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<h2>Summary Report of Peer Review</h2>
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(Provisional Translation)

Place of
Review:

**Genkai Nuclear Power Station,
KYUSHU ELECTRIC POWER COMPANY
(Genkai-machi, Higashimatsuura-gun, Saga-pref)**

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1. Objectives

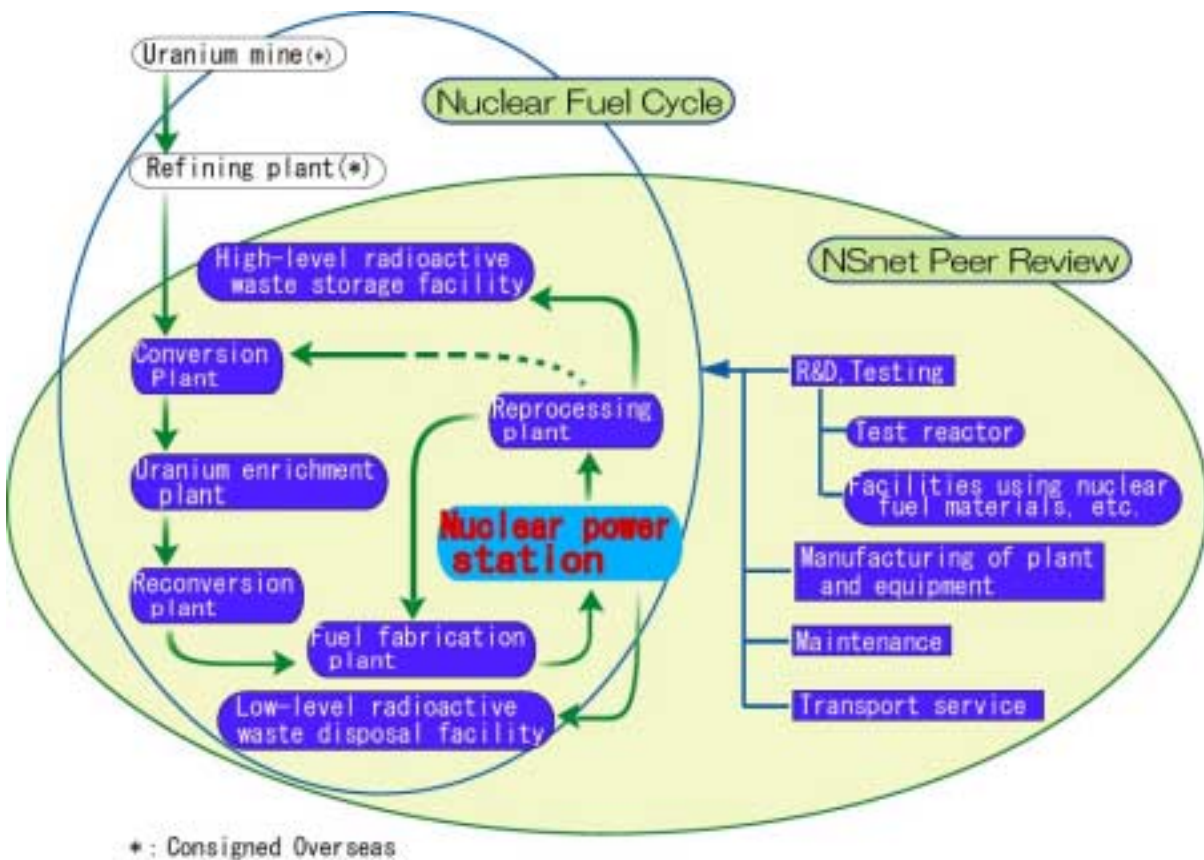
The purpose of the NSnet peer review (hereafter referred to as “review”) is to achieve an improvement in the “safety culture” of the entire nuclear power industry by sending review teams of member specialists to member facilities, where they conduct reciprocal evaluations on common nuclear safety subjects among members and share mutual knowledge about the horizontal progress of good practices as well as subjects that have been singled out.

2. Summary of Facility Operations

Kyushu Electric Power Co., Inc. owns two nuclear power stations at Genkai and Sendai. Together, they accounted for approximately 46% of the Company’s total power generation in FY 1999.

Genkai Nuclear Power Station (hereafter referred to as “Genkai”), which was the subject of the review, is located in the northwest of Higashi Matsuura Peninsula that protrudes into the sea of Genkai, approximately 15 km northwest of the city of Karatsu. It is the Company’s first nuclear power station with four PWR units.

