

Summary

1. Overview of the Reviewed Power Station

The Japan Nuclear Technology Institute (JANTI) conducted a peer review (Review) at Tokai No. 2 Power Station of the Japan Atomic Power Company (JAPC) from Monday, June 1 to Friday, June 12, 2009.

Tokai No. 2 Power Station is located along the coast of the Pacific Ocean in Tokai-mura, Naka-gun, Ibaraki Prefecture and has one Boiling Water Reactor (BWR). During the Review, the reactor was under operation at rated thermal output.

JAPC began construction on what would become Japan's first commercial nuclear power plant at Tokai site in 1960 and the construction of Tokai Power Station was completed in 1966. Later, the construction of Tokai No. 2 Power Station (Station) began in 1973 and was completed in 1978. Commercial operation of Tokai Power Station ceased in 1998, and the plant is currently being decommissioned.

The Station Director administrates the station giving top priority to safety, while adhering to this fiscal year's administration policies of "giving utmost consideration to operating the station in a cheerful way, providing safety and peace of mind" by "constantly asking questions, learning, and taking the initiative to foster safety culture with the view to maximum priority on safety."

As of April 1, 2009, the Station had approximately 360 personnel and there were 1020 contractor employees approximately.

Rated electric output (MWe)	Commercial operation commencement date	Operation performance (as of March 31, 2009)	
		Generated energy ^{*1} (billion kWh)	Capacity factor ^{*2} (%)
1100	November 1978	219.3	74

*1) Generated energy: includes periods of operational testing

*2) Capacity factor: since commencement of commercial operation

2. Review schedule

After the reviewer training and preparation at JANTI office from Wednesday, May 27th to Friday, May 29th, 2009, the Review was conducted at the station for two weeks from Monday, June 1st to Friday, June 12th, as shown in Table 1.

Prior to the Review, field observations were conducted to observe field works at the Station for the three days from Wednesday, March 3rd to Friday, March 5th, 2009 (work observations).

Also, on Wednesday, April 15th and Thursday, April 16th, 2009, operations shift crew performances at training was observed at the full-scope simulator facility of BWR Operator Training Center (Fukushima Center) (simulator training observation).

Table 1: Review schedule at the Station

		Review Description
June 1st (Mon)	(Morning)	<ul style="list-style-type: none"> · Entrance meeting (introduction of review team, review plan, etc.) · Schedule arrangement with the station counterpart in each review area
	(Afternoon)	<ul style="list-style-type: none"> · Plant inspection to observe plant equipment conditions, etc.
2nd (Tue)		<ul style="list-style-type: none"> · Plant inspection to observe plant equipment conditions, field observations, interviews, document reviews and discussions about these results with station counterparts. · Team meeting including station representatives
3rd (Wed)		<ul style="list-style-type: none"> · Field observations, interviews, document reviews and discussion about these results with station counterparts. · Team meeting including station representatives
4th (Thu)		
5th (Fri)		
6th (Sat)		Day off
7th (Sun)		<ul style="list-style-type: none"> · Team meeting (refine strengths and areas for improvement)
8th (Mon)		<ul style="list-style-type: none"> · Field observations, interviews, document reviews · Discuss causes and contributors related to problem areas with station counterpart · Confirm and review facts related to strengths and areas for improvement · Team meeting including station representatives
9th (Tue)		
10th (Wed)		<ul style="list-style-type: none"> · Discussion with station counterpart in each review area · Discussion between team leader and station representatives regarding strengths and areas for improvement · Team meeting including station representatives
11th (Thu)		<ul style="list-style-type: none"> · Review and finalization of strengths and areas for improvement · Discussion among exit representative, team leader and station representatives on strengths and areas for improvement · Compile material for exit meeting
12th (Fri)	(Morning)	<ul style="list-style-type: none"> · Exit meeting (explanation from review team regarding strengths and areas for improvement, as well as supplementary explanations when requested by the station)
	(Afternoon)	<ul style="list-style-type: none"> · Press conference organized by JANTI

3. Review methodology and review scope

The objective of the Review conducted by JANTI is to promote further improvements in the safety and reliability of the nuclear power stations. In addition, sharing strengths with nuclear industry as assistance is the purpose as well.

3.1 Review methodology

The Performance Objectives and Criteria (PO&C) used by WANO^{*3} (World Association of Nuclear Operators) were applied to the Review as a standard in spite that INPO^{*3} (Institute of Nuclear Power Operations) has its own PO&C, considering the continuity of JANTI and WANO peer reviews since JANTI and WANO have implemented reviews with each other and the relationship is mutually complementary.

This standard was formulated as a guideline to promote the highest level of the performance of nuclear power plant operations. In the review, the PO&C was used to identify "strengths" and "areas for improvement (AFIs)".

Strengths are items which have been judged to have reached the highest level possible. On the other hand, AFIs are items for which effort is required to reach the highest level possible, but does not always mean insufficient, inadequate or poor performance compared with industry standards.

