



Nuclear Safety Network (NSnet)
Otemachi Building #437
1-6-1 Ote-machi, Chiyoda-ku, Tokyo 100-0004
Tel: +81-3-5220-2666 Fax: +81-3-5220-2665
URL: <http://www.nsnet.gr.jp>

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Summary Report of Peer Review

(Provisional Translation)

Place of
Review:

**Ohi Nuclear Power Station,
THE KANSAI ELECTRIC POWER CO.,Inc.
(Ohi-cho, Ohi-gun, Fukui-pref)**

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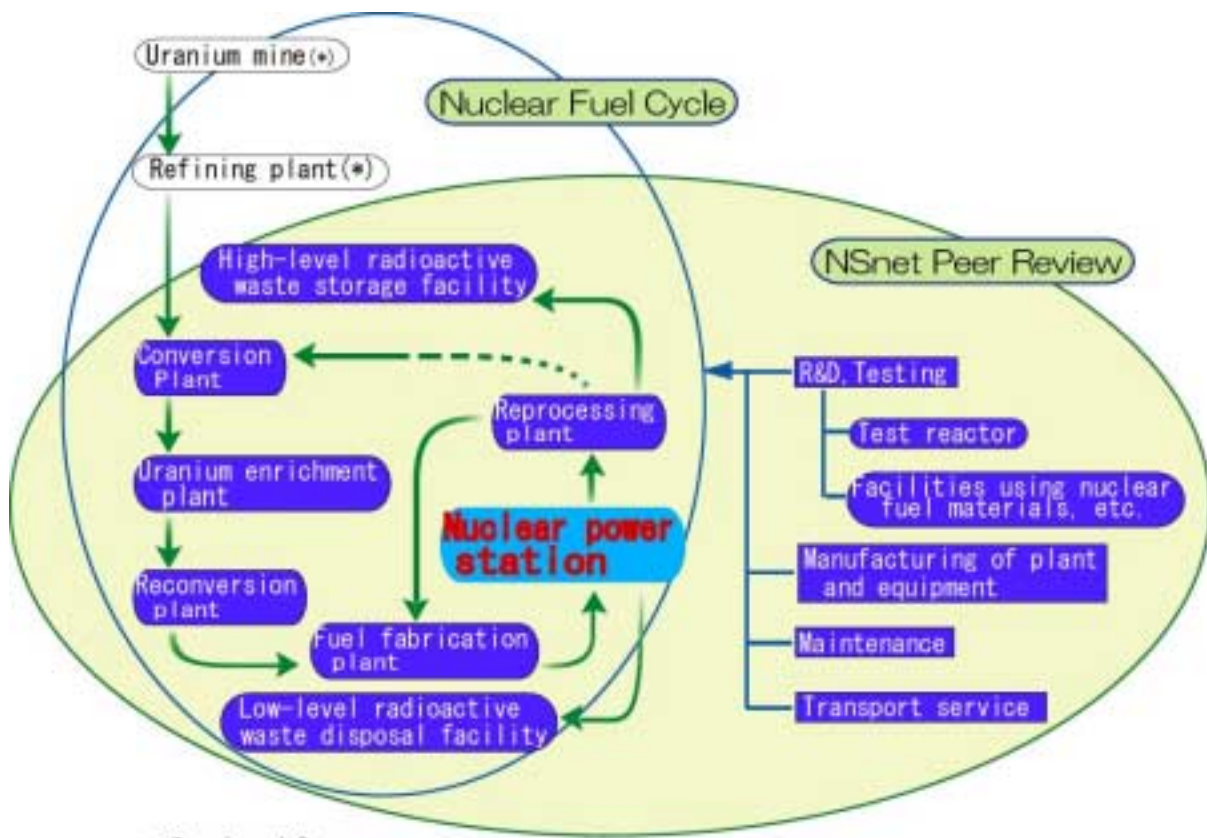
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1. Objectives

The purpose of the NSnet peer review (hereafter referred to as “Review”) is to improve the “safety culture” of the entire nuclear power industry by sending review teams of member specialists to member facilities. Through the Review on every nuclear safety practice, sharing the knowledge about good practices as well as subject to be improved would be achieved.

2. Summary of the Ohi nuclear power station

The present Kansai’s nuclear power generation division, comprising 3 power stations, Ohi, Takahama, and Mihama, and totaling 9770MW of installed power, generates 125.604 billion kWh in 2000, which accounts for roughly 55.8% of the companies total output.



✦: Consigned Overseas

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

The Ohi Nuclear Power Station (hereinafter referred to as the” Power Station”) has four pressurized water reactors (PWR) with the greatest capacity in Japan. Unit 1 commenced in March of 1979, Unit 2 in December of 1979, Unit 3 in December of 1991, and Unit 4 in February of 1993. (Refer to the table below.)

