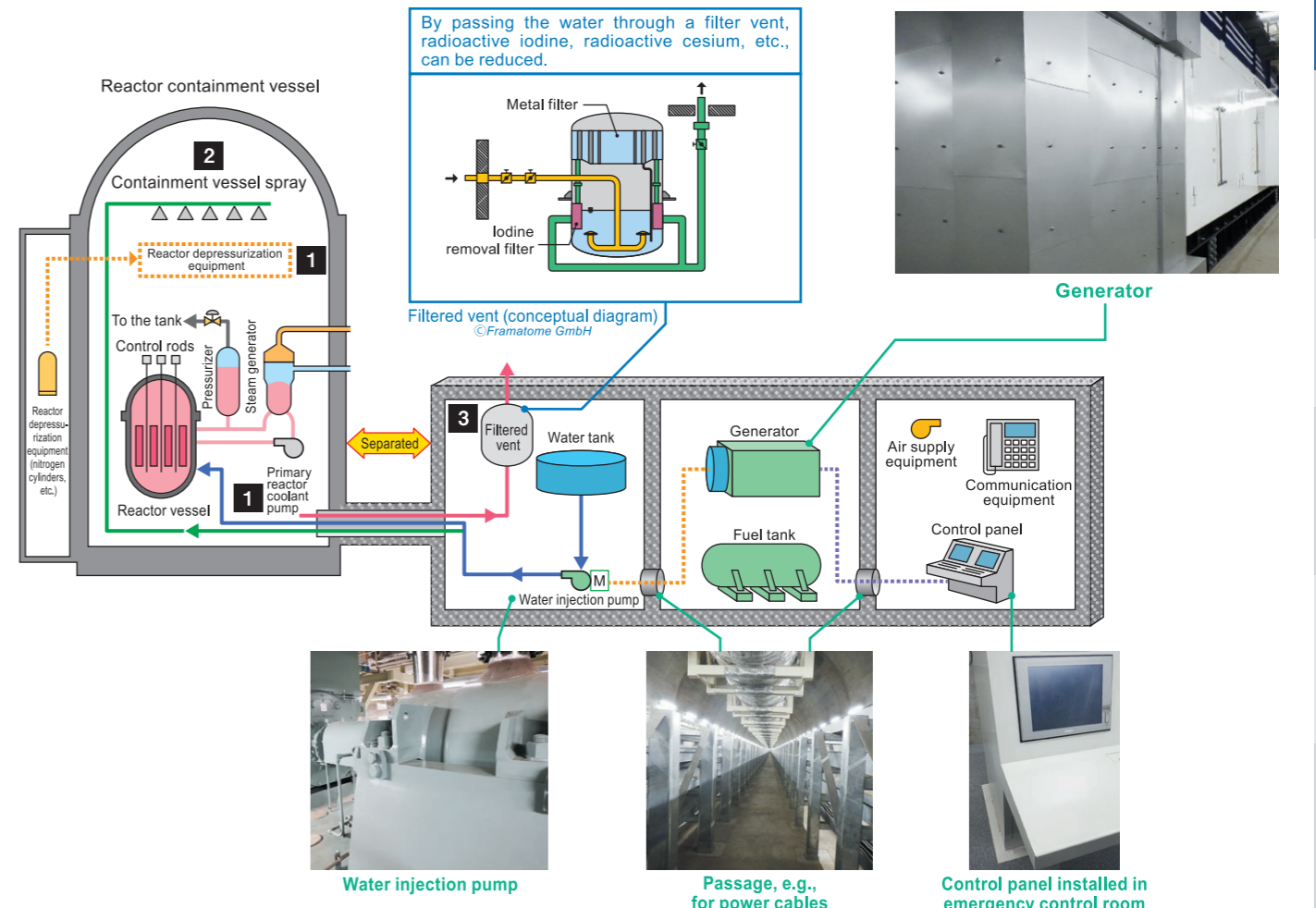
3. Use of filter vents to reduce radioactive substances

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.

