Nuclear Power-Related Information - Part 1 of 2 -

In this section, information regarding current topics on the operation of nuclear power stations such as our plu-thermal utilization ⓘ and radioactive waste ⓘ disposal is summarized.

Summary of Research on Pipe Thinning Conditions

After the piping rupture accident in Mihama Nuclear Power Station Unit 3 of Kansai Electric Power Co., Inc. in August 2004, we checked secondary piping in our nuclear power stations to see whether pipe thickness control had been conducted. The results revealed that there was no leakage in the locations inspected, thus we concluded pipe thickness control is managed properly.

Contents of prior inspections	[Inspection plan] • We managed pipe corrosion systematically such as assessing remaining life based on pipe thickness measured, by incorporating the “management guideline for nuclear facility secondary piping thickness (in Pressurized Water Reactor: PWR)” (“Management Guideline”) into the secondary piping inspection plan. [Selection method of sites to be inspected] • Based on the Management Guideline, we defined a main inspection system to be any system in which fluid condition in the pipes met the selection criteria. We selected and inspected locations within the main inspection system where drifts were observed. • In addition to the main inspection systems, other piping locations where the drifts were identified were also inspected as a precautionary measure. [Inspection method] • Pipe thickness was measured using an ultrasonic thickness gauge. [Assessment method for remaining life] • Applying the Management Guideline, we obtained measured minimum pipe thickness and thinning rate (mm/year), and then calculated the remaining life (number of years for the pipe thickness to fall below the level of the calculated necessary thickness required by the technical standard, etc.). If the number of years is two years or less, a replacement plan must be drawn to change them with those of pipe-corrosion resistant materials.
Contents of investigation	• The validity of the inspection locations was confirmed based on skeleton diagrams that project the inspected locations three-dimensionally. • The number of locations inspected was confirmed based on the skeleton diagram. • The scope of locations inspected was prepared using diagrams. • The validity of the pipe thickness management for the inspection locations was confirmed (investigation of inspection records).
Results of investigation	• Confirmation was made that there was no leakage in the locations inspected and those locations were managed properly as pipe thickness controlled areas. • Confirmation was made the decision of inspection intervals and the validity of the thickness management of inspection locations was properly practiced.

Outline of Plu-thermal Project

◊ Plan for plu-thermal project

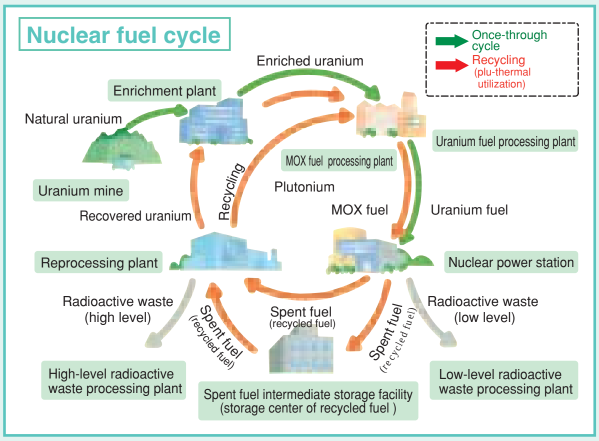
Uranium ⓘ fuel used at nuclear power stations contains new fuel called plutonium ⓘ. The plu-thermal project is a plan to call for recovery, recycling and utilization of plutonium in nuclear power stations.

◊ Necessity of plu-thermal project

When the scarcity of Japan’s resources is considered, the establishment of a nuclear fuel cycle ⓘ is essential to secure stable energy over a long period of time. Thus, it is important to implement the plu-thermal project, where plutonium recovered by reprocessing ⓘ spent fuel can be used in the existing nuclear power stations.

Note: The term “plu-thermal” is a combination of the terms “plutonium” and “thermal reactor”.

Kyushu Electric Power Co., Inc. already possesses 3.2 tons of plutonium as of the end of March 2005, which was recovered and reprocessed from spent fuel incurred at nuclear power stations. In the view of nuclear non-proliferation which proclaims that excess plutonium should not be retained for no intended use, we are required to use them steadily in a peaceful manner, that is, in the form of plu-thermal utilization.



