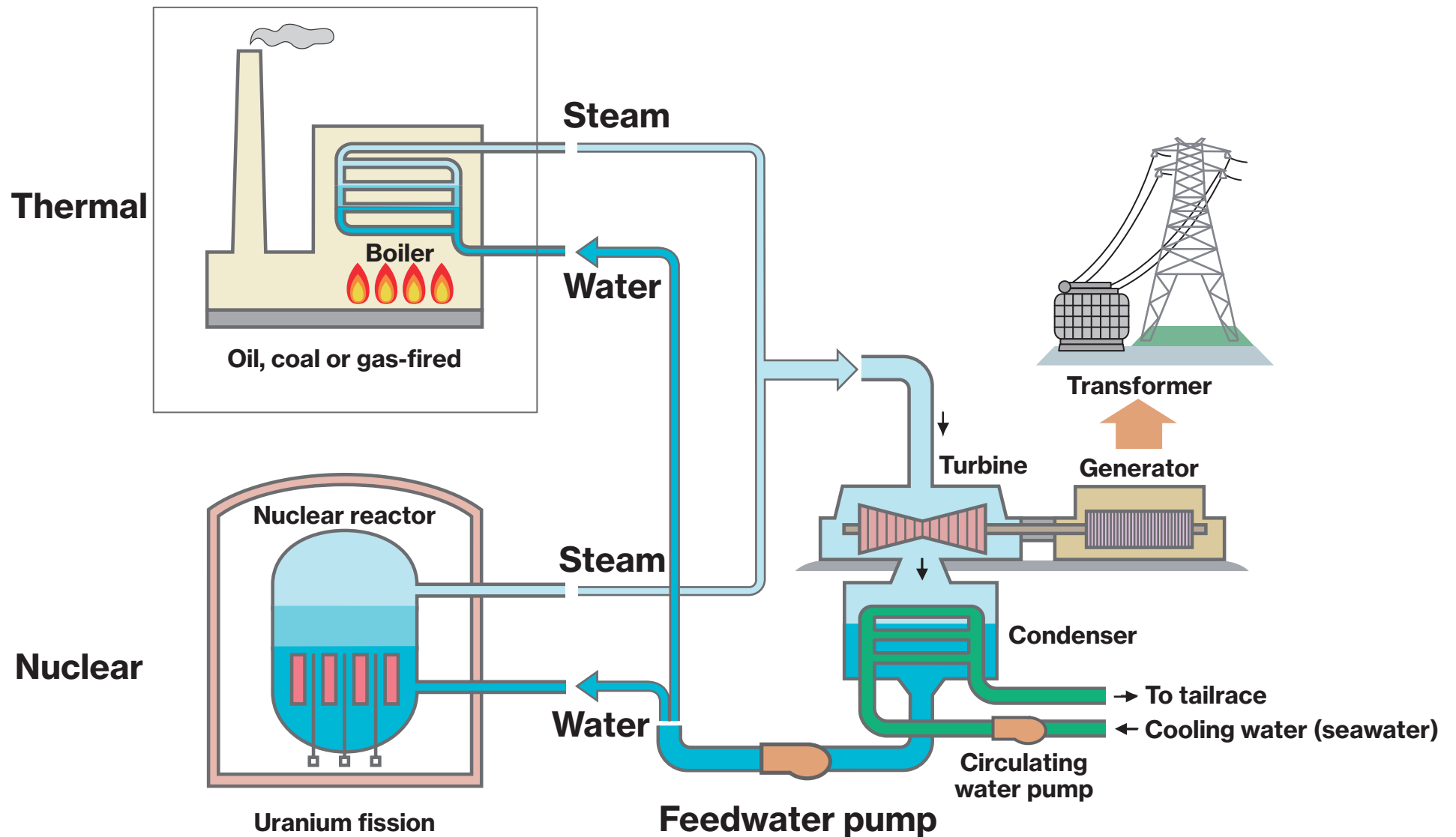
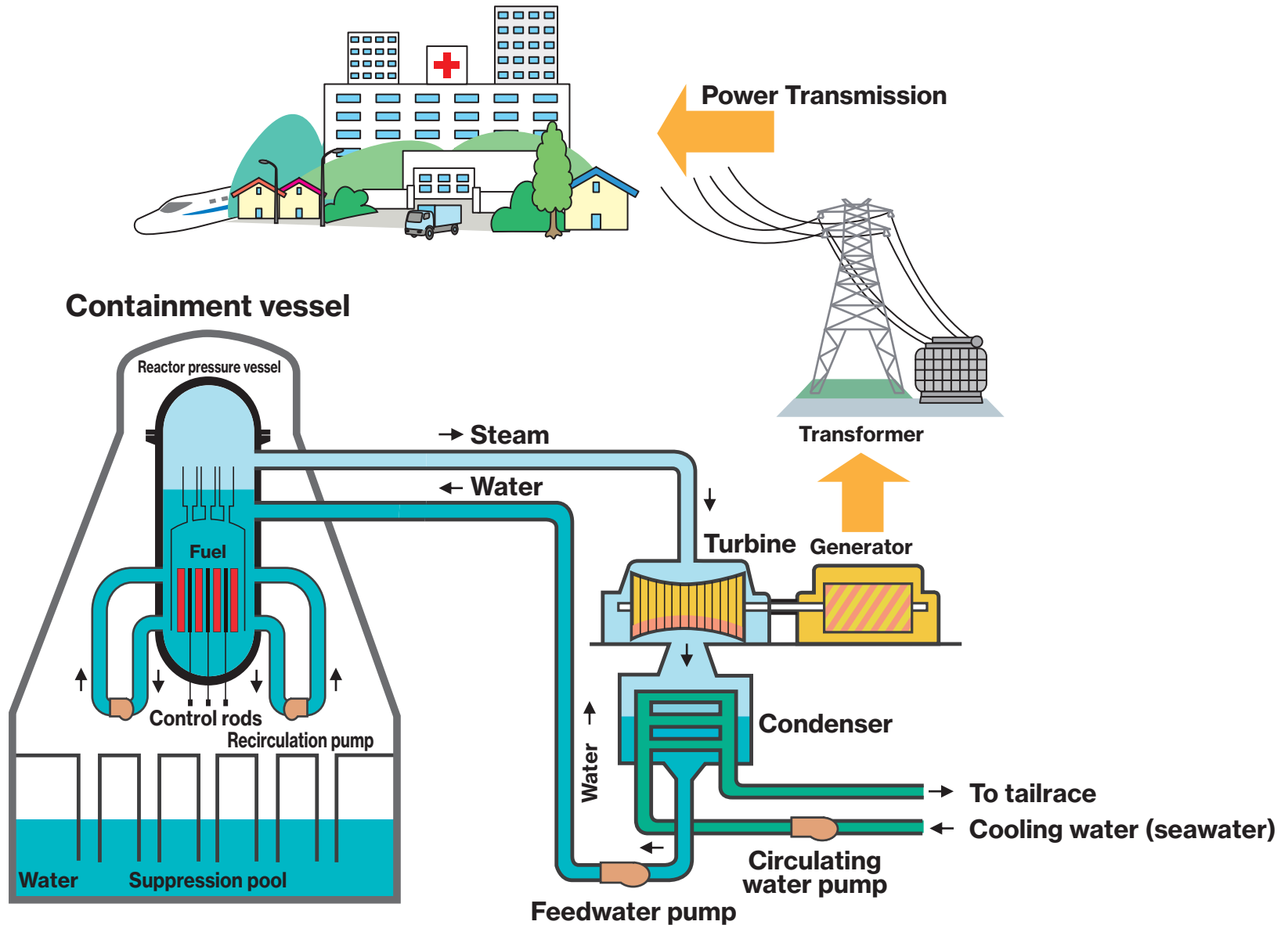


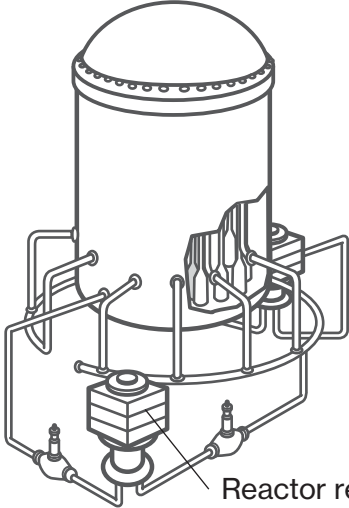
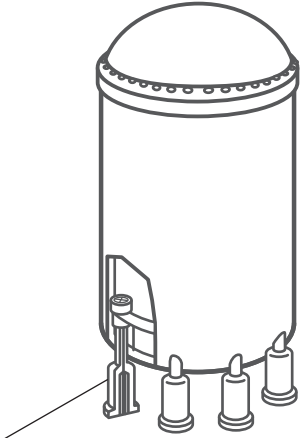
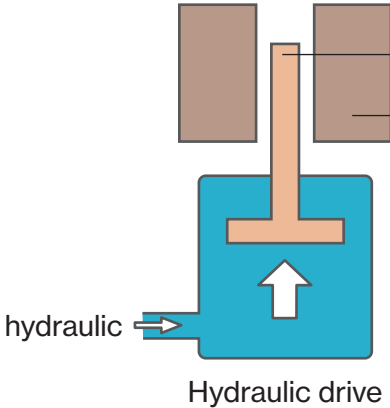
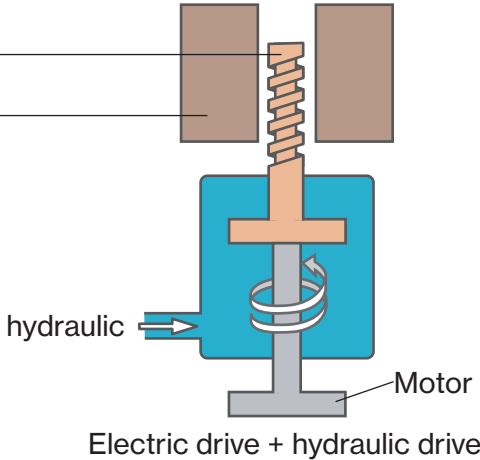
The Differences between Thermal and Nuclear Power Plants



How a Boiling Water Reactor (BWR) Works

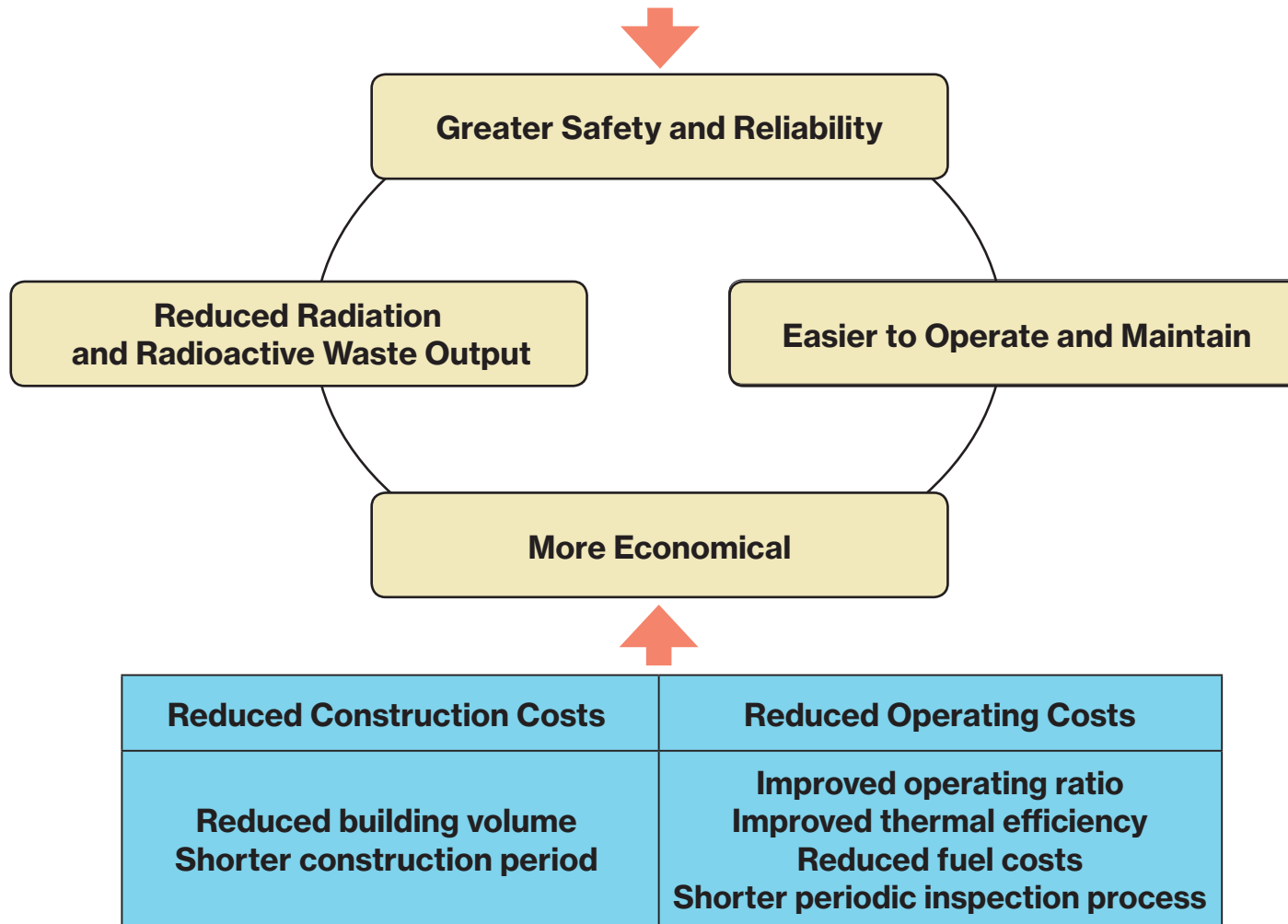


Structural Features of Advanced Boiling Water Reactors (ABWR)

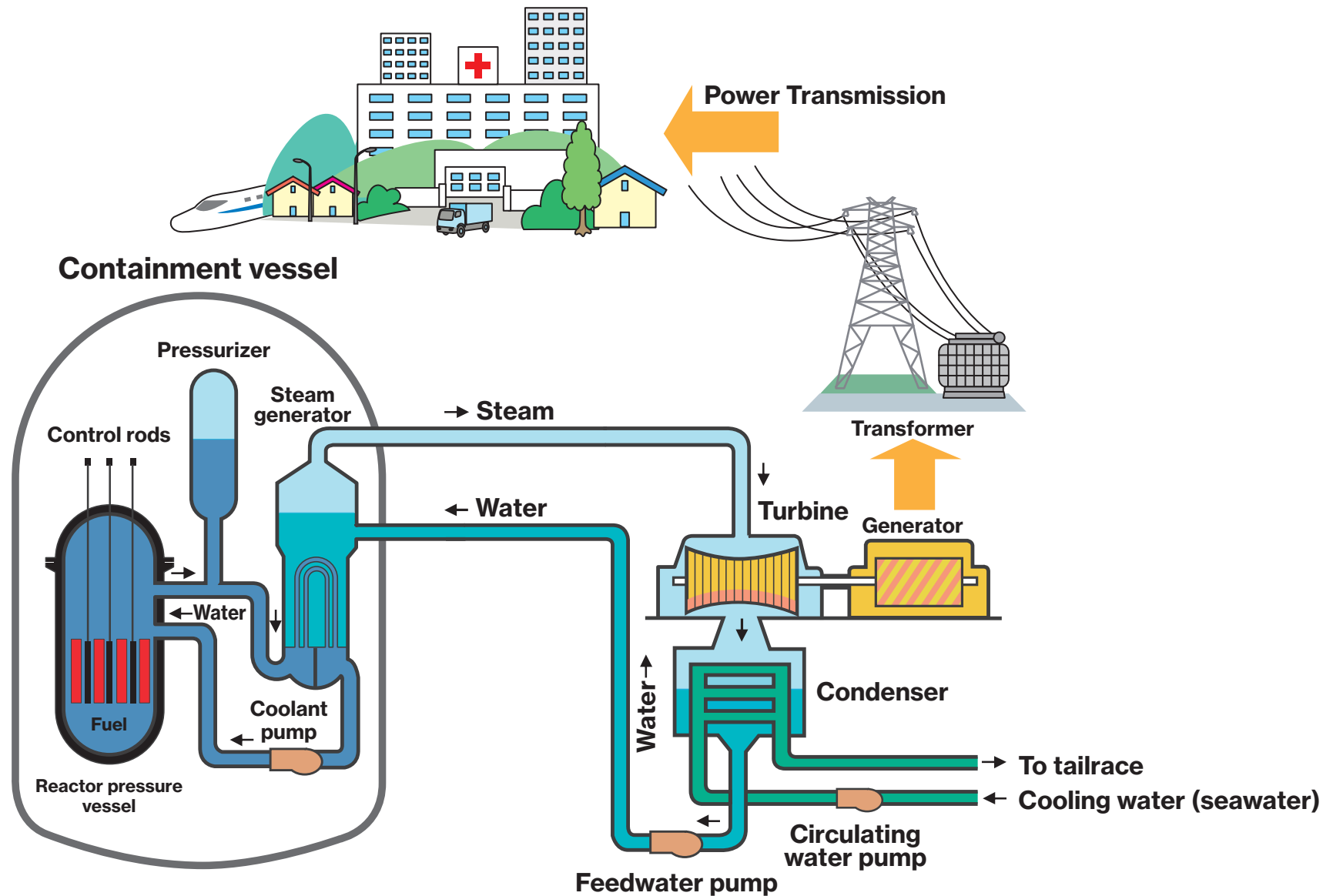
	BWR	ABWR
More compact containment vessel Simplified reactor systems	 <p>Reactor recirculation pump</p>	 <p>Internal reactor recirculating pump</p>
Diversification of control rod drive mechanisms	 <p>hydraulic</p> <p>Hydraulic drive</p>	 <p>hydraulic</p> <p>Motor</p> <p>Electric drive + hydraulic drive</p>

Features of Advanced Boiling Water Reactors (ABWR)

**Simplified reactor systems, more compact containment vessel and diversified core control drive mechanisms
Improved earthquake resistance and optimized emergency core cooling system**

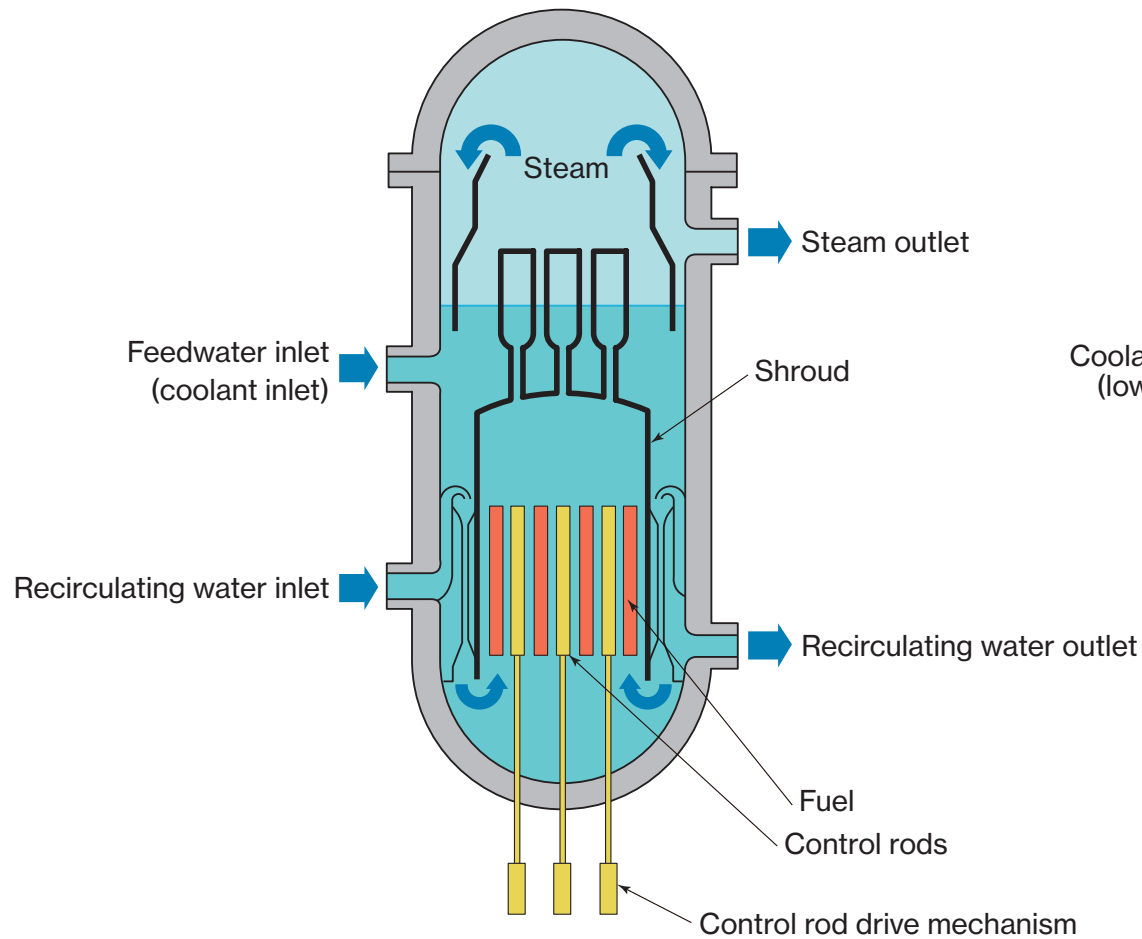


How a Pressurized Water Reactor (PWR) Works

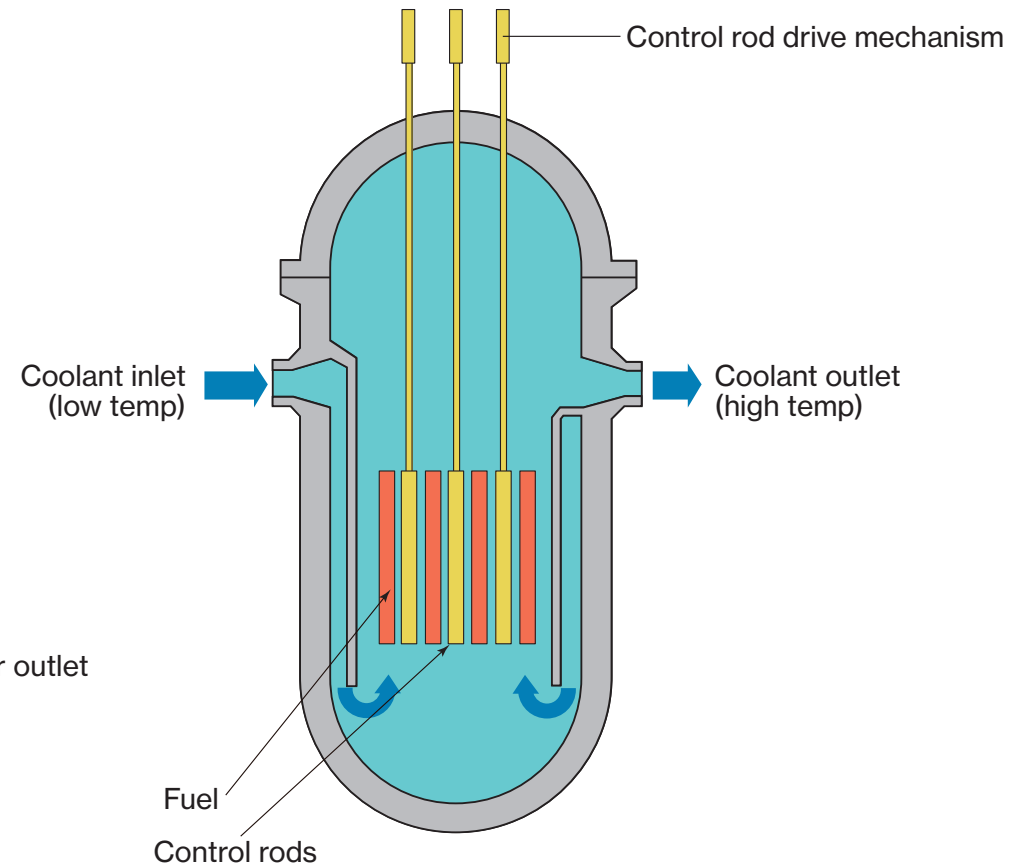


Cross-sections of Reactor Pressure Vessels

Boiling Water Reactor (BWR)

