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Summary Report of Peer Review

(Provisional Translation)

Place of
Review:

**Nuclear Engineering Laboratory,
TOSHIBA CORPORATION.
(Ukishima-cho, Kawasaki-ku, Kawasaki, Kanagawa)**

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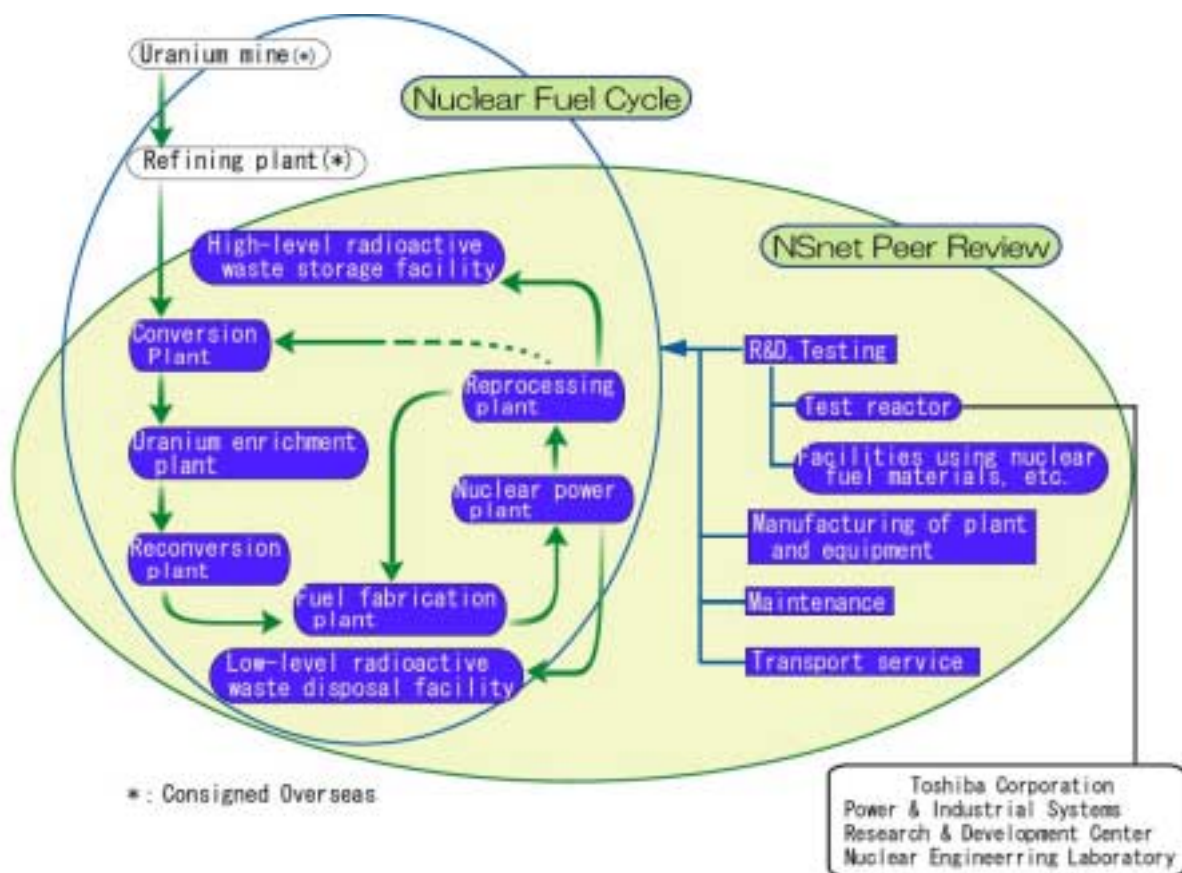
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1. Objectives

The purpose of the NSnet peer review (hereafter referred to as “the review”) is to achieve an improvement in the “safety culture” of the entire nuclear power industry by sending review teams of 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

A review was conducted at the Nuclear Engineering Laboratory (hereafter referred to as the Laboratory) of Toshiba Corporation located in the industrial zone of Kawasaki City near to the mouth of the Tama River facing Haneda Airport.



The position of the laboratory in the nuclear fuel cycle

The Laboratory is a part of the Power & Industrial Systems Research and Development Center (hereafter referred to as PIC), the research and development division of Power Systems and Services Company of Toshiba Corporation. The Laboratory is mainly engaged in research and development on fundamental technologies in the nuclear power industry such as mechanical and systems technology, instrumentation and control technology, chemical systems technology, system analysis technology, and so on. The Laboratory is also engaged in operation, experimentation and management of nuclear reactor facilities for testing and research (hereafter referred to as the Research Reactors) that are the object of this review.

