



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>

NSnet document number : (NSP-RP-009)
Date of publication: February 20, 2001

Summary Report of Peer Review

(Provisional Translation)

Place of
Review:

**Onagawa Nuclear Power Station,
TOHOKU ELECTRIC POWER CO.,INC.
(Onagawa-cho & Oshika-cho, Oshika-gun, Miyagi-pref)**

Date of
Review:

January 22-26, 2001

Publisher
:

Nuclear Safety Network

Contents

1. Objectives	1
2. Summary of Facility Operations	1
3. Points of Review	2
4. Period and Outline of Review	4
5. Schedule of Review	5
6. Methods and Items of Review	6
7. Conclusions	9

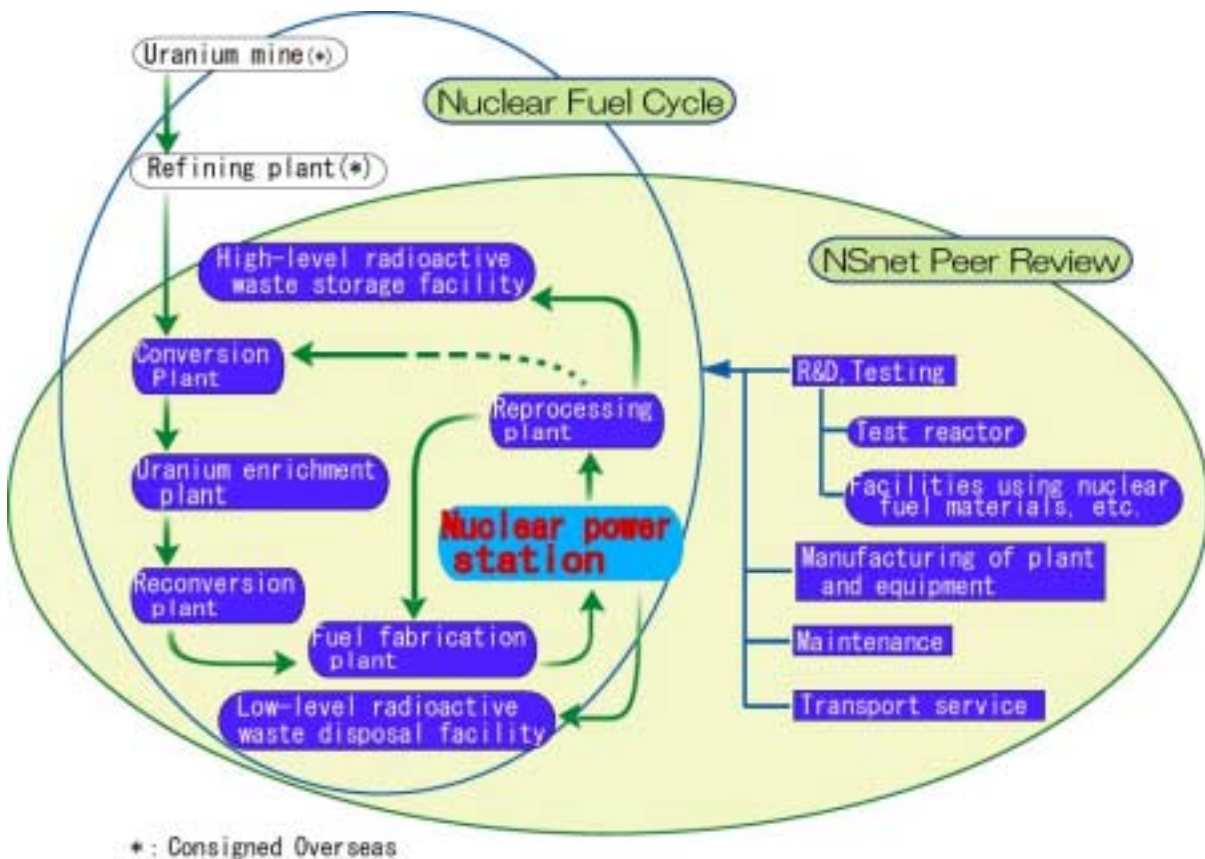
1. Objectives

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 of good practices as well as subjects that have been singled out.

