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

Place of
Review:

**Tokai Daini Nuclear Power Station,
JAPAN ATOMIC POWER COMPANY
(Tokai-mura, Naka-gun, Ibaraki-pref)**

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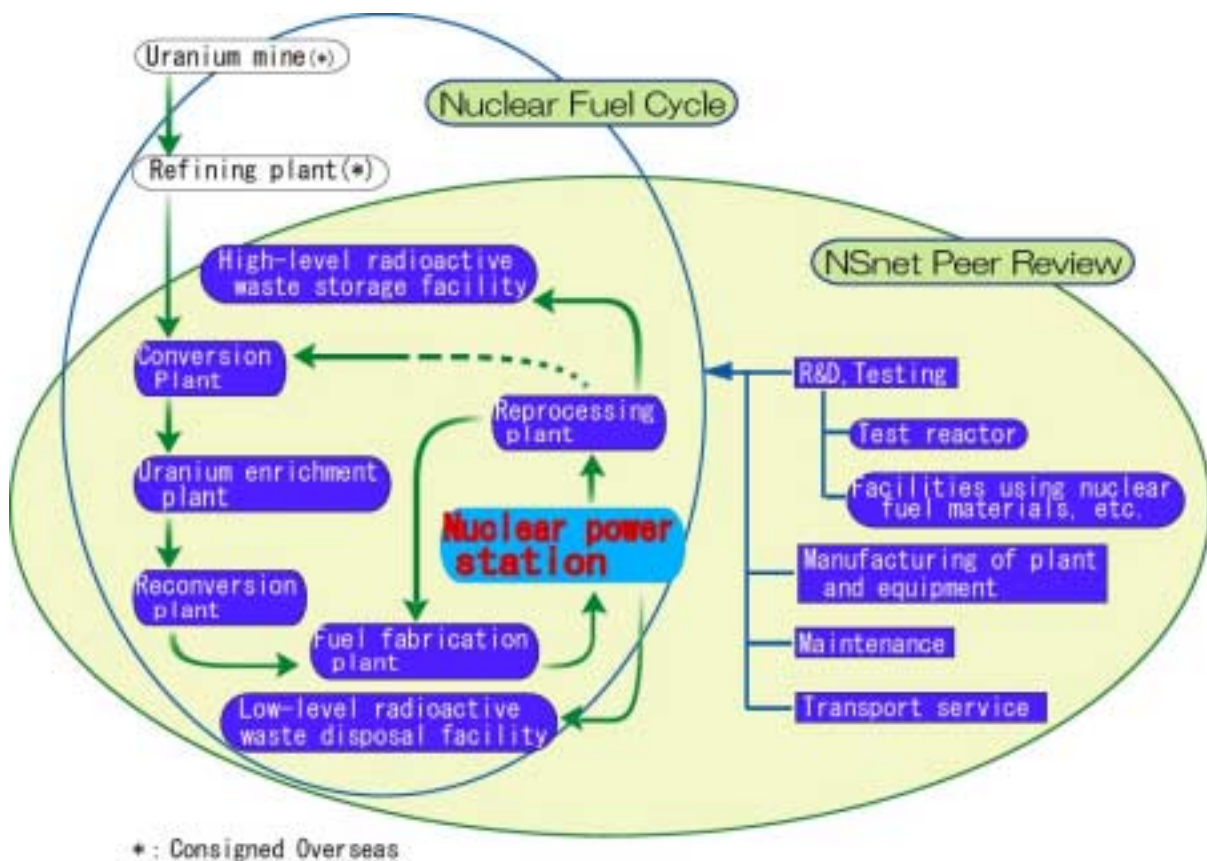
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1. Objectives

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

The Japan Atomic Power Company (JAPC) is a wholesale power operator established in 1957. JAPC has Tokai Power Station, which is Japan’s first commercial nuclear power station (its commercial operation started in July 1966 and terminated in March 1998, and currently its in-core fuel is being discharged), Tokai Daini Power Station, and Tsuruga Power Station Units 1 and 2.



