

I. Overview

1. Introduction

This report summarizes the results of peer review (hereafter referred to as "review") conducted on Hitachi-GE Nuclear Energy, Ltd. ("Hitachi-GE"). In the reviews conducted by Japan Nuclear Technology Institute (JANTI), review teams consisting of experts from both the member organization and JANTI visit the member facilities to conduct a specialized technical review regarding the theme of nuclear safety. The purpose of the review is to promote safety culture in the whole nuclear power industry by identifying good practices from which other members can learn and areas for improvement of the facility.

2. Overview of the Reviewed Facility

Hitachi-GE was founded on July 1, 2007 in a merger of management resources between Hitachi Ltd. and the US General Electric Company, as a manufacturer whose goal is the construction of nuclear power facilities and provision of maintenance/services for said facilities on a global scale. Hitachi-GE deals with the development, design, manufacturing, installment and maintenance of power-generating boiling water reactors (BWR), fast breeder reactors, nuclear fuel cycle-related facilities, as well as other related products and services. Various products are manufactured at the following Hitachi Works locations: the Rinkai factory, Kaigan factory, and Futo factory.

The main targets of this peer review were the Hitachi-GE Design/Manufacturing/Quality Assurance Divisions at the Rinkai and Kaigan factories. The Rinkai factory contains such facilities as the nuclear large-scale cannery and nuclear precision instrument factory, producing core shrouds and other core internal structures, reactor core vessels, and control rod drives. The Kaigan factory, home to Power Systems Hitachi Works, Hitachi Ltd. offices, produces nuclear power turbines, generators, and other power generation components. As of September 2008, the number of Hitachi-GE employees was approximately 1,500.

At present, for Shimane Nuclear Power Station Unit 3 the Kaigan factory is manufacturing core internal structures such as core shrouds, steam-water separators, and steam dryers, as well as control rod drives, replacement core shrouds, replacement jet pumps and other equipment for existing plants .

The Generator Turbine Design Division of Power Systems Hitachi Works, Hitachi Ltd. was an also target in this peer review.

3. Review Viewpoint

This was the second time JANTI had performed a peer review on Hitachi-GE, if one includes the review conducted during July 24 - 26, 2002 on Hitachi Works, Hitachi Ltd. (Nuclear Power Division) by the precursor to JANTI, the Nuclear Safety Network. This peer review was conducted accordingly, focusing on activities after the previous peer review, including corrective actions against previous Area For Improvement.

Hitachi-GE, in response to the "piping annealing problem" identified in 1997, designated October 13 - the day administrative action was carried out - as "Fundamentals and Righteousness Day." Since then, "Fundamentals and Righteousness Reinforcement Rallies" have been held on the 13th of every month, with the aim of thorough compliance penetration/proliferation.

Additionally, we are undertaking efforts outlined in the "Action Plan for Improving the Safety of Nuclear Power," which are based on the results of overall inspection of generation equipment as per the directions given by the Ministry of Economy, Trade and Industry (METI) in November 2006. Specifically, actions are being carried out for "thorough penetration of compliance/corporate ethics," "creating a technological base for safety technology," and "information sharing to raise safety standards."

Also, recurrence prevention measures against the "reprocessing facility seismic resistance calculation input error problem" - reported in May 2007 to the regulatory agency - are proceeding smoothly.

The review took all of the above factors into consideration, focusing on the points below:

- Efforts to cultivate safety culture
- Penetration of the top management policies in design/manufacture work
- Efforts for industrial safety
- Knowledge transfer
- Worker performance in manufacturing sites
- Human error prevention measures
- Status of efforts for recent problems

Specific areas of review included the 3 areas of "organization/administration," "training," and "design/manufacturing," as well as the key issue of "nonconformity management and human error prevention."

4. Conducting the Review

(1) Review dates

September 24(Wed) - September 26(Fri), 2008

(2) Review team composition

Team leader: JANTI NSNet Division

Team members: one from Mitsubishi Electric Corporation, one from Mitsubishi Nuclear Fuel Corporation, and two JANTI NSNet Division

(3) Allocation of review group assignments

Group A: organization/management, key issues

Group B: training, design/manufacturing

5. Review schedule

The review spanned three days, with each group following the schedule shown below.