Unit 1 has been in operation for 25 years since the start of commercial operation in October 1975. Unit 2, which started commercial operation in March 1981, is known as a nuclear power station with a high capacity factor, achieving the world’s longest continuous operation. Units 3 and 4 started commercial operation in March 1994 and July 1997, respectively.



The position of “NUCLEAR POWER STATION” in the nuclear fuel cycle

In the year 2000, Genkai achieved the total power generation of 250 billion kWh (see the table below).

Unit	Power Output (MW)	Reactor Type	Start of Commercial Operation	Main Contractor	Performance (Total) (As of the end of November 2000)	
					Power Generated (billion kWh)	Capacity Factor (%)
1	559	PWR	October 1975	Mitsubishi Heavy Industries	87.8	71.3
2	559	PWR	March 1981	Mitsubishi Heavy Industries	79.2	82.2
3	1,180	PWR	March 1994	Mitsubishi Heavy Industries	58.0	83.5
4	1,180	PWR	July 1997	Mitsubishi Heavy Industries	30.2	87.0
Total	3,478	-	-	-	255.2	78.8

Genkai has approximately 500 employees, some 200 of whom are directly engaged in operation in six groups in three shifts. Approximately 110 of the remaining employees belong to the Maintenance Department, 90 to the Technical Support Department, and 100 to other departments including the General Affairs Department. In addition, approximately 1,500 employees from cooperating companies are stationed at Genkai to support the operation and maintenance of the plant.

The total capacity factor¹ of Genkai from the start of commercial operation amounted to 78.8% (as of the end of November 2000). It reached 86.9% in FY 1999, indicating its favorable operating status.

3. Points of Review

The NSnet was established following the first criticality accident that ever occurred in Japan at the conversion test building (fuel processing facilities) of JCO on September 30, 1999 (hereafter referred to as “the JCO accident”). The NSnet peer review on operations that has nuclear fuel facilities, including fuel-processing facilities, has focused on “the prevention of fatal accidents, such as critical accidents.” In this review, in view of the recent trends in nuclear safety and accident prevention, we focused on the following five basic points in terms of both technical and social safety:

- (1) Foundation to ensure nuclear safety
- (2) Relationship with the community (improving anti-disaster measures)
- (3) Incorporating operating experience into the improvement of safety

¹ Capacity factor (%): [total power generation (kWh)] x 100 / [licensed output (kW) x total hours of operation (h)]

- (4) Reflecting and addressing lessons from the JCO accident
- (5) Recent issues concerning LWRs

Review items were decided and compared with best practices in the nuclear industry by classifying individual elements of the above five viewpoints into the following six areas: organization/administration, emergency measures, education/training, operation/maintenance, radiation protection, and addressing important issues.

“(1) Foundation to ensure nuclear safety:” Safety culture should be fostered to establish an effective organization. Sufficient education and training should be provided to operators and maintenance personnel. Effective documentation of operation and maintenance administration should be promoted and complied with. Appropriate communication with subcontractors should be ensured. Radioactive waste disposal and radiation protection should be conducted appropriately.

“(2) Relationship with the community (improving anti-disaster measures):” Emergency measures should be implemented without fail. Efforts should be made to coexist with the community and promote the safety of nuclear energy through disclosure and public acceptance activities.

“(3) Incorporating operating experience into the improvement of safety:” Problems that occurred at nuclear power generation facilities in the past should be incorporated into the subject facilities in an appropriate manner to facilitate the improvement of equipment and operating methods.

“(4) Reflecting and addressing lessons from the JCO accident:” Critical safety control² at new fuel storage warehouse, spent fuel storage pool, and so on should thoroughly be ensured. In-core fuel management should be carried out appropriately to ensure nuclear safety³. Activities should be promoted to foster and improve the nuclear safety culture in view of factors that have caused accidents.

“(5) Recent issues concerning LWRs:” Quality control should be enhanced to prevent the problem of data manipulation in inspections of piping welds, spent fuel transportation containers, and MOX fuel⁴. Activities should be promoted to develop measures to prevent human error and ensure safety at reactor shutdown and aged plants.

4. Period and Outline of Review

- (1) Date

December 12 (Tuesday) to December 15 (Friday), 2000

- (2) Formation of Review Teams

1st group: Hitachi, Ltd.; The Chugoku Electric Power Company, Inc.

2nd group: Sumitomo Metal Mining Co., Ltd.; Chubu Electric Power Company, Inc.