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

Three units are in operation, generating 2.617 million kW (at the end of October 2000) (See the tables below).

[Power Stations in Operation]

Power Station (Unit No.)	Power Output (MW)	Reactor Type	Start of Commercial Operation	Performance (from the start of commercial operation to the end of October 2000)	
				Power Generated (billion kWh)	Capacity Factor ¹ (%)
Tokai 2	1,100	BWR	1978/11	154.28	75.0
Tsuruga (Unit 1)	357	BWR	1970/03	61.79	65.8
Tsuruga (Unit 2)	1,160	PWR	1987/02	113.13	81.2
Total	2,617				

[Power Stations out of Operation]

Power Station	Electric Output (MW)	Reactor Type	Start of Commercial Operation	End of Commercial Operation	Power Generated (billion kWh)	Capacity Factor (%)
Tokai	166	GCR	1966/07	1998/03	29.0	62.9

BWR: Boiling Water Reactor

PWR: Pressurized Water Reactor

GCR: Graphite-moderated, Carbon Dioxide Gas-cooled Reactor

The review was conducted at the Tokai Daini Power Station (hereafter referred to as "Tokai 2") located in Tokai-mura, Ibaraki Prefecture. Tokai 2 (electric output: 1.1 million kW) started its commercial operation as a plant serving as a basis for large-scale nuclear power stations in Japan in November 1978. Since then, it has been continuing a safe and stable operation (average capacity factor: 75.0%), renewing its record of accumulated power generation as a single BWR unit of a plant in Japan (154.28 billion kWh as of the end of October 2000).

Tokai 2 had approximately 280 employees as of the end of October 2000 (employees except the Operation Department are concurrently working for Tokai 1 located on the same site). There are approximately 20 executive staffs, including Superintendent. Approximately 70 employees in the Plant operation office (55 of them are working as operator in 6 groups in 3 shifts), approximately 70 in the Maintenance sections, approximately 50 in other technical sections, and approximately 70 in administrative work sections, such as the General Affairs section. In addition, approximately 600 employees from the subsidiaries and subcontractors are stationed the offices located on the same site to support operations and maintenance work.

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

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

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
- (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 to ensure plant safety during reactor shutdown period and against aged plant matter.

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.”)

4. Period and Outline of Review

- (1) Date: October 17 (Tuesday) to October 20 (Friday), 2000
- (2) Formation of Review Teams
 - 1st group: Mitsubishi Heavy Industries Ltd.; Electric Power Development Co.
 - 2nd group: The Hokkaido Electric Power Co., Inc.; Japan Atomic Energy Research Institute
 - 3rd group: Mitsubishi Nuclear Fuel Co., Ltd.; NSnet Office
 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

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
Nov. 14 (Tue.)	A M	Opening (Introductory outline of company/facilities, etc.)		
		Plant Tour		
Nov. 14 (Tue.)	P M	Document examination (1. Organization/ administration)	Document examination (4. Operation/maintenance)	Document examination (6. Addressing important issues: 6-1. Nuclear energy safety)
				Interview [Responsible personnel]
Nov. 15 (Wed.)	A M	Document examination (2. Emergency measures)	Document examination (4. Operation/maintenance)	Document examination (6.2 Reflecting on past problems)
		Field observation [Emergency Operation Room]	Interview [Managers] [Responsible personnel]	
	P M	Interview [Superintendeeent] [Managers] [Responsible personnel]	Field observation [Main control room] Interview [Managers] [Responsible personnel]	Field observation [spent fuel pool etc.]
Nov. 16 (Thu.)	A M	Field observation [Nuclear power plant training center]	Document examination (5. Radiation protection)	Document examination (6.3 Activities to cope with secular changes)
		Document examination (3. Education/training)	Field observation [Radioactive solid waste storage facility]	
	P M	Verification of Fact	Verification of Fact	Verification of Fact
Nov. 17 (Fri.)	A M	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 their useful examples of activities, 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 directors, 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 accident management (AM)⁶ 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.