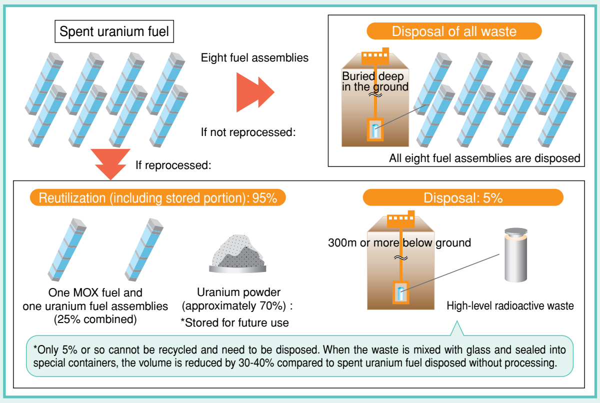
◊ Benefits of plu-thermal utilization

Uranium fuel used in nuclear power stations (spent fuel) still contains uranium and plutonium that are usable as fuel, amounts of which are around 94% and 1% respectively. Thus, approximately 95% of spent fuel is recyclable.

About 25% of the spent fuel is regenerated into new fuel (eight fuel assemblies of spent fuel yield one uranium fuel and one MOX fuel ⓘ assembly) and the remaining 70% or so is stored as resources for future use, which will be converted to plutonium in fast breeder reactors (FBR) ⓘ. (An example of trial calculations).

Were spent fuel not recycled (in the case of once-through cycle), all the spent fuel must be processed as high-level radioactive waste ⓘ. Recycling enables us to reuse approximately 95% of spent fuel, and therefore, it will greatly contribute to limiting discharge of high-level radioactive waste.

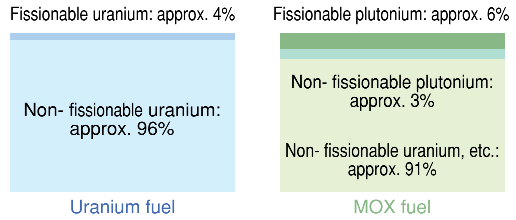
■Recycling with plu-thermal utilization and reduction of high-level radioactive waste (an example of trial calculations)



◊ Uranium fuel and MOX fuel

Two types of fuel are used in the plu-thermal utilization, uranium fuel and MOX fuel. MOX stands for Mixed Oxide Fuel, and is a fuel consisting of a mixture of plutonium, recovered from spent uranium fuel, and non-fissionable uranium. MOX fuel is sealed into fuel-cladding after densification like pottery is fired, and then fabricated into a fuel assembly for use. Uranium fuel and MOX fuel have exactly same shape and size.

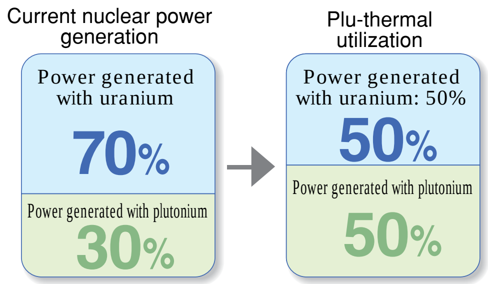
■Difference between uranium fuel and MOX fuel



◊ Safety

In current nuclear power generation using only uranium fuel, some uranium transforms into plutonium in the nuclear reactor, which is utilized as fuel in power generation. The ratio of power generation attributable to this transformed plutonium accounts for about 30%. In the case of the plu-thermal utilization, the ratio goes up to about 50%, since the fuel already contains plutonium from the beginning.

■Ratio of power attributable to plutonium



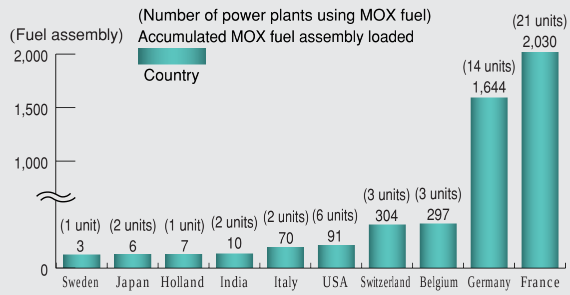
According to the Nuclear Safety Commission of Japan, MOX fuel has characteristics similar to those of uranium fuel under the condition that the ratio of MOX fuel used in the nuclear reactor is one third or less, thus the current safety design and evaluation method can be applied.

In the plu-thermal utilization planned by Kyushu Electric Power Co., Inc., the ratio of MOX fuel containing plutonium will be around 25%. Our plu-thermal project can be implemented safely by properly understanding and addressing the characteristics of plu-thermal utilization. For example, plutonium has a tendency to absorb more neutrons ⓘ than uranium, slightly lowering the effect of the control rod that adjusts and suspends the nuclear reactor's output. However, it will cause no impact since the function of the control rod will be secured through proper fuel placement and other methods.