3rd group: Japan Nuclear Fuel Co., Ltd.; NSnet Office

² To ensure safety so that fissile substances must not reach criticality to cause critical accidents in facilities handling fissile substances, such as nuclear fuel processing plants and spent fuel reprocessing plants (excerpted from “Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.”)

³ Referring to the safety of nuclear facilities against nuclear accidents. A nuclear accident at a nuclear reactor means an accident in which reactivity increases sharply due to failure or breakdown of equipment that affects reactivity (e.g., reactivity control system), causing the thermal output of the reactor to increase rapidly, which in turn causes the fuel to overheat (excerpted from “Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.”)

⁴ Mixed-Oxide Fuel: Nuclear fuel that contains fissile nuclides composing of two or more types of oxides. Generally, it refers to nuclear fuel mainly composing of uranium oxide and plutonium oxide (excerpted from “Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.”)

Coordinators: NSnet Office

(3) Fields of Responsibility

1st group: Organization/administration, emergency measures, education/training

2nd group: Operation/maintenance, radiation protection

3rd group: Addressing important issues

(4) Facilities to be Reviewed

Organization/administration, emergency measures, and education/training were reviewed for the station. Field observations and document examinations in other areas, including operation/maintenance, were carried out with respect to Unit 3 and 4 as representatives.

5. Review Schedule

The review was carried out over a four-day period according to the schedule shown below.

		1 st Group	2 nd Group	3 rd Group	
Dec. 12 (Tue.)	AM	Opening (Introductory outline of company/facilities, etc.)			
		Plant Tour [Main control rooms for Units 3 and 4]			
	PM	Document examination (1. Organization/ administration)	Field observation [Unit 3 and 4 Main control room]	Document examination (6. Addressing important issues: 6-3: Activities to improve the safety and reliability of the power station 6-1. Addressing nuclear energy safety centering on nuclear safety)	
			Document examination (4. Operation/maintenance: (1) Effective operation administration)		
Field observation [Unit 3 Main control room]					
Dec. 13 (Wed.)	AM	Document examination (2. Emergency measures)	Document examination (4. Operation/maintenance: (2) Effective maintenance administration)	Document examination (6. Addressing important issues: 6-1. Addressing nuclear energy safety centering on nuclear safety 6-2 Reflecting on past problems)	
		Field observation [Emergency Operation Room]			
	PM	Interview [General manager] [Managers] [Responsible personnel]	Interview [Managers] [Responsible personnel] (Operator, maintenance-engineer)		Interview [Responsible personnel]
			Field observation [Unit 3 spent fuel treatment facility]		
Dec. 14 (Thu.)	AM	Document examination (3. Education/training)	Document examination (5. Radiation protection)	Document examination (6.3 Coping with aged plants)	
		Verification of Fact	Field observation [Radioactive solid waste storage facility]	Field observation [Unit 3 and 4 Main control room] [Radioactive waste treatment facility]	
	PM			Verification of Fact	Verification of Fact
Dec. 15 (Fri.)	AM	Verification of Fact, Closing			

6. Methods and Items of Review

6.1 Review Methods

The review was conducted with respect to various activities to improve plant safety as outlined below. Good practices and items to be improved were identified through field observations of such activities, examination of the documents presented by the plant, and interviews with the employees.

During the review process, the review teams also introduced useful examples of activities, such as the example of the education/training to transfer of technical know-how, the ethics, and the activity for critical safety, to facilitate nuclear cultural exchange.

(1) Field Observations

Direct observation was made with regard to actual activities compared with the items confirmed through document examinations and interviews. Findings were compared with reviewers' knowledge and experience.

(2) Document Examination

With regard to each review item, documents were examined while receiving explanation on them and requesting relevant documents as the need arises. In-depth examination was conducted, asking for relevant documents after observing field facilities and activities.

(3) Interviews

Interviews were conducted with respect to General manager, managers, operators, and maintenance personnel with the following objectives:

- a. Collecting additional information that cannot be verified through documents
- b. Questions and answers on problems identified during document examination
- c. Grasping the degree of understanding of determined items and responsibilities imposed on each individual
- d. Understanding the compliance status of determined items and whether such items have become dead letters
- e. Understanding the attitude and awareness toward nuclear safety

6.2 Items of Review

Field observations, document examinations, and interviews were conducted based on the review items identified in "3. Points of Review." Results were evaluated and itemized. They were then summarized in "7. Main Conclusions."

Section 1: Organization/Administration

To ensure nuclear safety, the review was conducted to check whether the necessary personnel are assigned to ensure safe operation, whether "safety culture" that always prioritizes safety is fully recognized, whether effective communication with subcontractors is maintained, and whether public acceptance activities for the local community are promoted through disclosure.