The Research Reactors in the Laboratory consist of Toshiba Nuclear Critical Assembly (hereafter referred to as NCA) and Toshiba Training Reactor (hereafter referred to as TTR). They were built as facilities for fundamental research for the purpose of research and development on BWR fuel (for NCA) and the purpose of research and development on reactor technology as well as training of reactor engineers (for TTR).

In NCA, which started operating in 1963, development of BWR fuel has been conducted as well as verification of the analysis code, development of radiation measurement technology, fundamental testing of burn up monitoring system and so on. Its core is comprised of fuel rods of sintered pellets of uranium dioxide of 10mm in diameter contained in aluminum cladding tubes. Dimension, chemical form and enrichment of the fuel rods are the almost same as those of BWR fuel. Light water is used for the moderator. These factors permit experiments to be conducted on nuclear properties of a core, which simulates the fuel assembly of a BWR. Although the maximum thermal output of NCA is 200 W, it is actually operated at maximum to the order of 10 W, usually within 0.1 W or less.

In TTR, training of engineers has been conducted as well as development of reactor control, diagnosis technology for reactor events, sensors to detect neutrons in the reactor and so on. Its core is comprised of 24 fuel assemblies (MTR type), each of which is composed of 10 plate-shaped fuels of uranium/aluminum alloy contained in aluminum clad. The reactor is of the swimming pool type, the core is contained in a pool having about 3 m in wall thickness and 6.6 m in depth. Even in case of operation at maximum thermal output of 100 kW, the radiation level around the pool rises very little and work can be done with no radiation exposure. The fuel is about 40 °C in temperature and cooled by natural convection of the pool water. The pool water temperature rises very little. TTR, in operation since 1962, has no operation program after fiscal year 2001 due to the judgment that its role is over and its decommissioning plan is in progress, with scheduled submission of the report to the government in August 2001¹.

Today, the Laboratory has approximately 240 employees. Approximately 20 of them are engaged in operation of the Research Reactors. In addition to these employees, security guards are engaged in patrols to check the Research Reactors at night and on days off.

Research Reactors in Nuclear Engineering Laboratory, Toshiba Corporation

Reactor	Max. Thermal Power	Reactor Type	Date of first criticality	Current status (as of July 19,2001)
NCA	200 W	Slightly enriched uranium Light water moderated	Dec. 1963	In operation
TTR	100 KW	Swimming pool type Natural convection cooling	Mar. 1962	Decommissioning is being planned

3. Points of Review

The motive for the establishment of the NSnet was the unprecedented criticality accident in Japan (hereafter referred to as JCO accident) which occurred on September 30, 1999 at the Conversion Test Building (Fuel Processing Facility) of JCO Co. Ltd. The peer review for nuclear fuel facilities and nuclear power plants is characterized by the peculiarity of the facility to be reviewed in such a manner that the emphasis of review is put on “prevention of serious accidents such as criticality accidents” for the former and on “appropriate management of reactor cores” for the latter.

On the basis of the above facts and recent tendencies in nuclear safety, three fundamental points are set up for review at the Laboratory as follows:

- (1) basis of ensuring safety,
- (2) reflection and practice of the lesson learned from the JCO accident, and
- (3) peculiarities of research reactors.

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

As for “(1) Basis of ensuring safety,” are enhancement of the safety culture, establishment of an effective organization, promoting the sufficient education and training to employees, achievement the effective operation and maintenance administration by provision and observance of the documents/manuals, conducting radioactive waste treatments and radiation protection appropriately.

“(2) Reflection and practice of the lesson learned from the JCO accident:” are accomplishment of criticality safety control² in fuel rooms, observance of thermal and nuclear limits with appropriate methods and activities in the Laboratory for promoting and improving the nuclear safety culture on the basis of background factors of the accident.

“(3) Peculiarities of research reactors” are teamwork and interface between operators and researchers, safety measures on startup and shutdown, and safety measures on fuel storage.

4. Performing of the Review

Date

July 17 (Tuesday) to July 19 (Thursday), 2001

Formation of Review Teams

1st group : Hokkaido Electric Power Company, Incorporated;
Nuclear Fuel Transport Co., Ltd.

2nd group : Japan Atomic Energy Research Institute; Japan
Nuclear Fuel Limited, Hokuriku Electric Power Co., Inc.