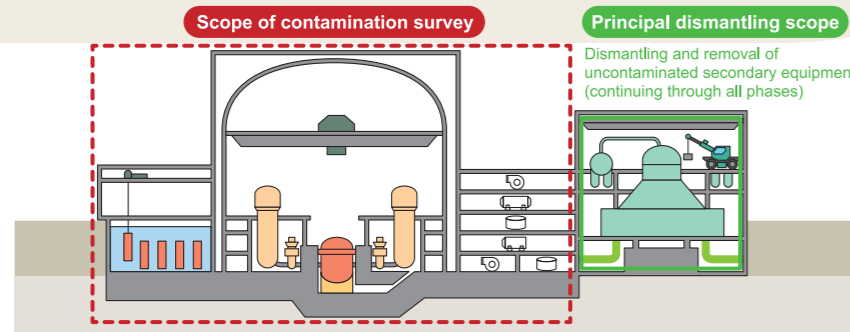


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Overview of the decommissioning plan

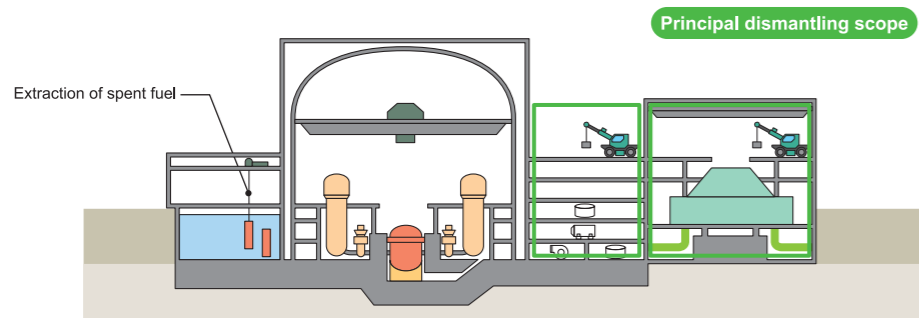
Decommissioning for Units 1 and 2 will be conducted in four major stages.

I Preparing for dismantling (July 2017 to March 2026)



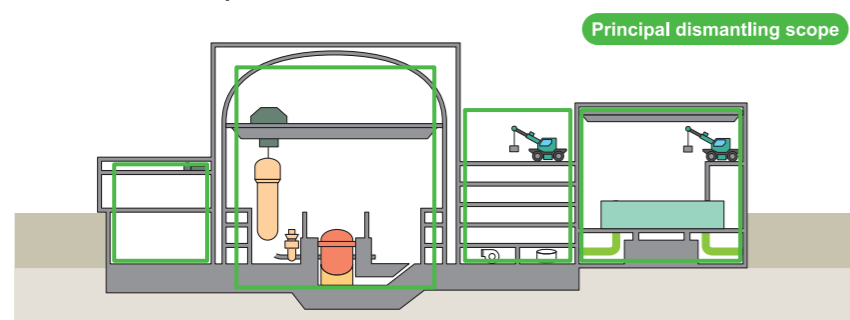
- Conducted surveys on the contamination status of equipment.
- Used chemicals to remove (clean) radioactive substances adhering to pipes and other components.

II Dismantling and removing equipment around the reactor (April 2026 to FY2040)



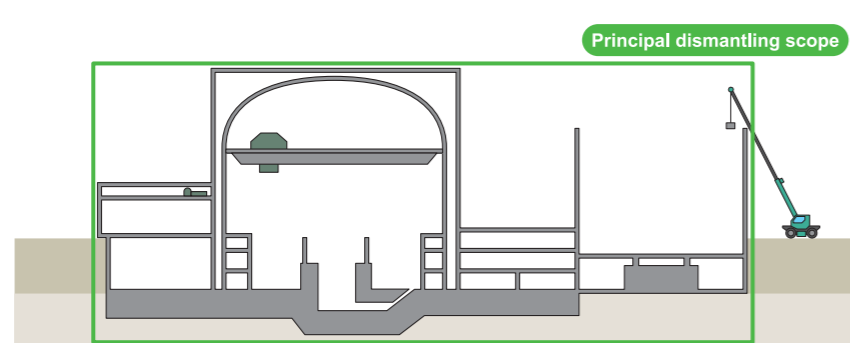
- Dismantling and removing low-radiation equipment from the primary system equipment.
- Completing the removal of spent fuel from Units 1 and 2 to outside the Unit 1 and 2 facilities.