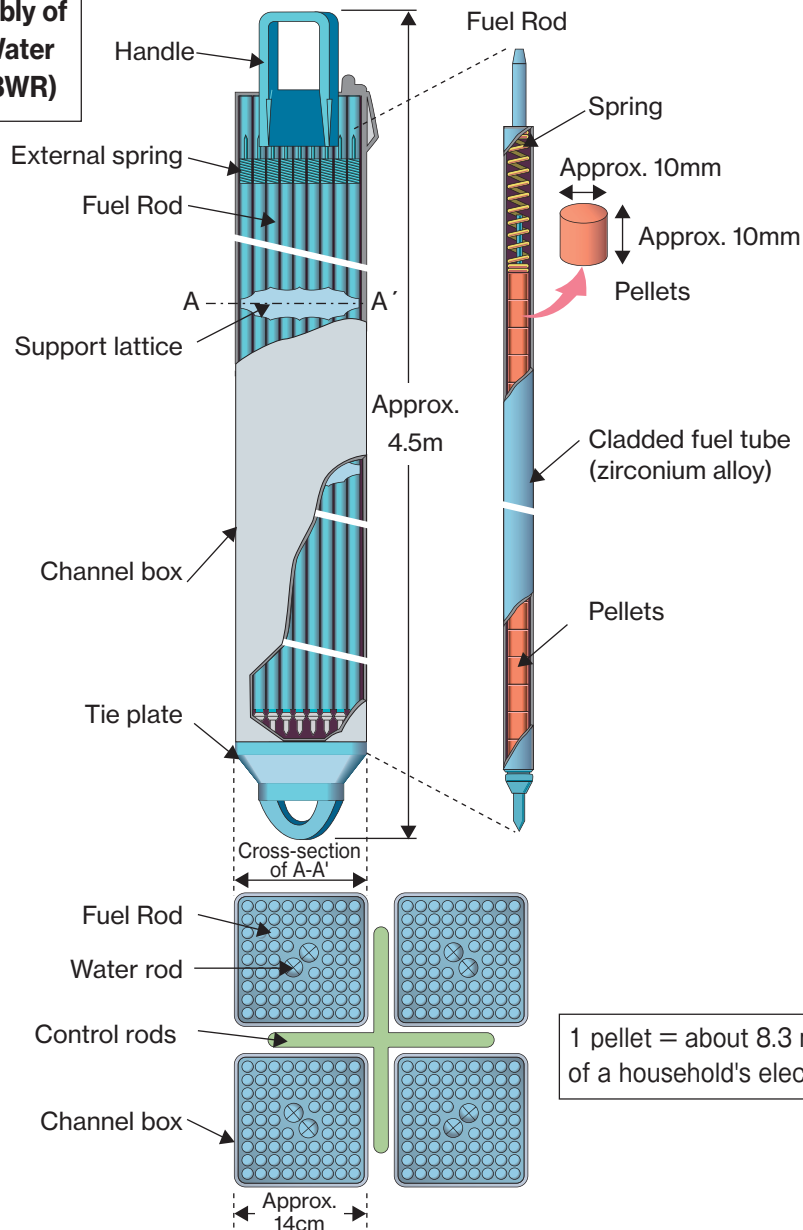


Pressurized Water Reactor (PWR)

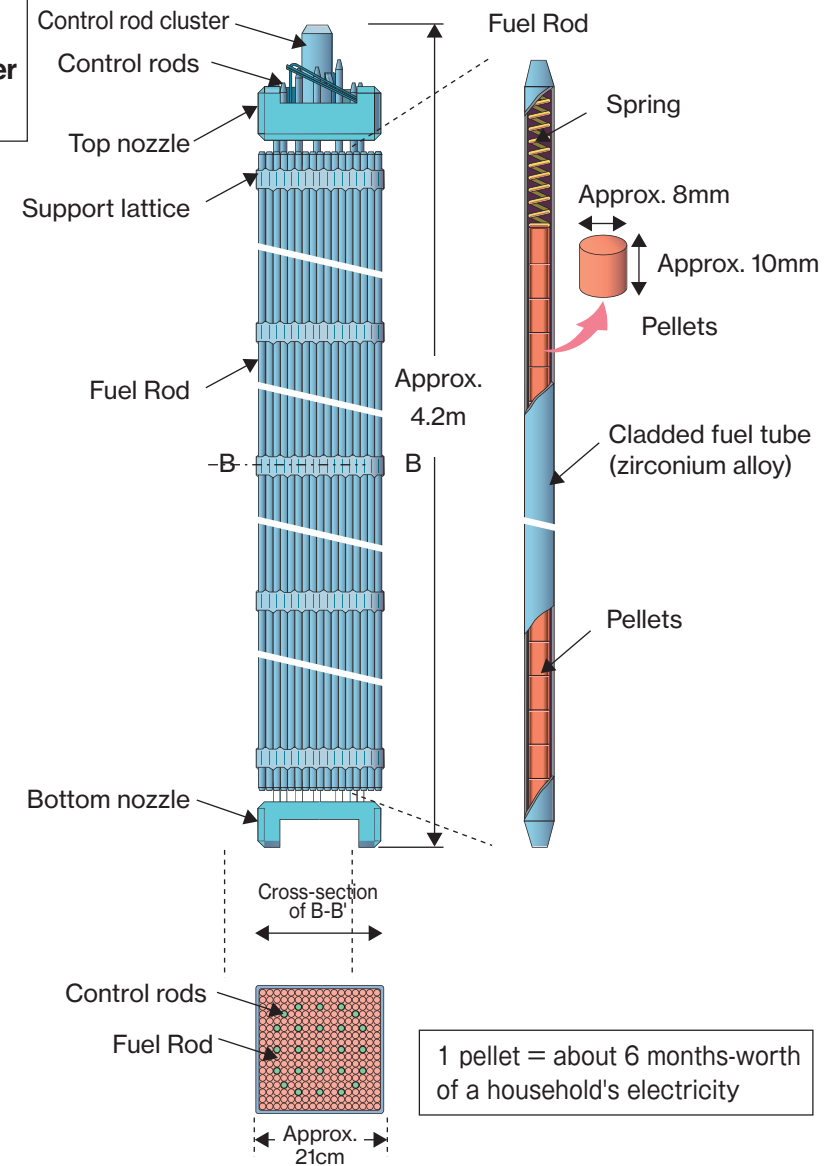


Fuel Assembly Structures and Control Rods

Fuel Assembly of a Boiling Water Reactor (BWR)



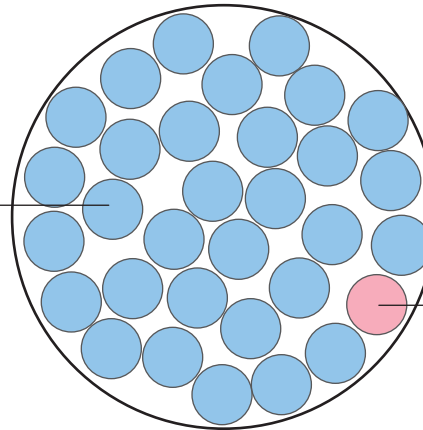
Fuel Assembly of a Pressurized Water Reactor (PWR)



Natural Uranium & Enriched Uranium

Natural Uranium

Uranium 238
99.3%

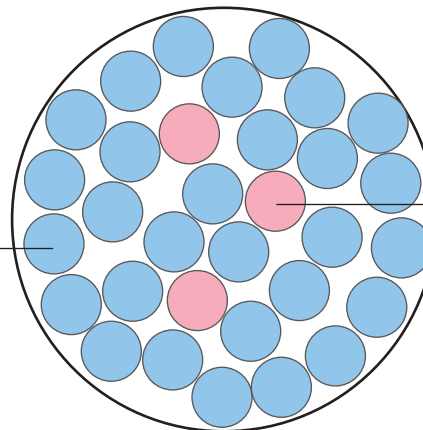


Uranium 235
0.7%

Enrichment

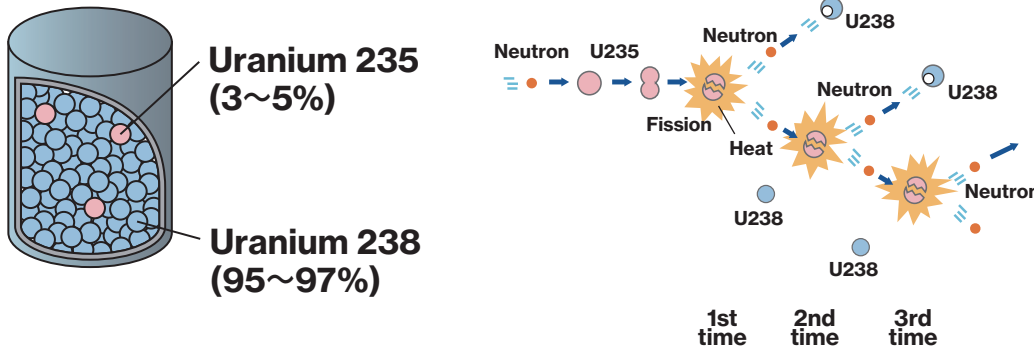
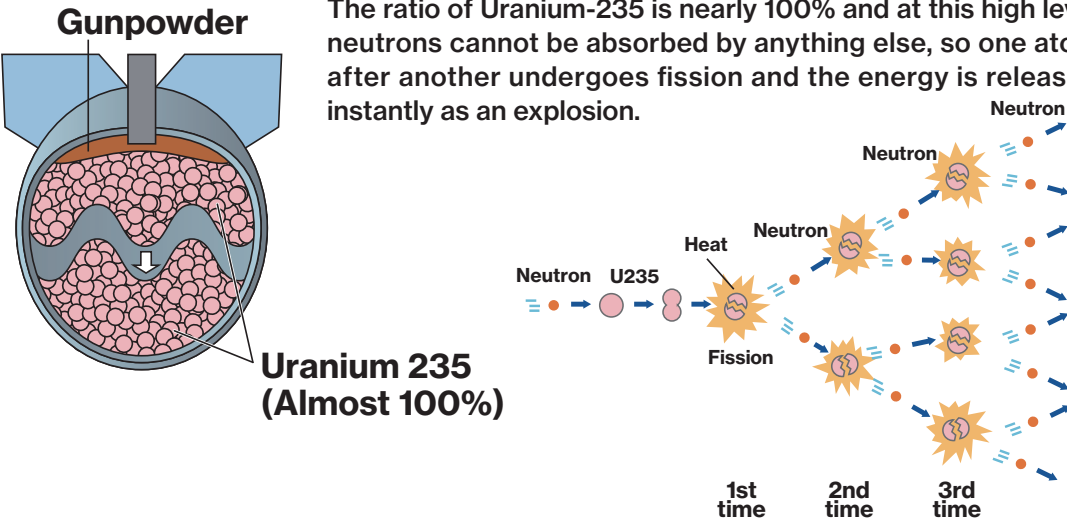
Low-enriched Uranium

Uranium 238
95~97%

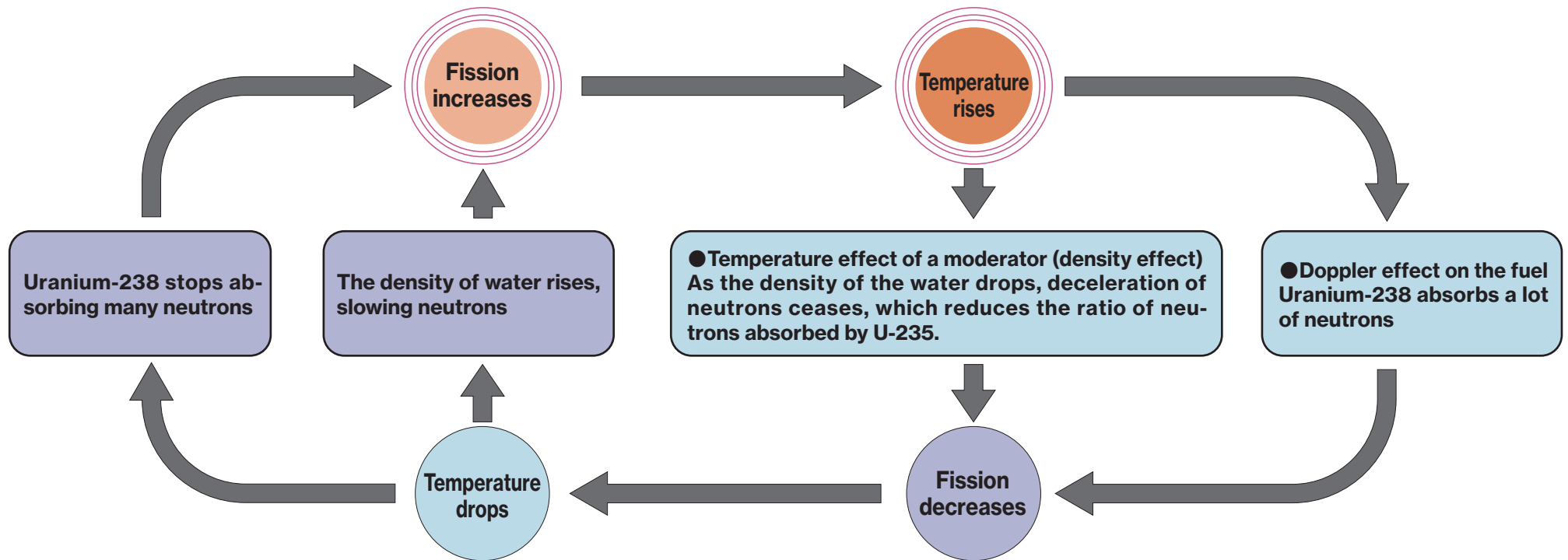


Uranium 235
3~5%

Differences between Nuclear Power and Nuclear Bombs

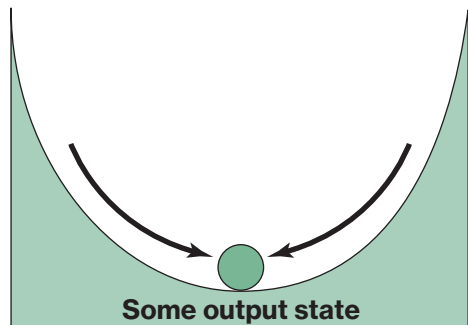
	Ratio of Uranium-235 to Uranium-238 & Chain Nuclear Reaction	Method of Controlling Fission Rate
In a Nuclear Power Plant	<p>The ratio of Uranium-235 is low, so fission is sustained at a constant scale, for reasons such as absorption of neutrons by Uranium-238.</p>  <p>Uranium 235 (3~5%)</p> <p>Uranium 238 (95~97%)</p> <p>1st time 2nd time 3rd time</p>	<p>Many control rods are installed and the reactions are self-limiting, so the rate of fission cannot increase rapidly.</p>
In a Nuclear Bomb	<p>The ratio of Uranium-235 is nearly 100% and at this high level neutrons cannot be absorbed by anything else, so one atom after another undergoes fission and the energy is released instantly as an explosion.</p>  <p>Gunpowder</p> <p>Uranium 235 (Almost 100%)</p> <p>1st time 2nd time 3rd time</p>	<p>No control rods are installed and the reactions are not self-limiting, so the rapid increase in fission cannot be stopped.</p>

Inherent Safety of Nuclear Reactors (Self-Limiting)



Self-limiting

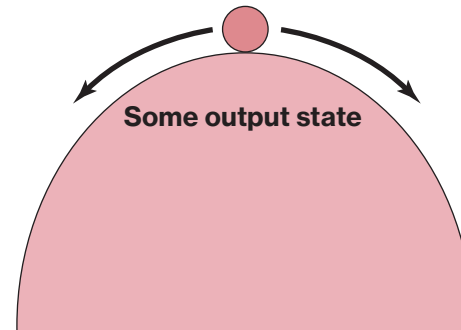
Safe even if left alone (stable)



[Low output state] [High output state]

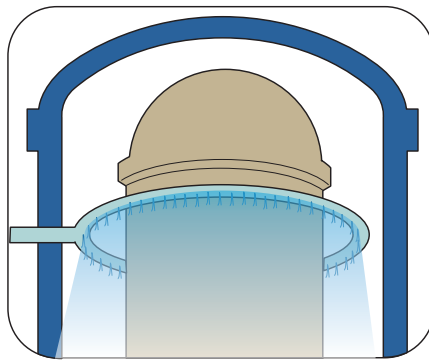
Not Self-limiting

Moves to one side if left alone (unstable)



[Low output state] [High output state]

Example of an Emergency Core Cooling System (BWR)

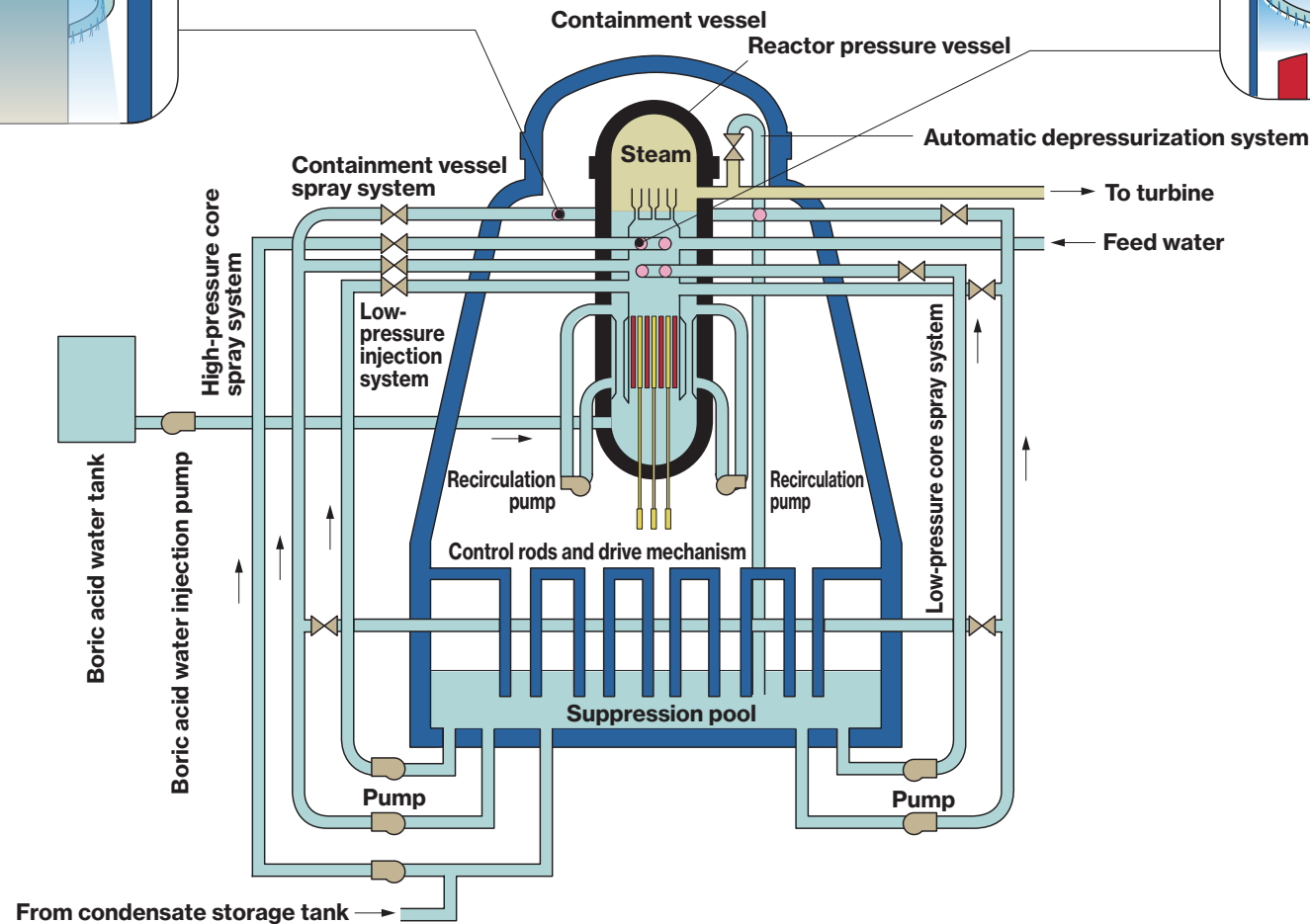
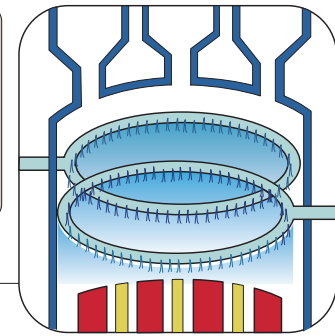