		Group A (Organization/Management, Key issues)			Group B (Training, Design/manufacturing)			
Sep. 24 (Wed)	AM	Review Team Meeting						
		Opening (greeting, member introduction)						
		Interview with President						
		Overall	Follow-up during visit to coordinators	Document review	Training Design/manufacturing	Management	Interview	
	PM	Organization/administration Key issue	Management, Person responsible	Interview	Overall	Follow-up during visit to coordinators	Document review	
					Training	Training school/NDE Center	Event observation	
					Design/manufacturing	Events-related	Document review/interview	
		Review Team Meeting						
		Meeting with host coordinators	Confirm review results Confirm schedule for 2nd day		Meeting with host coordinators	Confirm review results Confirm schedule for 2nd day		
		Sep. 25 (Thu)	AM	Organization/Management	Morning greeting, KY activities	Event observation	Design/manufacturing	Factory work/equipment/ component Equipment Status
Organization/Management Key issues	Management class, Member class			Interviews	Training Design/manufacturing	Management class, Member class	Interviews	
PM	Overall			Document review	Training	Status of training in each dept. Management class, Member class	Interviews	
	Organization/Management Key issues		Member class in Manufacturing	Interviews				
	Organization/Management		Management class, Member class	Interviews	Design/manufacturing	Management class, Member class	Interviews	
	Review Team Meeting							
	Meeting with host coordinators		Confirm review results Confirm schedule for 3rd day		Meeting with host coordinators	Confirm review results Confirm schedule for 3rd day		
	Sep. 26 (Fri)		AM	[Confirm findings]				
Final adjustments with host								
PM			Closing preparations					
		Lecture on efforts to foster safety culture						
Closing (explanation of results, etc)								

6. Review method and method of summarizing review results

6.1 Review method

(1) Document review

Received explanation and copies of work policy, regulations and related documents; extracted major points and observation items.

(2) Interview

Interviews on the theme of "efforts for nuclear safety arena" with a total of 53 people, including the business proprietor (president), managers, and members. Also, uncertainties arise in the document review were clarified in the follow-up interviews.

(3) Observation

In the review, activities carried out in the plant were observed. Also, while carrying out document review, interviews and site observations, the review team carried out mutual opinion exchange, providing information and examples of "best practices" employed in the nuclear power industry to be used for reference at the plant .

6.2 Method of summarizing review results

"Good practices" and "areas for improvement" were identified, based on document reviews, interviews, and observations for each review item. "Good practices" is defined as "an outstanding practice or process in the safety related plant activities which contributes to the good performance with accuracy, effectiveness and originality. Accordingly, it is worth being shared not only with other JANTI members but also with whole nuclear power industry." "Areas for improvement" is defined as "suggestions for further improvement in the activities to enhance nuclear safety of the plant in contrast with the best practice employed in nuclear power industry to achieve excellence." Accordingly, areas for improvement can be suggested even when the performance of the plant activities is better than the standard level in the nuclear power industry.

7. Overview of interview with President

The review team interviewed the President of Hitachi-GE in order to understand top management policies. His thought was expressed as follows.

(1) What nuclear safety means to Hitachi-GE

Here at Hitachi-GE, "MONOZUKURI" refers to the method used for all work activities, from product development to design, manufacturing, installment, test operation, and inspection/maintenance. To ensure nuclear safety, we make sure that "MONOZUKURI" is carried out according to the rules, so as to ensure that Hitachi-GE provides high-reliable plant equipment which is able to "stop," "cool," and "contain" not only during normal operation, but also during emergency situations.

During daily business, it is imperative that we are consciously aware that the items we are handling are products for use in nuclear power. All work must be conducted with an awareness of how society views nuclear power, and the effects our products could have. By remaining aware of the importance of working with "MONOZUKURI" in mind, we raise awareness of nuclear safety and work towards raising the level of safety.

(2) Efforts to foster safety culture

It is set in the nuclear equipment quality management policy ("quality management policy") that the fostering of safety culture is a goal which requires our efforts, and various activities are promoted towards this end. They include interviewing instructors prior to their deployment to a site, "Fundamentals and Righteousness Proliferation Rallies," sending executive messages, and distributing corporate ethics awareness cards.

Employees working for nuclear power station sites face various situations there. Therefore, outage managers and instructors to be deployed there are told, through pre-deployment interviews, the types of situations others have faced and the ways in which they dealt with those situations. We tell our employees that, when faced with a problem with no easy solution, they should either discuss the matter with their superior or notify me directly without worrying alone. We also tell them that, in order to avoid making wrong decisions, employees should gather opinions and knowledge from a wide variety of people and discuss the matter with them. By doing so, employees solve problems as an organization.

We endeavor to increase compliance awareness for workers at our offices, beginning with designers by explaining past cases at "Fundamentals and Righteousness Reinforcement Rallies." These "Fundamentals and Righteousness Proliferation Rallies" are held once a month, with approximately 150 participants. Those who attend return to their workplaces and perform T.T. (technology transfer) for those who did not attend.

