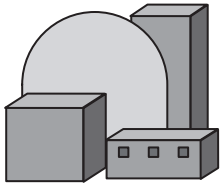
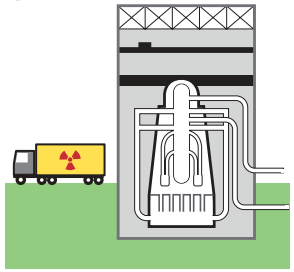
Decommissioning Process of Nuclear Power Plant

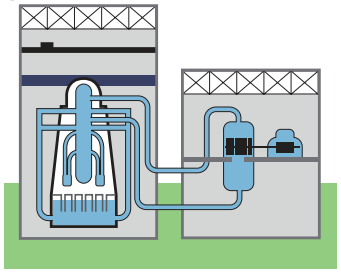


Termination of Operation

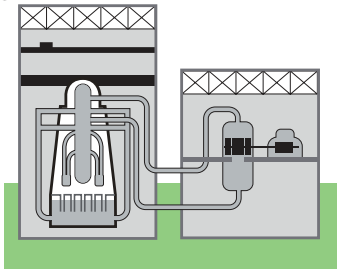
●Standard stages of decommissioning (Note:) Boiling water reactor (BWR)

① 

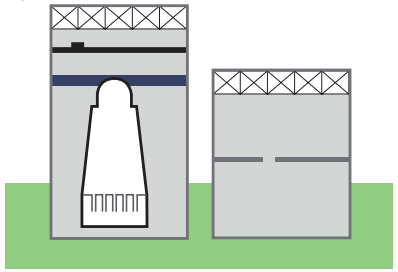
Unloading of spent fuel
Spent and unused fuel is carried out to reprocessing plants and storage facilities, where it is subject to careful controls and processing.

② 

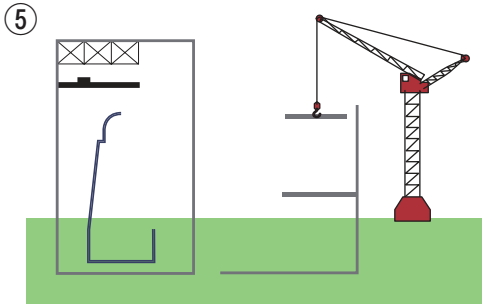
System decontamination - clean-up
Chemicals are used to remove as much of the radioactive substances remaining in the facility's piping and container vessels as possible in order to facilitate subsequent dismantling work.

③ 

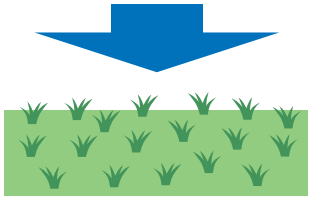
Safe storage - standby
The facility is put into safe storage under proper management as long as required and then further dismantling awaits decay of radioactivity to facilitate that work.

④ 

Dismantling (1) - internal demolition
To avoid release of radioactive substances to the outside, the equipment inside the building, such as piping and vessels, are first dismantled.

⑤ 

Dismantling (2) - building demolition
After confirming that the targeted radioactive substances from inside the building have in fact been removed, the building is dismantled in the same way as a normal building.



Site Use
The site can be used for a variety of purposes once it goes through legal procedures and its safety is confirmed.
Alternatively, one current proposal is for the site to continue to be used effectively as a nuclear power site through cooperation with the local community.

(Note) The operator determines the specific method according to the conditions, and the Nuclear Regulatory Commission confirms the safety.

Quantity and Types of Waste Generated During Decommissioning

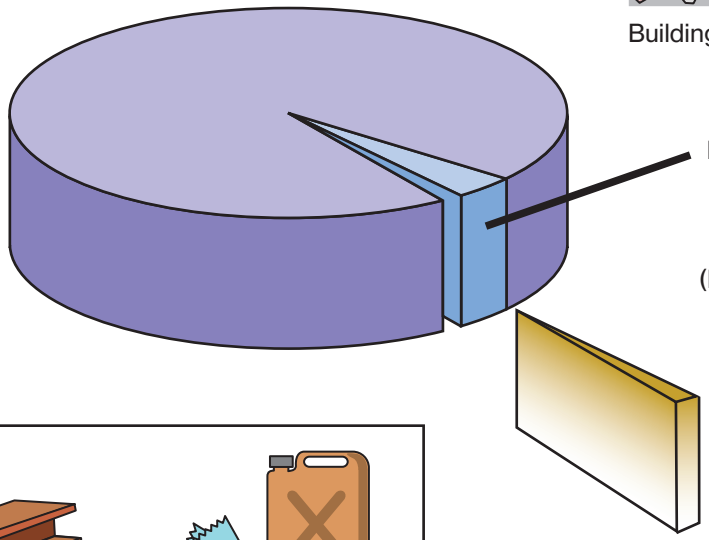
The total amount of waste generated in decommissioning a 1.1 million kW class boiling water reactor (BWR) is approx. 536,000 tons.