Containment Vessel Spray System

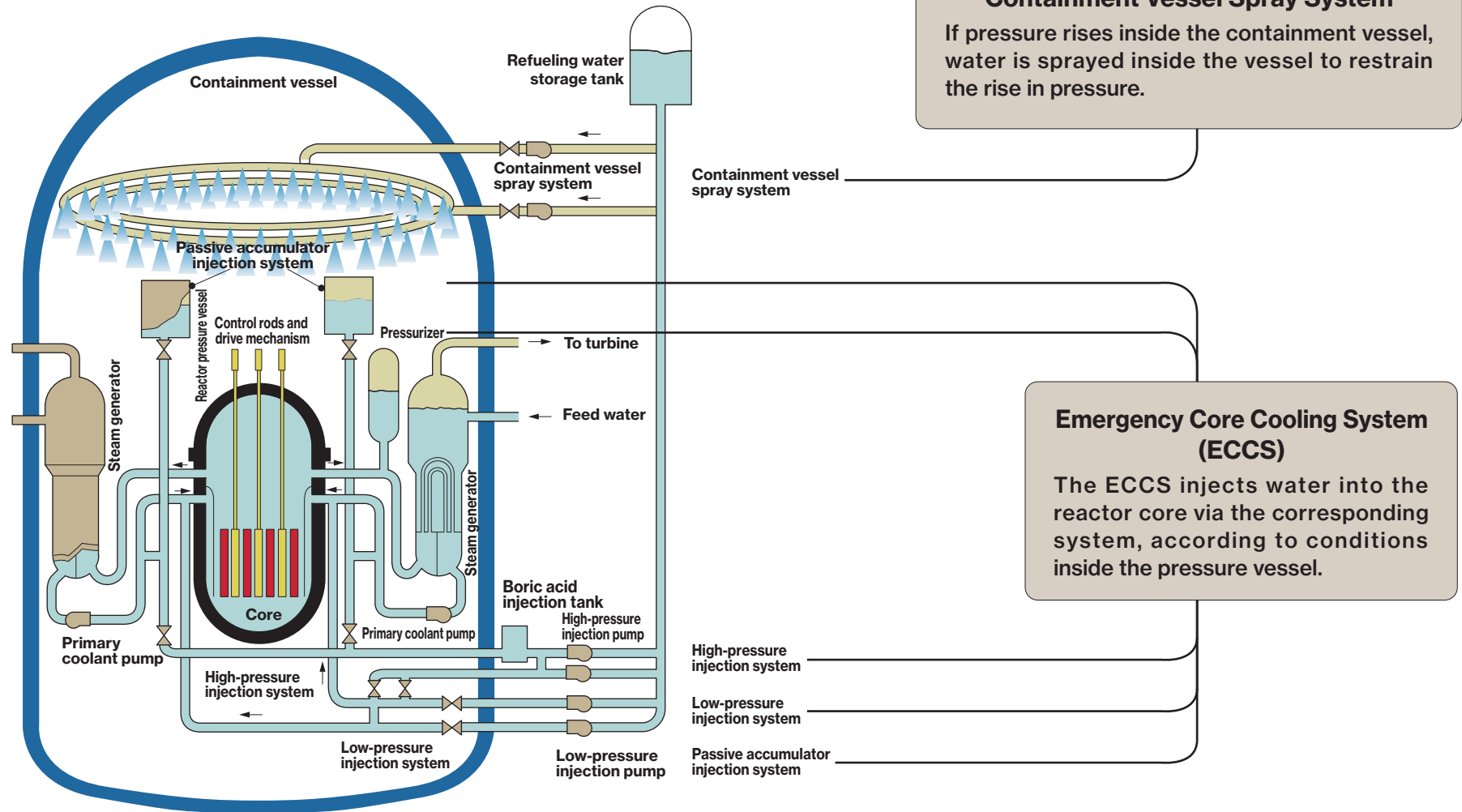
A donut-shaped spray tube is installed on the inner wall of the containment vessel and cools the inside of the vessel by showering it with cool water. This is a containment vessel spray system.

Emergency Core Cooling System

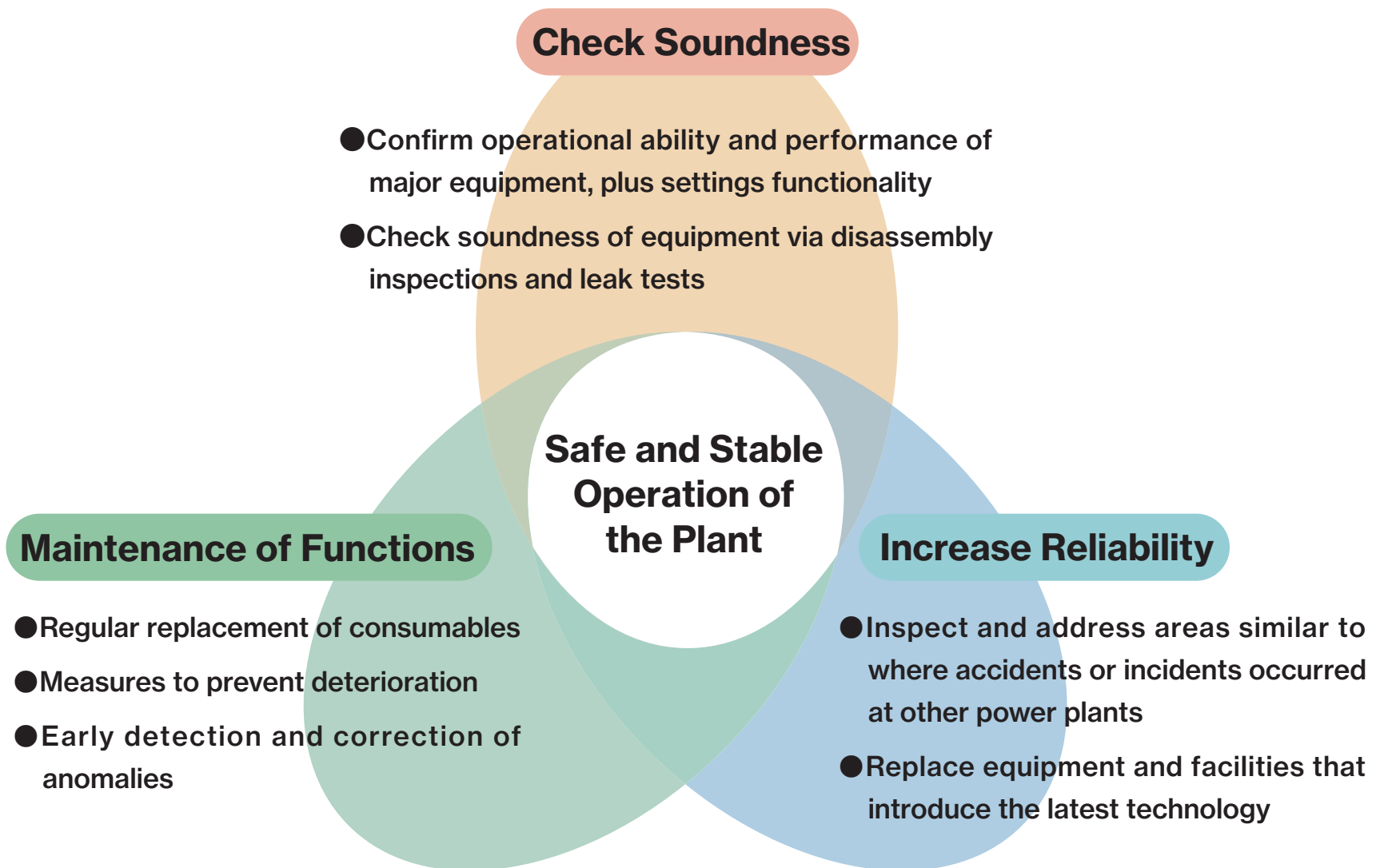
Water pipes in a donut shape are perforated, so if the water in the reactor core drops, it automatically sprays the fuel and cools it. This is a spray type of reactor core cooling system.



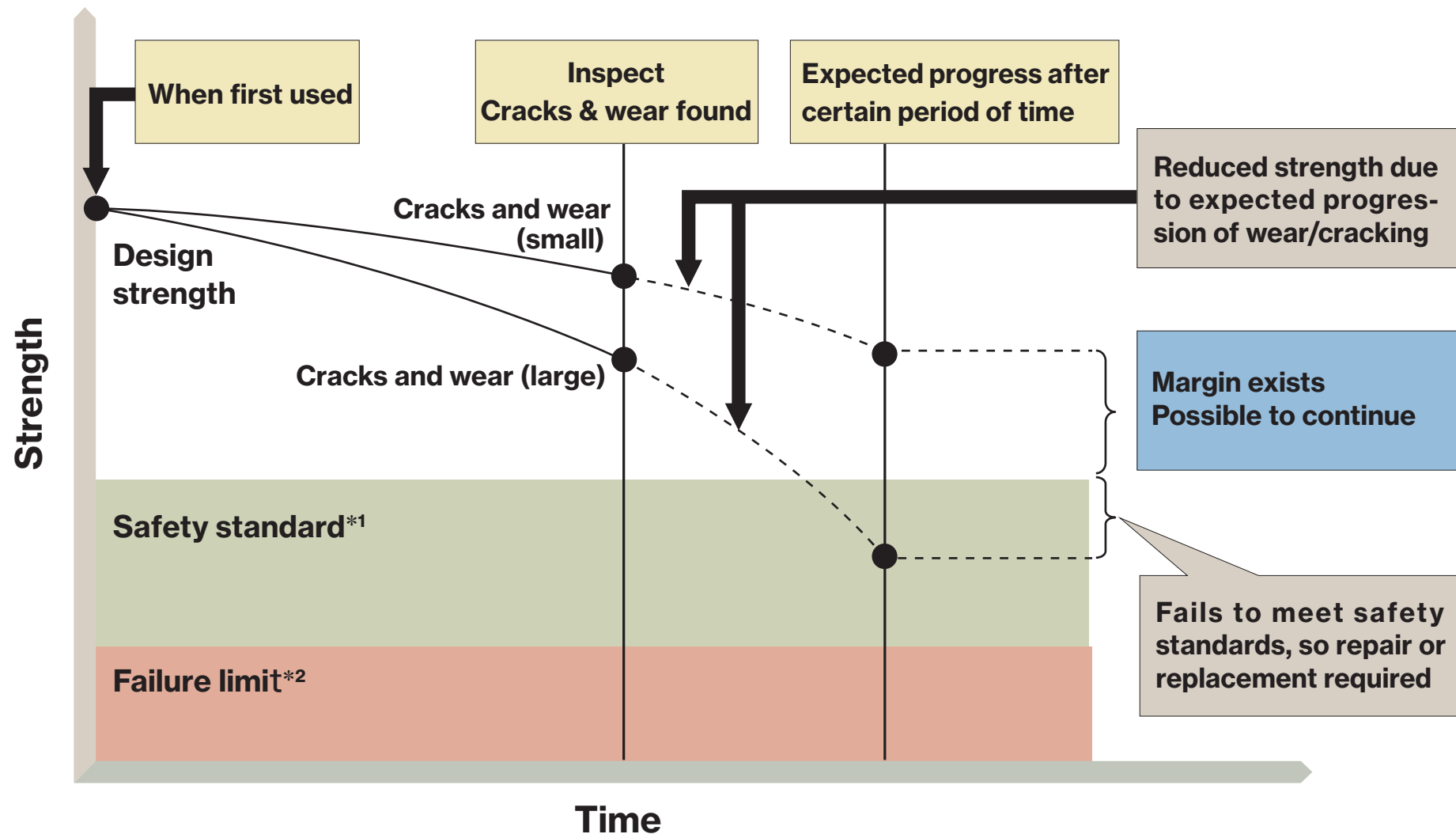
Example of an Emergency Core Cooling System (PWR)



Purposes of Periodic Inspections of Nuclear Power Plants



Methods for Evaluating the Soundness of Equipment

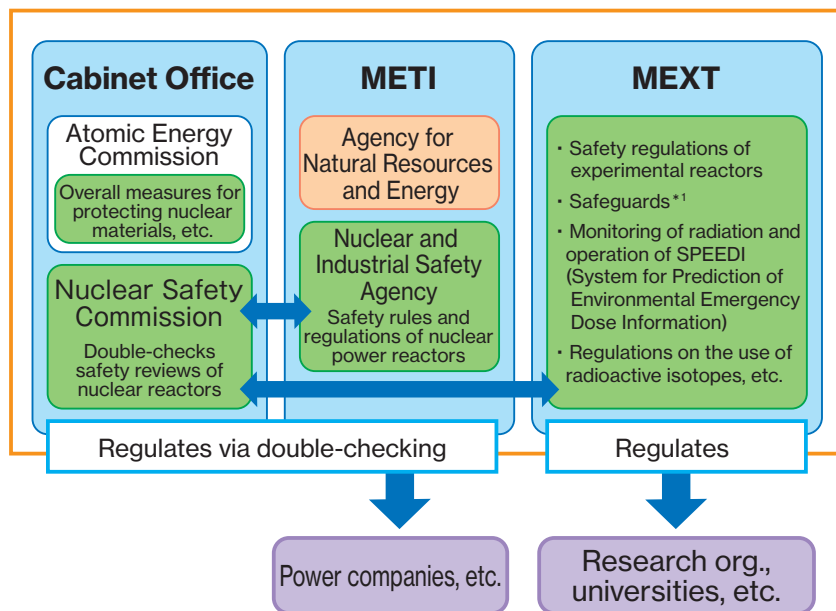


*1: Safety standard includes a tolerance margin over actual failure limit

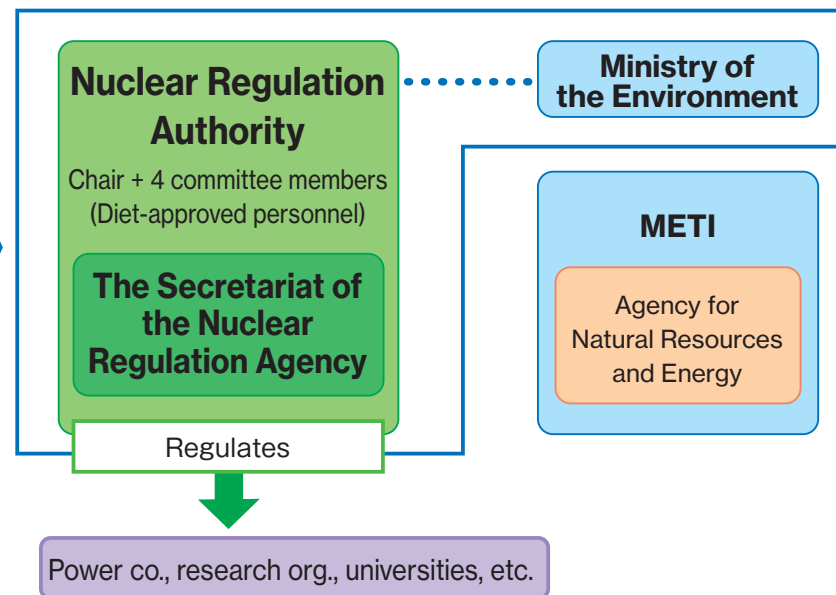
*2: Minimum strength for equipment to withstand conditions without failing

Changes in the Nuclear Safety Regulatory System

【Former Regulatory System】



【New Regulatory System】



Promotional (Agency for Natural Resources and Energy) and regulatory agencies (Nuclear and Industrial Safety Agency) exist together within METI.

Ensure Independence

Separated from METI and established the Nuclear Regulation Authority as an external bureau (Article 3 Committee*2)

Decentralized to the Nuclear and Industrial Safety Agency, Nuclear Safety Commission & MEXT

Centralization of Regulatory Affairs

Decentralization of functions, including safeguards for non-proliferation*1 Monitoring of radiation and use of radioisotopes

*1 Refers to verification measures to ensure that nuclear materials are only used for peaceful purposes and not diverted to military use, such as for weapons.

*2 Commissions of the so-called Article 3 (of the National Government Organization Law, Article 3, Paragraph 2, Establishment of Administrative Organs) are not under the command or supervision of top level organs (e.g. set up under the minister of a cabinet) and are independent, with exercise of their authority guaranteed by mechanisms of the Diet.

Nuclear Safety Regulation System

The Nuclear Regulation Authority

NRA Human Resource Development Center

Human Resource Development
Policy Planning Div.

Personel Development and
International Training Programs Div.

Nuclear Regulation
Training Programs Div.

Reactor Technology
Training Programs Div.

Councils and others

Reactor Safety
Examination Committee

Nuclear Fuel Safety
Examination Committee

National Research and
Development Agency Council

Radiation Council

The Secretariat of the Nuclear Regulation Authority

Secretary-General

Deputy Secretary-General

Deputy Secretary-General for Technical Affairs

Secretary-General's Secretariat

Policy Planning and Coordination Div.

Personnel Div.

Div. of Budget and Accounting

Div. of Legal Affairs

System Revision Deliberations Off.

Emergency Preparedness and Response Off.

Off. for Administrative Affairs of the Commission

Off. for Public Records Management and Information Technology

Management System Off.

Public Information Off.

International Affairs Off.

Accidents Response Off.

Off. for Litigation

Information Systems Off.

Regulatory Standard and Research Department

Regulatory Standard and Research Div.

Div. of Research for Reactor System Safety

Div. of Research for Severe Accident

Div. of Research for Nuclear Fuel Cycle and Radioactive Waste

Div. of Research for Earthquake and Tsunami

Radiation Protection Department

Radiation Protection Policy Planning Div. Japan Safeguards Off. (JSGO)

Radiation Monitoring Div. Environmental Radioactivity Off.

Div. of Nuclear Security

Div. of Regulation for Radiation

Nuclear Regulation Department

Nuclear Regulation Policy Planning Div.

Fire Management Off.

Off. for Accident Measures of the Fukushima-Daiichi NPS

Nuclear Regulation Department (Licensing)

Div. of Licensing for Nuclear Power Plants

Div. of Licensing for Research Reactors, Use of Nuclear Material

Div. of Licensing for Nuclear Fuel Facilities

Div. of Licensing for Earthquake and Tsunami

Nuclear Regulation Department (Oversight)

Oversight Planning and Coordination Div.

Risk Management Off.