The issue of data manipulation was examined in terms of quality control enhancement and morality.

(Review Items)

(1) Effective organization management

- a. Clarifying the line-organization and the system of responsibility
- b. Setting up goals of the organization

- c. The leadership of the managers
- (2) Activities to promote safety culture and improve morality
 - a. Specific activities to promote “safety culture”
 - b. Specific activities to improve morality
 - c. Public acceptance activities for the local community
- (3) Quality control
 - a. Effective audit system
 - b. Preventing data manipulation

Section 2: Emergency Measures

Considering the enforcement of the Nuclear Disaster Special Measures Law in June 2000 (hereafter referred to as the “Nuclear Disaster Law”), the review was conducted to examine whether emergency plans and equipment are in place and whether training is carried out responsibly.

(Review Items)

- (1) Emergency plans
 - a. Drawing up emergency plans
 - b. Improving emergency organizations
 - c. Developing emergency procedures
 - d. Keeping employees well informed
- (2) Emergency facilities, equipment, and resources
 - a. Inspection and maintenance of facilities, equipment, and resources
- (3) Emergency training
 - a. Implementation of training (actual results)

Section 3: Education/Training

Based on the idea that improving technical skills and safety awareness among employees contributes to improving nuclear safety, the review was conducted to examine whether effective education and training systems, including the systems of subcontractors, have been developed, whether credential certification systems have been introduced, and whether they have been implemented responsibly.

How the accumulation and transfer of technical know-how is incorporated in the education and training system was also included in the review items.

(Review Items)

- (1) Qualifications
 - a. System of certificate qualifications
 - b. Evaluation criteria
- (2) Training plans and implementation
 - a. Education and training plans
 - b. Implementation of education and training plans

Section 4: Operation/Maintenance

The review was conducted to check whether high-level safety is ensured with regard to various items concerning operation and maintenance administration. Regarding the Operation and Maintenance Departments, it was examined as a common issue whether adequate personnel, including those from subcontractors, are assigned and whether documentation is facilitated and complied with. In addition, the review focused on compliance with operating limits in the area of operation administration and functional classification of individual systems and equipment as well as corresponding maintenance and inspection in the area of maintenance administration. Paying attention to shortened annual inspection, moreover, it was examined whether inspection periods are

not shortened disregarding safety.

(Review Items)

- (1) Effective operation administration
 - a. Operation organization
 - b. Operating books and manuals, and compliance with them
 - c. Design control (compliance with operating limits)

- (2) Effective maintenance administration
 - a. Maintenance organization
 - b. Maintenance documents and procedures, and compliance with them
 - c. Maintenance systems and equipment
 - d. Work plans and administration

Section 5: Radiation Protection

To ensure adequate dose control for employee based on the idea of ALARA⁵, monitoring of radiation dose outside the controlled area, and disposal and reduction of radioactive waste, various measures and their implementation status were reviewed.

(Review Items)

- (1) Dose control for employees engaging in radiation related tasks and ALARA plans
- (2) Monitoring radiation dose
 - a. Monitoring radiation dose in normal and accident situations
- (3) Disposal and reduction of radioactive waste
 - a. Radioactive waste disposal
 - b. Reducing the generation of radioactive waste

Section 6: Addressing Important Issues

Each step of nuclear safety was examined from the acceptance of new fuel, fuel loading/operation/removal to spent fuel storage and transportation to extend criticality safety at nuclear fuel facilities to nuclear power stations. In addition, activities concerning risk evaluation were examined, such as periodic safety review (PSR)⁶ reports and accident management (AM)⁷ measures.

The review also focused on the system and record reflecting problematic events that have occurred at domestic and overseas nuclear facilities in the past.

The Company's activities to improve the safety and reliability of Genkai were also reviewed. These include PSR conducted at Genkai and specific instances of the upgrading work on the major equipment of Units 1 and 2, scheduled to be carried out in 2001.

⁵ ALARA stands for as low as reasonably achievable. It is the basic concept for conducting radiation protection recommended by the International Commission on Radiological Protection (ICRP).

⁶ PSR stands for Periodic Safety Review. It means to conduct a periodic review on nuclear reactor facilities that have been in operation for a certain period since the start of operation with regard to the status of incorporating operating experience and the latest technical knowledge and information (excerpted from "1999 Nuclear Safety White Paper").