Waste that does not emit radioactivity

Approx. 93%

(Mostly waste concrete: approx. 495,000 tons)

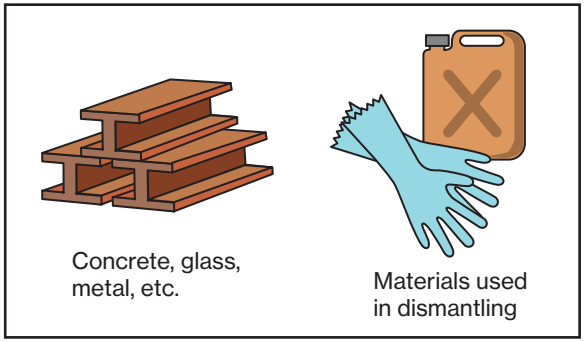
Building concrete, glass, metal, etc.



Materials below clearance level

Approx. 5%

(Metal and concrete waste: approx. 28,000 tons)

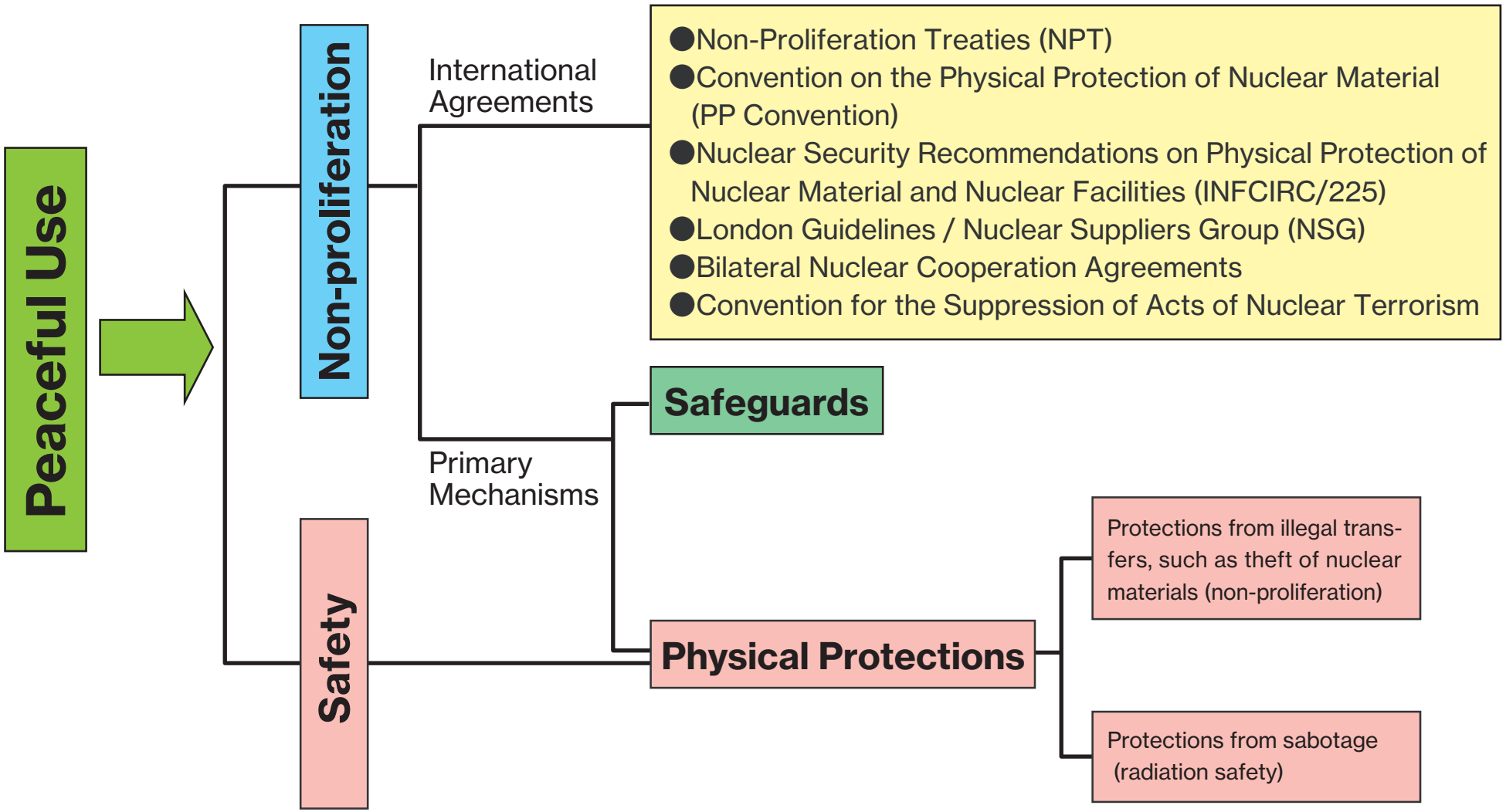


Low-level radioactive waste **Approx. 2%**

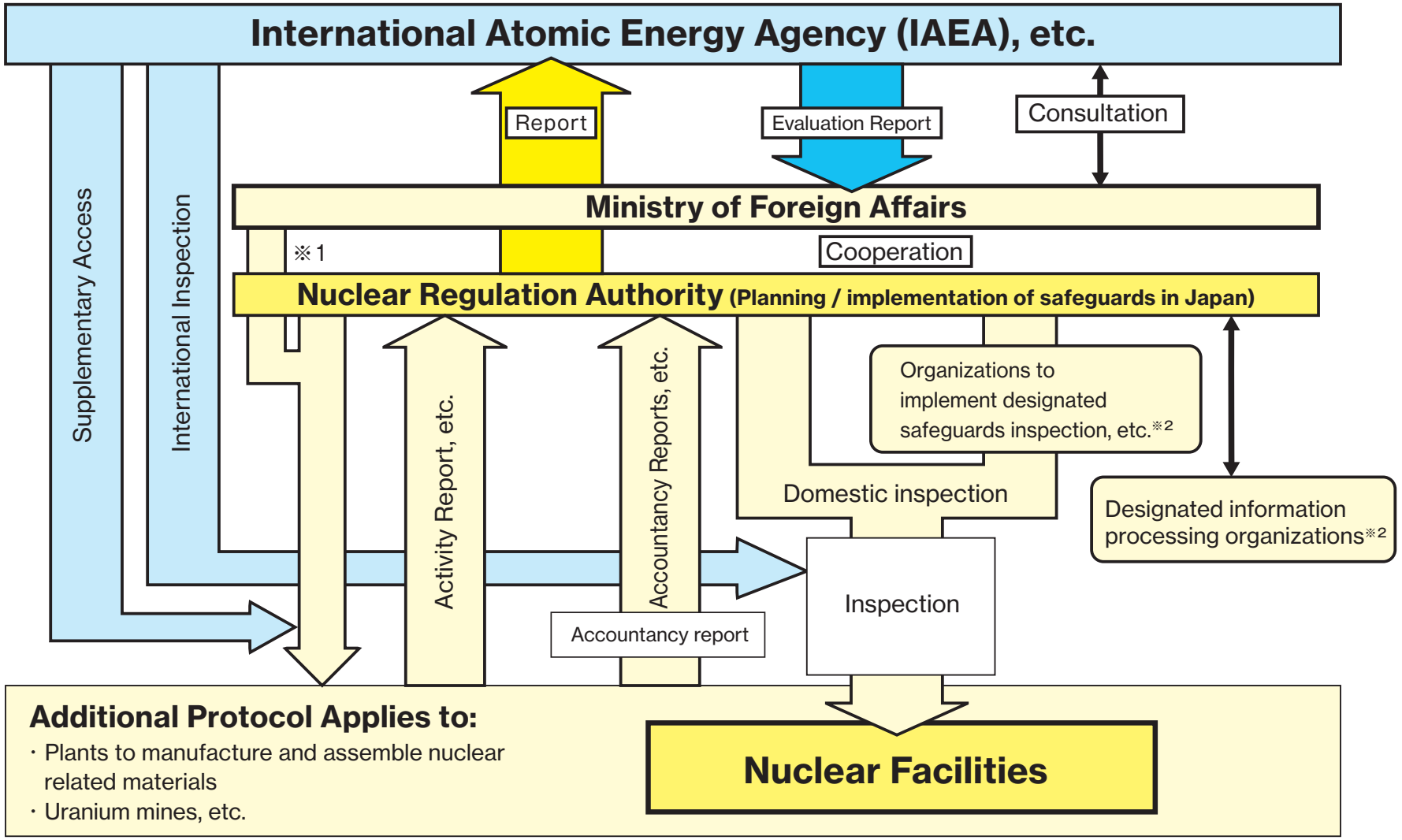
(Mostly metal waste: approx. 13,000 tons)

Source: Nuclear and Industrial Safety Agency (at the time), Decommissioning of Nuclear Facilities

The Peaceful Use of Nuclear Energy and Protection of Nuclear Materials



Safeguard System in Japan



※1 Except supplemental access, such as when arises during a normal inspection

※2 The Nuclear Material Control Center is specified according to the Nuclear Reactor Regulation Law as a Designated Organization for Implementing Safeguards and Inspections as well as a Designated Information Processing Organization.