Coordinators : NSnet Office

Fields of Responsibility

1st group : Organization/administration, Emergency

measures,

Education/training

2nd group : Operation/maintenance, Radiation protection,
Addressing important issues

Target Sites

The review was conducted at the Research Reactors of the Laboratory. In conformity with current status of the facilities, site observation and document confirmation for “Section 4: Operation and Maintenance” and “Section 6: Serious Accident Prevention” in “6.2 Review Items” were conducted at NCA and review on safety management for Section 6 (3) was conducted at TTR.

5. Review Schedule

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

		1 st Group			2 nd Group		
		Opening (Greetings, Introductory outline of laboratory, etc.)					
July 17 (Tue.)	A M	1.Organization/ administration	Effective organization management Activities to Promote safety culture	Document examination	4.Operation / maintenanc e	Effective operation administration Effective maintenance administration	Document examination
	P M	1.Organization/ administration	Activities to Promote safety culture	Document examination	4.Operation / maintenanc e	Effective maintenance administration	Document examination
		2.Emergenc y measures	Emergency plans Emergency equipment, tools and resources Emergency trainings		1.Organization/ administrat ion	Quality control	
		5.Radiation protection			Dose control, ALARA plans Radiation monitoring Waste treatment, reduction		
1.Organization/ administrat ion	[Managers]	Interview	6.Addressin g important issues	Reflecting on past problems			
July 18 (Wed.)	A M	2.Emergenc y measures	[Emergency Operation Room]	Field observatio n	6.Addressin g important issues	Criticality safety/ Fuel storage management Safety management of TTR	Document examination
			[employee]	Interview	4.Operation / maintenan ce	Control room (Compliance operating limits)	Field observatio n
		3.Education / training	Planning and Implementation of education and training	Document examination	5.Radiation protection	[Monitors] [Waste storage building, etc.]	
				6.Addressin g important issues	Fuel storage room Control room (Human error) NCA room (Human error)		
	P M	Verification of facts			Verification of facts		
July 19 (Thu.)	A	Verification of facts					
	M	Closing					

6. Procedures and Items of Review

6.1 Review Procedures

The review was conducted with respect to various activities to improve 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 laboratory, and interviews with the employees.

During the review, the review teams also introduced useful examples of activities, such as the transfer of technical know-how and the incorporated education and training system. This facilitated nuclear safety cultural exchange.

6.1.1 Review Methods

(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 the general manager, employees with the following objectives:

- a. Understanding the attitude and awareness toward nuclear safety
 - b. Collecting additional information that could not be confirmed 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 not been ruined.

6.1.2 Good Practices and Suggestions for Improvement

(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 recommended for further improvement 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

Based on the following review items identified and developed in “3. Points of Review,” field observations, document confirmation, and interviews were conducted, and the results were summarized into “7. Main Conclusions.”

Section 1: Organization/Administration

To ensure nuclear safety, the review was conducted to check whether the personnel were appropriately assigned necessary for safe operation and experiment, whether safety culture that always prioritizes safety was fully recognized, whether effective communication with the local community were promoted through the information disclosure.

(Review Items)

- (1) Effective organization management
 - a. Determination of security system and responsibility
 - b. Setting up goals of the organization
- (2) Activities to promote safety culture and improve morality
 - a. Specific activities to promote safety culture and morality
 - b. Information disclosure to the local community
- (3) Quality control
 - a. Effective audit system
- c. Actions regarding the revised Law on Reactor Regulation and the revised Safety Rules.

Section 2: Emergency Measures

Emergencies here means the events described in the Special Law of Emergency Preparedness for Nuclear Disaster (hereafter referred to as the “Nuclear Disaster Law”) and other events defined as emergency and abnormal in the Safety Rules. In the review, we focused on activities based on the Nuclear Anti-Disaster Law and Safety Rules.

(Review Items)

- (1) Emergency plans
 - a. Drawing up emergency plans
 - b. Establishment of emergency organizations (including notification and liaison systems)
 - c. Establishment of emergency procedures
 - d. Education of emergency procedures to the employees and well known
- (2) Emergency equipment, tools and resources
 - a. Inspection and maintenance of equipment, tools, and resources
- (3) Emergency training
 - a. Implementation of training (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 established, 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) Training plans and implementation

- a. Education and training plans
- b. Implementation of education and training (Improvement skill, Technical transfer)

Section 4: Operation/Maintenance

The review was conducted to examine whether a high-level of safety is ensured concerning work items on operation management and maintenance management. With respect to each of operation and maintenance, it was examined whether documents such as work procedures and manuals have been developed and observed without fail. The review focused on the operation program and advance-confirmation of safety in operation management and implementation of maintenance and checking with special consideration of safety in the maintenance management.

