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 Sendai Nuclear Station (hereafter, station) of Kyushu Electric Power Co, Inc. from Monday, October 16, 2006 to Friday, October 27, 2006. The station has two pressurized water reactors (PWR) and both of them were in operation with rated thermal power output during the review period.

The station has 253 personnel and approximately 500 employees of cotravtors (as of the end of September 2006).

Unit	Rated Electric Output (MWe)	Commercial Operation Started	Operating Performance (As of the end of September 2006)	
			Electricity Generated*1 (billion kWh)	Capacity Factor*2 (%)
1	890	July 1984	146.46	82.6
2	890	November 1985	138.1	83.6

*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 Power Station is situated in a coastal area near the mouth of the Sendai River flowing into the East China Sea, and is the second largest nuclear power station in Kyushu after the Genkai Nuclear Power Station. Unit 1 and Unit 2 are both improved standard PWR plants. It should be noted that the premises set aside sufficient space for dissembling inspections, facilitating easy maintenance and inspection of even craning facilities.

The Power Station has performed well with the capacity factor of 83.0% and only four forced shutdowns from the commencement of its commercial operation to the end of September 2006.

It has actively upgraded main equipment, including the replacement of the turbine at Unit 1 in FY2005. Major upgrading works scheduled include replacing the reactor vessel head at Units 1 & 2, replacing the steam generator at Unit 1, and replacing the main transformer at Unit 1.

Under the philosophy of “environmentally-friendly power station” that contributes to the effort to

prevention of global warming, the Power Station acquired ISO 14001 certification (Environmental Management System) in March 1999, and renewed the certification in March 2005. Specific initiatives by each department include incinerating combustible radioactive waste to reduce environmental strains, and recycling dehydrated sludge to work toward zero-emission.

In addition, the station has conducted an environmental study since October 2003 as preparation work for the construction of Unit 3.

2. Review Schedule

After reviewer training and preparations at the JANTI office from Wednesday, October 11, 2006 to Friday, October 13, 2006, the review was conducted at the station for two weeks from Monday, October 16, 2006 as shown in Table 1.

Table 1: Review Schedule at the Station

		Review Description
Monday, October 16	(Morning)	・ Entrance meeting (introduction of the review team and the station counterparts, briefing of plant operating status and issues)
	(Afternoon)	・ Observation of plant equipment conditions, etc. ・ Schedule arrangement with the counterparts in each review area
Tuesday, October 17		・ 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 18 Thursday, October 19 Friday, October 20		・ Field observations, interviews, and document reviews, and exchange of views on results with the counterparts ・ Team meeting including the station representatives
Saturday, October 21		Day off
Sunday, October 22	(Morning)	・ Team meeting (to discuss Strengths and ”Areas for Improvement Needed” (hereafter, AFIN))
	(Afternoon)	・ Analyzing observations in each review area
Monday, October 23 Tuesday, October 24		・ Field observations, interviews, and document reviews ・ Discussing the causes and contributors of problems with the counterparts ・ Confirming and discussing the facts concerning Strengths and AFINs ・ Team meeting including the station representatives
Wednesday, October 25		・ Discussing with the counterparts in each review area ・ Managing representative, team leader and the station representatives to discuss Strengths and AFINs ・ Team meeting including the station representatives
Thursday, October 26		・ Review and finalize Strengths and AFINs ・ Compiling the exit meeting
Friday, October 27	(Morning)	・ Exit meeting (review team to explain Strengths and AFINs and give supplementary explanations as requested by the station)
	(Afternoon)	・ Press conference organized by JANTI (at the station exhibition hall)

3. Review Methodology

The objective of review conducted by JANTI is to promote the highest level of excellence in the operation, maintenance and support of operating nuclear power plants.

3.1 Review Process

The “Performance Objectives and Criteria” (PO&Cs) used for World Association of Nuclear Operators (WANO) Peer Review 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 complementarity with the outcome of WANO Peer Review.

These criteria are guidelines for leading the way to promote highest level of safe and reliable nuclear power plant operation. In this review, they were used to identify “Strengths” and “Areas for Improvement Needed”.

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 plant 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[*4] review methodology.

*3) INPO (Institute of Nuclear Power Operations) was established by the U.S. nuclear electric utility industry, following the Three Mile Island accident in 1979. It is an organization that is reviewing nuclear power stations in U.S. periodically. The main process of INPO review is field observation conducted at station for two weeks. 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 340. Sorting them out by appropriate review area, there were approximately 150 cards in Operations area, 120 in Maintenance, 60 in Engineering Support, 40 in Radiological Protection, 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 elaboratively in accordance with the review plan and note drawn up in advance, followed by interviews and document reviews. Reviewers judged whether the obtained information was important or not based on the review criteria (PO&Cs) and their own work experiences. The significant facts identified in the observations, interviews, and document reviews were recorded as excellent or problematic examples for further deliberation. The Review team frequently exchanged opinions on these facts with the counterparts and, if necessary, employees of contractors to ensure them.

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

3.1.2 Analyzing information

Reviewers in each area evaluated issues identified through the information collecting process as described in 3.1.1 and determined excellent and problematic practices in comparison with the review criteria (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 review criteria (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 the 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 Reviewed 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.