Div. of Oversight of Nuclear Power Plants

Div. of Oversight of Nuclear Fuel Related Facilities and Research Reactors

Div. of Specified Oversight

Regional Organizations

NRA Regional Offices · Branch

Regional Administrators

Nuclear Vessel Monitoring Center

Rokkasho Safeguards Center

Incorporated Administrative Agencies <Partial Jurisdiction>

Japan Atomic Energy Agency (JAEA)

National Institutes for Quantum and Radiological Science and Technology (QST)

New Regulatory Requirements for Nuclear Power Plants

〈 Previous Regulatory Requirements 〉

Design basis to prevent severe accidents
(Confirm that a single failure would not lead to core damage)

Consideration of natural phenomena
Fire Protection
Reliability of power supply
Function of other SSCs*
Seismic/tsunami resistance

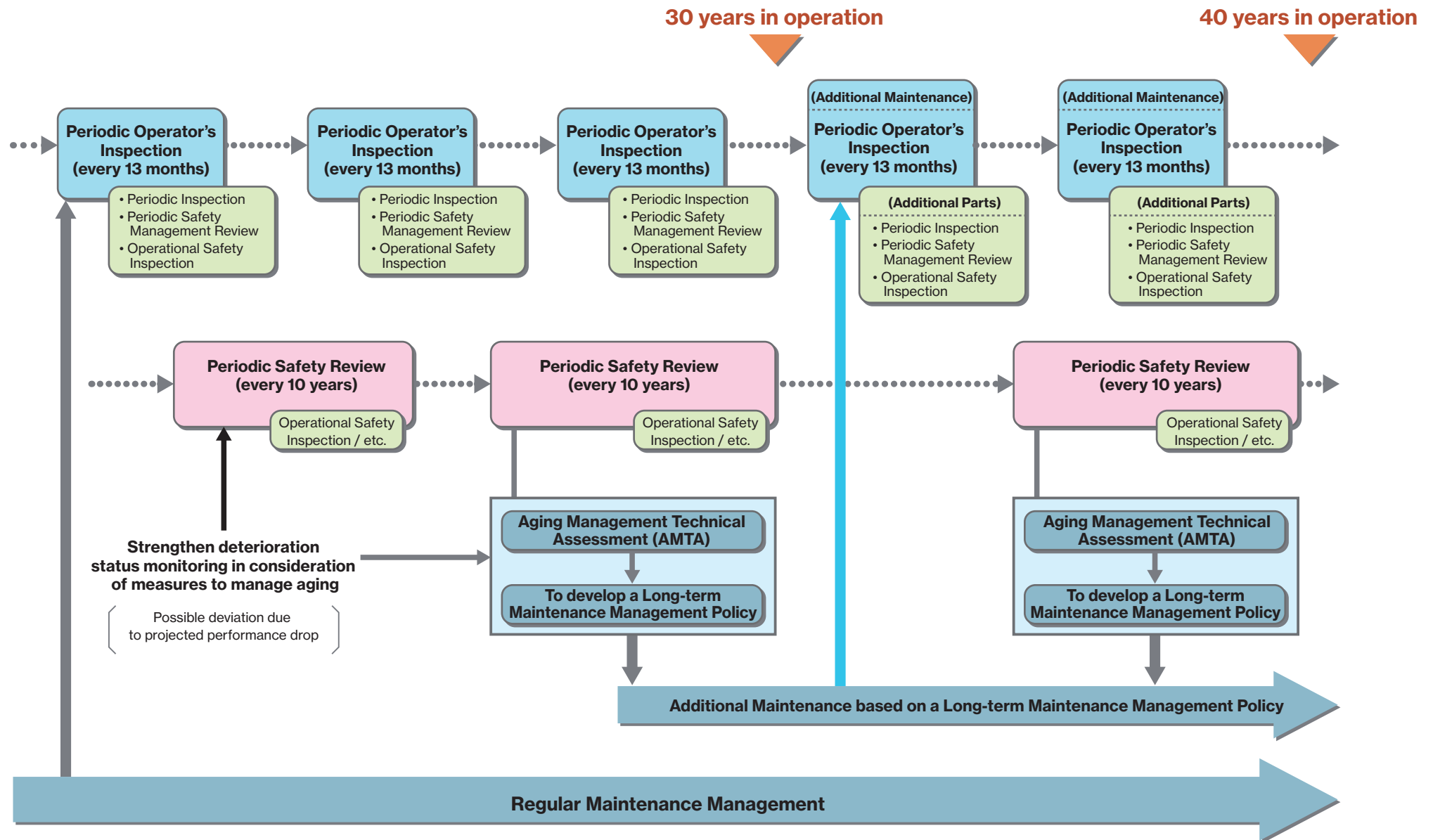
Reinforcement of design criteria
Expansion of consideration for external events

〈 New Regulatory Requirements 〉

Response to international aircraft crashes	Newly introduced (measures against terrorism)
Measures to suppress radioactive materials dispersion	
Measures to prevent containment vessel failure	Newly introduced (measures against severe accidents)
Measures to prevent core damage (Postulate multiple failures)	
Consideration of internal flooding (newly introduced)	Reinforced or newly introduced
Consideration of natural phenomena in addition to earthquakes and tsunamis-volcanic eruptions, tornadoes and forest fires	
Fire Protection (Use of flame retardant cable. other)	
Reliability of power supply (Secure two independent lines. other)	
Function of other SSCs (Enhance communication facilities. other)	
Seismic/tsunami resistance (Setting of lake bank. other)	Reinforced

*SSC: Structure, Systems and Components

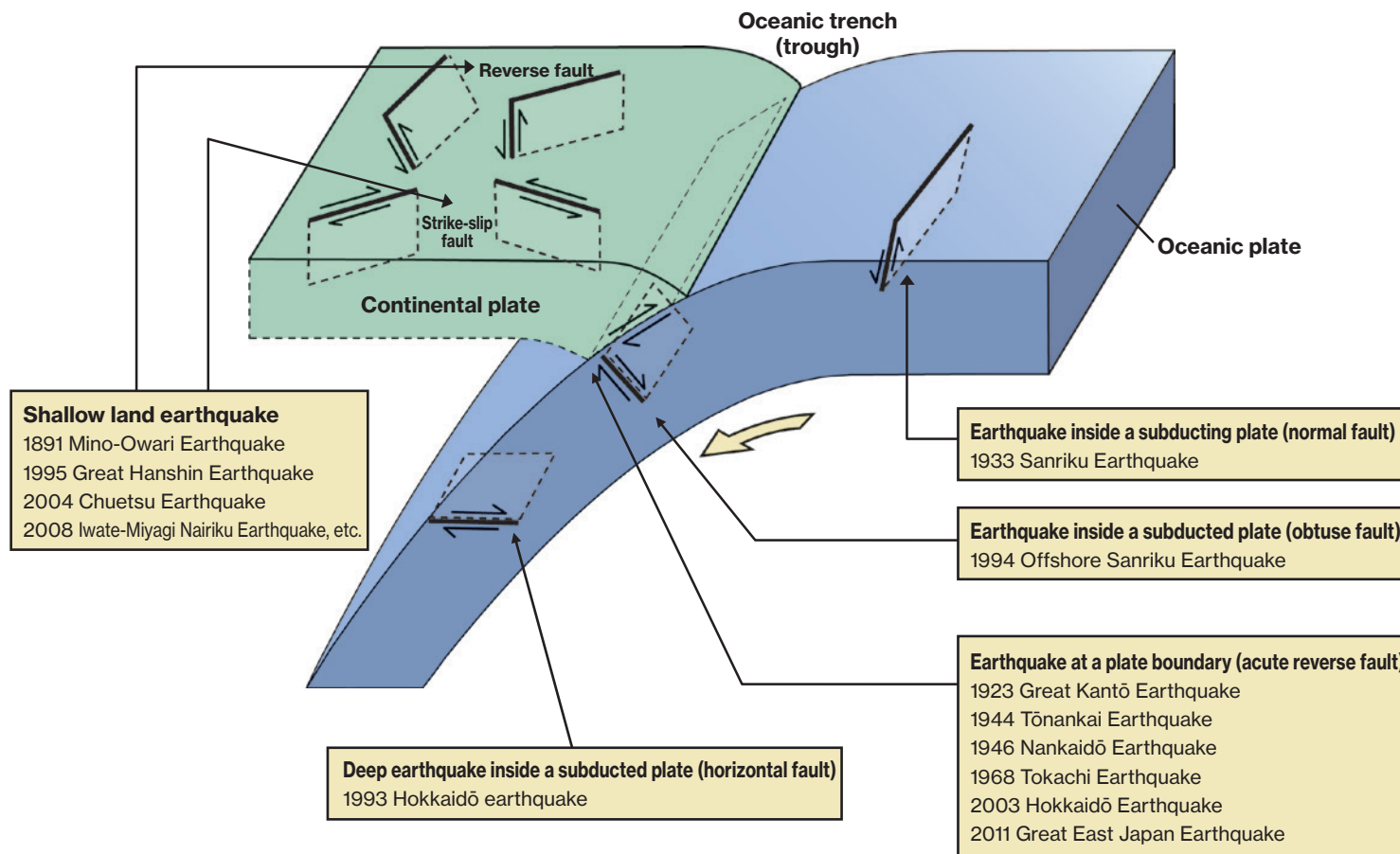
Periodic Safety Review of Nuclear Power Plant and Measures for Aging Management



Our Knowledge About Earthquakes

◎Earthquake Mechanisms

There are four tectonic plates in the area around the Japanese archipelago and each plate moves slightly over the course of many years. When they do, a great deal of pressure is brought to bear both at plate boundaries and within the plate; when plates are displaced, it generates an earthquake.



◎Scale of Earthquakes

Magnitude	Magnitude (earthquake size) is a measure of the amount of energy released by the earthquake.
Gal	Gal is a unit of measure that expresses the strength of the shaking of an earthquake numerically in terms of acceleration (cm/sec). In general, the greater the Gal number, the greater the seismic intensity.
Shindo (seismic intensity)	Shindo is the Japanese measure of the strength of shaking of the earthquake at an observation point on a decimal scale from 0 to 7. There are some 4,200 observation points across Japan monitored by the Japan Meteorological Agency.

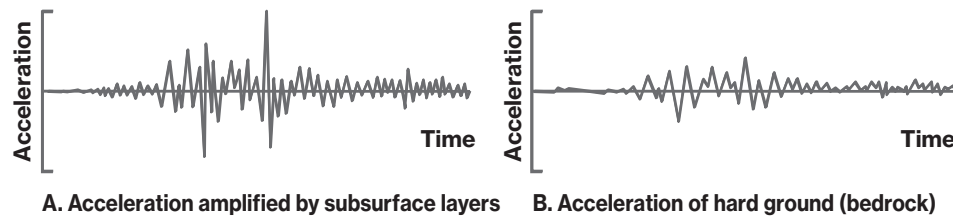
The 2011 Great East Japan Earthquake was a magnitude of 9.0 and the fault stretched some 450km long by 200km wide.

◎Active Faults

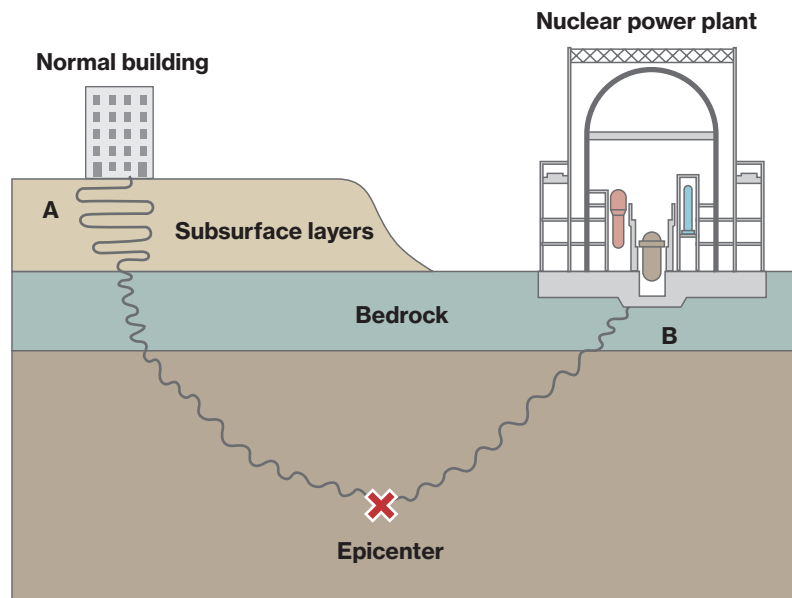
This refers to a fault that has been active repeatedly in recent geological history and may be active again in the future.

Differences in Vibrations between a Nuclear Power Plant and a Normal Building

How vibrations are transmitted from a nuclear power plant built on solid ground (bedrock) and a normal building

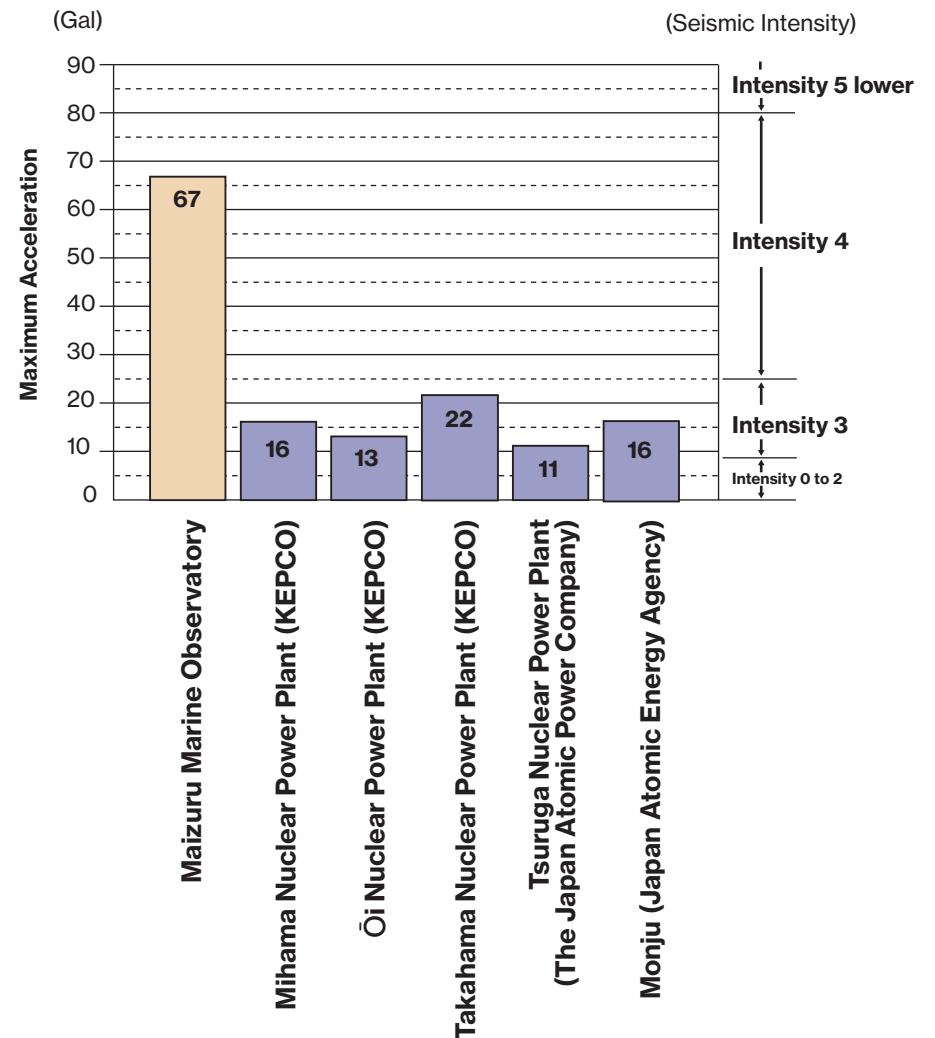


(Note) The seismic waveform is a schematic diagram.

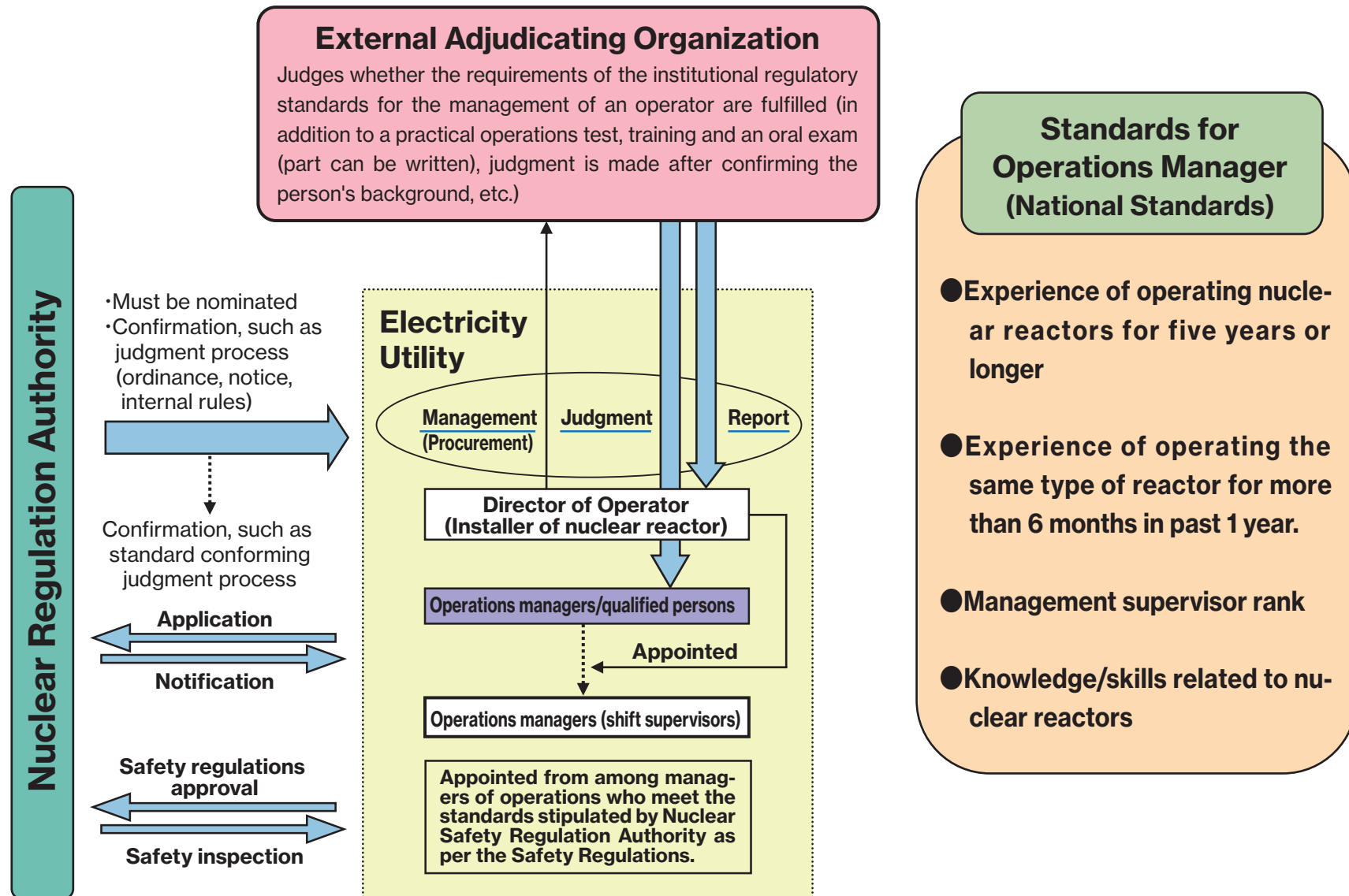


Vibration of hard ground (bedrock) is 1/3 to 1/2 that of subsurface layers.

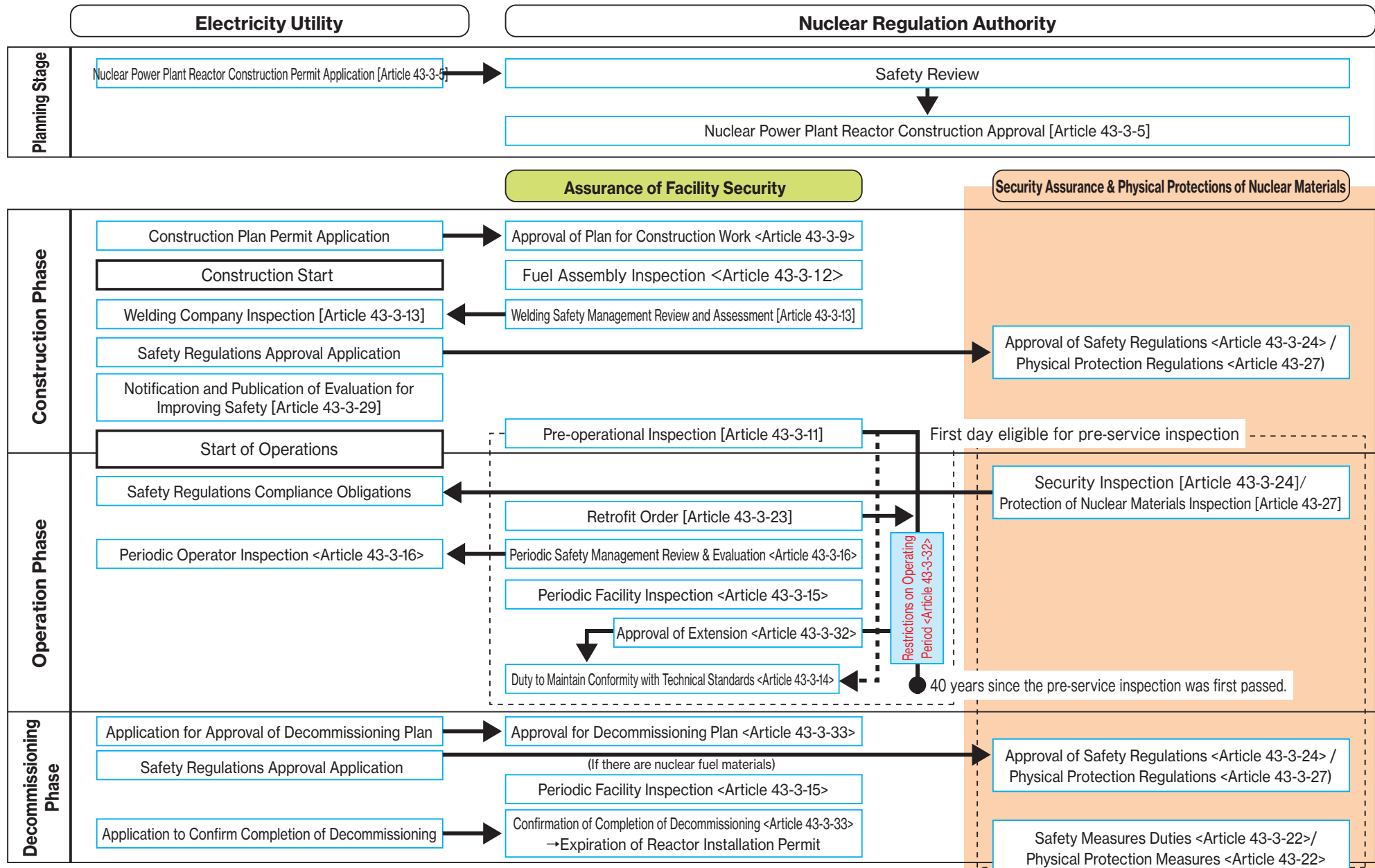
Maximum accelerations observed around Wakasa Bay during the 1995 Great Hanshin Earthquake