(Review Items)

- (1) Effective operation administration
 - a. Documents and procedures regarding to the operation
 - b. Design management
 - c. Operation/ experiment plans and their management
- (2) Effective maintenance administration
 - a. Maintenance documents and procedures
 - b. Work plans and administration

Section 5: Radiation Protection

To ensure adequate dose control for employees based on ALARA³, monitoring of radiation dose inside/outside the controlled area, and treatment and reduction of radioactive waste, various measures and their implementation status were reviewed.

(Review Items)

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

Section 6: Serious accident prevention

From the point of view of the criticality safety management in nuclear fuel

facilities, the review was conducted on ensuring safety in respect to nuclear safety (neutronics safety⁴) especially in respect to fuel storage. The status with respect to reflection on problem cases of nuclear facilities at home and abroad and safety management of TTR which decommissioning program is in progress, were also reviewed.

(Review Items)

- (1) Nuclear safety focused on criticality safety
 - a. Fuel storage management
- (2) Reflection on problem cases which have ever occurred
 - a. Improvements of facilities and operating method
 - b. Prevention of human error
 - c. Measures taken in case of abnormal event
- (3) Safety management of TTR
 - a. TTR safety management system (including fuel management)
 - b. Implementation of reliable safety management

7. Main Conclusions

Summarizing the results from the review of the Laboratory, no problematic item was identified, in the nature of which may cause a serious accident unless nuclear safety improvement measures were taken immediately. In addition, it was confirmed that all employees, including the Director, are seriously endeavoring to continue enhancing nuclear safety.

Especially considering the fact that the impact on society and the surrounding environment and businesses would be enormous if any accident occurred at the Laboratory, the employees do their duty steadily in conformity with the principle of “The Laboratory allows absolutely no occurrence of any accident.” This has resulted in favorable safety performance with no accident during the approximately 40 years since the start of operation of the Research Reactors.

It is expected that the Laboratory will aim to further promote its safety culture by continuing voluntary efforts to ensure safety.

A number of good practices were identified during the review, which should be introduced extensively to other members of the NSnet and the nuclear industry. The major commendable practices are as follows:

- Embodiment of the safety action principle of the Director of the Laboratory such as thorough observance of ordinances.

In order to realize the action principle of “The Laboratory allows absolutely no occurrence of any accident”, the Laboratory takes the following measures:

Implementation of routine checks and observance of work manuals in conformity with ordinances and quick revision of the work manuals.

The editing instruction documents by experts and their distribution and explanation to the participants.

Planned renewals of facilities over a span of about 40 years.

Safety confirmation on operation by double-checking.

Positive reflection on problem cases of other facilities from the viewpoint of preventive maintenance.

- Development of work procedures concretely indicating emergency actions reflecting the results of training

The procedure of “Report, Communication and Initial Action” which concretely indicates actions to be taken in an emergency was incorporated into “Training Manual for Nuclear Disaster Prevention” based on “Manual for Nuclear Disaster Prevention”. Lessons obtained through the practical training are to be reflected on the procedure in a timely manner.

- Further efforts to reduce exposure using the “Radiation Work Plan”

Most exposure doses of the employees were lower than the detection limit, therefore, satisfactorily lower than the dose limit. In the Laboratory, further efforts are made toward exposure reduction by such means as directives to wear protectors and to reduce work time in conformity with the “Radiation Work Plan”. This is made through examination of work procedures conducted by a person in charge of radiation management and workers prior to the start of work and investigation of the cause and examination of measures using the “Questionnaire on Exposure Dose” for employees exposed to excessive radiation.

On the other hand, several suggestions were made to improve the current activities to ensure safety at the Laboratory as well as to continue favorable performance. The major proposals are as follows:

- Stipulation of procedures for revision of the Direction Sheet for Reactor Operation and the Radiation Work Plan

It is desirable to stipulate the procedures for revision of the Direction Sheet for Reactor Operation and the Radiation Work Plan, which have not been necessarily clear so far, to develop these into a form of the work procedures or manuals.

- Determination of the position of the Problem Case Study Meeting

Problem cases have been so far examined at the Problem Case Study Meeting summoned by the Manager of Toshiba Nuclear Critical Assembly. It is desirable to authorize the Problem Case Study Meeting by determining its position from the viewpoint of promoting awareness of accident prevention by extracting cases with sufficient adequacy that can be effectively used as information incorporated into the Laboratory.

Itemized reports are published on the Japanese homepage.

¹ After the peer review was completed, the TTR decommissioning report was submitted to the Ministry of Education, Culture, Sports, Science and Technology on August 8, 2001.

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 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).

⁴ 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.”)