Source: Nuclear Regulation Authority

Parties to the NPT and IAEA Safeguard Agreements

(As of February, 2015)

Parties to the NPT (191 Countries)

(As of May 21, 2014)

Parties to the Comprehensive Safeguards Agreements (174 Countries)

East Asia (4)
- ★ Korea
- North Korea
- ★ Japan
- ★ Mongolia

Southeast Asia (10)
- ★ Indonesia
- ★ Cambodia
- ★ Singapore
- ★ Thailand ●
- ★ Philippines
- ★ Brunei
- ★ Vietnam
- ★ Malaysia ●
- ★ Myanmar ●
- ★ Laos ●

Oceania (13)
- ★ Australia
- Kiribati ●
- Samoa
- Solomon
- Tuvalu
- Tonga
- Nauru
- ★ New Zealand
- ★ Papua New Guinea
- Vanuatu
- ★ Palau
- ★ Marshall Islands
- ★ Fiji

Middle East & Southeast Asia (18)
- ★ Afghanistan
- ★ United Arab Emirates
- ★ Yemen
- ★ Iraq
- ★ Iran ●
- ★ Oman
- ★ Qatar
- ★ Kuwait
- ★ Saudi Arabia
- ★ Syria
- ★ Sri Lanka
- ★ Nepal
- ★ Bahrain
- ★ Bangladesh
- Bhutan
- Maldives
- ★ Jordan
- ★ Lebanon

Eastern Europe (27)
- ★ Azerbaijan
- ★ Albania
- ★ Armenia
- ★ Ukraine
- ★ Uzbekistan
- ★ Estonia
- ★ Kazakhstan
- ★ Kyrgyzstan
- ★ Georgia
- ★ Croatia
- ★ Slovakia
- ★ Slovenia
- ★ Serbia ●
- ★ Tajikistan
- ★ Czech Republic
- Turkmenistan
- ★ Hungary
- ★ Bulgaria
- ★ Belarus ●
- ★ Poland
- ★ Bosnia-Herzegovina
- ★ Macedonia
- ★ Moldova
- ★ Montenegro
- ★ Latvia
- ★ Lithuania
- ★ Romania

Western Europe (24)
- ★ Iceland
- ★ Ireland
- Andorra
- ★ Italy
- ★ Austria
- ★ Netherlands
- ★ Greece
- ★ Cyprus
- ★ San Marino
- ★ Switzerland
- ★ Sweden
- ★ Spain
- ★ Denmark
- ★ Germany
- ★ Turkey
- ★ Norway
- ★ Vatican
- ★ Finland
- ★ Belgium
- ★ Portugal
- ★ Malta
- ★ Monaco
- ★ Liechtenstein ●
- ★ Luxembourg

Africa (44)
- ★ Algeria
- ★ Angola
- ★ Uganda
- ★ Egypt
- ★ Ethiopia
- ★ Ghana
- ★ Cameroon ●
- ★ Gabon
- Gambia
- ★ Kenya
- ★ Cote d'Ivoire ●
- Comoros
- ★ Republic of Congo
- ★ Democratic Republic of Congo
- ★ Zambia ●
- ★ Sierra Leone
- ★ Djibouti
- ★ Zimbabwe
- ★ Sudan
- ★ Swaziland
- ★ Seychelles
- ★ Senegal ●
- ★ Tanzania
- ★ Chad
- ★ Central Africa
- ★ Tunisia ●
- ★ Togo
- ★ Nigeria
- ★ Namibia
- ★ Niger
- ★ Burkina Faso
- ★ Burundi
- ★ Botswana
- ★ Madagascar
- ★ Malawi
- ★ Mali
- ★ South Africa
- ★ Mauritius
- ★ Mauritania
- ★ Mozambique
- ★ Morocco
- ★ Libya
- ★ Rwanda
- ★ Lesotho