2. Summary of Facility Operations

Tohoku Electric Power Co., Inc. supplies electricity to six prefectures in the Tohoku district and Niigata Prefecture. In FY 1999, the company generated and received a total of 79.585 billion kWh, approximately 19% of which was generated by nuclear energy.

In addition to Units 1 and 2 in operation at Onagawa Nuclear Power Station, the company is constructing a third unit at Onagawa Station and its first unit at Higashidori Nuclear Power Station in Higashidori-mura, Shimokita-gun, Aomori Prefecture.



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

Onagawa Nuclear Power Station (hereafter referred to as the “Station”), the subject of the review, is located on a site extending from Onagawa-cho to Oshika-cho, facing the Pacific Ocean. The site is on the north side in the middle of Oshika Peninsula, which has been designated as Minami Sanriku Kinkazan National Park, in the eastern part of Miyagi Prefecture, approximately 70 km east of the city of Sendai. The site has an area of approximately 1.73 million m². It is the

company's first nuclear power station with two BWR units in operation. The third BWR is under construction on the same site.

Unit 1 has been operating for more than 15 years since the start of commercial operation in June 1984. Unit 2 started commercial operation in July 1995. The total power generated by the two units is expected to reach 100 billion kWh in 2001.

The construction of Unit 3 started in September 1996. Its commercial operation is scheduled to start in January 2002. (See the tables below).

[In Operation]

Unit	Electric Output (MW)	Reactor Type	Start of Commercial Operation	Performance (total) (As of December 2000)	
				Power Generated (billion kWh)	Capacity Factor (%) ¹
1	524	BWR	June 1984	59.3	77.8
2	825	BWR	July 1995	33.7	85.7
Total	1,349	-	-	93.0	80.5

[Under Construction]

Unit	Electric Output (MW)	Reactor Type	Planned Start of Commercial Operation	Progress of Construction (As of the end of December 2000)	
				Progress of Overall Construction (%)	Number of Construction Workers
3	825	BWR	January 2002	94.5	203*

* 68 of these workers concurrently work for the Station.

The Station has approximately 310 employees, 110 of whom belong to the Operation Department who work in six groups on three shifts. Of the remaining employees, approximately 80 belong to the Maintenance Department, 60 to the Technical Support Department, and 60 to other departments, such as the General Affairs Department. In addition, approximately 730 employees (approximately 520 of whom are residents of Onagawa-cho, Oshika-cho, and Ishinomaki-shi) from cooperating companies are assigned to the Station to support the operation and maintenance of the plant.

The overall performance of the Station has been favorable since the start of commercial operation, as exhibited by the 80.5% total capacity factor (as of the end of December 2000) and the capacity factor for FY 1998 and FY 1999 was 90.6% and 83.4%, respectively.

3. Points of Review

The NSnet was established following the first criticality accident to ever occur 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 criticality accidents." In this review, in view of the recent trends in nuclear safety and accident prevention, we focused on the following five points in terms of both technical and social awareness of nuclear safety:

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

- (1) Foundation to ensure nuclear safety(contain communication with subcontractors)
- (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 selected and compared with the 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 (include communication with subcontractors):” 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:” Criticality safety control² at new fuel storage warehouses, spent fuel storage pools and other facilities handling nuclear fuel should be thoroughly 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 during reactor shutdown.

² To ensure safety so that fissile substances do not reach criticality and cause criticality 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 composed of two or more types of oxides. Generally, it refers to nuclear fuel mainly composed of uranium oxide and plutonium oxide (excerpted from “Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.”)

4. Period and Outline of Review

(1) Date

January 22 (Monday) to January 26 (Friday), 2001

(2) Formation of Review Teams

1st group: Ishikawajima-Harima Heavy Industries Co., Ltd.; Electric Power Development Co.

2nd group: The Kansai Electric Power Company, Inc.; Mitsubishi Heavy Industries, Ltd.