III Dismantling and removal of the reactor and related equipment (FY2041 to FY2047)



- Once radioactivity levels have fallen, equipment such as the reactor vessel and steam generator is dismantled and removed.

IV Dismantling and removal of buildings (FY2048 to FY2054)



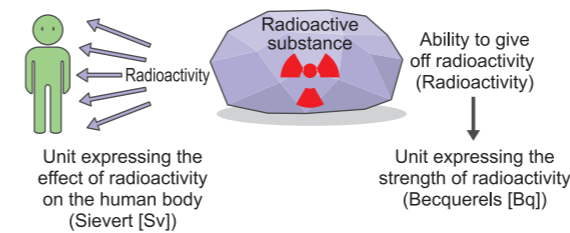
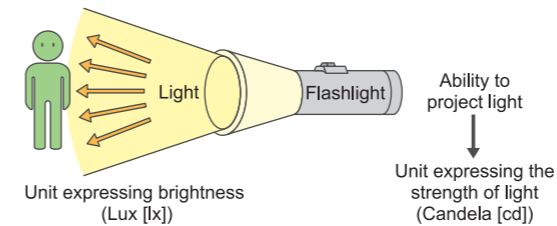
- Once contaminants inside buildings have been removed, buildings* are dismantled and removed.

*Except underground buildings, underground structures, and foundations that have not been contaminated with radioactive substances.

Everyday Life and Radiation

Radiation and Radioactivity

The capacity to emit radiation is called radioactivity. Substances which have this capability are called radioactive substances. In other words, using a lamp as an example, it could be said that the light bulb is like the radioactive substance, the light emitted by the bulb is radiation, and the capacity to emit light is radioactivity.



Natural Radiation and Artificial Radiation

Radiation includes natural radiation, which exists in nature, and artificial radiation, which includes X-rays used in medical procedures, and emissions from nuclear power stations and other devices. However, the effect on the human body is the same regardless of the source, as long as the radioactive values are the same.

Radiation in the Vicinity of Nuclear Power Station

The target value of the radiation dose received by persons in the vicinity of a nuclear power station as a result of station operation is set at 0.05 millisieverts per year. However, the radiation dose emitted by power stations in actual operation is held under 0.001 millisieverts. This is far lower than the radiation we receive from natural sources, and has no effect whatsoever on the human body.