Unit	Power Output (MW)	Reactor Type	Start of Commercial Operation	Performance (Cumulative Totals) (As of the end of March 2001)	
				Power Generated (billion kWh)	Availability ¹ (%)
1	1,175	PWR	March, 1979	1,39.4	61.5
2	1,175	PWR	December, 1979	153.06	69.7
3	1,180	PWR	December, 1991	84.83	88.3
4	1,180	PWR	February, 1993	70.09	83.1

The location of the Power Station (Oshima, Ohi-cho, Ohi-gun, Fukui Prefecture) is to the west of Obama City that is the center of the Wakasa Region, at the tip of the Oshima Peninsula, where the site area covers approximately 1,880,000 square meters.

The organization of the Power Station is divided into four departments, operation, maintenance, engineering (Engineering, Safety Control, Radiation Control) and administration. The operation department consists of two offices, which are respectively responsible for unit No.1, 2 and unit No.3, 4. The number of the company's staff of this organization is approximately 510. (Operations: 180, Maintenance: 160, Engineering: 90, Administration: 80) In addition, approximately 2,500 employees of cooperating companies are working in this site on the contract of the maintenance and other administrative activities.

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 (including the improvement of emergency prevention)
- (3) Improvements of safety based on operating experience
- (4) Lessons learning from the JCO accident
- (5) Recent issues concerning LWRs

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

The viewpoints of the Review based on above five basic points are followings.

"(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 the rules based on these documentation should be complied with. Appropriate communication with subcontractors should be ensured. Radioactive waste disposal and radiation protection should be conducted appropriately.

"(2) Relationship with the community (including the improvement of emergency prevention):" Emergency preparedness should be implemented adequately. Efforts such as public

open policy should be emphasized on promoting nuclear safety.

“(3) Improvements of safety based on operating experience:” Preventive countermeasures based on some troubles at other plants should be appropriately implemented in an operating method as well as equipment.

“(4) Lessons learned from the JCO accident:” Appropriate nuclear fuel management should be ensured to prevent critical phenomenon at the storage. In addition, reactor control² should also be adequately managed in order to maintain sound core condition. (neutronics safety³) Furthermore safety culture should be enhanced in the general practices at the Power Station.

“(5) Recent issues concerning LWRs:” Quality control should be enhanced to cope with the problem of data falsification in inspections of piping welds, spent fuel transportation containers, and MOX fuel⁴. Activities should be promoted to develop measures of the recent topics to avert the risks such as recriticalization during midloop operation.

4. Period and Outline of Review

(1) Date

January 22 (Tuesday) to January 25(Friday), 2002

(2) Formation of Review Teams

A group: Central Research Institute of Electric Power Industry; Sumitomo Atomic Energy Industries, Ltd.

B group: Tohoku Electric Power Company, Inc.; Toshiba Corporation

C group: Global Nuclear Fuel Japan Co., Ltd.; NSnet Office

Coordinators: NSnet Office

(3) Fields of Responsibility

A group: Organization/administration, emergency measures, education/training

B group: Operation/maintenance

C group: Radiation protection, 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. Schedule of Review

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

		A Group	B Group	C Group
Jan. 22 (Tue.)	M	Opening (Greetings, Introductory outline of station/facilities, etc.)		
		Plant Tour [Main control room]		
	M	Document examination (1. Organization/ administration)	Document examination (4.2 Maintenance administration)	Document examination (5. Radiation protection)
			Field observation [Main control room (Observing the status of taking over shift operation)]	Field observation [Drum yard, etc.]
Jan. 23 (Wed.)	M	Field observation [Nuclear power maintenance training center ⁵]		
		Interview [General manager] [Managers]	Document examination (4.2 Maintenance administration)	Document examination (6.1 Neutronics safety)
	M	Document examination (3. Education/training)	Interview [Managers] [Maintenance personnel]	Interview [Responsible personnel]
		Document examination (2. Emergency measures)	Field observation [Main control room]	Field observation [Reactor building]
		Field observation [Engineering simulator]	Document examination (4.1 operation administration)	Document examination (6.2 Reflecting past problematic events)
		Field observation [Emergency Operation Room]		
Jan. 24 (Thu.)	M	Document examination (2. Emergency measures)	Document examination (4.1 operation administration)	Document examination (6.2 Reflecting past problematic events)
		Field observation [Monitoring car, etc.]	Interview [Managers] [Operators]	
		Interview [Responsible personnel]		
	M	Verification of Facts		
Jan 25 (Fri.)	M	Verification of Facts, Closing		

6. Methods and Items of Review

6.1 Review Methods

The Review was conducted on activities for the promotion of improvement of safety in the Station. In the Review, investigation was conducted through observation of the site where the activities are practiced, verification of the documents presented, and discussion based on the documents and interviews with the employees. Then, the results were evaluated to select examples of good practices and items to be improved.