◊ Status of plu-thermal utilization worldwide

Nuclear power plants (55 units) around the world, especially in Europe, have over 40 years of experience in loading about 4,400 MOX fuel assemblies cumulatively. Currently, MOX fuel is used in France, Germany, Belgium and Switzerland without problems, and the ratio of MOX fuel against the total fuel loaded in these countries is about one third at maximum. There has been no reported case of fuel damage or power plant troubles attributable to characteristics particular to MOX fuel.

■MOX fuel used in light-water reactors in various countries



Source: Nuclear Power 2004 by the Agency for Natural Resources and Energy

In Japan, MOX fuel was introduced in Mihama and Tsuruga Nuclear Power Stations on a trial basis, where its safety was confirmed.

◊ Plu-thermal project by Kyushu Electric Power Co., Inc.

Considering above mentioned aspects, we submitted a prior consent request based on the safety agreement to Saga Prefecture and Genkai Town in May 2004, to implement a plu-thermal project in Genkai Nuclear Power Station Unit 3 targeted by fiscal 2010. We also submitted an application for nuclear reactor installation and alteration approval to the Japanese government as set forth in the Nuclear Reactor Regulation Law.

The subject plant was selected for its capacity that loads more fuel and its large work area for handling fuel.

We are committed to every effort to gain people's understanding towards the plu-thermal project by making safety our first priority.

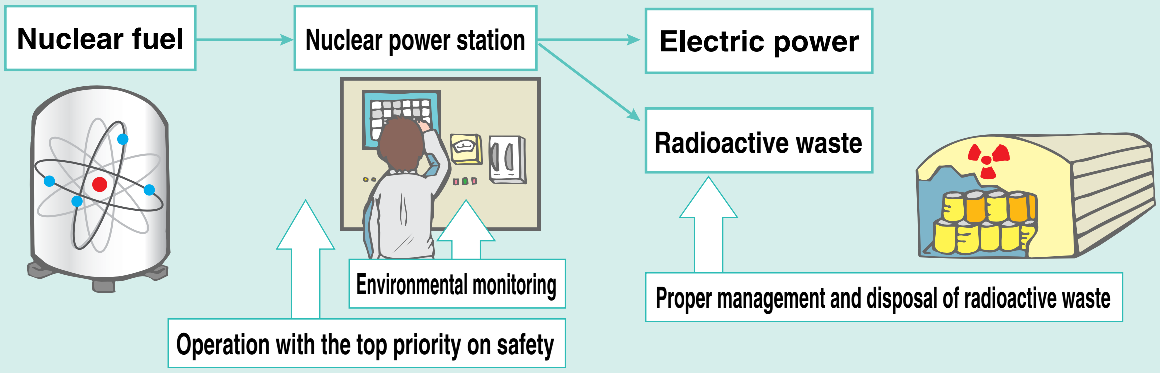
TOPIC No.4

Open Discussion on Plu-thermal Project

Kyushu Electric Power Co., Inc. holds explanatory meetings and lectures and places newspaper advertisements to promote understanding of local residents for the plu-thermal utilization. In fiscal 2004, an open discussion was held on the plu-thermal project to gain further understanding. Such efforts in offering information disclosures and easy explanations shall be continued in the future to gain trust from and create a sense of security among the local people.

[A case of open discussion]
Date: February 20, 2005 (Sunday), Place: Cultural Hall of the Genkai Town Center
Number of attendees: 574

■Illustration of environmental conservation management in nuclear power stations

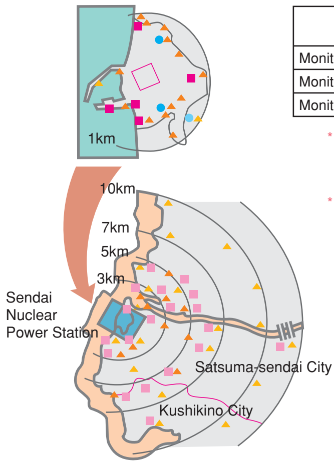


Environmental Radiation ⓘ Monitoring around Nuclear Power Stations

At nuclear power stations, the ambient radiation ⓘ dose and the level of radioactivity in the environmental samples of seawater and agricultural and marine products are measured in addition to regular environmental monitoring. Similar measurements are also performed in prefectures where nuclear power stations are located. *For regular environmental monitoring, see page 40.*

- We have been reporting the results of measurement to relevant prefectures. The prefectures in turn review and evaluate the reports under guidance and with advice of academic experts, and publicize the findings periodically in their public relations magazines.
- The radiation dose on people living near power stations is less than 0.001 milisievert (mSv) ⓘ per year, which is much lower than the statutory dose limit of the 1mSv per year and the annual 0.05mSv target set by the Nuclear Safety Commission.