Activities concerning a periodic safety review (PSR)⁷ and engineering work to cope with secular changes were reviewed.

(Review Items)

Section 6.1: Activities for nuclear safety

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 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”).

⁷ 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”).

- (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 Cope with Secular Changes

- (1) Periodic safety review
- (2) Engineering work to cope with secular changes

7. Main Conclusions

Summarizing the results from the review of JAPC's Tokai 2, no items were identified that may lead to the occurrence of serious accidents without immediate improvement measures in terms of nuclear safety must be taken. In addition, it was confirmed that at Tokai 2, all the employees, including Superintendent and employees of cooperating companies, are seriously endeavoring to continue and enhance nuclear safety.

JAPC also has rich experience in terms of safety control as a pioneer of Japan's nuclear power generation. It is actively promoting for the safety management against the prevention of human error and the adaptation of various ideas in terms of both hardware and software.

Moreover, since Tokai 2 is located in Tokai-mura with many other nuclear facilities, JAPC seems to be striving for sharing nuclear safety culture by utilizing local networks and exchange with other nuclear facilities, such as the Nuclear Establishment Safety Cooperation Agreement (hereafter referred to as "Tokai NOAH⁸ Agreement.")

In the future, it is desirable for Tokai 2 to continue voluntary safety efforts, aiming to further improve its safety culture, rather than being satisfied with the current performance.

It is also expected that the fruitful results from the review will be incorporated in activities at Tokai and Tsuruga Power Stations including the subsidiaries and subcontractors.

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

- Thorough efforts are being made to promote equal partnership with cooperating companies through various activities, such as making pocket-size

⁸ Tokai NOAH: Using the initials of the municipalities, namely Naka-machi, Oarai-machi, Asahi-mura, and Hitachinaka-shi, together with Tokai-mura, in which 21 nuclear operators are located who signed the Safety Cooperation Agreement among Nuclear Operators. This agreement is referred to as the "Tokai NOAH Agreement."

brochures titled “Rules for personnel entering the site,” in which preparation as the employee of the power station and cooperating companies, and proposals for cultural reforms are described. And collecting opinions from related companies by setting up an opinion box on the Internet, and organizing informal gatherings on site among managers and employees of cooperating companies.

- In an effort to prevent the recurrence of past problems in cooperation with contractors, past problems are surely incorporated into work procedures according to the “Work Procedure Check Sheets” based on the “Work Procedure Check Sheet and Recurrence Prevention Manual”, when the work procedures submitted by contractors are checked. Contractors are also informed of the contents of these check sheets with the aim of sharing information.
- HIYARI-HATTO instances (near miss situations) are widely collected from various sources, including cooperating companies, to ensure safety consciousness. Specifically, a system has been developed and put into operation to allow ongoing examination, in which HIYARI-HATTO instances are collected routinely and informed to concerned parties the following week.
- To prevent human error in operation, shift operators are required to consider and input prevention measures, using the “Human factor lessons utilization program,” which are then examined by each shift groups. Results are published on the electronic bulletin board on the in-house LAN to inform all concerned personnel.

On the other hand, several suggestions are made to improve the activities to ensure safety at Tokai 2 of The Japan Atomic Power Company. Major proposal are as follows:

- Programs have been developed to increase the number of personnel in their 20s and 30s who have the license of chief reactor engineers. It is expected that such programs be surely implemented.
- Regarding the utilization of “Work Procedure Check Sheets” based on the “Work Procedure Check Sheet and Recurrence Prevention Manual,” which was pointed out as a good practice, although the utilization of check sheets is prescribed in the manual, it is not stipulated to inform such check sheets to contractors (who prepare work procedures). This work is considered very effective in sharing information to prevent the recurrence of problematic instances. It is, therefore, desirable to specify the timing and method for sharing information in that manual.

Itemized reports are published on the Japanese homepage.