(1) Organization and Administration
(2) Operations
(3) Maintenance
(4) Engineering Support
(5) Radiological Protection
(6) Operating Experience
(7) Chemistry
(8) Training
(9) Fire Protection
(10) Emergency Preparedness

3.2.2 Review Team Members

The review team consisted of:

Managing Representative： Mori, Director of JANTI
Team Leader ： Naruse, Director of JANTI
Team Members ： 14 members including Naruse
(3 INPO staff members, 3 staff members from JANTI member organizations and 8 JANTI staff members)

4. Outline of the Results

The following Strengths and AFINs were identified. In view of extremely good operation performance of the station, extra attention was paid to the background contributing such excellent performance.

4.1 Strengths

Strengths identified by the review team are following three items.

[Engineering Support]
(1) Operator training simulators are also provided as means of training for non-operator staff and employees of contractors.

For example, maintenance staff and cotractors employees make use of the simulators to understand plant behavior during startup and shutdown from technical aspect.

[Organization and Administration]

(2) The station places emphasis on administration management and actively implements preventive maintenance, thereby achieving a safe and reliable plant operation for an extended period of time as a result.

For example, Kyushu Electric Power Company has a policy of making the necessary investment for preventive maintenance and conducting performance assessment after replacement of equipment so as to maintain safe and reliable operation. This policy is thoroughly informed to all plant personnel. Replacement of main components, such as a reactor vessel head and steam generator, is currently being planned. Other small equipments are also replaced as required to extend the plant's lifetime. It is believed that there are other fundamental factor(s) that contribute to the station's solid operation performance, but this review did not identify such factors.

(3) The station maintains close communication with maintenance-related contractors to implement daily activities in unity. As a result, station's expectations are well informed to contractors and ownership (strong sense of responsibility for job) is fostered among them.

For example, employees of such contractors participate in plant patrol to identify any problems in facilities, and always have conscious awareness that this is their own plant. This is believed to be attributable to Kyushu Electric Power Company's long-standing management strategy to establish a system of having contractors play the central role in maintenance. These activities and awareness integrate employees of contractors into the workforce team, thereby actualizing the Site President's policy of "identifying small problems before they turn into big problems".

4.2 AFINs : Areas for improvement needed

On the other hand, 12 areas for improvement needed were identified.

[Operations]

(1) Operation managers do not clearly define expectations for plant monitoring at the control room, pre-job briefing for periodic test, and supervisor's monitoring and direction in simulator training, therefore fail to hold shift managers and supervisors accountable for consistently monitoring and directing operating crews. Even when expectations are defined, they are not set at a high level, and have room for improvement.

For example, it was observed that a shift manager did not address operators who failed to monitor instrument panels during shift turnover briefing.

(2) There is room for improvement in respect to simulator training at the Training Center, and the consistency between simulators and actual control room.
For example, inconsistency between simulator and control room in existence of switch cover was observed.

[Maintenance]

(3) Maintenance managers should establish high expectations and standards, and ensure to communicate them to all concerned personnel.
For example, although the openings of piping and parts are supposed to be covered to prevent the foreign material incursion, specific foreign material exclusion implementations often rely on the personal knowledge and skills of supplemental personnel.

(4) There is room for improvement in regard to the mechanism for foreign materials exclusion around the spent fuel pit and during maintenance work activities.
For example, the barriers surrounding the spent fuel pits at Unit 1 and Unit 2 are installed with fine mesh metal screens for the purpose of foreign materials exclusion. However, the screens height of 30 to 40 centimeters is insufficient.

(5) The industrial standard for rigging and lifting were not implemented in some cases. There is also room for improvement in the management of rigging and lifting tools.
For example, it was found that one sling was not marked with a color-coded label indicating that it was available for use in that month.

(6) There is room for improvement in measures for preventing electric shocks and arc discharge during electric tests and circuit breaker operations.
For example, there was no access restriction in place during work on low-voltage power supplies, or no specific provisions regarding safety zones during the conducting period.

[Engineering Support]

(7) In regard to permanent or temporary storage of articles within the station premises, there is room for improvement in administrating and managing them to minimize any impact on the facilities during a seismic event or fire.
For example, several dozen of cardboard boxes containing filters were stored temporarily at several locations on the premises.

[Radiological Protection]

(8) There is room for improvement in the posting and indication to communicate dose rate to on-site

workers.

For example, radiation survey map was not posted at the entrance to high dose zones such as the liquid waste evaporator room, but only maximum dose rate.

(9) There is room for improvement in the control of contamination for temporary equipments.

For example, decontamination tank, temporarily placed in a radiation controlled area, was not fully covered on the underside.

[Operating Experience]

(10) It is desirable to explore ways of prioritizing the processing of operating experience that should be examined swiftly, and compiling them so that it can be more effectively utilized in the course of daily operations.

For example, there is no clear timeframe defined for examining industry operating experience. It was also found that operating experience information is not compiled into a database that would facilitate easy access.

[Organization and Administration]

(11) Performance indicators and systematic approach in observing and providing guidance to on-site activities for continuous assessment of station performance are seldom utilized. The station should conduct benchmarking on best practices abroad to obtain information of a higher level of standard.

For example, the station did not employ performance indicators on the rate of human errors, widely used overseas.

(12) There is room for improvement by simplifying the policy for the use of personal protective equipment to enhance industrial safety.

For example, on the first floor of the turbine building at Unit 1, where the level of noise was high, supplemental workers wore earplugs, but the inspection supporters standing nearby workers at the power supply panel didn't. The current station's policy stipulate that "persons who conduct actual operations" must wear earplugs. The interpretation as to whether the inspection supporters constituted "persons who conduct actual operations" was left to the discretion of individual workers.