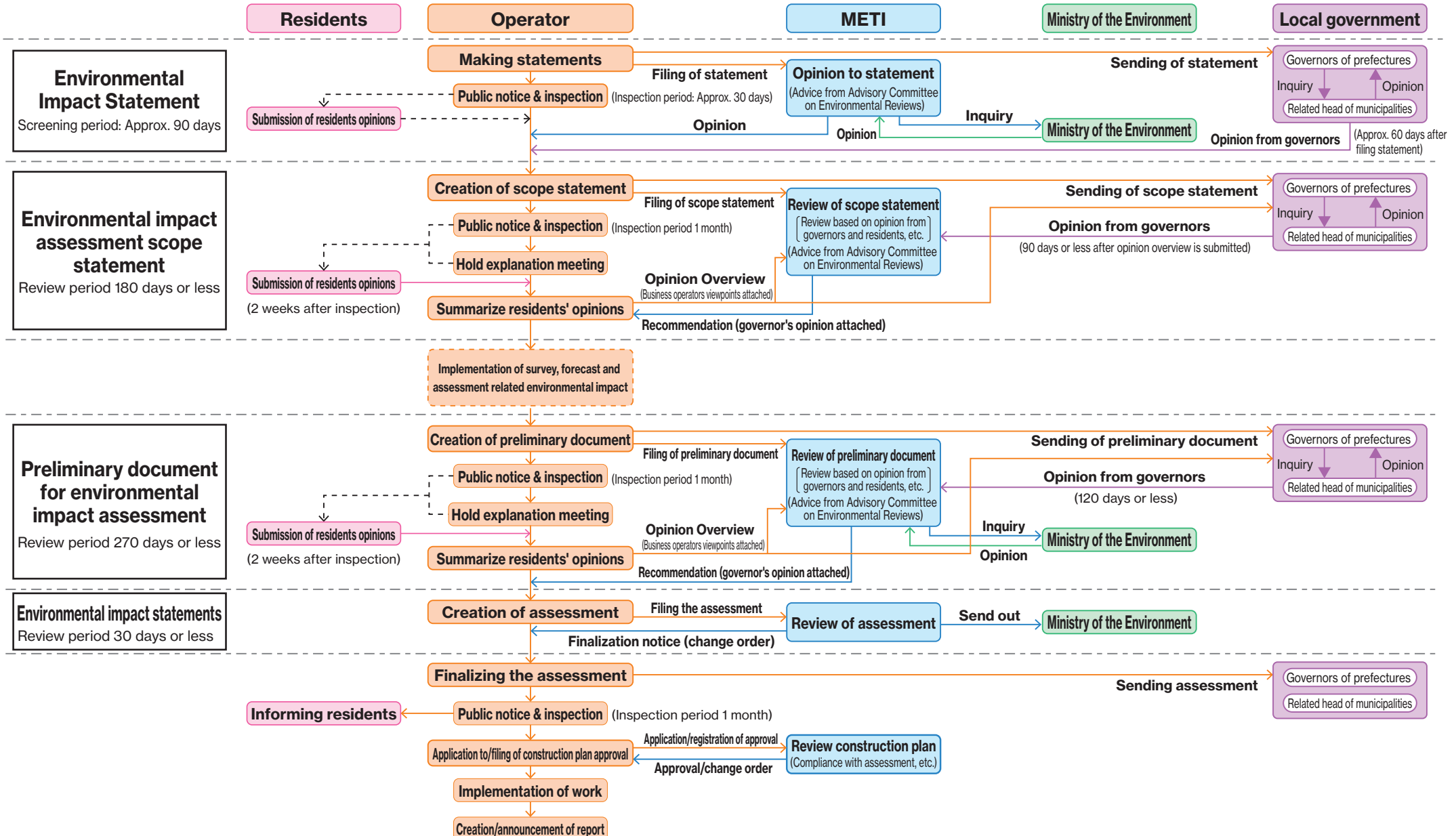
Appointment of Operations Manager



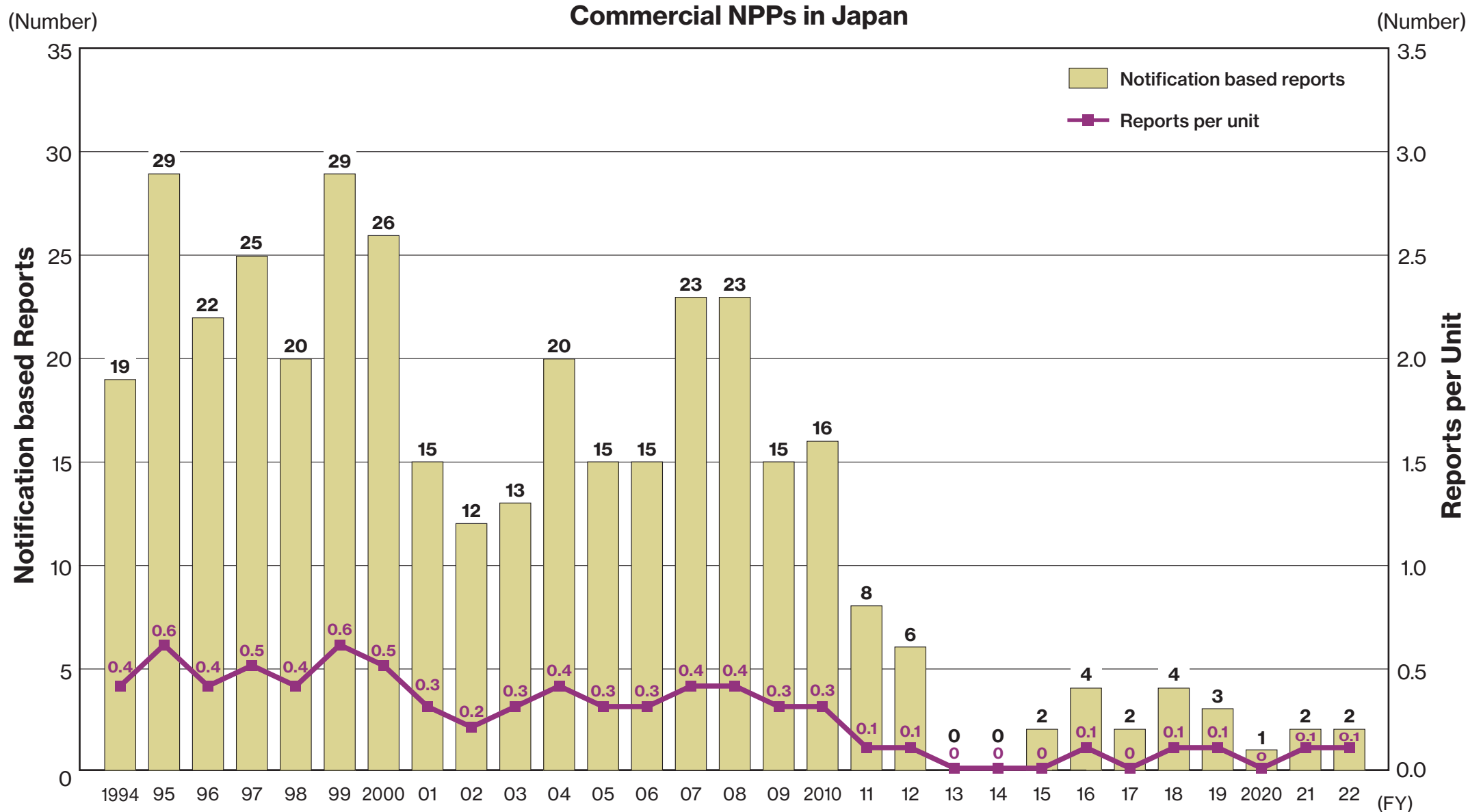
Regulatory Flow for Commercial Nuclear Power Plant



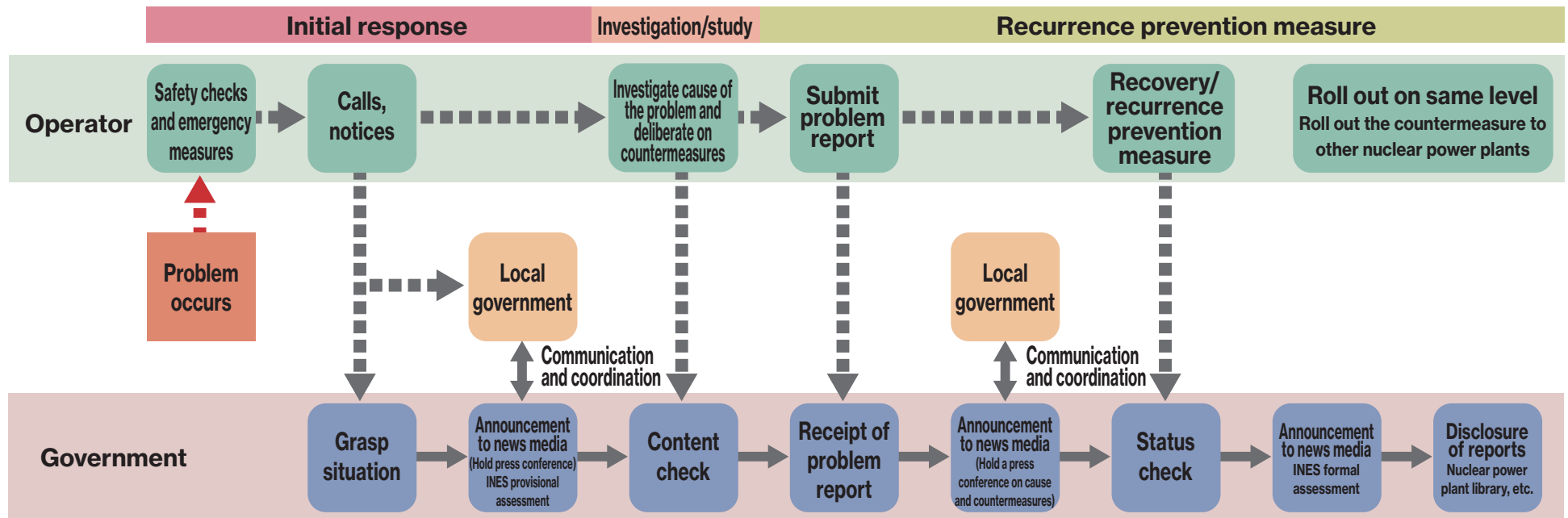
Environmental Assessment System Leading Up to Construction of Power Station



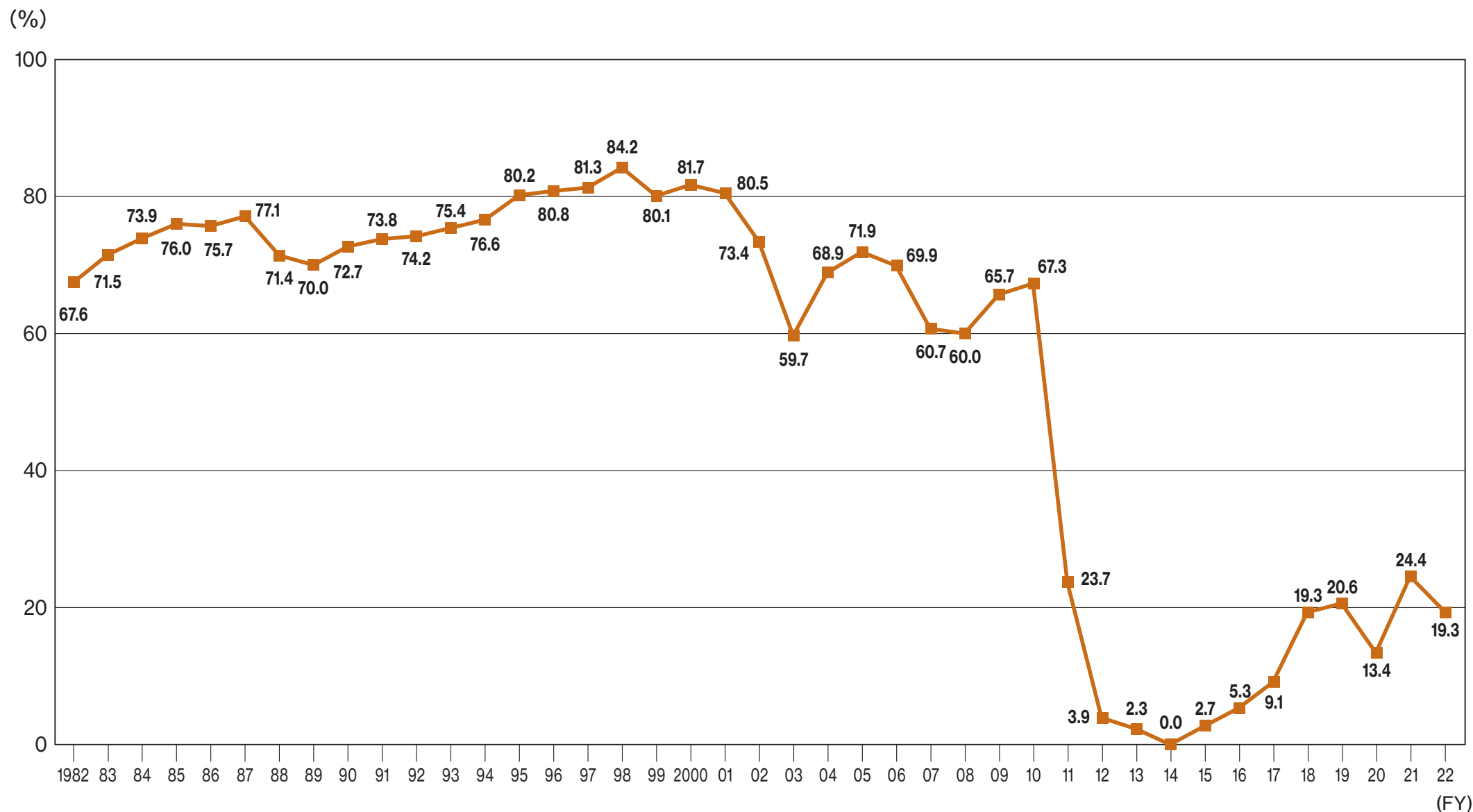
Historical Trends in Reported Incidents and Failures at NPPs in Japan



Troubleshooting

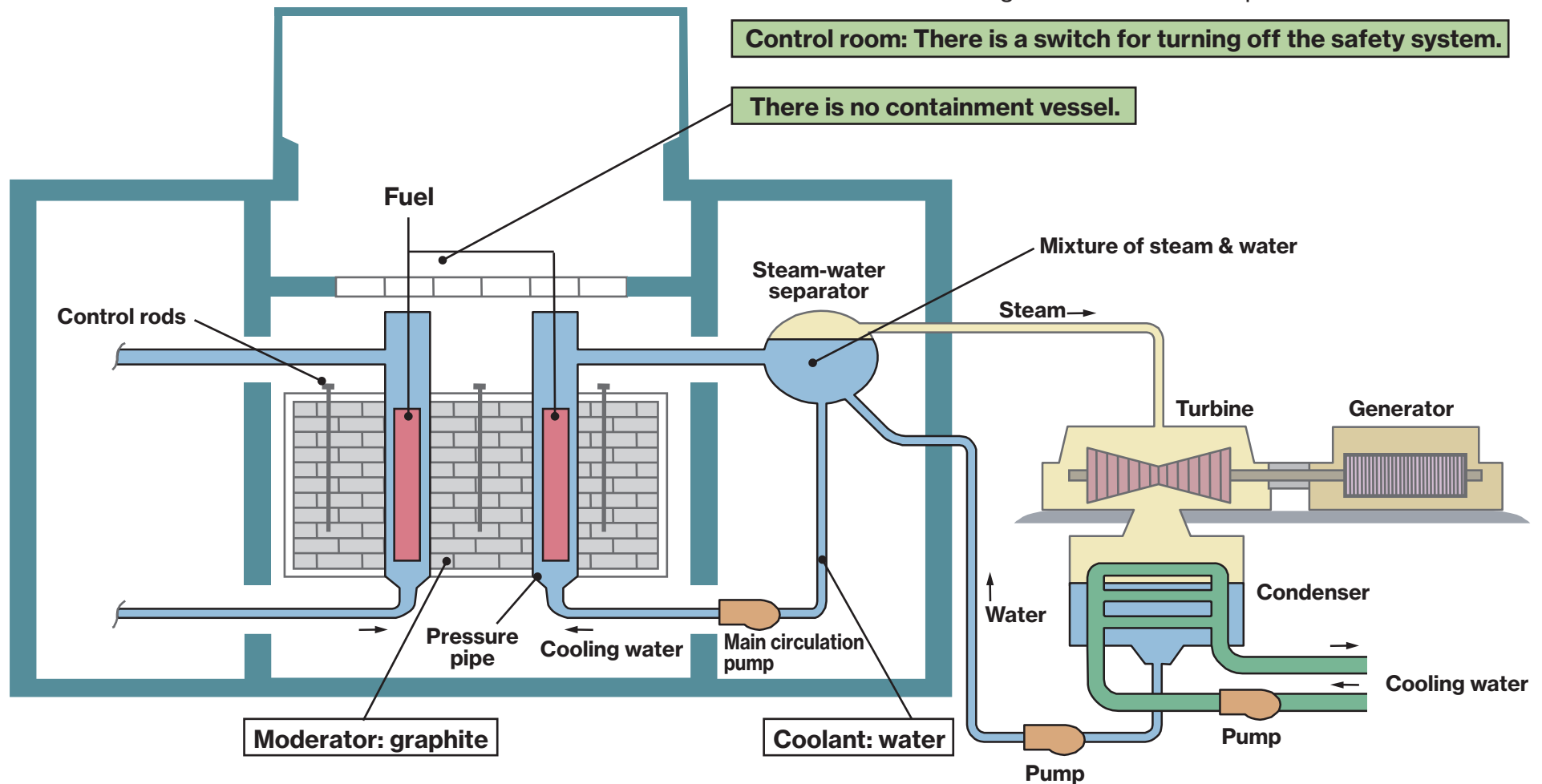


Equipment Utilization Rate of Nuclear Power Plant



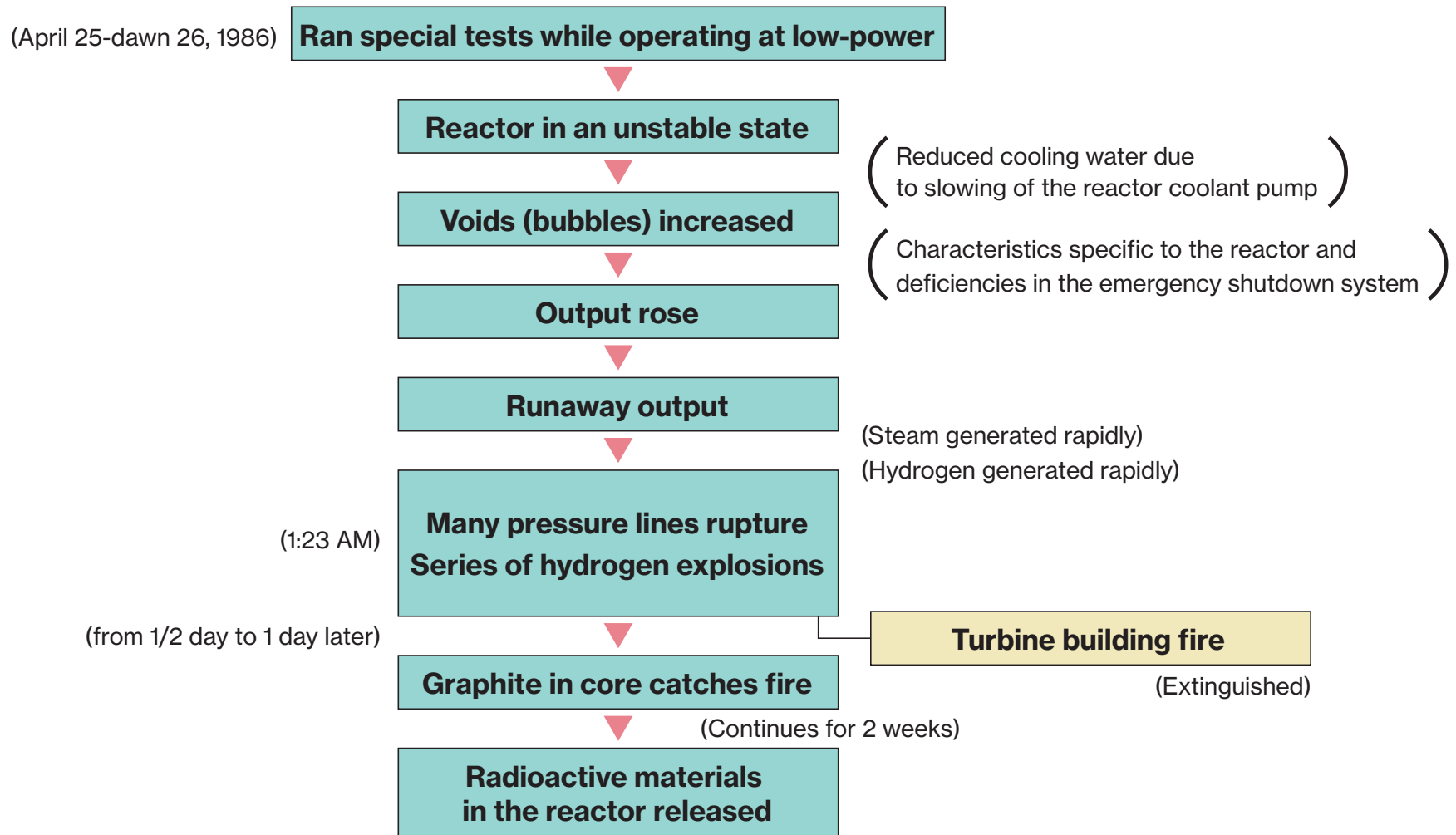
Structure of the Chernobyl Nuclear Power Plant

(Light Water Cooled Graphite-Moderated Reactor RBMK)



	Japanese Reactor	Chernobyl Reactor
Self-Limiting Function	Yes	May cease to work
Coolant	Water	Water
Neutron moderator	Water	Graphite
Safety Equipment	Interlock prevents dangerous operations	Easily defeated
Robust containment vessel covering the reactor core	Yes	No

Course of Events of the Chernobyl Nuclear Accident



Causes of the Accident at Chernobyl Nuclear Power Plant

Lack of Safety Culture

Design Defects

- No containment vessel
- Designed to easily turn off safety equipment
- Positive void coefficient; during low power operation, the more voids (froths) in cooling water, the more output, etc.

Operator Regulation Violation

- Withdrew control rods more than regulated
- Operated with Emergency Core Cooling System (ECCS) turned off
- Conducted a special test at lower power than planned

Continuous operation was prohibited due to instability at low power range (less than 20% of total output), etc.