The Station performance in around April 2007 or later was determined to be reviewed. The review team conducted the Review as described below, focusing on field observations and closely discussing with station counterparts in accordance with INPO^{*4} (Institute of Nuclear Power Operations) and WANO review methodology.

- *3) WANO was founded in 1989 by nuclear operators world-wide, after the 1986 accident at the Chernobyl Nuclear Power Plant made it painfully clear that a global information network of nuclear power utilities was needed. Its mission is to improve the operational safety and reliability of nuclear power stations to the greatest extent possible, by implementing a variety of support activities for nuclear power stations. These include reviews of nuclear power stations throughout the world, as well as exchanging information concerning accidents and problematic events.

INPO was established by the US nuclear power industry after the 1979 accident at Three Mile Island nuclear power station. Regular review of US nuclear power stations is one of INPO's principal activities, and these are mainly accomplished by staying at the nuclear power station for two weeks and conduct on-site observations. The JANTI review follows this method. Since 1990, the contributions of INPO are recognized as being among the most extensive from those involved with nuclear power in improving safety and reliability at US nuclear power stations.

3.1.1 Information gathering and analysis

Reviewers for each area analyzed the information provided by the station in advance, which included: in-station operating experiences, procedures, meeting minutes, and work observations and simulator training observations developed by JANTI. This is in order to prepare a review plan for effective implementation of station review.

3.1.2 Observations of equipment and facility conditions at the Station

First of all at the station, all reviewers conducted plant inspection and observed equipment conditions in the area assigned to each of them and noted any issues noticed. The number of collected issues was 230 in total. When sorted by appropriate review area, there were, approximately, 160 issues in operations, 120 issues in maintenance, 60 issues in engineering support, and 40 issues in radiation protection. Each reviewer utilized these records as material to understand the current situation of the Station for the subsequent review.

Since the content of many items falls under several categories, the sum of all categories is greater than the total number of items.

3.1.3 Field observations and follow-up

Following the observation of equipment conditions, the reviewers assigned to the specific review area started observations of the condition of the station facilities and equipment, and performance and behaviour of station personnel including contractor employees from a point of view of expert. Then, they made interviews and reviewed documentation to follow-up the results obtained through detailed observations. Each reviewer decided whether the gathered information was significant or not based on the review standard (PO&C) and his/her own practical experience. The significant facts identified as beneficial or problematic were recorded and noted as the issues need further evaluation. Each reviewer exchanged opinions about these facts with station counterpart and, if necessary, employees of contractors over and over.

The results of the aforementioned were presented at the evening review team meeting, and matters considered as excellent or problematic were deliberated by all members of the team.

3.1.4 Analysis of observation results

Reviewers for each area identified the excellent points and problematic issues according to the review standard (PO&C) from among matters gathered through the processes listed in 3.1.1, 3.1.2, and 3.1.3.

The excellent points were consolidated as "strengths," and information about them was included so that other stations may use them as reference.

The problematic issues were further analyzed to clarify what the problem nature was, why they occurred (causes and contributors), and how they could be solved (how to make improvement). In cases where additional information was required for this work process, additional field observations, document reviews, or interviews were conducted once more, and AFIs were developed based on the results.

AFIs including their nature, causes and contributors were presented to the station counterparts with reference to the PO&C and actual industry best practices. Discussions were repeated until a mutual understanding about the nature of the problem, the causes, and the background.

The details of these discussions and feedbacks from station personnel were presented again at the review team meeting. All of review team member made further discussion and analysis in order to brush up strengths and AFIs in terms of accuracy and appropriateness from multiple perspectives considering the feedback.

3.2 Review Scope

3.2.1 Review Areas

In the review, six functional areas listed in (1) through (6) below were reviewed. The other areas (7) through (10) were reviewed as required as part of six functional 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 Composition

The review team consists of:

- Exit Representative: Ohide, Technical Advisor of JANTI
Team Leader: Kawashima, Director of JANTI
Team Members: 15 members excluding Exit Representative and Team Leader
(2 JANTI member organization personnel; 13 JANTI personnel)

4. Summary of results

The following strengths and AFIs were identified by the review team.

4.1 Strengths

The following six strengths were identified:

[Operations]

- (1) Since 1980, the Operation Department has recorded data on every type of trouble occurring at the Tokai No. 2 Power Station (accidents, failures, non-conformities with useful lessons on plant operations) into its Technical Object Program of Peculiar Information Control System for Plant (TOPICS) database and has been effectively using this data when responding to similar troubles as well as for prevention. For instance, cases of trouble that have occurred in the past are made known to operators prior to each surveillance test, and made use of during operator training.

[Engineering Support]

- (2) Diagnosis of the emergency diesel generator (D/G) engine's characteristics is carried out by taking vibration measurements using ultrasonic waves and wave form analysis in order to early detect any signs of abnormality during surveillance tests of the D/G.
- (3) When the corrugated panels of the moisture separator were being replaced, the work was carried out vigorously adapting the latest technology from overseas, using mock-ups for detailed technological verification, and reflecting on operating experience, thus improving reliability and efficiency of the plant.