North & South America (34)
- ★ Argentina
- Antigua & Barbados
- ★ Uruguay
- ★ Ecuador
- ★ El Salvador
- ★ Guyana
- ★ Canada
- ★ Guatemala
- Grenada
- ★ Cuba
- ★ Costa Rica
- ★ Columbia
- ★ Jamaica
- Suriname
- St. Kitts and Nevis
- Saint Vincent and the Grenadines
- Saint Lucia
- ★ Chile
- ★ Dominica
- ★ Dominican Republic
- ★ Trinidad and Tobago
- ★ Nicaragua
- ★ Haiti
- ★ Panama
- ★ Bahamas
- ★ Paraguay
- Barbados
- ★ Brazil
- ★ Venezuela
- ★ Belize
- ★ Peru
- ★ Bolivia
- ★ Honduras ●
- ★ Mexico

Oceania (1)
- Micronesia

Southeast Asia (1)
- East Timor ●

Africa (9)
- ★ Eritrea
- Cape Verde ●
- Guinea ●
- Guinea-Bissau ●
- Sao Tome and Principe
- Equatorial Guinea
- Somalia
- ★ Benin ●
- ★ Liberia

Middle East & South Asia (1)
- Palestine

Voluntary Safeguards Agreement Countries (Nuclear-weapon States)
- ★ U.S.A.
- ★ U.K.
- ★ France
- ★ Russia
- ★ China

Countries with other safeguard agreements
- ★ Israel
- ★ India ●
- ★ Pakistan

★: IAEA Signatories (164 countries)

: Additional Protocol Parties (126 countries)

●: Parties that Signed but Failed to Ratify the Additional Protocol (15 of the 21 Parties to the Comprehensive Safeguards Agreements)

〈IAEA Board〉

35 Countries (2014-15)

〈Other Notes〉

・The IAEA concluded a safeguard agreement with Taiwan as well.

・The IAEA concluded an additional protocol with EURATOM.

Source: The Denki Shimbun, Nuclear Pocket Book FY2015

Electric Power Development based on the Three Laws

①Law on Tax for Promotion of Electric Power Development

Tax rate
Until Sep.2003 JPY 0.445/kWh
Oct.2003 - Mar.2005 JPY 0.425/kWh
Apr.2005 - Mar.2007 JPY 0.40/kWh
Apr.2007 From JPY 0.375/kWh

①,② and ③are called “Electric Power Development based on the Three Laws”.

(Consumers)
↓
Electric Power Companies
↓
(Tax for Promotion of Electric Power Development)
JPY 323 billion
↓
General Account
JPY 304.2 billion

from draft budget for fiscal 2015

②Law on Special Accounts

Surplus from previous fiscal year, etc. — JPY 27.1 billion

Fund for developing surrounding areas — JPY 17.3 billion

Miscellaneous income — JPY 0.7 billion

Special Accounts for Energy Measures
Accounts for Promotion of Power Development
JPY 349.5 billion

Budget by Ministries
Cabinet Office JPY 13.9 billion
Ministry of Education, Culture, Sports, Science and Technology JPY 109.9 billion
Ministry of Economy, Trade and Industry JPY 178.9 billion
Ministry of Environment JPY 46.6 billion

Measures for Electric Power Plant Location Accounts
- ○Development of power supply region
  - ・Development of infrastructure
  - ・Industrial development
- ○Emergency preparedness measures for power source region
- ○Promotion of public understanding of long-life fixed generation facilities
- ○Enhancement and strengthening of activities for harmonious coexistence in power supply regions
- ○Enhancement and strengthening of measures for nuclear emergency preparedness, environmental conservation and safety
- ○Measures for enhancement of public understanding of nuclear power generation

Electric Power Generation Diversification Accounts
- ○Promotion of development of power generating facilities etc.
- ○Measures for smoother power supply
- ○Nuclear safety measures
- ○Promotion of research and development concerning the nuclear fuel cycle
- ○Promotion of advanced nuclear science and technology
- ○Securing safety, and others

Nuclear Safety Regulation Measures
- ○Ensuring the safety of nuclear power facilities, etc.
- ○Disaster prevention measures around nuclear facilities
- ○Health management for victims of nuclear accidents

③Law on the Development of Areas Adjacent to Power Generating Facilities

Grant to support power supply regions

Financial support to smoothen construction and operation of power generation facilities