Radiation Management for Personnel Working at the Genkai Nuclear Power Station

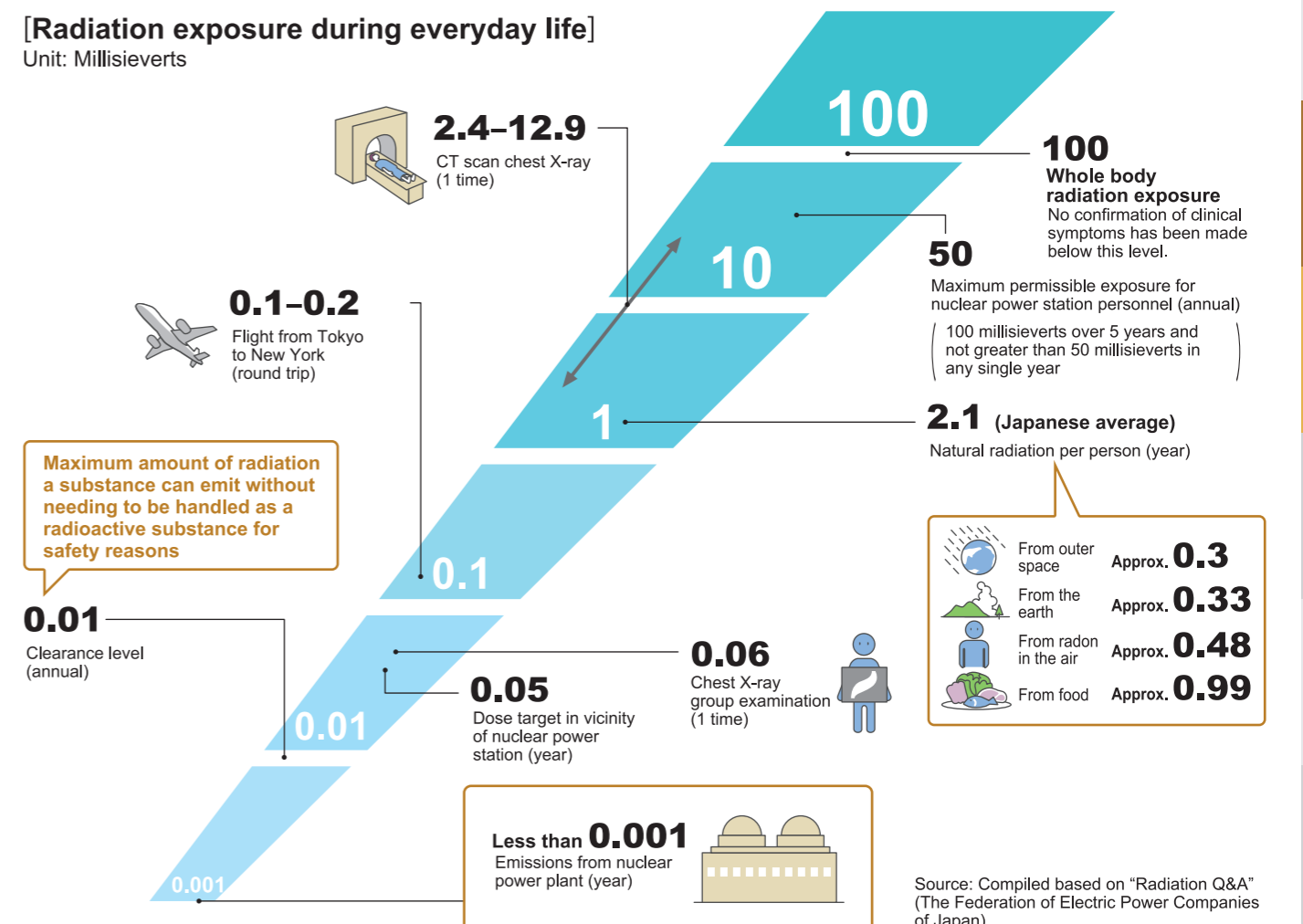
The radiation doses actually received by personnel who work at nuclear power stations average 0.1 millisieverts per year (data from FY2024), far less than the legal limit of 50 millisieverts per year. Moreover, various considerations are being taken in terms of both planning and management to reduce this amount even further.

Note: The maximum exposure under law is 50 millisieverts per year, and 100 millisieverts over a 5-year period.

Radiation in everyday life

[Radiation exposure during everyday life]

Unit: Millisieverts



Source: Compiled based on "Radiation Q&A" (The Federation of Electric Power Companies of Japan)

Environmental Radiation Measurement

Environmental Monitoring

To confirm that there have been no changes in environmental radiation since the start of operation at the Genkai Nuclear Power Station, monitoring stations and monitoring posts* have been installed near the station boundaries to continuously measure and monitor radiation levels and other parameters. Additionally, crops, soil, drinking water, fish, seaweed, seawater, and other materials from the area surrounding the site are periodically sampled to measure radiation and radioactivity concentrations. Further, monitoring vehicles are used to periodically measure radioactivity in the area surrounding the power station. These activities are termed environmental monitoring. Measurement results are published by Saga Prefecture, and the plant publishes environmental radioactivity results.

- *Monitoring stations : Continuously measure and monitor radioactivity and airborne radioactive concentrations using gamma ray monitors and dust monitors.
- Monitoring posts : Continuously measure and monitor radioactivity using gamma ray monitors.



Monitoring station



Environmental sample collection (soil)