■Radioactivity inspection in vicinity of Sendai Nuclear Power Station



	Prefecture	Kyushu Electric Power Co., Inc.
Monitoring station	●	●
Monitoring post	■	■
Monitoring point	▲	▲

* Monitoring station and post: conducted sequential measurements of ambient radiation.

* Monitoring point: conducted measurements of the accumulated radiation for a certain period.

Management and Disposal of Radioactive Waste

Radioactive waste includes low-level radioactive waste ⓘ incurred at nuclear power stations and high-level radioactive waste ⓘ incurred in the process of spent fuel reprocessing, each requiring different management and disposal methods.

◊ Low-level radioactive waste management

- Gas waste is treated to attenuate its level of radioactivity, measured for radioactivity to confirm its safety, and then released into the air.
- Liquid waste is separated into concentrated wastewater and distilled water in processing equipment. Distilled water is discharged to the sea after being measured for radioactivity and confirmed its safety.
- Treated concentrated wastewater is solidified with asphalt and sealed inside drums.
- Solid waste is first bulk-reduced by incineration and/or compression, and sealed inside drums.

These drums are first stored stringently in the solid waste storage located within power station sites. They are then transferred to the Low-level Radioactive Waste Disposal Center ⓘ of Japan Nuclear Fuel Limited ⓘ (located in Rokkasho-mura, Aomori Prefecture) where they are buried and stored until the waste ceases to have any effect on the human living environment.

■Accumulated amount of radioactive solid waste stored

Unit:container (each equivalent to a 200-liter drum)

	Waste stored in power station sites	Waste transferred*
Genkai Nuclear Power Station	23,495 (20,480)	6,536 (6,536)
Sendai Nuclear Power Station	11,740 (11,173)	—
Total	35,235 (31,653)	6,536 (6,536)

Note: Figures are accumulated amounts as of the end of fiscal 2004 (those in parentheses are as of the end of fiscal 2003)

* Waste transferred to the Low-level Radioactive Waste Disposal Center

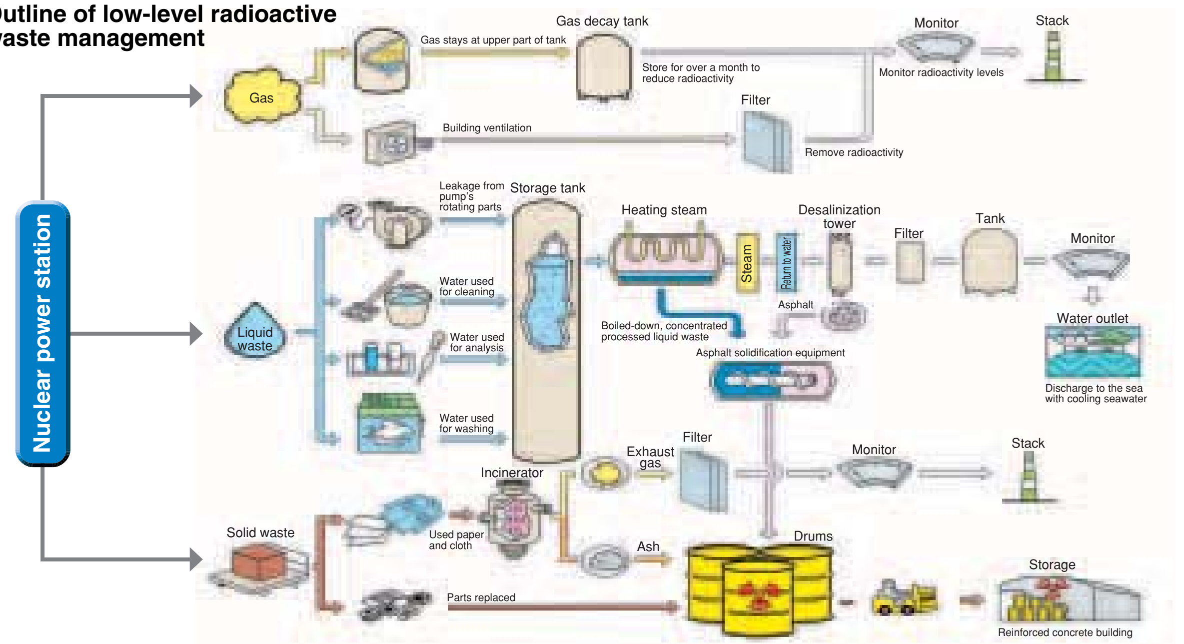
■Status of radioactive gaseous or liquid waste discharged

Unit: Becquerel (Bq.)

