I Summary

1. Overview of the Reviewed Establishment

1.1 Overview

The Japan Nuclear Technology Institute (hereafter, JANTI) conducted a peer review (hereafter, review) at Shimane Nuclear Power Station (hereafter, station) of the Chugoku Electric Power Co., Inc. from Monday, October 15, 2007 to Friday, October 26, 2007. The station has two boiling water reactors (BWR) and both of them were in operation with rated thermal output during the peer review period.

The station has 337 personnel and 666 employees of contractors (as of the end of September 2007).

Unit	Rated Electric Output (MWe)	Commercial Operation Started	Operating Performance (as of the end of September 2007)	
			Electricity Generated*1 (billion kWh)	Capacity Factor*2 (%)
1	460	March 1974	98.93	73.2
2	820	February 1989	110.56	82.5

*1) Electricity Generated: Including the commissioning (trial operation) period

*2) Capacity Factor: Since commercial operation started

1.2 Conditions Surrounding the Station and its Activities to Deal with them

The Station is located north of Matsue City, in the central part of the Shimane Peninsula and faces the Sea of Japan. The station was built as the fifth nuclear power station in Japan and only locates in the prefectural capital.

Unit 1 was built as the first domestic product by joint study of the Chugoku Electric Power and a domestic supplier. Unit 2 adopted an improved primary containment vessel, an automated refuelling system, a high-speed control rod drive system, etc.

At Unit 1, comprehensive preventive maintenance measures moved forward, such as replacement of the reactor shroud in FY2000. At Unit 2, the storage capacity of the spent fuel pool was increased, and a miscellaneous solid waste treatment facility, which can reduce volume of waste using a high-frequency melting furnace, was built.

A specific point that must be mentioned with the operational performance is that the station has no fuel leak in the 33 years since Unit 1 started commercial operation and the 18 years since Unit 2 started commercial operation.

The previous inspection results were rechecked in November 2006 based on instructions from the Ministry of Economy, Trade and Industry, and the results of recheck were reported in March 2007. Then, the comprehensive measures to prevent recurrence of inappropriate incidents have been moving forward.

As part of these measures to prevent reoccurrence, the “Quality Policies”, which is the basis of station operation, have been revised and the following initiatives are being implemented by the headquarters and the station: 1) promoting quality assurance activities aggressively with the first priority put on nuclear safety, 2) improving the quality

management system continuously by taking questioning attitudes, 3) enhancing communication and sharing information, 4) realizing a three-part principle that takes account of worksites, actual things, and realities (*genba*, *genbutsu*, *genjitsu*).

Based on the experience with the Niigataken Chuetsu-oki Earthquake, establishing a structure for reporting events quickly and accurately is in progress.

A project to implement plutonium thermal use at Unit 2 by FY2010 is moving forward.

Unit 3 under construction will adopt an advanced boiling water reactor (ABWR) incorporating the latest technology; the construction was started in December 2005. Construction is currently on track and the unit is planned to start commercial operation in December 2011.

2. Review Schedule

After reviewer training and preparations at the JANTI office from Wednesday, October 10, 2007 to Friday, October 12, 2007, the review was conducted at the station for two weeks from Monday, October 15, 2007 to Friday, October 26, 2007 as shown in Table 1.

In advance of the review, for three days from Wednesday, June 13, 2007 to Friday, June 15, 2007, field observations were conducted during annual refuelling outage at Unit 2. (Hereafter, outage observation)

Also, at the onsite full-scope simulator facility, an operations shift crew performance was observed on Wednesday, September 19, 2007 and Thursday, September 20, 2007. (Hereafter, simulator observation)

Table 1: Review Schedule at the Station (Results)