[Radiological Protection]

- (4) With the aim of reducing exposure dose and radioactive waste during outages, every department in the station and contractors make utmost endeavors by organizing and conducting "ALARA* coordination meetings" where relevant information is shared and mutually reflected on.

*ALARA: Acronym for "As Low As Reasonably Achievable," which reflects the principles reducing exposure dose.

- (5) In order to assure that fundamentals of radiological protection are practiced in radiation controlled areas while outage work is being performed, mini-peer review activity is conducted by the team consisting of five personnel including one supervisor of Radiation Control Section and personnel responsible for radiation control of each contractor. The team picks out specific works and observes radiological protection measures. The team members share identified strengths and AFIs, which are reflected in the performance of works done by the contractors of the members.

[Operating Experience]

- (6) Injuries and troubles that have occurred on the same date in the past are introduced in the daily morning meeting where managers in the station attend. Cases introduced at the

meetings are put to use by personnel in the Operations and Maintenance in formulating cautions to be heeded in routine work.

4.2 Areas for improvement

The following eleven areas for improvement were identified.

[Operations]

- (1) Improvement is desired since the operations managers do not effectively reinforce expectations for operators or set high standards of operations including use of the procedures, fundamental behaviors (pointing and calling, repeating, peer checking), maintaining the proper environment of the main control room, briefing, and walk down. For instance, after shutting down the residual heat removal system in fuel pool cooling mode, operators forgot to restore the interlock because of improper use of the procedure.
- (2) Improvement is desired since the simulator training is not being effectively utilized in order to achieve high level operator performance. For instance, in the review session following simulator training, many comments were given concerning procedures, however, there were no comments in regard to fundamental behaviors such as pointing and calling, and repeat back.
- (3) Improvement is needed since status of plant system is not always controlled adequately. During the outage, for instance, the emergency diesel generator was automatically started up because the diesel generator automatic selector switch was restored to the "in use" position from the "lock" position without checking to see that the breaker was open.

[Maintenance]

- (4) Improvement is needed since work is being performed in some cases without using human error prevention tools such as self-checks and adherence to procedures, and checking the work area, some of which resulted in LCO entry. For instance, during a surveillance test of the diesel generator for the high pressure reactor core spray system, the engine restarted after performing the engine shut down operation. The cause was that, when the timer test was restored, the dial was accidentally touched and the setting was changed.
- (5) Inappropriate rigging and lifting lead to workplace injuries and damage to equipment. In addition, there are cases of inappropriate storage of wire ropes, chain blocks and other rigging equipment. Improvement is needed in control of rigging and lifting work. For instance, when riser pipe was being hoisted, the pipe swayed due to the use of inappropriate hoisting pieces.
- (6) Improvement is desired in thoroughness of foreign material exclusion since some improper work practices were observed in the spent fuel pool vicinity as well as in general areas. For instance, there was no foreign material exclusion covers to detached burners and cooling pipes of the auxiliary boiler for inspection.

[Engineering Support]

- (7) Improvement is desired since control of fire protection equipment and the carrying in of combustible materials is inadequate throughout the station.
For instance, there were about 10 cans of lubricating oil for which nobody was accountable on top of a cabinet next to the high pressure reactor core spray system diesel generator oil station.

[Radiological Protection]

- (8) Improvement is desired since there are inadequacies in the setting of contaminated areas within controlled areas and workers' behavior within the contaminated areas, as well as contamination measurements.
For instance, the vinyl sheets over the metal fence demarcating the high contamination area (Area D) were covered insufficiently. Workers inside the area contacted with the uncovered metal fence, which could result in the spread of contamination.

[Operating Experience]

- (9) Improvement is desired since the activities to improve station performance through reporting and analyzing operating experience including non-conformities and near miss events are not effective.
For instance, even though near miss events and adverse conditions reported in various patrols are adequately handled in a complete and reliable manner, trend analysis is not conducted in order to identify the performance weakness of the station.

[Organization and Administration]

- (10) In some occasions, inappropriate work practices and work conditions (environment) were observed in the field at the station. Further improvement is needed to achieve higher level of industrial safety.
For instance, workers were taking dimensional measurements of equipment located near the ceiling in the residual heat removal system pump room on the second basement floor of the reactor building. Although the workers were using safety belts, the belts were hooked below the workers' waist line.
- (11) Improvement is needed since the top and middle management of the station does not always set high standards of expectations or reinforced the standards for industrial safety, human performance, operations, maintenance, use of operating experience, fire protection and training among station personnel and contractors. In addition, the top and middle management of the station are not sufficiently engaged in monitoring, observing accurately the performance of the station and taking corrective actions toward the issues.
For instance, even though the station management recognizes the extreme importance of human performance (i.e., reducing human errors), endeavors to the human performance as the organization on the whole are insufficient. As the result, human errors occurred repeatedly in operations and maintenance.