			Targeted discharge management	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004
Gaseous waste	Rare gases ⓘ	Genkai NPS*	2.2×10^{15}	2.9×10^{10}	1.1×10^{10}	8.8×10^{9}	1.2×10^{10}	9.9×10^{9}	1.6×10^{10}
		Sendai NPS*	1.6×10^{15}	6.7×10^{10}	3.1×10^{10}	1.5×10^{10}	1.6×10^{10}	3.1×10^{10}	4.4×10^{10}
	Iodine ⓘ	Genkai NPS*	5.9×10^{10}	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		Sendai NPS*	6.2×10^{10}	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Liquid waste (excluding tritium)		Genkai NPS*	1.4×10^{11}	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
		Sendai NPS*	7.4×10^{10}	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.

Note 1: The unit Becquerel indicates the level of radioactivity. Note 2: N.D. indicates concentration levels less than the detection limit.

■Outline of low-level radioactive waste management



◊ Disposal of high-level radioactive waste

In Japan, fuel used in nuclear power stations (spent fuel) is put to reuse as nuclear fuel through reprocessing.

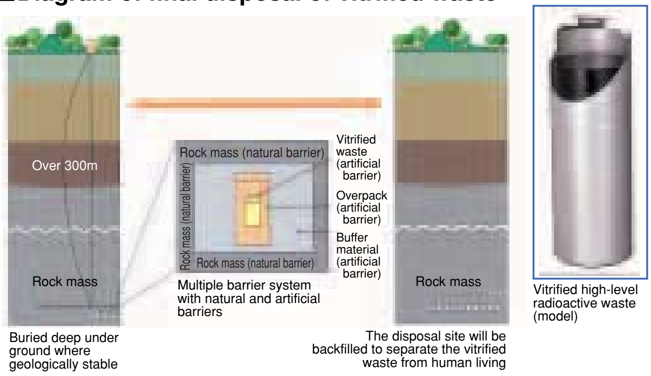
The high-level radioactive liquid waste generated in the process of spent fuel reprocessing is mixed with glass matrix and encapsulated and solidified in stainless steel containers called canisters. This product is called high-level radioactive waste.

Guidelines set by the Japanese government require that high-level radioactive waste be stored in High-level Waste Storage Management Center in Rokkasho-mura, Aomori Prefecture for cooling storage for 30 to 50 years, and then finally disposed of in a stable geological formation at more than 300 meters below ground.

In October 2000, the Nuclear Waste Management Organization of Japan (NUMO) ⓘ was established for the purpose of implementing final disposal of high-level radioactive waste in accordance with the Specified Radioactive Waste Final Disposal Act (promulgated in June 2000.)

Final disposal is intended to start sometime in the late 2030s. Applications for preliminary survey sites have been opened since December 2002 to all the local municipalities across Japan for selection of a final disposal.

■Diagram of final disposal of vitrified waste



■Main schedule (source: the Nuclear Waste Management Organization of Japan brochure)

After FY2002	First phase	Survey based on documents and data ▼ Selection of preliminary survey sites
Around FY2008-2012	Second phase	Survey through boring, etc. ▼ Selection of detailed survey sites
Around FY2023-2027	Third phase	Survey with underground facilities ▼ Selection of final disposal construction site
————	Designing of disposal facility Safety review by the Japanese government Construction of disposal facility	
Around FY2033-2037	Start of final disposal of waste	

Miscellaneous Items

◊ Effective utilization of nuclear power stations

Kyushu Electric Power Co., Inc. implements measures to increase the capacity factor of nuclear power generation which is highly effective in reducing CO_2 ⓘ emissions.

- Constant cycling at rated thermal output ⓘ

  To constantly operate reactors at rated thermal output (100%), which was certified by the government, allowed a 1.5-point increase in nuclear power capacity factor in fiscal 2004, which is equivalent to a reduction of 550 thousand tons-CO_2.

◊ Reducing the use of fuel assemblies

The use of high burn-up fuel ⓘ (55,000 MWd/t), which has a higher concentration level of uranium ⓘ 235, was started in the Unit 1 and 2 of Genkai Nuclear Power Station and contributed to extending the duration of fuel use, and as a result, reducing the amount of spent fuel produced.

■Status of spent fuel storage as of the end of FY2004

Unit: pieces

	Accumulated generation	Accumulated emission	Amount stored	
			Amount stored as of the end of FY2004	Storage capacity
Genkai NPS	2,631	1,105	1,526	3,278
Sendai NPS	1,844	374	1,470	2,374
Total	4,475	1,479	2,996	5,652