		Review Description
Monday, October 15	(Morning)	・Entrance meeting (introduction of the review team, review plan, etc.) ・Schedule arrangement with the counterparts in each review area
	(Afternoon)	・Observation of plant equipment conditions, etc.
Tuesday, October 16		・Observation of plant equipment conditions and field, interviews, document reviews, and exchange of views on results with the counterparts ・Team meeting including the station representatives
Wednesday, October 17 Thursday, October 18 Friday, October 19		・Field observations, interviews, document reviews, and exchange of views on results with the counterparts ・Team meeting including the station representatives
Saturday, October 20		Day off
Sunday, October 21		・Team meeting (to discuss Strengths and "Areas for improvement Needed" (hereafter, AFIN)
Monday, October 22 Tuesday, October 23		・Field observations, interviews, and document reviews ・Discussion about the causes and contributors of problems with the counterparts ・Confirmation and discussion about facts concerning Strengths and AFINs ・Team meeting including the station representatives
Wednesday, October 24		・Discussion with the counterparts in each review area ・Discussion by the team leader and the station representatives concerning Strengths and AFINs ・Team meeting including the station representatives
Thursday October 25		・Review and finalization of Strengths and AFINs ・Discussion by the managing representative, the team leader, and the station representatives regarding Strengths and AFINs ・Compilation of materials for exit meeting
Friday, October 26	(Morning)	・Exit meeting (explanation from review team regarding Strengths and AFINs, and supplemental explanations as requested by the station)
	(Afternoon)	・Press conference organized by JANTI (at the station administrative building)

3. Review Methodology and Review Scope

The objective of review conducted by JANTI is to promote further improvements in the safety and reliability of the nuclear power stations.

3.1 Review Methodology

The "Performance Objectives and Criteria" (PO&Cs) used by WANO[*3] (World Association of Nuclear Operators) were applied to the review as a standard. Although INPO[*3] (Institute of Nuclear Power Operations) also offers its set of Performance Objectives and Criteria, the WANO version was applied from the perspective of maintaining continuity and mutual complementarily with the outcome of WANO peer review.

The PO&Cs is a guideline for leading the way to promote the highest level of safe and reliable nuclear power station operation. In this review, the PO&Cs was used to identify "Strengths" and "Areas for Improvement Needed (AFINs)."

Strength is a significant beneficial practice, activity, or process employed by a station that results in achieving a high level of performance or desired high quality results and benefits. On the other hand, AFIN is a problem or vulnerability that needs to be resolved to enhance the ability of the station to safely and reliably operate the station and to make and sustain future improvements. Identified AFIN is for worthwhile improvement from the standpoint of excellence, but does not always mean insufficient, inappropriate nor poor performance compared with industry standard.

The review team conducted the review as described below, focusing on field observation and closely exchanging opinions with the counterparts in accordance with the INPO review methodology.

*3) WANO was established by nuclear power station operators all over the world in 1989 in the wake of the Chernobyl accident in 1986 for promoting a global information network among nuclear power stations in the world. The mission of WANO is to promote the highest level of safe and reliable nuclear power operation. WANO conducts various support activities for nuclear power stations all over the world such as peer reviews and events information exchange, etc.

INPO was established by the U.S. nuclear electric utility industry, following the Three Mile Island accident in 1979. INPO reviews nuclear power stations in the U.S. periodically. The main process of INPO review is field observation conducted at station for two weeks. JANTI peer reviews are based on this system. It is known world nuclear industry-wide that INPO has contributed a great deal to improve safety and reliability of U.S. nuclear power stations since the 1990s.

3.1.1 Collecting Information

First, all reviewers conducted plant walkdown and observed equipment conditions in the areas assigned to each of them and noted any issues noticed. The number of white cards on which issues were noted amounted to approximately 490. Sorting them out by appropriate review area, there were approximately 210 cards in Operations area, approximately 140 cards in Maintenance area, approximately 90 cards in Engineering Support area, and approximately 110 cards in Radiological Protection area, and so forth. These cards were distributed to each review area and used as a starting point of the review.

Note that the numbers of white cards for individual categories add up to a number greater than the overall total, because some white cards covered information on more than one area.