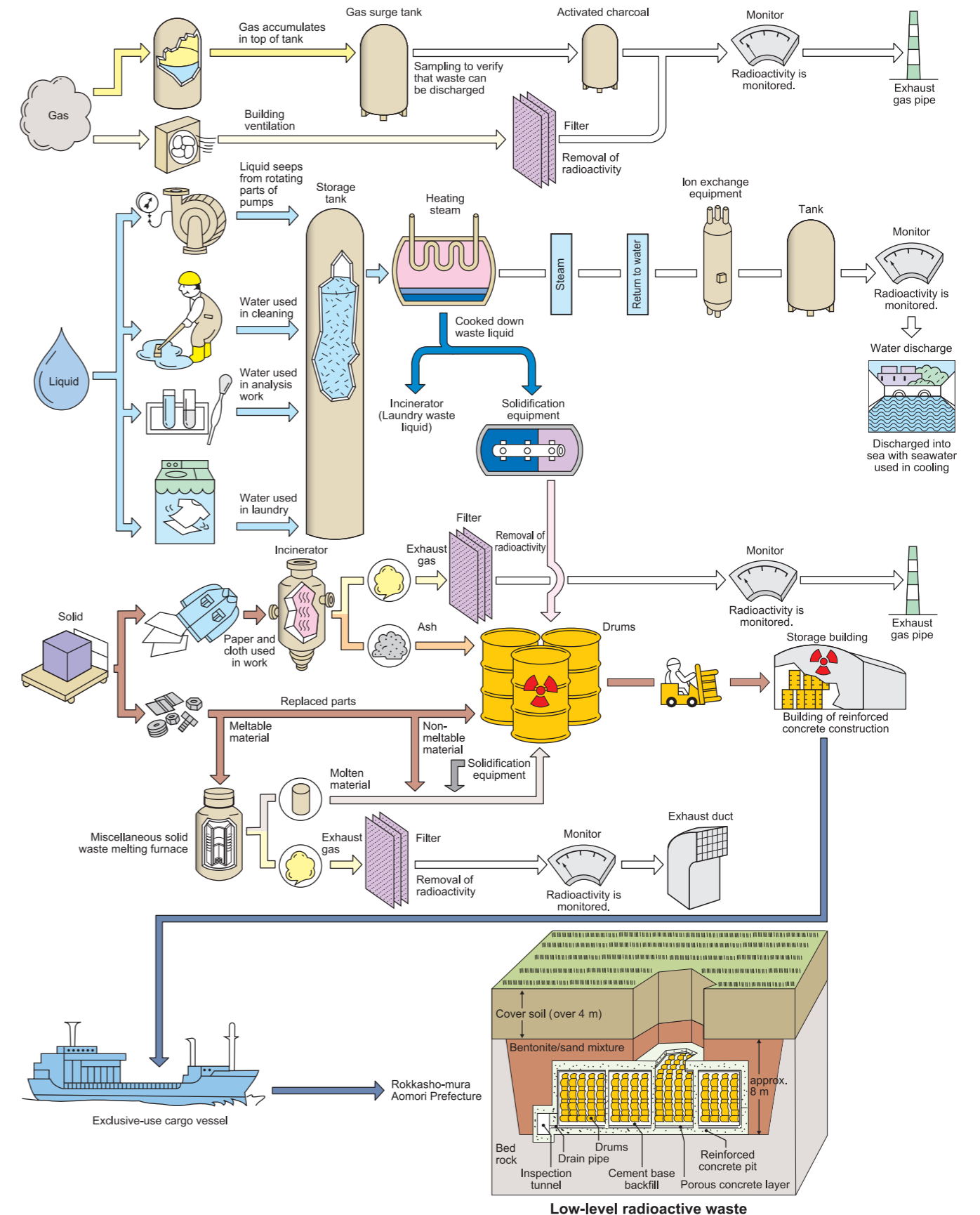
Monitoring vehicle



Environmental sample collection (Matsuba)

Treatment of Radioactive Waste

Radioactive waste generated in nuclear power stations includes low-level radioactive gaseous, liquid, and solid waste. Gaseous and some liquid wastes are treated appropriately, and then discharged into the air or the sea after their safety has been confirmed. Moreover, the remainder of the liquid wastes, and the solid wastes, are treated, sealed into drums, and then stored under strict conditions in a storage building on-site.



Welcome to Genkai Energy Park

At Genkai Energy Park, which opened in March 2000, visitors are introduced to nuclear energy as they walk around and see its facilities. It is both a learning and playing experience.

The park's main attraction, the PR Center, consists of two facilities, the Science Pavilion and Kyushu Furusato Pavilion. The former exhibits, for the first time in Japan, a full-view reactor mock-up, while the latter introduces traditional crafts and folklore from all over Kyushu. Other facilities include the Taiyo-no-Hiroba with outdoor play equipment and Jabu-Jabu Pond, and the "Visitor's conservatory"

In March 2006, Yuchuntei Awatsuki, built in traditional Japanese style with a Japanese garden, was completed in Camellia Park to mark Genkai Energy Power Station's 30th anniversary. Calming and wood-scented, Awatsuki can be used for various events such as tea ceremonies, haiku meetings, and flower arrangement (free of charge; reservations required). It is operating in conjunction with the adjoining Genkaicho Next Generation Energy Park Asupia, offering an expanded variety of outdoor facilities.