3rd group: Nuclear Development Corporation; NSnet Office

Coordinator: NSnet Office

(3) Fields of Responsibility

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

2nd group: Operation/maintenance

3rd group: Radiation protection, addressing important issues

(4) Facilities to be Reviewed

Organization/administration, emergency measures, and education/training were reviewed for the entire operation. Document examinations in operation/maintenance, were carried out with respect to Unit 2 as representative of the facility.

5. Review Schedule

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

		1 st Group	2 nd Group	3 rd Group
Jan. 22 (Mon.)	P	Opening (Introductory outline of company/facilities, etc.)		
	M	Plant Tour [Main control rooms for Units 1 and 2, reactor buildings, etc.]		
Jan. 23 (Tue.)	A	Document examination (1. Organization/ administration)	Document examination (4. Operation/maintenance: (2) Effective maintenance administration	Document examination (5. Radiation protection)
	M	Document examination (2. Emergency measures)		Field observation [Radioactive waste treatment facility, etc.]
	P	Field observation [Emergency Operation Room]	Interview [Managers] [Responsible personnel]	Document examination (6. Addressing important issues: 6-1. Addressing nuclear energy safety centering on nuclear safety)
			Field observation [Unit 2 Reactor buildings]	Interview [Responsible personnel]
Jan. 24 (Wed.)	A	Document examination (3. Education/training) Field observation	Document examination (4. Operation/maintenance: (1) Effective operation administration	Document examination (6. Addressing important issues: 6.2 Reflecting on past problems)
		Field observation [Nuclear power plant training center]		
	P	Interview [Directors] [Managers] [Responsible personnel]	Interview [Managers] [Responsible personnel] Field observation [Unit 1, 2 Main control room]	Field observation [Control buildings] [Unit 2 Reactor buildings] [Unit 1, 2 Main control room]
Jan. 25 (Thu.)	A	Verification of Facts	Verification of Facts	Verification of Facts
	M			
Jan. 26 (Fri.)	P	Verification of Facts, Closing		
	M			

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 Educational Material for criticality safety control, to facilitate nuclear cultural exchange.

(1) Field Observations

Direct observation was made of actual activities to check whether they corresponded to items listed in documents 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 arose. In-depth examination was conducted, asking for relevant documents after observing field facilities and activities.

(3) Interviews

Interviews were conducted with directors, managers, operators, and maintenance personnel with the following objectives:

- a. Collecting additional information that could not 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. Conclusions."

Section 1: Organization/Administration

To ensure nuclear safety, the review was conducted to check whether the necessary personnel were assigned to ensure safe operation, whether "safety culture" that always prioritizes safety was fully recognized, whether effective communication with subcontractors was maintained, and whether public acceptance activities for the local community were 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. 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
 - c. Improving documents associated with the revision of safety regulations

Section 2: Emergency Measures

A review was conducted in accordance with the Nuclear Disaster Special Measures Law enacted in June 2000 (hereafter referred to as the “Nuclear Disaster Law”), to examine whether emergency plans and equipment were in place and whether training was carried out responsibly.

(Review Items)

- (1) Emergency plans
 - a. Drawing up emergency plans
 - b. Improving emergency organizations (including reporting 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 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
- (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. The common issue of whether adequate personnel, including those from subcontractors, are assigned and whether documentation is facilitated and complied with in the Operation and Maintenance Departments was examined. 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. An examination of the shortened annual inspection was carried out to see whether these shorter inspection periods did not disregard the safety aspects.

(Review Items)

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

In addition to ensuring criticality safety at nuclear fuel facilities, this policy must be applied to nuclear power stations as well. Thus, each step of nuclear fuel handling at power stations was examined from the acceptance of new fuel, fuel loading/operation/removal to spent fuel storage and transportation. Also, 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 for evaluation of events that have occurred at domestic and overseas nuclear facilities in the past along with the activities that have been taken to prevent such events from occurring in the future.