Subsequently, the review started in each area separately. Specifically, two or three reviewers formed a team in each area to observe plant equipment conditions and daily activities of the station personnel including employees of contractors. Each reviewer conducted field observations elaborately in accordance with the review plan, followed by interviews and document reviews. Reviewers judged whether the obtained information was important or not based on the PO&Cs and their own work experiences. The significant facts identified were recorded as excellent or problematic examples for further deliberation. Each reviewer frequently exchanged opinions on these facts with the counterparts and, if necessary, employees of contractors to ensure them.

The results of above activities were introduced and discussed if it should be determined as either excellence or problem based on each team member's experience and the best practice in the industry at the team meeting in the evening (approximately one hour).

3.1.2 Analyzing Information

Reviewers in each area evaluated issues identified through the outage observation, the simulator observation, and the information collecting process as described in 3.1.1 and determined excellent and problematic practices in comparison with the PO&Cs. Among these, excellent practices were put together as "Strengths," including the necessary information so as to provide reference for other stations.

On the other hand, problematic issues were further analyzed and discussed to clarify what the problem nature was, why they occurred (analysis of causes and contributors), and how they could be solved (how to make improvement). When additional information was required in this process, additional field observations, document reviews, or interviews were conducted, and AFINs were developed considering these analysis and evaluation of the facts.

AFINs including specific problem examples were explained to the counterparts with reference to the PO&Cs and actual industry best practices. Discussions were repeated until mutual understanding and recognition with respect to the nature, route cause and contributors of the problems were attained.

The details of these discussions and feedbacks from the counterparts were presented again at the review team meeting. All of the review team made further discussion and analysis to brush up Strengths and AFINs in terms of accuracy and appropriateness from multiple aspects considering the feedbacks.

3.2 Review Scope

3.2.1 Review Areas

In the review, six fundamental areas [(1) through (6)] were reviewed. The other areas [(7) through (10)] were reviewed as required as part of the six fundamental areas.

⑴ **Organization and Administration**
⑵ **Operations**
⑶ **Maintenance**
⑷ **Engineering Support**
⑸ **Radiological Protection**
⑹ **Operating Experience**
⑺ Chemistry

⑻ **Training**
⑼ Fire Protection
⑽ Emergency Preparedness

3.2.2 Review Team Members

The review team consist of:

Managing Representative: Matsushita, Director of JANTI
Team Leader : Kawashima, Director of JANTI
Team Members : 19 members including Kawashima
(3 WANO staff members, 2 staff members from JANTI member organizations, and 14 JANTI staff members)

4. Outline of the Results

The following Strengths and AFINs were identified by the review team.

4.1 Strengths

Strengths identified were following three items.

[Engineering Support]

(1) The station employed several methods and facilities voluntarily or in advance for maintaining fuel integrity, which are being employed in a standard manner currently in the industry, and have steadily and cautiously continued to be used over many years. As a result, the both units, Unit 1 and 2, have had no fuel leak since commercial operation started.
For example, the station employed the Pre-Conditioning Interim Operating Management Recommendation (PCIOM) to reduce the fuel load since the Unit 1 commissioning stage in 1973 and is preventing fuel damage by the PCI (pellet-clad interaction effects) that could occur with control rod operation or power increases during unit start-up or adjusting control rod positions.
Further, the station installed “condensate filter” and “condensate demineralizer” for cleaning condensate water at Unit 1 as a unique design, although the original design had only a “condensate demineralizer.” Consequently, water quality of the coolant was improved, and this technology went on to be a BWR standard system in Japan.

(2) A “fire alarm system” for identifying fire locations quickly and for displaying response procedures in the main control room was installed in April 2001 and has been in operation.
For example, a fire location detected by the system is displayed in red on a site map on the monitor, which is on the shift manager’s desk. Further, if a fire alarm appears in an adjacent zone, it is displayed in blue, and possibility of the fire spreading could be identified.
Furthermore, a flow chart of immediate actions with respect to the fire is displayed on the monitor for quick responses.