During the Review, the Review team appropriately showed useful examples of activities of the reviewer's company. This facilitates nuclear safety culture each other.

6.1.1 Review Procedures

(1) Field Observations

Field observation was made with regard to actual activities on the field 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 the 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 employee's understanding with respect to safety rules and responsibilities imposed on each individual
- d. Understanding the state of compliance with safety rules, verifying not to be rubber-stamping
- e. Understanding the attitude and awareness toward nuclear safety

6.1.2 Standing point to select Good Practices and Suggestions for Improvement

(1) Good Practices

"Information on good practices incorporating appropriate, effective, and unique methods into activities to ensure safety shall be widely distributed to the members of the NSnet and the nuclear industry".

(2) Suggestions for Improvement

"After comparing the station's practices with the best in the nuclear industry, suggestions to improve and enhance safety activities should be implemented so as to achieve the highest level of nuclear safety."

Even if current activities are equal to or higher than general standards in the nuclear industry, there is still room for improvement.

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 public-open-policy.

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

(Review Items)

- (1) Effective organization management
 - a. Clarifying the 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 falsification
 - c. Revising documents in accordance associated with the revision of safety regulations

Section 2: Emergency Measures

Considering the enforcement of the Special Measures Law for Nuclear Disasters in June 2000, 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. Establishment emergency organizations (including notification and liaison systems)
 - 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 view points 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
- (3) Technical transfer
 - a. Operators
 - b. Maintenance personnel

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 to clarify the appropriateness of personnel and organizations as well as the establishment and compliance with in-house standards and manuals as common items. In addition, the Review focused on compliance with operating limits in the area of operation administration and on the maintenance and inspection corresponding with functional classification in the area of maintenance administration. It was also examined whether inspection periods are not shortened disregarding safety.

(Review Items)

- (1) Effective operation administration
 - a. Organization
 - b. Manuals
 - c. Activities

- (2) Effective maintenance administration
 - a. Organization
 - b. Maintenance documents and procedures
 - c. Management
 - d. Schedule control

Section 5: Radiation Protection

To ensure adequate dose control for employee based on the idea of ALARA⁶, the way of monitoring of radiation dose outside the controlled area, and disposal and reduction of radioactive waste 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. Management of radioactive waste disposal
 - b. Management of reducing the volume of radioactive waste

Section 6: Special issues

The way of critical control was examined on the every step of fuel handling, such as fuel loading/operation/removal to the spent fuel storage pool and transportation. In addition, activities

concerning risk evaluation were examined, such as accident management (AM)⁷ measures.

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

(Review Items)

Section 6.1: Activities for nuclear safety

- (1) New and spent fuel management
- (2) In-core fuel management
- (3) Safety measures during reactor shutdown
- (4) Activities based on probabilistic safety assessment

Section 6.2: Reflecting past problematic events

- (1) Modifying systems and improving operating procedure
- (2) Activities for human error prevention
- (3) Activities for emergency
- (4) Measures to prevent fuel leakage and fuel integrity monitoring
- (5) Fire and explosion prevention

7. Main Conclusions

Summarizing the results of the Review of the Power Station, no particular items that might cause serious accidents problems without improvement of nuclear safety were identified.

It was confirmed that all members of staff in the Power Station, including employees of cooperating companies, are enthusiastically making every effort with regard to nuclear safety.

The General Manager, head of the Power Station, sets up the following policies with a slogan of “Our Own Plant”. “Making a friendly and trustworthy power station with a local community based on the good performance of safety and stable operations.” ”Having good relationships with each other. Making challenging and fascinating jobs”. These policies are developed into detailed guidelines, named “Action Emphasis Policies”, involving maintaining trouble-free facilities and raising an availability. They also involve policies of establishing safety culture such as intensive communication and compliance with safety regulations. These activities and efforts are also translated into a few of measurable objectives/performance indicators and also reviewed periodically by the managerial classes.

In the future, it is desirable that the Power Station will continuously make efforts to promote safety activities without sense of obligation.

In addition, it is expected that the achievements of this Review of the Power Station will also be found in the Mihama Power Station and the Takahama Power Station, as well as in the cooperating companies.

In this Review, several good practices which should be widely introduced not only to members of the NSnet, but also to the nuclear power industry were found. Some good practices are as follows.

Fostering safety culture through effective use of performance indicators

Concrete performance indicators related to the operation of the Power Stations have been well arranged. “Comprehensive indicators” are set up by the General Manager. Sub-indicators, which contribute to achieving “Comprehensive indicators”, have been decided by the every section manager based on the “Action Emphasis Policies”. In addition, “the Annual of the Power Station” in which these indicators are summarized simply, is issued every year and distributed to all employees. The actual monthly state of affairs is updated in a timely manner into the Power Station’s database, and is displayed on the electronic bulletin board. This is making a contribution to the nurturing of safety culture among the employees.