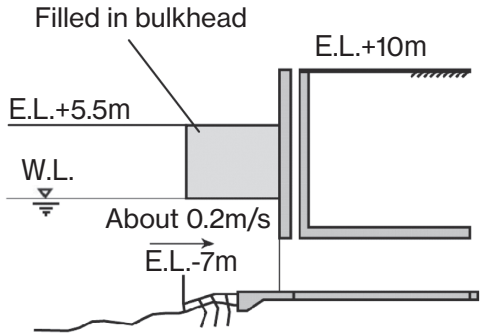
- Grants based on location of electric power plants
- Subsidy for supporting industrial development in power supply regions
- Subsidy for development of power supply regions

and others

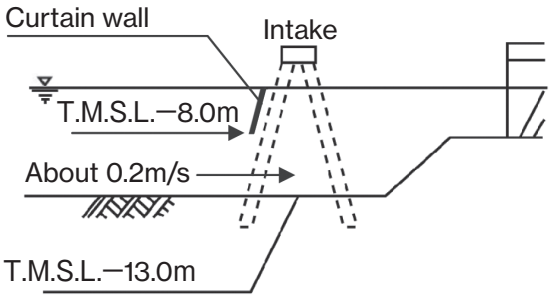
※ “Special Accounts for Promotion of Electric Power Development Acceleration Measures” and “Special Accounts for Petroleum and Sophisticated Structure of Energy Supply and Demand” were merged into “Special Accounts for Energy Measures” in FY2007. Among this, “Accounts for Promotion of Electric Power Development” took over operation of the “Special Account for Promotion of Electric Power Development Acceleration Measures”.
※ Since FY2007, the revenue from “Promotion of Power-resources Development Tax” has transferred to the annual revenue of the general account. The necessary amount has been transferred from the general account to “Special Accounts for Energy Measures” each year.
※ In addition, approximately 8.8071 billion yen is set aside as a nuclear damages compensation support account.
※ Revenue of Power-Resources Development Tax is the estimated amount for the 2015 fiscal year.

Source: The Denki Shimbun, Nuclear Pocket Book FY2015

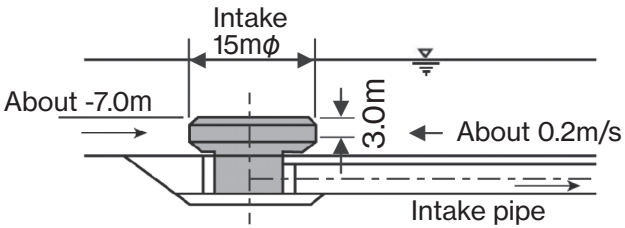
Overview of Water Intake Systems



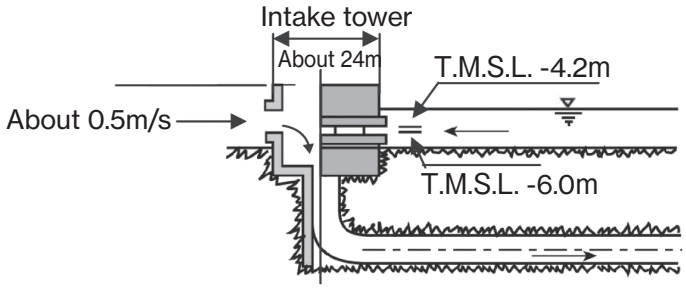
Surface water intake system (Tomari Nuclear Power Station, Units 1, 2)



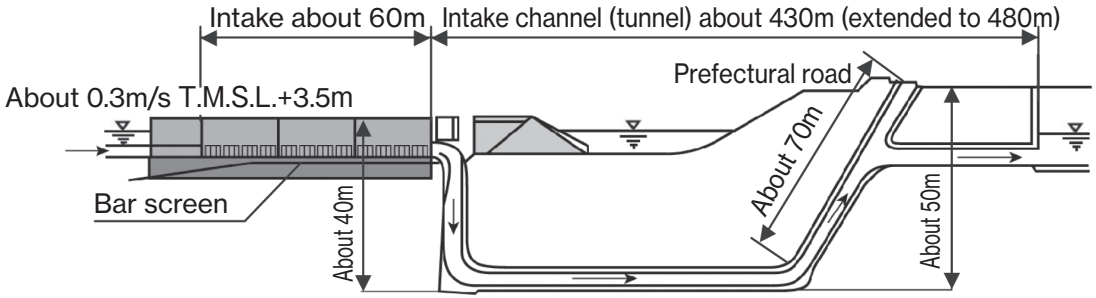
Curtain wall-type deep water intake system
(Tomari Nuclear Power Station, Units 1 to 4)



Intake pipe-type deep water intake system
(Yanai Power Plant, Units 1, 2)