(Review Items)

Section 6.1: Activities for nuclear safety

- (1) New and spent fuel management
- (2) In-core fuel management
- (3) Shutdown safety measures

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. This refers to measures to be taken to mitigate the effects of severe accidents caused by an event exceeding the scope of design standard events (events that may lead to abnormal status and are used to evaluate the safety design of nuclear facilities), which may cause significant damage to the reactor core (excerpted from “1998 Nuclear Safety White Paper”).

- (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
- (4) Fire and explosion prevention

6.3 Good Practices and Suggestions for Improvement

Good practices and suggestions for improvement are as follows:

- (1) Good Practices

Information on good practices incorporating appropriate, effective, and unique methods into activities to ensure safety should 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.

7. Conclusions

Summarizing the results from the review of Onagawa Nuclear Power Station of Tohoku Electric Power Co., Inc., no items were identified as leading to the occurrence of serious accidents unless immediate improvement measures in terms of nuclear safety is taken. In addition, it was confirmed that at the Station, all the employees, including General Manager and employees of cooperating companies, are seriously endeavoring to continue and enhance a policy of nuclear safety.

This is represented by the General Manager's policy to achieve the highest level of safety by incorporating the idea of Japanese "Do (spirit)" into its safety culture, thereby further improving the safety culture as a "spirit of safety" that is carried out on the initiative of every employee.

In addition, Onagawa Nuclear Power Station acquired the ISO 14001 certificate, an international standard for environmental management systems, on January 23 during the review. It is obvious that the Company is very much interested in environmental preservation activities.

In the future, it is desirable for the Station to continue voluntary safety efforts, aiming to further improve its safety culture, rather than being satisfied with the status quo.

Also, fruitful results are expected and these will be incorporated into activities at cooperating companies as well as the Higashidori Nuclear Power Station currently under construction.

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

- Activities to promote improved communication and foster closer ties with cooperating companies

Activities are carried out to promote better communication through forming closer relations with those companies that work during the periodic inspection periods. These include joint kick-off assemblies prior to periodic inspections, friendship events (sporting events), and award presentations to companies and individuals that rendered exceptional services during periodic inspections.

- Developing a quick report support system
To ensure transmission of quick and accurate reports to relevant agencies when problems occur, a "Quick Report Support System" has been voluntarily developed, utilizing personal computers and large displays. This allows the persons concerned to share information and prepare quick reports in the emergency operation room.
- Utilizing the nuclear maintenance support system
Maintenance work on various systems and equipment is carried out based on "maintenance work sheets" to ensure safety and post-work restoration. This practice has been organized as the "Nuclear Maintenance Support System" (nickname: PERMIT'98) using the in-house LAN. The use of this system ensures the safety and completion of maintenance work with adequate cooperation between the Operation and Maintenance Departments.
- Taking exposure reduction measures based on consistent administration from planning through evaluation
The Station has been endeavoring to achieve exposure reduction and setting high standards from the plant design and construction stages. The accumulation of radiation in the primary reactor piping is controlled by implementing appropriate water quality control corresponding to equipment design after the start of operation. During periodic inspections, precise radiation control is ensured for individual work. The Station has been endeavoring to reduce exposures based on consistent administration from planning through evaluation, steadily achieving favorable results, such as low values in the overall dose equivalent during periodic inspections.

On the other hand, several suggestions have been made to improve activities to ensure safety at the Station. The major proposals are as follows:

- Enhancing measures to prevent equipment and fixtures in the emergency operation room from falling (to cope with major earthquakes)
Preventive measures have been taken for important pieces of equipment, such as the "Safety Parameter Display System," in the emergency operation room, to ensure the maintenance of functionality in the event of major earthquakes. It is desirable, however, to take similar preventive measures for other equipment and fixtures as well.
- Improving the "manuals" that put together measures to ensure safety.
Effective measures are taken to ensure safety by organizing meetings to read through work procedures prior to periodic inspections as well as informing cooperating companies of malfunction and events. It is desirable, however, to incorporate such methods into the "manual."

Itemized reports are published on the Japanese homepage.00