[Organizational and Management Structure]

(3) The station has been making steady efforts to have good communication with contractors. Consequently, good relationships between the station and contractors have been maintained, and they have been taking initiatives in the daily works for safe operation.
For example, the station conducts meetings after each annual refuelling outage to hear requests for improvement from contractors, but the meetings are not held only for primary contractors but also for secondary and tertiary contractors.
Moreover, the station executives visit supplier's and the related companies' offices to inform the "request items upon implementing outage works" for conducting a high quality outage activities before each annual refuelling outage.

4.2 AFINs: Areas for Improvement Needed

On the other hand, 12 AFINs were identified.

[Operations]

(1) Operations management do not clearly define a high level of standards and expectations for control board monitoring at the main control room, control room environment, and operator fundamentals, and do not sufficiently introduce measures for operators to perform their duties on a higher level of performances.
For example, the lack of restrictions for entering the main control room and approaching the control boards were observed.

(2) The housekeeping in the plant should be improved, because inappropriate temporary storages and housekeeping in some areas were observed.
For example, a situation was observed that a fence installed temporally for dividing temporary storage areas in front of the hydrogen and oxygen injection system control panel on the second floor at Unit 1 turbine building could interrupt the control panel access.

[Maintenance]

(3) Maintenance management should establish a high level of standards and expectations in maintenance activities and ensure to communicate them to all concerned personnel.
For example, a situation was observed that a work environment was not in order at a work site.

(4) There is room for improvement in regard to the measures for foreign materials exclusion for equipment in maintenance work and around the spent fuel pool.
For example, it was observed that there was no foreign materials controlled area around the spent fuel pool, and anyone could easily get near.

[Engineering Support]

(5) Engineering support management should improve some parts of the structure to adequately make plans and review such as design changes and introduce of new engineering technologies.
For example, during inspection in the reactor before water jet peening in the 13th annual refuelling outage of Unit 2, it was identified that seven high pressure core spray nozzle deflectors had slipped off. The results of the investigation presumed that this was caused by vibrations during water jet peening on the reactor shroud that had been conducted during the 12th annual refuelling outage.

(6) Engineering support management should ensure using the fire prevention measures.
For example, it was observed that a large amount of cardboard boxes, paper rags, and wooden material, etc. had been stored in the reactor and turbine buildings.

[Radiological Protection]

(7) Radiological protection management should introduce more precise contamination control measures in work activities and workplace control, etc. in the contamination control areas for preventing contamination spread.
For example, it was observed that workers touched an uncontaminated item wearing rubber gloves that could be contaminated.

(8) There is room for improvement in regard to the contamination management for releasing objects and exiting workers from radiation control areas.
For example, a contamination survey for releasing objects at the second checkpoint is implemented using a beta-gamma sensitive monitor, and the action is observed through a camera from the access control room. However, contracted radiation control staff could not confirm the action because of the inadequate camera position.

[Operating Experience]

(9) Some parts of the operation experience program are not being effectively implemented such as corrective actions, preventive actions, and collection of minor incidents.
For example, it was confirmed that a trend analysis of the contents of maintenance requests issued by the Operation Section and nonconformities identified in restricted area patrols had not been carried out.

[Organization and Administration]

(10) Station management do not clearly define a high level of standards and expectations or do not ensure to communicate their standards and expectations to station personnel and contractors in operations, maintenance, fire protection, and operating experience areas.
There is room for improvement in the activities by station executives and managers for accurately monitoring and observing plant operating situation and correcting problems.
For example, it was confirmed that station management had not utilized performance indicators to grasp and continuously assess the current plant situation.

(11) There is room for improving industrial safety management in lifting and rigging activities and use of personal protection items.
For example, in a workplace with a high noise level, several cases were observed where workers were not using hearing protection item.

(12) The implementation of station training and the training programs do not ensure that station personnel are fully trained to perform their duties and understand management expectations.
For example, it was confirmed that the station had not used objective measurements to ensure trainees have accumulated the required knowledge at the completion of training.