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Summary Report of Peer Review

(Provisional Translation)

Place of Review:	**Tomari Nuclear Power Station, HOKKAIDO ELECTRIC POWER CO.,INC. (Tomari-mura, Furuu-gun, Hokkaido)**
Date of Review:	**March 27-30, 2001**
Publisher :	**Nuclear Safety Network**

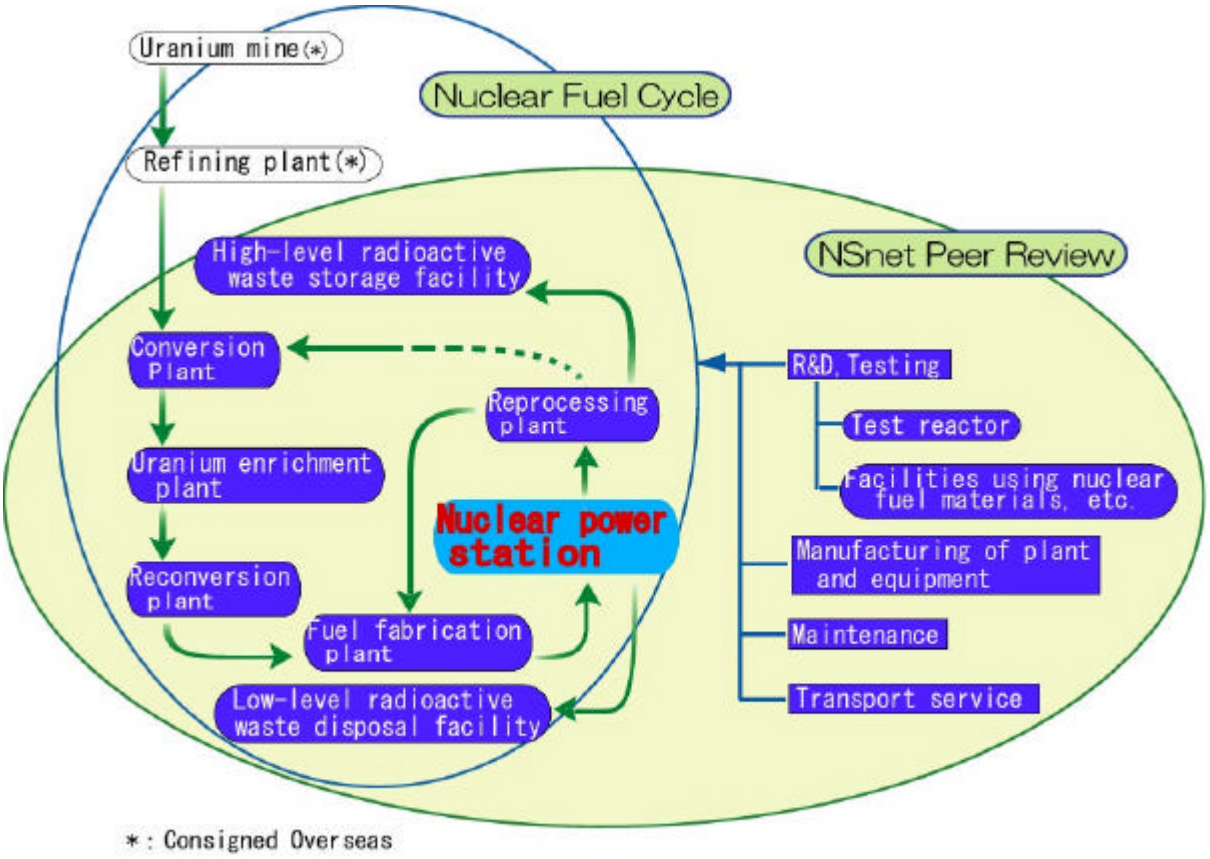
Contents

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

Tomari Nuclear Power Station (hereafter referred to as the "Station"), which was subjected to the review, is located in Tomari-mura, Furuu-gun, facing the Sea of Japan on the Shakotan Peninsula, (70 km west of Sapporo). The annual average temperature there is 8 to 9 degrees Celsius. Since it is particularly cold in winter there, the refueling water tank, primary pure water tank, circulating water pumps, and so on are installed indoors to prevent them from being frozen in winter. The site area covers approximately 1.28 million square meters.



The position of "NUCLEAR POWER STATION" in the nuclear fuel cycle

The Station has two nuclear reactors. Nuclear energy accounted for 29% of the overall power generation of the Hokkaido Electric Power Co., Inc. in FY 1999. Units 1 and 2 started commercial operation in June 1989 and April 1991, respectively. Neither Units 1 nor 2 have had unplanned

outages and both have shown favorable operating results as represented by high capacity factors[1] as shown in the table below.

The Station is carrying out a project to construct Unit 3, aiming to start its commercial operation in December 2008. During the review, a ceremony was held to pray for safety, and the preliminary construction began.