The system for cooperation with other power stations in the event of an emergency situation

In preparation for the occurrence of an emergency situation, cooperation between this company's three nuclear power stations is stated in the "Ohi Power Station Nuclear Power Industry Disaster Prevention Plan." In addition, along with the conclusion of the "Confirmation Report Concerning Cooperation among Wakasa-Region Nuclear Power Operators in the Event of a Nuclear Disaster" between the companies, Kansai Electric Power Co., Inc., the Japan Atomic Power Company, and the Japan Nuclear Cycle Development Institute, that have power stations in the Wakasa Region, a "confirmation report concerning cooperation among the nation's nuclear power generating firms" has been concluded. That means the cooperative system has been established.

Accumulation of such things as safety-related know-how through the utilization of the Power Station database

Through the shared use of databases such as the following types, safety-related know-how will be accumulated, contributing to the improvement in safety.

1. "Annual Inspection Operation Database": The isolation and restoration procedures at the annual inspection are systematically organized in the database system with experimental know-how and results.
2. "Technology Dissemination Database": Knowledge and techniques with regard to the change of facilities and operating manuals are organized so as to accumulate the operating experience.
3. "Annual Inspection Introspection Database": Experience such as inspection results, causes of troubles, schedule during the annual inspection are shared among the staff.

Utilization of Equipment Handling support System

Bar codes are affixed to the valves in the sites. Isolation specifications are confirmed by a bar code reader, contributing to the human-error prevention.

Sharing of information regarding troubles

To manage the situations and items of trouble information exchange, they have constructed a company-wide exclusive database with formatted system, which covers all levels in trouble information exchange process, such as "finished," "underway," and "planned." All company employees can access the information via the intra-company LAN, serving the function of accurate operation of trouble information exchanges and following up on the implementation.

On the other hand, for the purpose of further safety culture, we instituted the following proposals.

Providing the latest model of infrastructures for on-site emergency center in the event of emergencies

Along with the plan of enlarging the space of the on-site emergency center, they are planning the provision of all types of infrastructure reflecting other companies' newest facilities to share information with the head office, the Wakasa Branch, and the Off-Site Center⁸. It is desirable that this plan will steadily be put into effect.

Enhancing the information exchange between operation sections

The Ohi Power Station has two operation sections. One is for units 1,2, and the other is for units 3,4. Operation section meetings with the shift supervisors of each operation section are held periodically, and mutual communication and information exchanges between each of the on-duty groups are striven for. However, the daily shift supervisors and the operation section manager who belong to the other operation section should participate as observers in these meetings to promote further communication.

Educational materials that enable a closer understanding of criticality safety

The description in the textbook, which deals with critical control of the fuel handling in the Power Station, are sufficient to understand the principles of criticality.

However it is desirable that the practical description such as notes for fuel handling should be added in order to understand the reasons broadly.

(Glossary)

- ¹ availability (%):
$$\frac{[\text{total power generation (kWh)}] \times 100}{[\text{licensed output (kW)}] \times [\text{total hours of operation (h)}]}$$
- ² Critical safety control : 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 Neutronics safety: 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.”)
- ⁵ Nuclear Power Plant Maintenance Training Center: The Nuclear Power Plant Maintenance Training Center of the Kansai Electric Power Co.,Inc. Human Development Center. In pursuit of increased trust in nuclear power generation, the Kansai Electric Power Co., Inc. established this in 1983, using past accidents and damage as valuable lessons, for the sake of improving maintenance techniques.
- ⁶ 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).
- 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”).
- ⁸ Off-Site Center: Off-Site Emergency Managing Control Center. In accordance with the Special Measures Law for Nuclear Power Disaster Countermeasures, in the event of a nuclear power emergency situation at a site, as a base for the national nuclear power disaster site countermeasure headquarters, the regional local self-governing body disaster countermeasure headquarters, etc., to share information and cooperatively undertake disaster response measures, the minister in charge designates in advance an emergency countermeasure base facility (Off-Site Center). The conditions for being an Off-Site Center are: 1) it is less than 20 kilometers from the nuclear power station; 2) roads and other measures for the assembly of concerned persons are secured; 3) it has a floor area of over 800 square meters; and so on. At present, nationwide 21 locations have been provisionally designated (8 from the Ministry of Education, Culture, Sports, Science and Technology, 15 from the Ministry of Economy, Trade and Industry, some of which are overlapping). In the Off-Site Centers, nuclear power disaster prevention specialists from the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Economy, Trade and Industry are stationed. (Cited from the “Nuclear Power Encyclopedia ATOMICA: Website of the Nuclear PA Database Center, Research Organization for Information Science & Technology”)