Operational Mismanagement

- Managed by a non-reactor-specialist
- A special test was conducted without due processes or approval throughout the power plant
- Inadequate examinations on safety measures, etc.

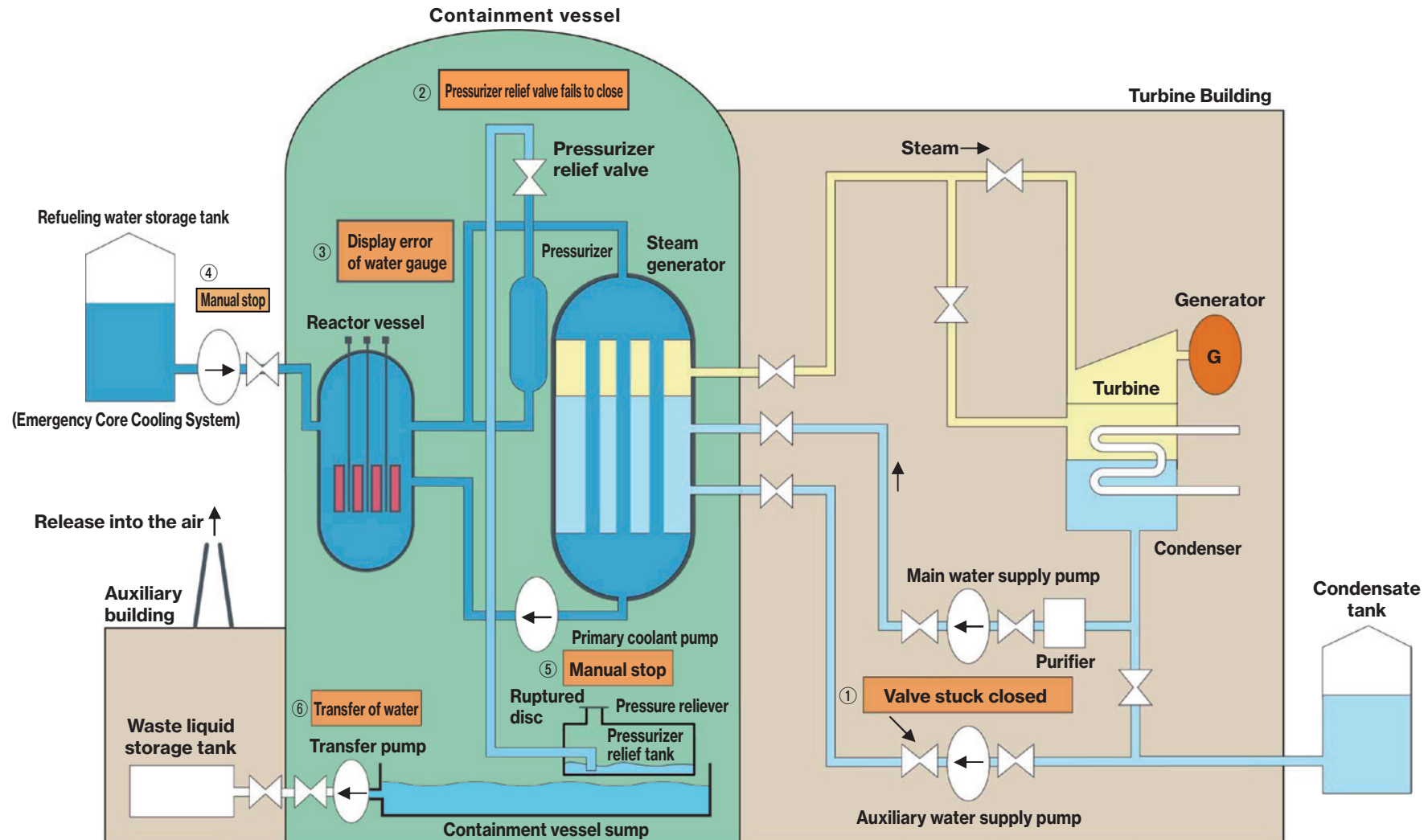
Overview of the Three Mile Island Nuclear Accident

○ Main Events in the accident

On March 28, 1979, the main feedwater pump stopped in reactor 2 of the Three Mile Island (TMI) nuclear power plant in Pennsylvania in the United States. Although the auxiliary feedwater pump started up automatically, the secondary cooling water failed to circulate due to a closed pump outlet valve; in addition, an operator misunderstood the Emergency Core Cooling System (ECCS) and manually stopped it. The result of equipment failure and operator error caused a partial meltdown of structures inside the reactor.

○ Impact on the environment

The dose of radiation received by the public in the area was a maximum of 1 mSv and an average of 0.01 mSv, which is an extremely low level in terms of impact to health.



Overview of Accident at Mihama Nuclear Power Plant, Unit 2

○ Overview of the accident

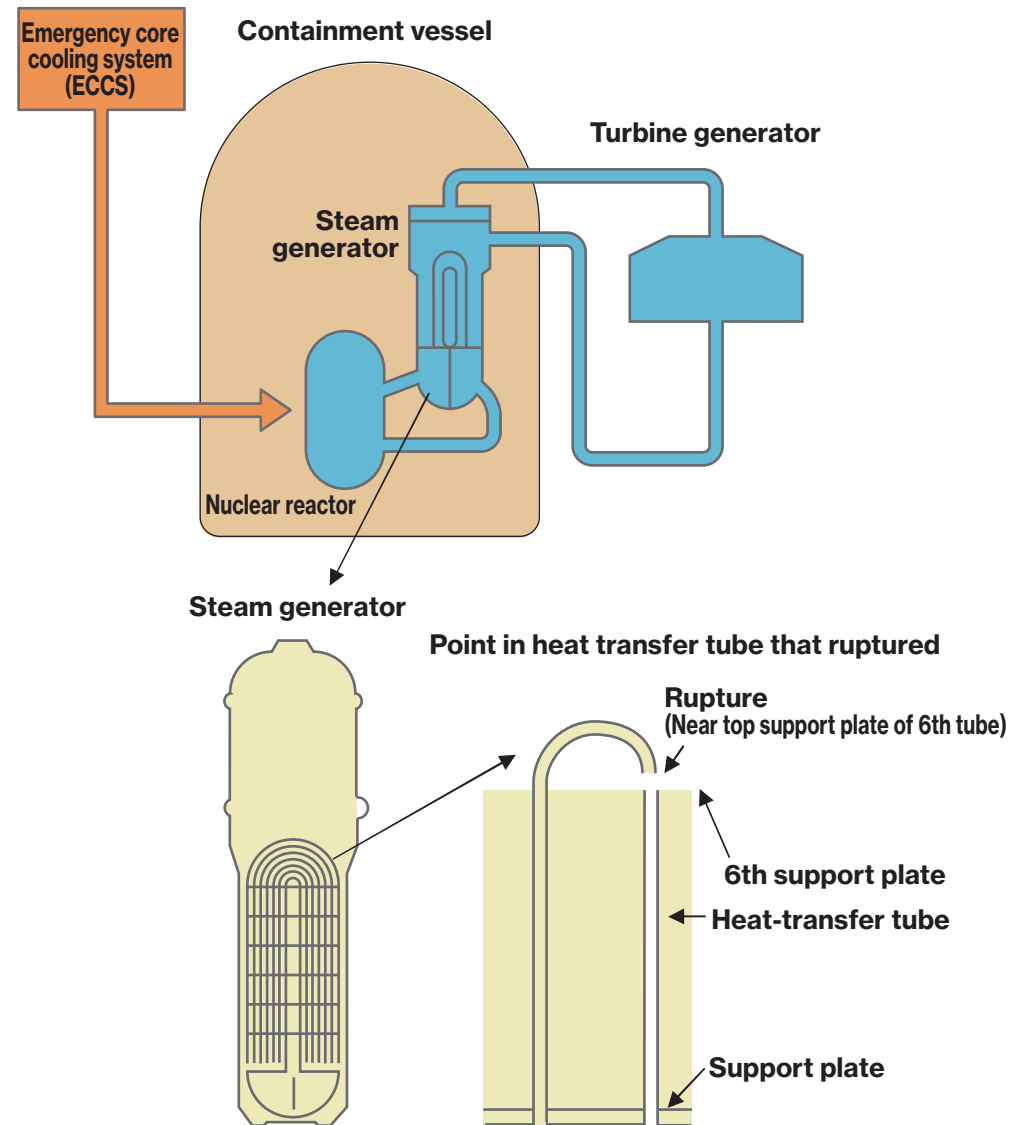
On February 9th, 1991, one heat-transfer tube on Unit 2 of Kansai Electric Power's Mihama Nuclear Power Plant ruptured, initiating automatic shutdown of the reactor and activating the Emergency Core Cooling System (ECCS).

The results of the ensuing investigation showed that a fixture designed to suppress vibration to the heat-transfer tube had not been inserted as far it was designed to be, resulting in abnormal vibrations of the tube.

As a result, it was found that this high cycle fatigue (force repeated over 100,000 times) led to the material not being able to withstand the force, and the pipe rupturing.

○ Impact on the environment

Although this was the first time in Japan that an emergency core cooling system (ECCS) had been activated due to spillage of primary coolant, the amount of radioactive materials released in the event was negligible and no impacts on the environment were observed.



Overview of Accident in Secondary Piping at Mihama Nuclear Power Plant, Unit 3

○ Overview of the accident

On August 9th, 2004, an accident occurred in Unit 3 of the Mihama Nuclear Power Plant owned by Kansai Electric Power Co., in which pipes in the secondary system ruptured.

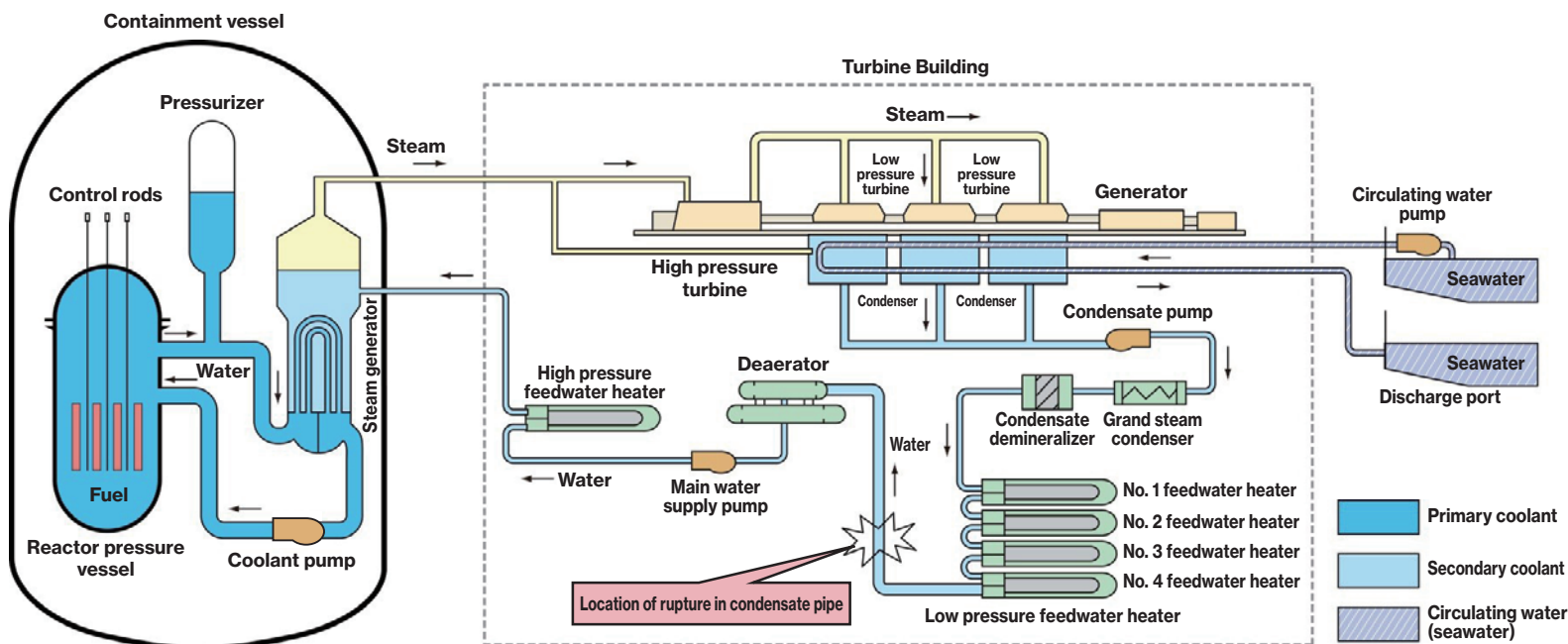
At the time of the accident, contracted workers were inside the building that housed the turbines of the Mihama 3 reactor preparing for the 21st periodic inspection that was scheduled to start from the 14th of August.

With the workers inside, a condensate pipe ruptured near the ceiling on the 2nd floor inside the building housing the turbine, causing hot water at 140°C and 9 atmospheres of pressure to blast out as steam.

Operators who were in the building for inspections immediately found victims who had passed out in front of the elevator on the 2nd floor of the turbine building.

Although the 11 victims of the contracted company were transported to a hospital, 5 died and the other 6 were seriously injured.

However, the accident in the secondary and main cooling systems did not affect the public or nearby workers with radioactive materials.

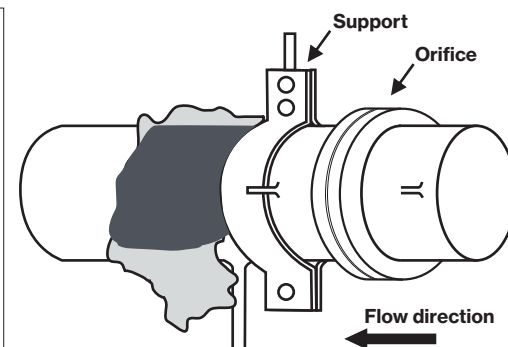
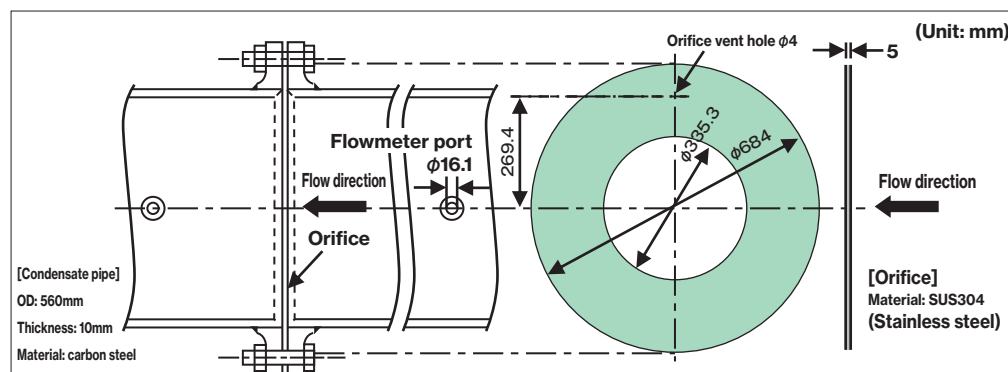


○ Cause of the accident

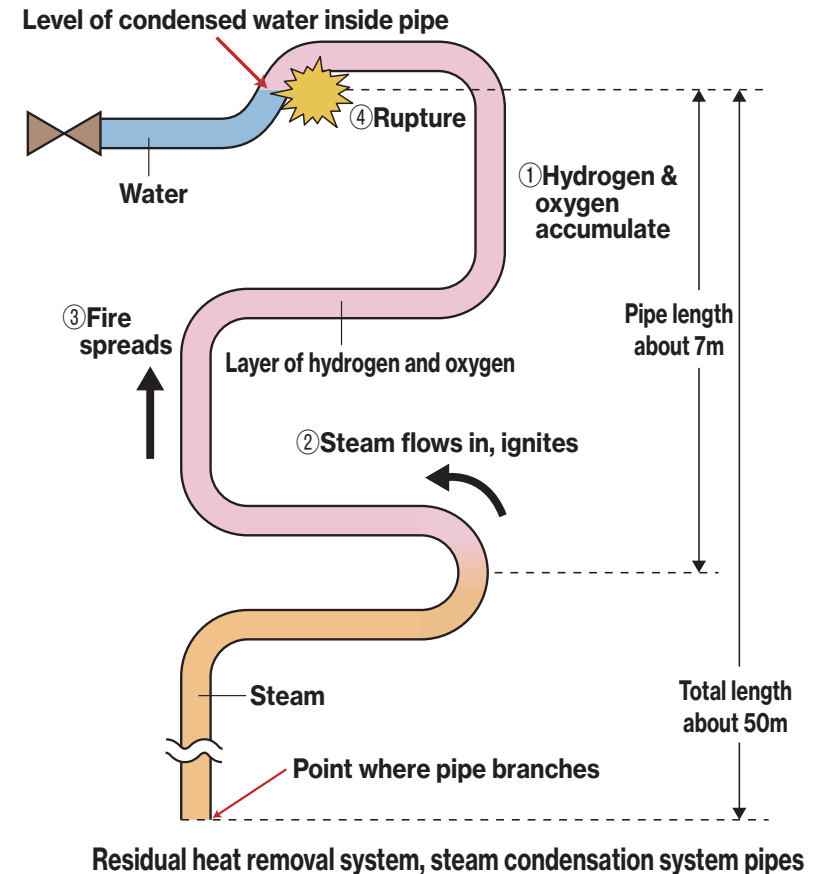
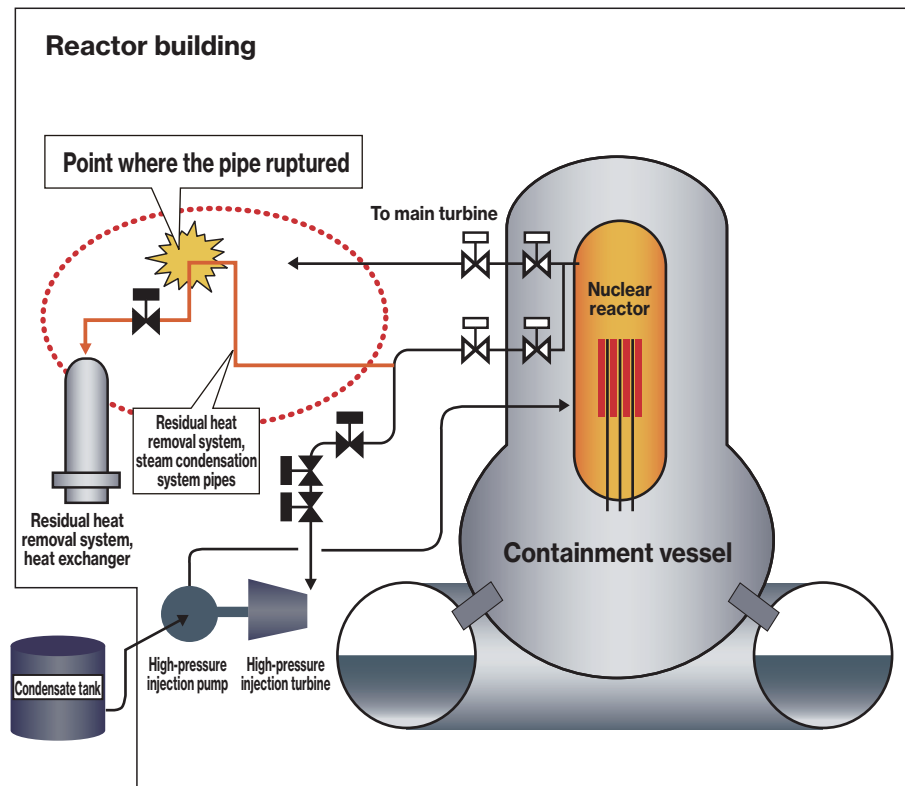
A large rupture was found downstream of an orifice (flowmeter) for measuring condensate pipe water flow.

The investigation found that turbulence was likely to occur at points downstream of the orifice and an internal inspection of the part that ruptured found that the so-called erosion-corrosion process had gradually reduced the thickness of the pipe, thus weakening it to the extent that it ruptured due to the load during operation at the time.

Management guidelines were established in 1990 for the wear of secondary piping in PWR, and from that time parts of pipes that were anticipated to be corroded had been measured according to plan. However, the part of the pipe that ruptured (A line) was from the very beginning supposed to be measured, but it had been missed and the thickness of the pipe had never been measured at the time of the accident.



Overview of Pipe Rupture in the Accident at Hamaoka Nuclear Power Plant, Unit 1



○ Overview of the accident

During a manual inspection at 5:02pm on November 7, 2001 of the high-pressure injections system of reactor 1 at the Chubu Electric Power Co., Inc., Hamaoka Nuclear Power Plant, a condensed steam pipe in the residual heat removal system ruptured.

○ Cause of the accident

- ① Steam condenses in the upper part of the pipe. A high concentration of hydrogen and oxygen accumulated at a point about 7m from the surface of the water.
- ② During the manual inspection of the high-pressure injection system, the change in pressure caused super-hot steam to flow into the layer of hydrogen and oxygen, igniting it. Precious metals may have acted as a catalyst.
- ③ Once ignited, the flame spread into the layer of hydrogen and oxygen (combustion state: deflagration → detonation)
- ④ The pressure inside the pipe rose precipitously, rupturing an elbow near the surface of the water (about 3,000 atmospheres of pressure). Other parts of the pipe were deformed.