[In Operation]

Unit	Electric Output (MW)	Reactor Type	Start of Commercial Operation	Performance (total) (As of the end of March 2001)	
				Power Generated (billion kWh)	Capacity Factor (%)
1	579	PWR	1989/06	50.64	86.5
2	579	PWR	1991/04	42.82	85.1
Total	1158	-	-	93.46	85.8

[Planning]

Unit	Electric Output (MW)	Reactor Type	Start of Commercial Operation
3	912	PWR	2008/12

The Station, together with the Nuclear PR Center, Nuclear Training Center, Tomari Nuclear Power Station Construction Preparation Office, and so on, is organized as a part of Tomari Nuclear Power Office under the supervision of the General Manager of Tomari Nuclear Power Office.

At present, the Station has approximately 320 employees, including the General Manager of the Station (hereafter referred to as "General Manager"). Approximately 120 employees (Operation Department) are directly engaged in operation in six groups on three shifts. There are approximately 170 employees in engineering sections (Engineering, Safety Control, Equipment Control, Electric Maintenance, Mechanical Maintenance, Civil Engineering) and 30 employees in deskwork sections (General Affairs and Labor Safety). In addition, approximately 600 employees from cooperating companies are stationed at the Station to support plant operation and maintenance.

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 basic points in terms of both technical and social awareness of nuclear safety:

(1) Foundation to ensure nuclear safety (contain communication with cooperating companies)
(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 power industry

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

by classifying individual elements of the above five points into the following six areas: ① organization/administration, ② emergency measures, ③ education/training, ④ operation/maintenance, ⑤ radiation protection, and ⑥ addressing important issues.

"(1) Foundation to ensure nuclear safety (include communication with cooperating companies):" 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 cooperating companies 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 control[2] 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 neutronics safety[3]. Activities should be promoted to foster and improve the nuclear safety culture in view of factors that have caused the JCO accident.

"(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 fuel[4]. Activities should be promoted to develop measures to prevent human error and ensure safety during reactor shutdown.

4. Period and Outline of Review

(1) Date
March 27 (Tuesday) to March 30 (Friday), 2001

(2) Formation of Review Teams
1st group : Sumitomo Atomic Energy Ind., Ltd.; Hitachi, Ltd.
2nd group : Mitsubishi Electric Corporation; The Japan Atomic Power Company, Inc.
3rd group : Kobe Steel, Ltd.; NSnet Office
Coordinators : NSnet Office

(3) Fields of Responsibility
1st group : Organization/administration, emergency measures, education/training
2nd group : Operation/maintenance

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[2] Criticality safety control: 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] 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 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.")

3rd group : Radiation protection, Addressing important issues

(4) Facilities to be Reviewed

The review was conducted with respect to the whole station including Twin Units 1 and 2. In the area of "Education and Training," however, the Nuclear Training Center and its activities were also included in the scope of the review.

5. Review Schedule

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

<table>
<tr><th></th><th></th><th>1st Group</th><th>2nd Group</th><th>3rd Group</th></tr>
<tr><td rowspan="5">March 27 (Tue.)</td><td rowspan="2">AM</td><td colspan="3">Opening (Introductory outline of company/facilities, etc.)</td></tr>
<tr><td colspan="3">Plant Tour
[Units 1and 2 Main control room]</td></tr>
<tr><td rowspan="3">PM</td><td rowspan="3">Document examination
1. Organization/ administration</td><td>Document examination
4. Operation/maintenance:
(1) Effective operation administration</td><td>Document examination
6. Addressing important issues:
6.1. Addressing nuclear safety centering on neutronics safety</td></tr>
<tr><td>Field observation
[Units 1and 2 Main control room]</td><td>Interview
[Responsible personnel]</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">March 28 (Wed.)</td><td rowspan="2">AM</td><td rowspan="2">Document examination
2. Emergency measures</td><td>Document examination
4. Operation/maintenance:
(2) Effective maintenance administration</td><td rowspan="2">Document examination
5. Radiation protection</td></tr>
<tr><td>Field observation
[Units 1and 2 Main control room]</td></tr>
<tr><td rowspan="2">PM</td><td>Interview
[General manager]
[Managers]
[Responsible personnel]</td><td rowspan="2">Document examination
4. Operation/maintenance:
(2) Effective maintenance</td><td rowspan="2">Field observation
[Unit 2 Fuel treatment Facility]
[Units 1 and 2 Main control room]
[Radwaste building]
[Drum yard]</td></tr>
<tr><td>Field observation
[Emergency Operation Room]
Interview
[Responsible personnel]</td></tr>
<tr><td rowspan="3">March 29 (Thu.)</td><td rowspan="2">AM</td><td>Document examination
3. Education/training</td><td rowspan="2">Interview
[Managers]
[Responsible personnel]</td><td rowspan="2">Document examination
6. Addressing important issues:
6.2 Reflecting on past problems</td></tr>
<tr><td>Field observation
[Nuclear Training Center]</td></tr>
<tr><td>PM</td><td>Verification of Facts</td><td>Verification of Facts</td><td>Verification of Facts</td></tr>
<tr><td>March 30 (Fri.)</td><td>AM</td><td colspan="3">Verification of Facts, Closing</td></tr>
</table>

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 suggestions for improvement were identified through field observations of such activities, examination of the documents presented by the plant, and interviews with the employees.