⁷ AM stands for Accident Management. Measures to be taken to mitigate the effect of severe accidents caused by an event exceeding the scope of design standard events (events that may lead nuclear facilities to the abnormal status and are determined to be considered when evaluating the safety design of nuclear facilities) to cause significant damage to the reactor core (excerpted from "1998 Nuclear Safety White Paper").

(Review Items)

Section 6.1: Activities for nuclear safety

- (1) New and spent fuel management
- (2) In-core fuel management
- (3) Shutdown safety measures
- (4) Activities concerning risk criteria

Section 6.2: Reflecting past problematic events

- (1) Modifying and improving systems and operating methods
- (2) Emergency response
- (3) Measures to prevent fuel leakage and fuel integrity monitoring (specific example 1)
- (4) Fire and explosion prevention (specific example 2)

Section 6.3: Activities to improve the safety and reliability of the power station

- (1) Periodic safety review (PSR)
- (2) Upgrading work on the major equipment of Units 1 and 2

7. Main Conclusions

Summarizing the results from the review of Genkai Nuclear Power Station, Kyushu Electric Power Co., Inc., no items were identified that may lead to the occurrence of serious accidents unless immediate improvement measures in terms of nuclear safety are taken. In addition, it was confirmed that at Genkai, all the employees, including the superintendent and employees of cooperating companies, are seriously endeavoring to continue and enhance nuclear safety.

Moreover, Genkai is endeavoring to improve the sense of reliability and safety concerning nuclear power generation by actively promoting local public acceptance programs. These include the opening of Genkai Energy Park at the end of March 2000, accepting school personnel at the Nuclear Training Center, presenting and explaining related facilities to the media and local fire fighting personnel, and routine dialog with local communities.

Furthermore, Genkai is actively implementing various measures to improve plant reliability, such as the upgrading work on major equipment, planned to be carried out during the 2001 annual inspection of Units 1 and 2.

In the future, it is desirable for Genkai to continue voluntary safety efforts, aiming to further improve its safety culture, rather than being satisfied with the current status. It is also expected that the fruitful results from the review will be incorporated into activities at Sendai Nuclear Power Station and affiliate companies.

The following major desirable practices were identified during the review, and these should be introduced extensively to other members of the NSnet and the nuclear industry:

- To promote public acceptance among local communities, dynamic activities are being carried out, such as the utilization of Genkai Energy Park, routine dialog, and quick and appropriate provision of information. These also include, in particular, opening to the local public the greenhouse utilizing the waste heat of blow-down water from the steam generator (hereafter referred to as "SG"), presenting and explaining related facilities to the media and local fire fighting personnel, and providing the local public with information obtained by installing a "PR seismometer" that measures seismic intensity at the plant.

- It is possible for Shift Managers to take appropriate measures when an alert sounded by utilizing the “Alert Measures Support System” installed in the central control room. This “Alert Measures Support System” displays presumed causes, actions to be taken, and predictable results corresponding to the alerts/alarms prepared in the central control room.
- When a department in charge of maintenance judges that certain domestic and overseas problems should be studied and effectively apply for the operations and failure prevention, specific remarks are required in “work manuals” submitted by contractors, the validity of which is then examined by the “Accident and Failure Information Examination Committee.” The information is revised as the need arises before it is put into operation.
- When the central instrumentation boards of Units 1 and 2 are replaced, operators who conduct actual operation from early stages participate in the examination of basic and detailed designs and work flows. Periodic meetings are held by personnel from Kyushu Electric Power Co., Inc. and manufacturers to ensure in-depth examination. In addition, to ensure the development of “Operating Standards,” a full-scope simulator identical to the actual system is installed at the Nuclear Training Center. The verification of the “Operating Standards” and activities to improve the degree of learning among operators are carried out systematically.

On the other hand, several suggestions have been made for improvement of the activities to ensure safety at Genkai. The major proposals are as follows:

- Genkai implements solid measures to ensure safety and stable operation. Although favorable operation is expected to continue, it should be considered as an objective in the future to establish training programs in which abnormal conditions, such as pump vibration and cavitation, can be experienced, using the existing training equipment.
- Although in-depth criticality safety education was conducted in FY 1999 in relation to the JCO accident, a certain form of periodic education is desirable.
- Notification and liaison systems in the event of fire are prescribed in the “Fire Fighting Program” as well as in a brochure called the “Work Safety Unified Rules,” which are distributed among the employees, including those from cooperating companies for their information. To ensure the success of such systems, it is desirable to consider posting the necessary information at major parts of the site.

Itemized reports are published on the Japanese homepage.