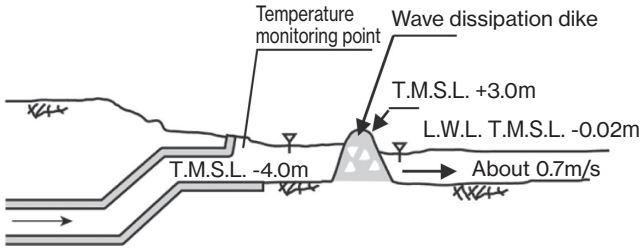
Intake tower-type deep water intake system (Hamaoka Nuclear Power Station, Unit 4)



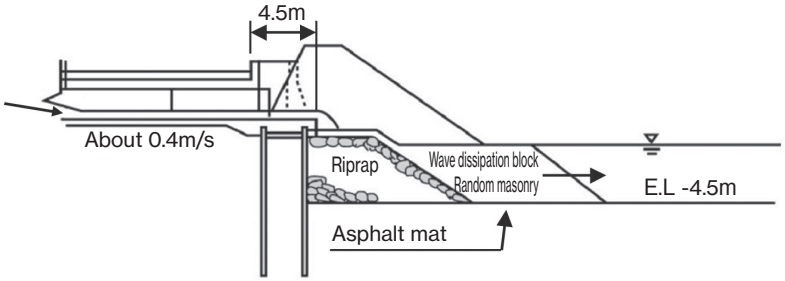
Porous dike-type deep water intake system (Shika Nuclear Power Plant, Unit 1)

Source: The Denki Shimbun, Nuclear Pocket Book FY2015

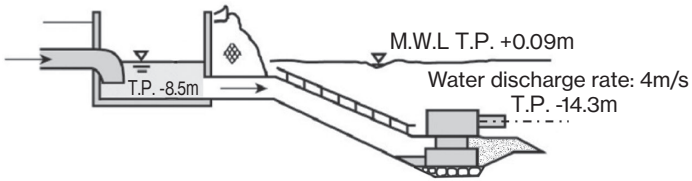
Overview of Water Discharge Systems



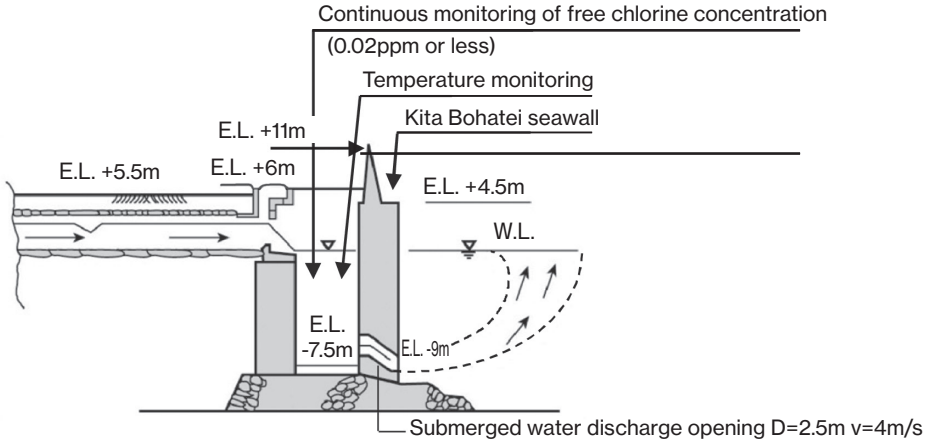
Surface water discharge system
(Tomari Nuclear Power Station, Units 1-4)



Multi-stage discharge water system
(Higashi Niigata Thermal Power Plant, Units 1-3)



Drainpipe-type submerged water discharge system
(Genkai Nuclear Power Plant, Units 3 , 4)



Porous dike-type submerged water discharge system
(Tomari Nuclear Power Station, Units 1 , 2)

Source: The Denki Shimbun, Nuclear Pocket Book FY2015

Table of Fish Breeders Using Hot Water from Power Plants (Nuclear-Power Related)

Business	Water Intake Source		Main Fish Species
	Power Plant	Capacity (10,000kW)	
Shizuoka Thermal Effluent Utilization Research Center	Chubu Electric Power Co. Hamaoka Nuclear Power Plant	Unit 3--110.0 Unit 4--113.7 Unit 5--126.7	(Hatchlings) Red sea bream, flounder, swimming crab, mud crab, abalone, Japan tiger prawn, grouper, tiger globefish
Ishikawa Prefectural Fisheries Research Center, Production Department Shiga Plant	Hokuriku Electric Power Co. Shika Nuclear Power Plant	Unit 1--54.0 Unit 2--120.6	Abalone, flounder, turban shell
Kansai Electric Power Co., Ltd. Takahama Nuclear Power Plant	Kansai Electric Power Co., Ltd. Takahama Nuclear Power Plant	Units 1,2--82.6 each Units 3,4--87.0 each	Abalone, turban shell