Taiyo-no-Hiroba



Visitor's conservatory



Yuchuntei Awatsuki

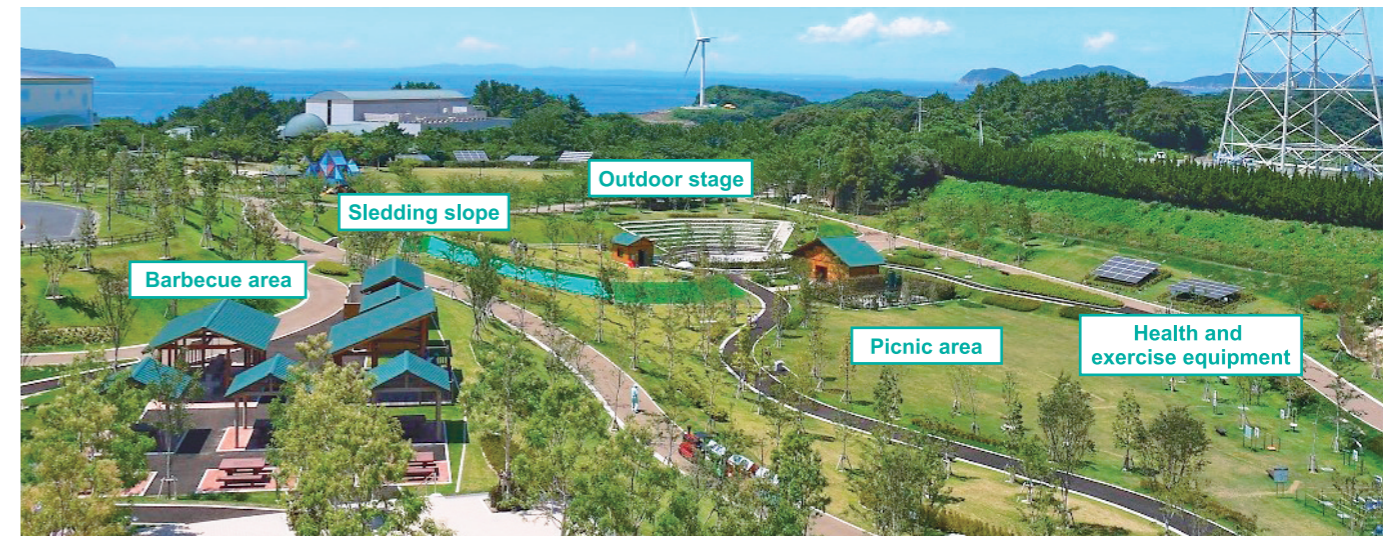
Facility Outline

	PR Center	Taiyo-no-Hiroba	Decorative plant greenhouse
Outline	Scale of structure Reinforced concrete structure, 1 basement and 4 stories above ground	Grassy plaza	Scale of structure Steel structure, 1 basement and 1 story above ground
	Building area approx. 5,400 m ²	Cherry tree Promenade	Building area approx. 1,300 m ²
	Total floor area approx. 9,700 m ²	Outdoor play equipment	Total floor area approx. 1,520 m ²
	Maximum height approx. 30 m of building	Jabu-Jabu Pond	Maximum height approx. 30 m of building

- Address: 4112-1 Oaza Imamura, Genkai-cho, Higashi-Matsuura-gun, Saga 847-1441 JAPAN
- Contact: Tel. 0955-52-6409 | Fax. 0955-52-3796
- Access: Take the Showa Bus from Karatsu (Oteguchi Bus Center) and get off at the Genkai Energy Park stop (Genkai Nuclear Power Station Entrance). Takes about 40 minutes.
- Hours: 9:00 to 17:00; admission free
- Closed: New Year's holidays (Dec. 29 to Jan. 2), third Monday of each month (or next day, if a holiday)

Tennis courts	From two weeks in advance
Yuchuntei Awatsuki	From the first day of the month in which the day falling three months before the desired reservation falls

Genkai Energy Park Expansion Area



Together with the Region

In operating a nuclear power plant, the cooperation of everyone in the area is indispensable. To deepen the understanding and friendly feeling of residents toward Genkai Nuclear Power Plant, we are fully involved in everyday dialogue activities, volunteer activities, sports, and other parts of the life of the community.