Overview of the Sodium Leak Accident at the Prototype Fast Breeder Reactor

○ Overview of the accident

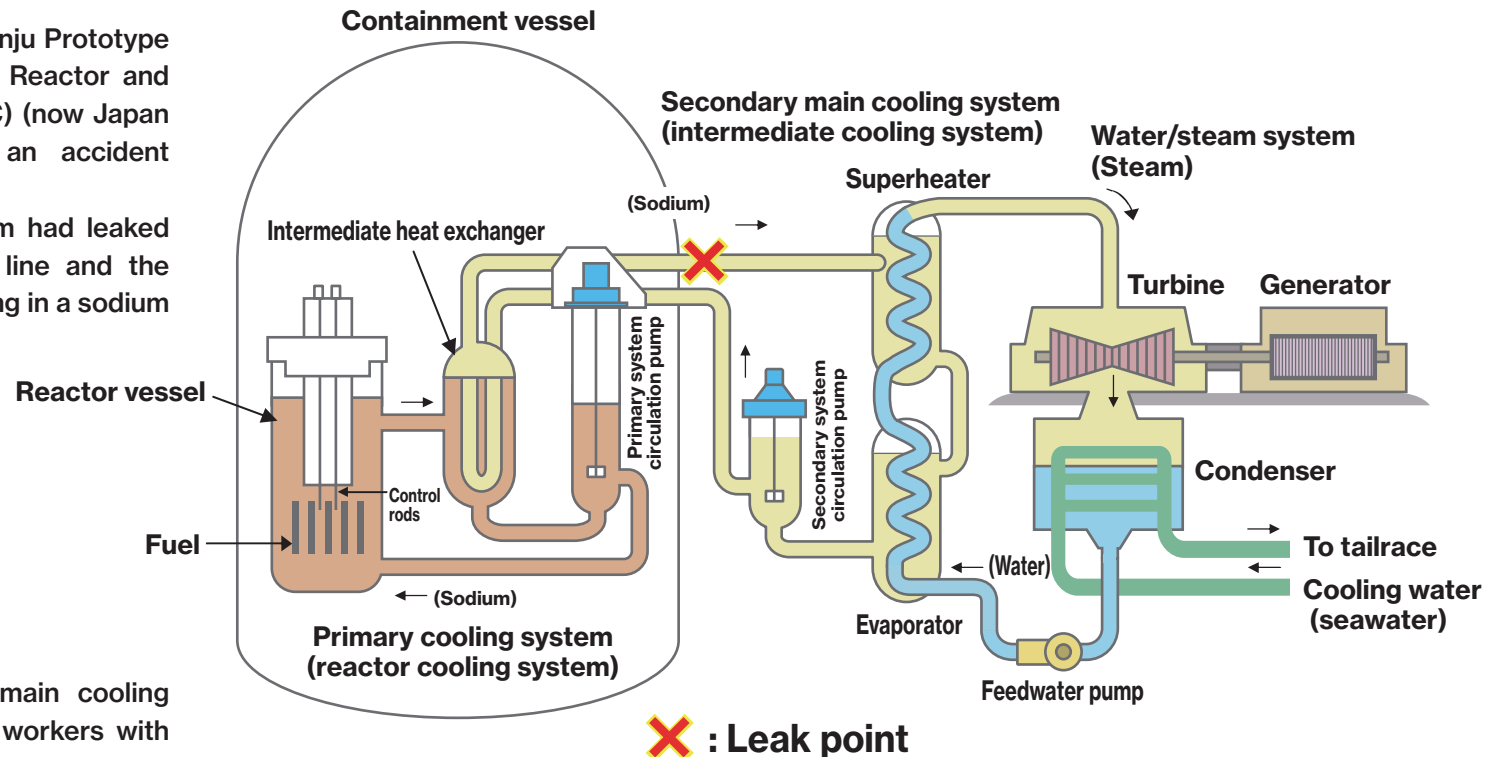
On December 8, 1995, while bringing the Monju Prototype Fast Breeder Reactor of the former Power Reactor and Nuclear Fuel Development Corporation (PNC) (now Japan Atomic Energy Agency) into operation, an accident occurred, resulting in a sodium leak.

The ensuing investigation found that sodium had leaked from a temperature gauge in the sodium line and the sodium reacted with oxygen in the air, resulting in a sodium fire.

○ Impact of the accident

However, the accident in the secondary main cooling system did not affect the public or nearby workers with radioactive materials. The nuclear reactor also shut down safely and the reactor core was unaffected.

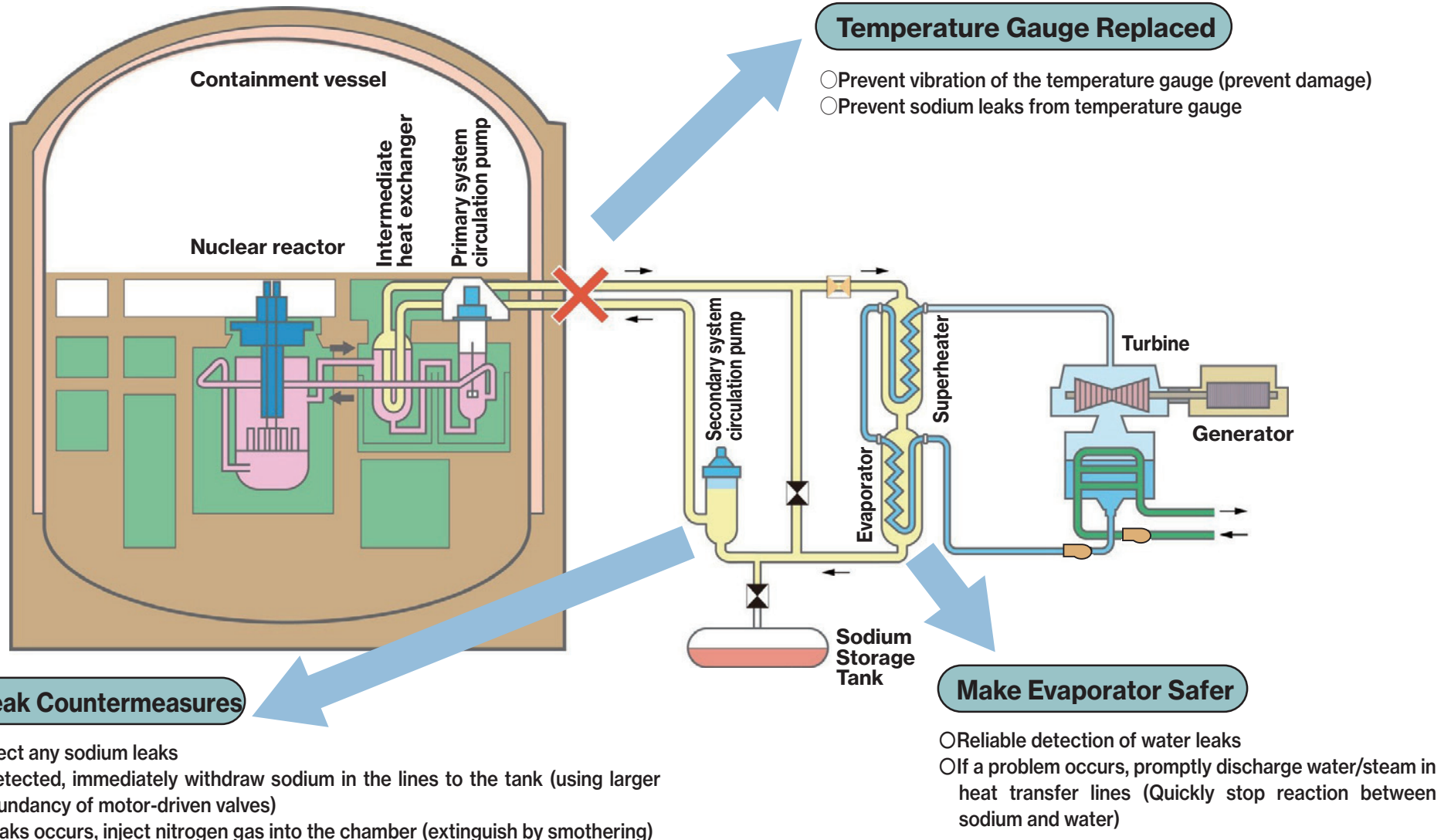
However, sodium did leak and the sodium fire did in fact broaden the impact. And because the operator, PNC at the time, clearly mishandled informing the public, it made many people, especially those living in the region, worry and mistrustful.



Overview of Modifications to the Monju Prototype Fast Breeder Reactor

Purposes of Modifications

1. Prevent any sodium leaks
2. If a leak occurs, detect it promptly and prevent spread of problems



Overview of the Criticality Accident at the JCO Uranium Processing Plant

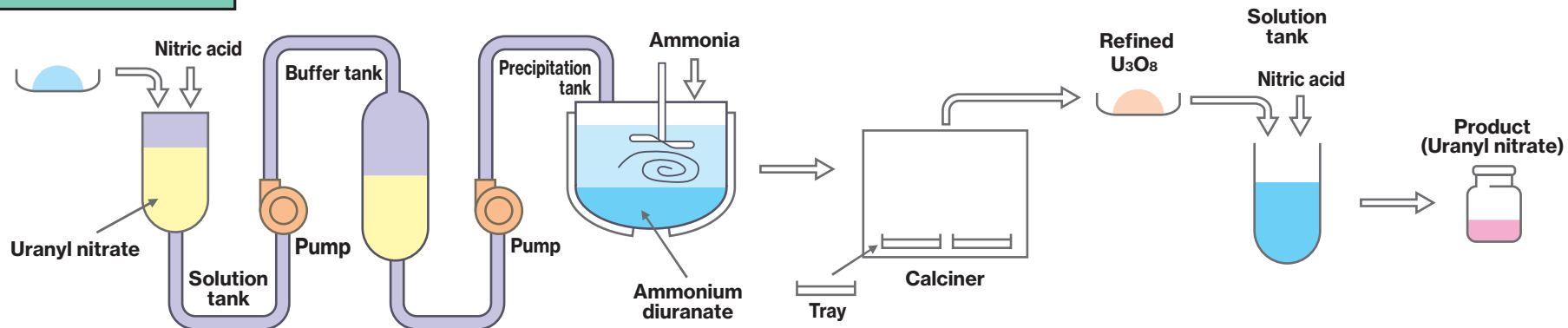
○ Overview of the accident

On September 30, 1999, while equalizing a solution of enriched uranium at the JCO uranium processing plant, workers poured a solution containing uranium into a settling tank not designed for that purpose beyond its critical mass, initiating a criticality accident. They were acting in accordance with an illegal company manual. The critical state continued for some 20 hours and resulted in the 2 workers dying.

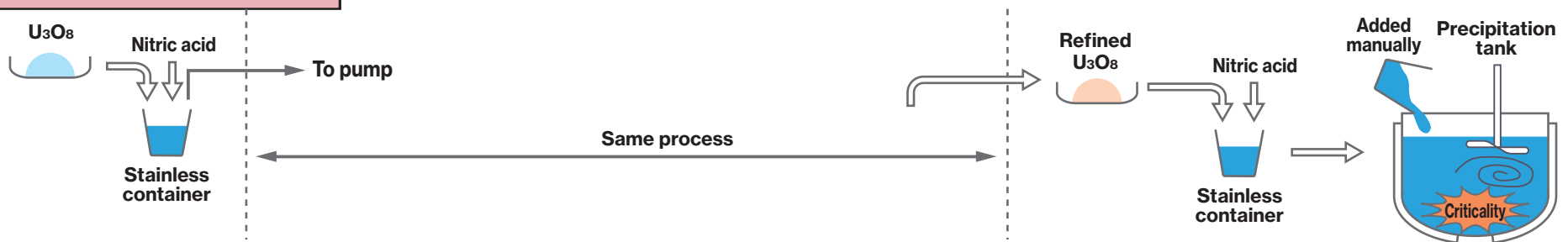
○ Impact on residents

In addition to the radiation emitted to the environs during the criticality period, a small amount of radioactive gas was also released into the air and some 319 people were estimated to have received a dose of radiation exceeding 1 mSv, the annual effective dose limit for the general public; those exposed include workers, disaster responders and the residents of the surrounding area (130 residents).

Authorized Procedure



Procedure Used in the Accident



International Nuclear Event Scale (INES)

	Level	Standards			Reference cases (includes material that has not been officially assessed via INES)
		Standard 1: People & Environment	Standard 2: Radiological Barrier & Control	Standard 3: Defense in Depth	
Accident	7 (Major Accident)	· Major release of radioactive material with widespread health and environmental effects.			· Chernobyl nuclear accident (1986) in former Soviet Union ----- Tentative Assessment · Fukushima Daiichi nuclear accident resulting from the Tohoku earthquake (2011)
	6 (Serious Accident)	· Significant release of radioactive material			
	5 (Accident with Wider Consequences)	· Limited emission of radioactive material · Several deaths from radiation	· Severe damage to reactor core · Release of large quantities of radioactive material within an installation with a high probability of significant public exposure		· Three Mile Island nuclear accident, U.S. (1979)
	4 (Accident with Local Consequences)	· Minor release of radioactive material · At least one death from radiation	· Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory · Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure		· JCO criticality accident (1999)
Incident	3 (Serious Incident)	· Exposure in excess of ten times the statutory annual limit for workers · Non-lethal deterministic health effect from radiation	· Exposure rates of more than 1 Sv/h* in an operating area. · Severe contamination in an area not expected by design, with a low probability of significant public exposure	· Near-accident at a nuclear power plant with no safety provisions remaining · Lost or stolen highly radioactive sealed source	
	2 (Incident)	· Exposure of a member of the public in excess of 10 mSv · Exposure of a worker in excess of the statutory annual limits	· Radiation levels in an operating area of more than 50 mSv/h · Significant contamination within the facility into an area not expected by design	· Significant failures in safety provisions but with no actual consequences	· Mihama Power Plant, Unit 2 Steam generator heat-transfer tube rupture accident (1991) · Radiation exposure accident of workers in the Plutonium Fuel Research Facility (PFRF) of the Oarai Research & Development Center (2017)
	1 (Anomaly)			· Overexposure of a member of the public in excess of statutory annual limits · Low activity radioactive source lost or stolen	· Monju sodium leak accident (1995) · Primary coolant leak at the Tsuruga Power Station Unit 2 (1999) · Hamaoka Nuclear Power Plant, Unit 1 residual heat removal system rupture accident (2001) · Mihama Nuclear Power Plant, Unit 3 secondary system pipe rupture accident (2004)
Below scale	0 (Deviation)	No safety significance		0+ Event with safety significance	
				0- Event with no safety significance	
Not Subject to Evaluation		Event unrelated to Safety			

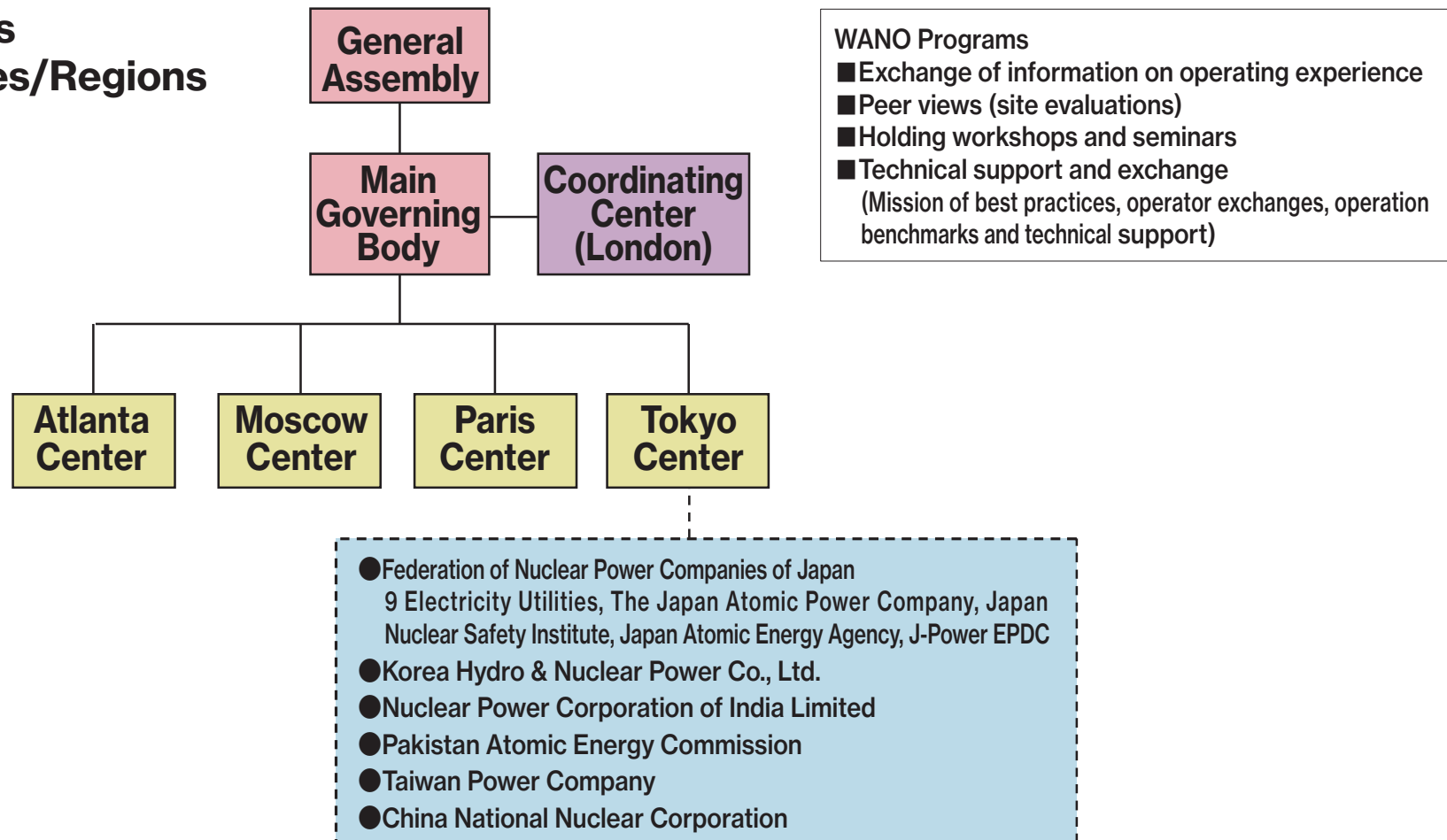
*Sievert (Sv): Unit representing the effect of radiation on the body. (1 mSv= 1/1,000 Sv)

World Association of Nuclear Operators (WANO)

WANO is a private organization comprised of members who are companies in the nuclear power industry.

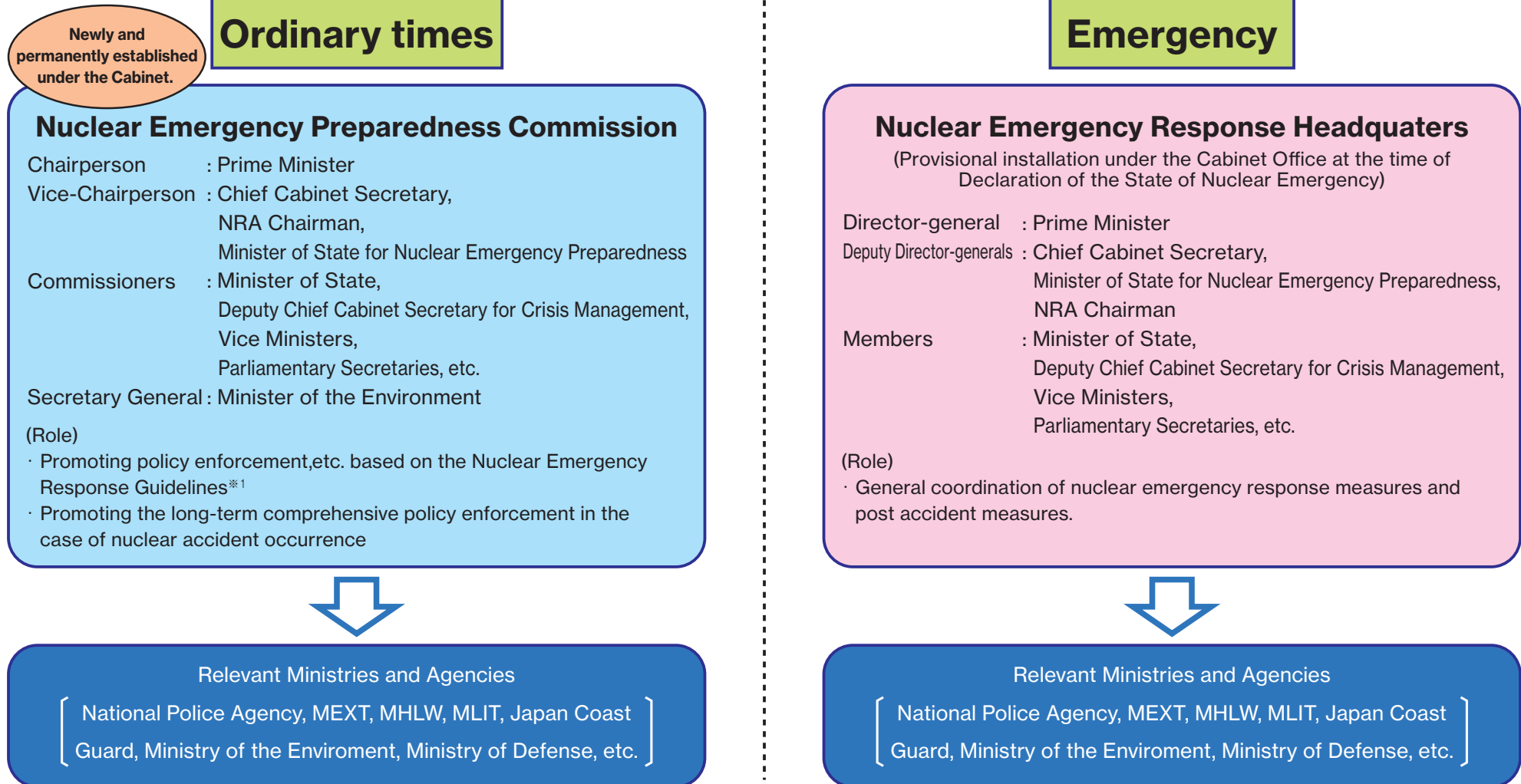
WANO aims to maximize the safety and reliability of nuclear power plants worldwide by working together to assess, benchmark and improve performance through mutual support, exchange of information and emulation of best practice (established May 1989).