During the review, the review teams also introduced useful examples of activities, such as efforts used to ensure labor safety by the companies and organizations to which the reviewers belong. This facilitated 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. Understanding the attitude and awareness toward nuclear safety
   b. Collecting additional information that could not be verified through documents
   c. Questions and answers on problems identified during document examination
   d. Grasping the degree of understanding of determined items and responsibilities imposed on each individual
   e. Understanding the compliance status of determined items and whether such items have become dead letters

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."

<u>Section 1: Organization/Administration</u>

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 cooperating companies 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 improvement.

(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 and morality
   b. 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, 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 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 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 cooperating companies, 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 (including voluntary efforts) and evaluation criteria

(2) Training plans and implementation

(3) Technology (know-how) hand-over

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 issues of whether adequate organization and personnel assignation, including those from cooperating companies, is formed 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 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, etc.)

(2) Effective maintenance administration
    a. Maintenance organization
    b. Maintenance documents and procedures, and compliance with them
    c. Maintenance systems and equipment (Clarify the safety function, etc.)
    d. Work plans and administration (Shortening the duration of annual inspection, etc.)

Section 5: Radiation Protection

To ensure adequate dose control for employees based on ALARA[5], 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 the point of neutronics safety 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 accident management (AM)[6] 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: Addressing nuclear safety centering on neutronics safety
(1) New and spent fuel management
(2) In-core fuel management
(3) Shutdown safety measures
(4) Activities concerning risk evaluation
Section 6.2: Reflecting on past problems
(1) Improving equipments and modifying operating methods

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[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. 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").

(2) Activities to prevent human-errors
(3) Response for unusual sign
(4) Measures to prevent fuel leakage and fuel integrity monitoring (specific example 1)
(5) Fire and explosion prevention (specific example 2)

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. Main Conclusions

Summarizing the results from the review of Tomari Nuclear Power Station of the Hokkaido Electric Power Co., Inc., no problematic items were identified of a nature which could cause a severe accident unless nuclear safety improvement measures were taken immediately. In addition, it was confirmed that at the Station, all employees, including the General Manager and employees of cooperating companies, are seriously endeavoring to continue to enhance nuclear safety.

Both Units 1 and 2 have shown favorable operating results without unplanned outages since Unit 1 started commercial operation in 1989. It was also confirmed that all employees believe it important to have strong belief and a sense of justice that "safety is built by one's own will" and to cumulate "safe and steady operation of Tomari Power Station."

It is expected that the Station will keep alerted and continue preventive maintenance activities, aiming to further promote its safety culture.

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

- Employment of effective maintenance related training systems
  For the purpose of maintenance training, the Station has actively employed a steam generator maintenance training system in which radioactive working environments can be simulated with ultrasonic and other systems, and in which abnormal conditions such as pump vibration and cavitation can be experienced. They are expected to show certain effects in safely while conducting maintenance and inspections, reducing workers' radiation exposure, detecting equipment failures in early stages, and so on.

- Promotion of unified control of necessary data and reductions in solid waste with the Solid Waste Control System
  A Solid Waste Control System has been developed and put into operation, which is capable of controlling radioactive solid waste generated at the Station from raw waste to waste contained in cylinders. Data, such as waste types, activity concentration, sources of generation, dates of generation, and work names are controlled in a unified manner. In addition, operating this system allows strict separation of combustibles from non-combustibles, which is expected to

reduce the volume of solid waste.

- Efforts to continue stable and safe operation
  The station has developed the workplace culture of "working together with cooperating companies to ensure safe and stable operation without being negligent of insignificant matters." Preventive measures and recurrence prevention measures applicable to past problems and human errors have thoroughly been made known and implemented. Work contents are thoroughly made known by reading through "Work Procedures," including the above-mentioned measures. Steady workflow is ensured by establishing numerous holding points in each work process. Procedures are made thoroughly known and complied with when unplanned work is performed. These efforts have lead to safe and stable operation of the Station.

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

- Periodic review of rules
  Although rules are certainly revised as the need arises, it is desirable to confirm the contents of the rules periodically.

- Stipulating the idea of periodic inspection cycles
  Periodic inspection cycles have been determined for individual systems and equipment based on the basic idea developed by the sections in charge of maintenance in view of actual results. It is desirable, however, to stipulate this basic idea by cumulating actual maintenance and inspection records and continually following through on the idea.

- Promoting the development and systematization of materials for criticality control education
  For criticality control education, the Criticality Control Procedures, materials newly developed after the JCO accident, and documents developed during safety examinations are used. Considering that the Safety Regulations have been revised to newly impose criticality control education on employees of cooperating companies who are engaged in the handling of fuel, it is desirable to review the existing materials and promote the development and systemization of educational materials in the future. In other words, it may lead to effective criticality control education to organize criticality control methods in each process from new fuel acceptance to spent fuel disposal, as well as to clearly decide which textbook to use for new employees, engineering employees, and fuel handling employees of cooperating companies.

Itemized reports are published on the Japanese homepage.