Events



Japanese croquet



Empty can and trash collection

Building a Better Community

We are also working to improve the social infrastructure of the area. For example, to improve welfare services, we have donated funds for the construction of public facilities under the three main laws for the promotion of power station construction.



Genkai Research Institute of Medicinal Plants



Recreation Plaza

Genkai Nuclear Power Station

Guide to the Surrounding Region

Genkai, a beautiful town blessed with blue sea and a fascinating history



1 Genkai Marine Observation Tower
From the tower built out from the tip of Cape Hato, it is possible to observe to a depth of 7 meters below water level.



2 Ruins of Nagoya Castle



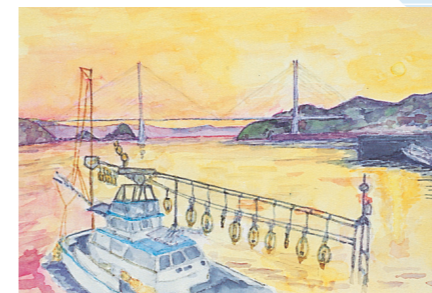
3 Saga Prefectural Nagoya Castle Museum
Dates from the 9th year of Tensho (1591). The remains of the castle constructed by Hideyoshi as the main base for an expedition to Korea. Ranks among the largest of Momoyama period castles remaining today in Japan. The Museum houses a collection of documents on the history of the castle and its vicissitudes.



4 Windview Hill Gardens

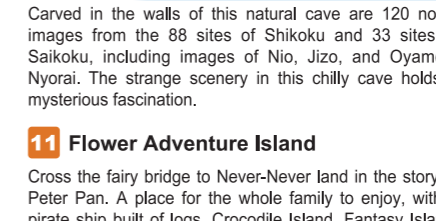


9 Kariya Bay



10 Tsuruno-iwaya

5 Yobuko-ohashi



11 Flower Adventure Island



6 Genkai Nuclear Power Station



12 Irohajima



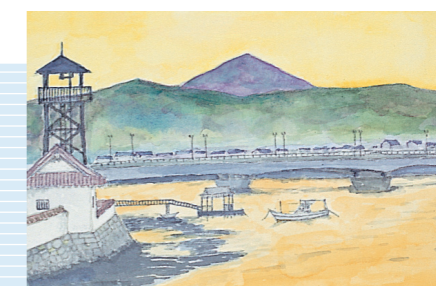
7 Terraced paddy field in Hamanoura



13 Kirigo Peonies



8 Mishima Park



14 Ukidake
Ukidake (Hamatama-machi, Karatsu City)
View from Karatsu Castle.



15 Niji-no-Matsubara
One of Japan's three great pine groves, Niji-no-Matsubara is 5 kilometers long and 1 kilometer wide, forming a rainbow-like arch along the sea and white sand. Planted by Terasawa Shimanokami Hirotake as a windbreak in the Bunroku era. Seen from Mt. Kagami, this is one of Japan's unsurpassed scenes of natural beauty.



16 Hikiyama Float Exhibition Hall
This exhibition hall houses the 14 Festival Floats, which play the main role in the Karatsu-Kunchi that enlivens the autumn season in Karatsu. The completion of the floats required years of work and mastery skill. These are truly mobile works of art. The festival itself has also been designated as an important intangible folk cultural property by the government.



17 Karatsu Castle
Construction of this castle by Hideyoshi's follower Terasawa Shimanokami Hirotake was completed in the 13th year of Keicho (1608). Also called the Dancing Crane Castle for its beautiful silhouette. Important historical documents are displayed on each floor.



18 Nanatsu-gama

Illustration: Kiyohiko Matsushita

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Serious Incident countermeasures

Response Facilities for Specified Serious Accidents

Decommissioning plan

Monitoring

Waste Treatment

Community Activities

A Guide to the Surrounding Region



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