Participants 32 Countries/Regions



Enhancement of the Nuclear Emergency Preparedness System

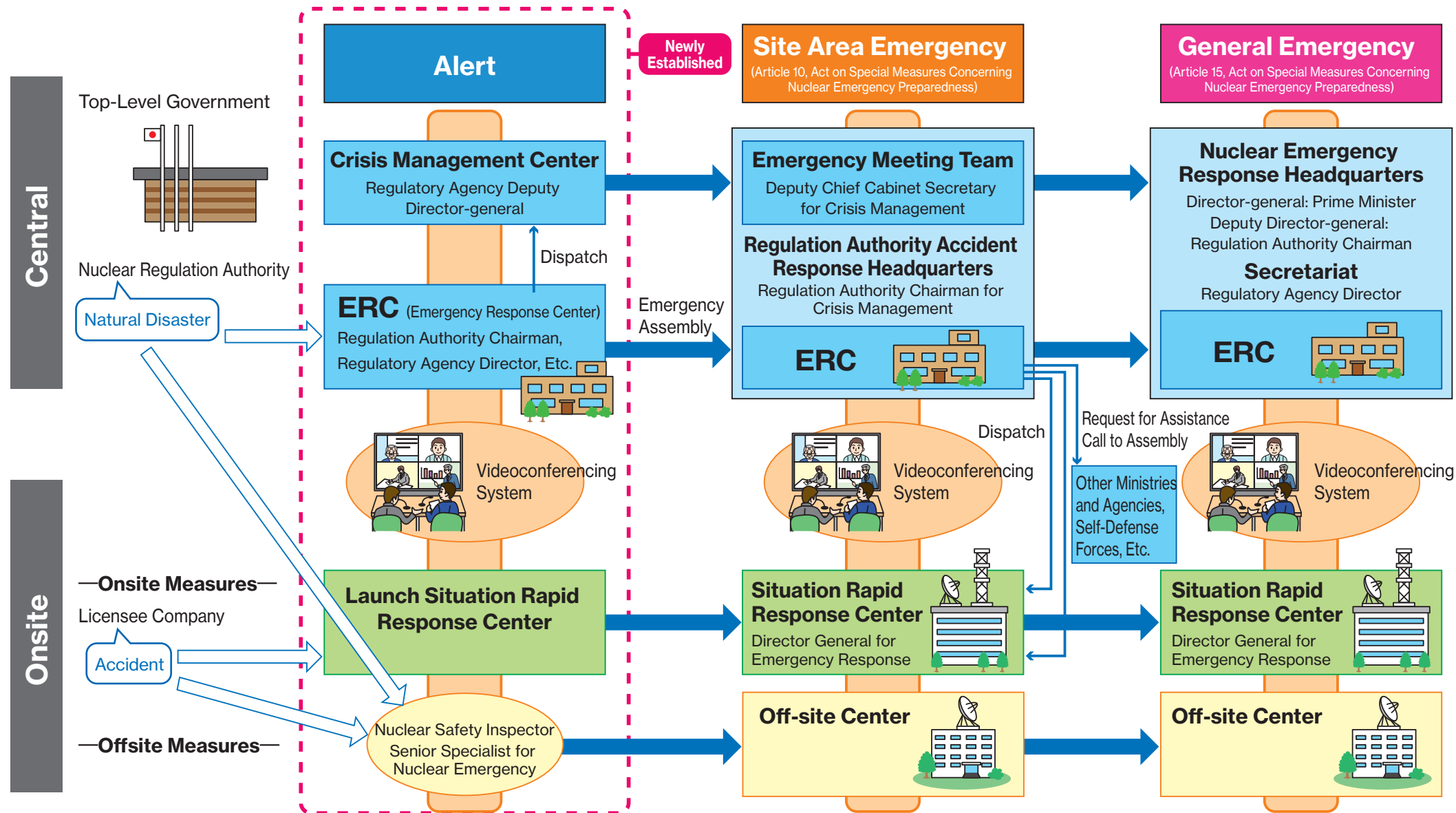
As a precaution against emergencies, a new Nuclear Emergency Preparedness Commission (NEPC) will be permanently established under the Cabinet to promote nuclear emergency preparedness measures throughout the government during normal times.



※ These are guidelines prepared by the Nuclear Regulation Authority for nuclear operators and local governments, etc. to ensure smooth implementation of nuclear emergency preparedness measures, emergency response measures, and measures for restoration from a nuclear emergency.

Clarification of Nuclear Emergency Categories (3 Stages)

Operational Chart – From Alert to General Emergency



Expansion of Nuclear Emergency Response Action Zone

Approx. 5 km Radius

PAZ

(Precautionary Action Zone)

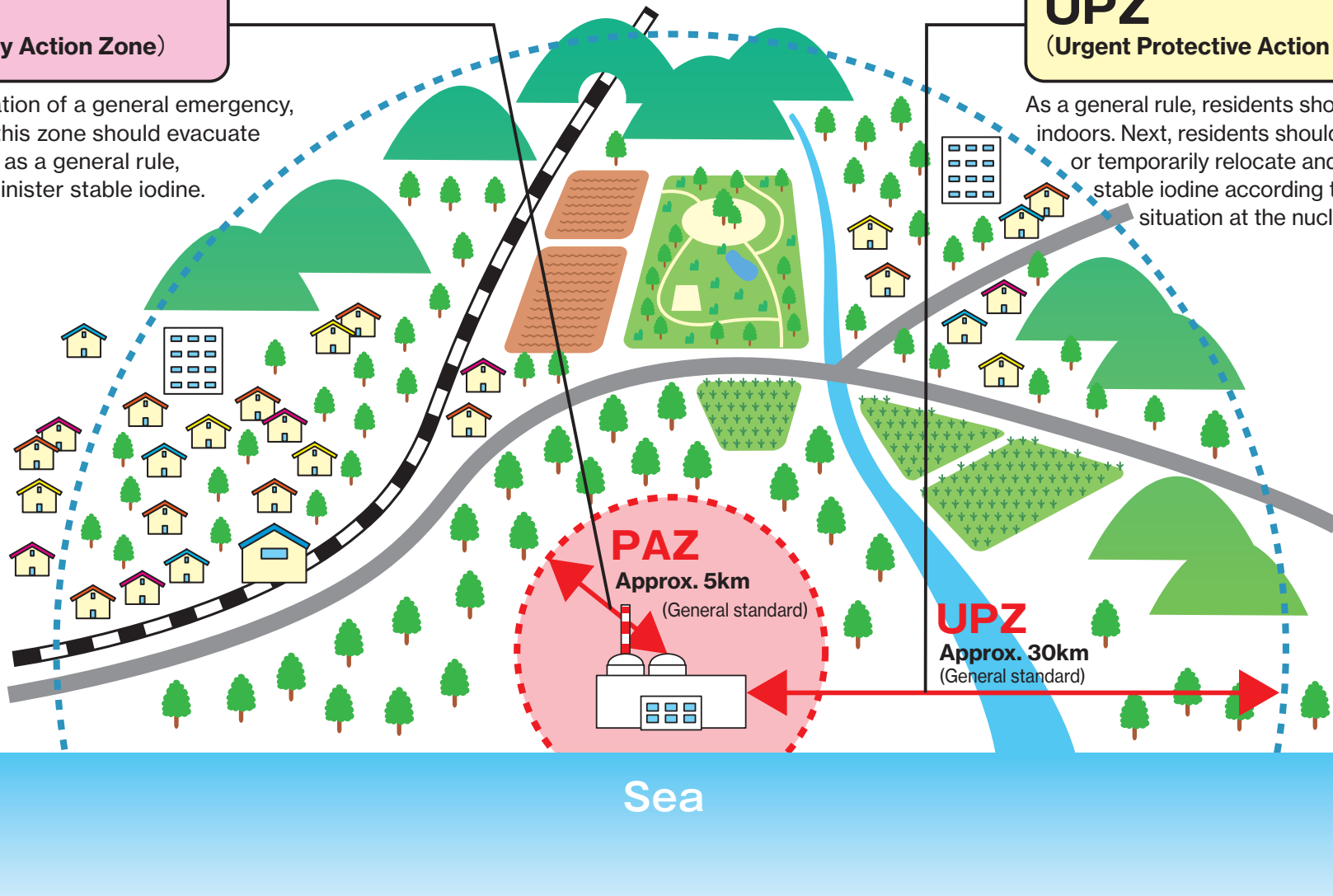
Upon the declaration of a general emergency, residents within this zone should evacuate immediately and, as a general rule, should each administer stable iodine.

Approx. 30 km Radius

UPZ

(Urgent Protective Action Planning Zone)

As a general rule, residents should first take shelter indoors. Next, residents should prepare to evacuate or temporarily relocate and also to administer stable iodine according to the developing situation at the nuclear power plant.



Radiation Protection for Residents

Extent of Emergency	PAZ (–5 km)	UPZ (5–30 km)	30– km
According to the situation at the facility, the nuclear power plant operator reports the emergency category to both the national government and local authorities.	<ul style="list-style-type: none"> Local authorities will prepare and implement necessary evacuations in response to instructions or orders from the national government. Either the national government or local authorities may issue instructions to residents to prepare and administer stable iodine. 		
Alert (EAL1*) (Ex.) Occurrence of large tsunamis, earthquakes with seismic intensity of 6 or higher, etc. Newly Established	<ul style="list-style-type: none"> Preparations for evacuation of persons requiring support. (those who are ill or injured, the elderly, physically challenged persons, infants, expectant and nursing mothers, etc.) 		<ul style="list-style-type: none"> Assistance with preparations for the evacuation of persons requiring support.
Site Area Emergency (EAL2*) (Ex.) Station Blackout over 30 minutes beyond, etc.	<ul style="list-style-type: none"> Evacuation of persons requiring support. Preparations for general evacuation. Preparations for administration of stable iodine. 	<ul style="list-style-type: none"> Preparations for indoor sheltering. Start of emergency monitoring by national government, local authorities and nuclear power plant operator.	<ul style="list-style-type: none"> Reception of persons requiring support. Start of emergency monitoring by national government and local authorities.
General Emergency (EAL3*) (Ex.) Station Blackout over 1 hour, etc. No Emission of Radioactive Materials	<ul style="list-style-type: none"> Administration of stable iodine. Evacuation of residents to outside the PAZ following the instructions of the national government.	<ul style="list-style-type: none"> Indoor sheltering. Preparations for administration of stable iodine. Preparations for evacuation, etc. 	<ul style="list-style-type: none"> Reception of evacuees. Assistance with evacuation, etc. Preparations for administration of stable iodine.
Emission of Radioactive Materials Outside of the Facility		Based on the results of emergency monitoring, the national government will implement necessary protective measures, such as evacuations, on the basis of air dose rates or other appropriate standards.	
		OIL*1 Air dose rate of 500 microsieverts per hour.	Evacuation
		OIL2 Air dose rate of 20 microsieverts per hour.	Temporary Relocation
		OIL6, etc. Radioactive iodine in drinking water. 300 becquerels/kg, etc.	Restrictions on the intake of local produce, etc.
			Screening of food and drink, restrictions on intake.
			Contamination Examination
			OIL4 Body surface beta radiation exposure of 40,000 cpm. (Dropping to 13,000 cpm after 1 month.)
			Body Surface Decontamination

※OIL: Standard for determining the necessity and extent of measures to be implemented for the protection of residents when radioactive materials have been emitted, based on the results of monitoring, etc.

Operational Intervention Level (OIL) and Protective Measures

	Type of Criteria	Overview of Criteria	Default Value *1			Overview of Protective Action
Urgent protective action	OIL1	Criteria whereby residents are told within a few hours to evacuate or stay indoors to prevent effects due to radiation from the ground, inhalation of airborne radioactive material or inadvertent ingestion.	500μSv/h (radiation dose rate measured at 1m above the ground)			Specify an area and conduct evacuation within a few hours. (Including persons with limited mobility to temporarily stay indoors)
	OIL4	Decontamination criteria to take precautions to prevent external exposure from inadvertent ingestion and skin contamination.	Beta rays: 40,000 cpm (count rate from detector a few cm from the skin)			Based on the criteria of evacuation or temporary relocation, carry out inspection of evacuees at shelters, and quickly carry out simple decontamination if the criteria are exceeded.
			Beta rays: 13,000 cpm [Value after 1 month] (count rate from detector a few cm from the skin)			
Early protective action	OIL2	Criteria to restrict consumption of local products*2 and temporarily transfer residents within approximately 1 week to prevent effects due to radiation from the ground, inhalation of airborne radioactive material or inadvertent ingestion.	20 μSV/h (radiation dose rate measured at 1m above the ground)			Specify the area within approximately 1 day, restrict the consumption of local products, and carry out temporary transfer within approximately 1 week.
Restrict food and drink intake	Screening standards for food and beverages	As criteria to determine restriction of food and drink consumption through OIL6, criteria used when specifying the area to carry out measurement of radionuclide concentrations in food and drink.	0.5 μSV/h (radiation dose rate measured at 1m above the ground)			Specify the area in which to measure radionuclide concentrations in food and drink within a few days.
	OIL6	Criteria used for restricting consumption of food and drink to avoid effects due to radiation from ingestion.	Nuclide	Drinking water Milk and dairy products	Vegetables, cereals, meat, eggs, fish, other	Measure and analyze radionuclide concentrations in food and drink within approximately one week, and swiftly implement restrictions on consumption of items that exceed the criteria.
			Radioactive iodine	300Bq/kg	2,000Bq/kg*3	
			Radioactive cesium	200Bq/kg	500Bq/kg	
			Alpha nuclides of plutonium and transuranium elements	1Bq/kg	10Bq/kg	
			Uranium	20Bq/kg	100Bq/kg	

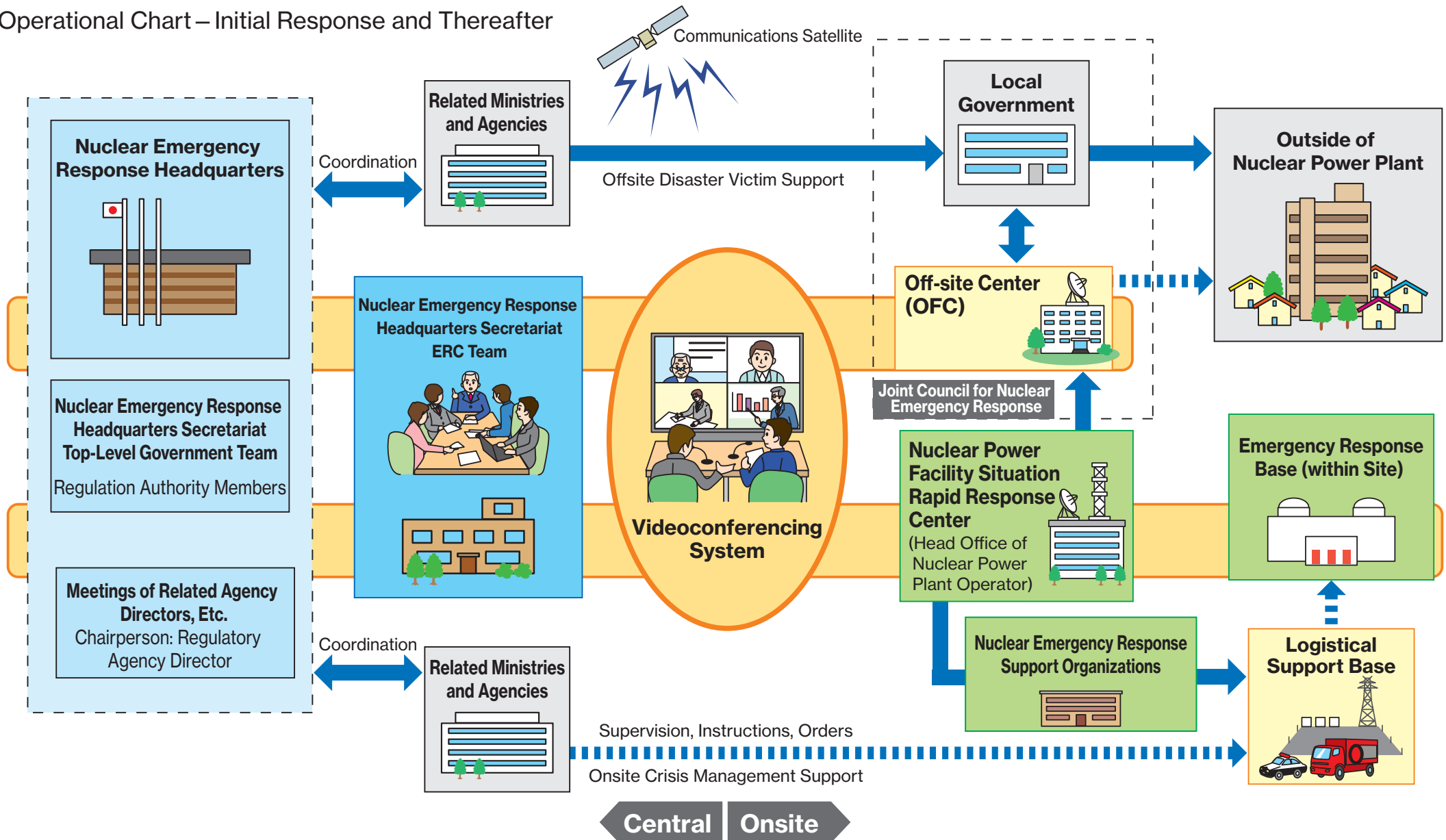
*1: The "default value" is the OIL value used at the start of an emergency situation, and when the radionuclide composition deposited on the ground becomes clear, the default OIL value is revised if required.

*2: "Local products" are food products that were produced outdoors in areas directly contaminated by radioactive materials that are consumed within a few weeks (for example vegetables or milk from cows that ate grass in the area).

*3: Vegetables are included apart from root vegetables and types of potato.

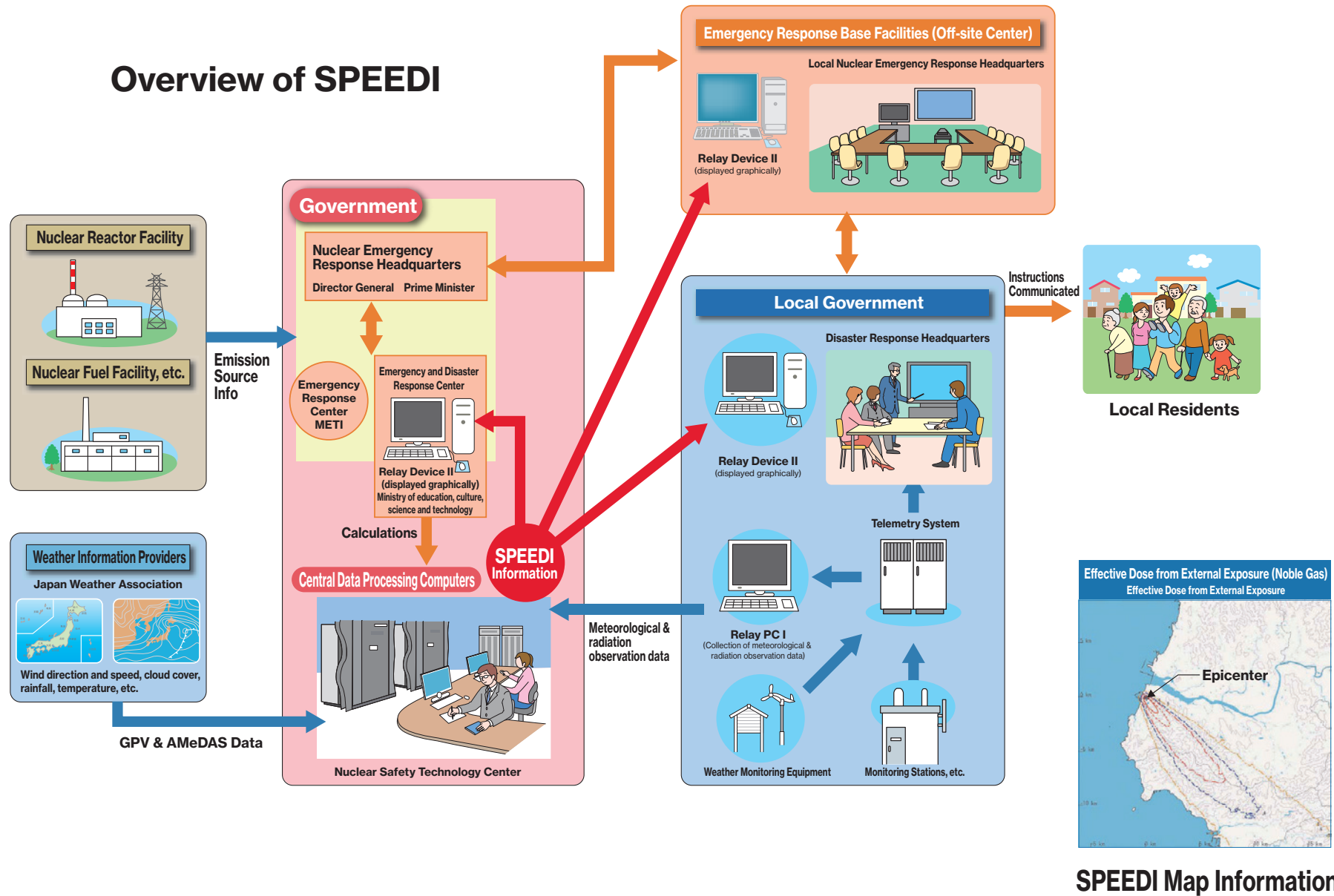
Reinforcement of Network between Government and Nuclear Power Plant Operators

Operational Chart – Initial Response and Thereafter



System for Prediction of Environmental Emergency Dose Information (SPEEDI)

Overview of SPEEDI



Nuclear Damage Compensation System