Source: The Denki Shimbun, Nuclear Pocket Book FY2015

Changes in Nuclear Fuel Tax Rates

(As of September 2023)

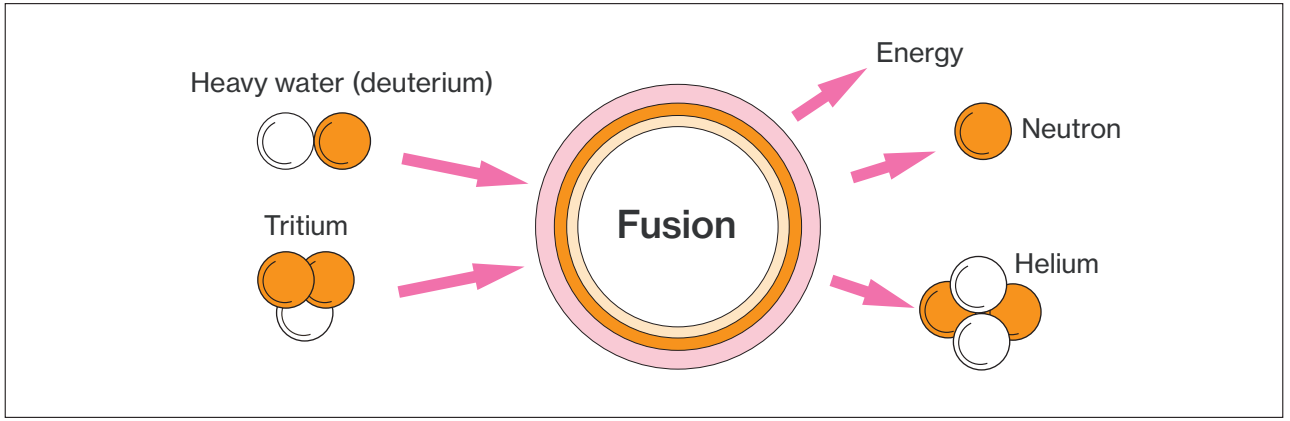
Prefecture	Established		Currently		
	Year Established	Tax Rate	Tax Rate	Valid	Notes
Fukui	1976	5%	18%*1, 6	Nov. 2021 to Nov. 2026	9th update
Ibaraki[*4]	1978	5%	17%*2	Apr. 2019 to Mar. 2024	8th update
Ehime	1979	5%	17%*2, 6	Jan. 2019 to Jan. 2024	8th update
Saga	1979	5%	17%*2, 6	Apr. 2019 to Mar. 2024	8th update
Shimane	1980	5%	17%*2, 6	Apr. 2020 to Mar. 2025	8th update
Shizuoka	1980	5%	17%*2	Apr. 2020 to Mar. 2025	8th update
Kagoshima	1983	7%	18%*1	Jun. 2023 to Jul. 2024	8th update
Miyagi	1983	7%	17%*2, 6	Jun. 2023 to Jun. 2028	8th update
Niigata	1984	7%	17%*3	Nov. 2019 to Nov. 2024	7th update
Hokkaido	1988	7%	17%*2	Sep. 2023 to Aug. 2028	7th update
Ishikawa	1992	7%	17%*2	Oct. 2022 to Oct. 2027	6th update
Aomori[*5]	2004	10% (Currently 12%)	17%*2	Apr. 2019 to Mar. 2024	4th update

＊1：The tax rate of 18% breaks down to 8.5% of the cost and 9.5% of the output (the output percentage is a conversion of the tax amount/heat output into a percentage - the notes below also apply this rule).
＊2：The tax rate at 17% breaks down to 8.5% of the cost and 8.5% of the output.
＊3：The tax rate at 17% breaks down to 4.5% of the cost and 12.5% of the output.
＊4：The nuclear fuel taxes for Ibaraki Prefecture have been taxed since April 1999 as a "Nuclear Fuel Handling Tax".
＊5：The nuclear fuel taxes for Aomori Prefecture are taxed from April 2004 as a "Nuclear Fuel Materials Handling Tax".
＊6：For Fukui Prefecture (from November 2016), Shimane Prefecture (from April 2017), Saga Prefecture (from April 2017), Ehime Prefecture (from August 2017) and Miyagi Prefecture (from March 2020), output tax is levied even during decommissioning.

Source: Federation of Electric Power Companies of Japan, Electricity Utilities and Taxes 2023

Nuclear Fusion and Fission

Principle of Fusion



Principle of Fission