In the FY2007 management review, there were orders to "reflect activities fostering safety culture in the Quality Management System (QMS)." The reason was to make it continuous activities to foster safety culture instead of one-time effort by procedures.

(3) Reinforcement of presidential policy (business plan) to the work site

We hold business plan explanations in April and October of each year. In April this year, the explanation took an hour and a half, and was carried out a total of six times; twice at the Rinkai factory, three times at the Kaigan factory, and once at our Head Office. This explanation was held for all workers, including managers and directors, in an effort to achieve dissemination of the business plan. The details of this business plan can be viewed on the company intranet.

At these explanation meetings, we held Q&A sessions directly with the workers, and I feel that is a good sign of reinforcement of the business plan to the work site.

For most employees, it seems that they have a good understanding of their own scope of responsibilities. However, they do not completely understand the state of business as a whole. It is this point which we expect to improve upon with these explanations.

(4) The culture of reporting

I believe that daily "reporting," "notifying," and "consulting" are being done properly.

We normally receive periodical reports on work such as preventative maintenance and fuel cycle at newly constructed/pre-existing plants from the people responsible for said work.

In the case that a product accident occurs, an accident occurrence bulletin will be sent out in a timely manner. After this accident bulletin is sent out, we receive reports on the latest information about our relations with customers affected by the accident and response status. We regularly teach our workers that they should report even the smallest problems, and that the worse the problem is, the faster it should be reported. This leads me to believe that most problems are being reported.

As for accidents involving nuclear power components, these fall into my area of responsibility. I receive a copy of all accident bulletins, even for product malfunctions from other divisions, allowing Hitachi-GE to handle measures against them.

(5) Hitachi-GE's areas of specialty and issues we face

Hitachi-GE is a company which specializes in "MONOZUKURI." We are particularly adept at in-factory production, where we produce core internal structures and other important reactor-related machinery. In construction engineering, we aim to reduce construction time and improve installation quality through use of modular construction.

The issue we face is choosing a US nuclear power station most suited to be our partner, and then building/improving our partnership with them. As constructing a plant in the US carries great risks, we must proceed carefully.

The strengths of the US-based GE-Hitachi Nuclear Energy lie in licensing, marketing, and global procurement. It is for these reasons that we wish to fully utilize our synergy with GE-Hitachi.

(6) Management expectations

Each division takes the business plan I have set out, developing them into business activity plans for their division and specific actions. I expect that the management from each division will assess the issues and problems facing them on the path to achieving their objectives, so they can discuss them with me early on.

I also expect that management will create quality at an early stage. For example, before placing an order at the estimation/ordering stage, they could evaluate technical risks and carry out thorough pre-ordering deliberations on items such as contract requirements.

Technological difficulty (high technical risk) is never a good reason to avoid taking on new challenges. Just the opposite is true. Taking on "challenges" is just one of my expectations. What is truly important is assessing just what is technically difficult, and devising ways to overcome this difficulty.

(7) Efforts for skill and knowledge transfer

A knowledge database is utilized in the Design Division to accumulate technical information. One example would be the CAD (Computer Assisted Drawing) used for system design. Design basis for such items as the necessity of valve installation can easily be referenced by using this knowledge database.

In the Manufacturing Division, the methods for various types of work are stored as a database of video files - the "e-Meister" database - utilized for skill and knowledge transfer in welding, assembly, and on-site installation work.

An added plus of skill and knowledge transfer efforts is that a consciousness of working towards attaining a higher level of technological skill has been fostered in the teaching side.

Also, Hitachi established and runs a "Hitachi Technical School" and "Skill Training School". Engineers gain manufacturing skills at these schools, and then are allocated in manufacturing sites at each office.

(8) Expectations for peer review

I expect that we will gain effective feedback to reinforce safety culture through peer reviews consisting of site observation, interviews, and document research.

I also expect that workers will increase their awareness of problems within the station through the peer review including preparations, leading to self-inspired improvement activities.

8. Review result overview

We at Hitachi-GE are undertaking efforts outlined in the "Action Plan for Improving the Safety of Nuclear Power," which are based on the results of overall inspection of generation equipment as per the directions given by METI in November 2006.

Specifically, actions are being carried out for "Nuclear Compliance Liaison," "Business Partner Safety/Quality Assurance/Quality Control Exchange," "Fundamentals and Righteousness Reinforcement Rallies," and "direct dialogues with superiors/executives." These efforts contribute to "adherence to laws/regulations," "penetrating

engineering ethics," "actively utilizing communication," and "ensuring swift reporting."

Hitachi-GE recognized that, among these activities, the "C" and "A" of PDCA are inadequate from activities to foster safety culture. Thus, in order to increase the effectiveness of activities to foster safety culture, as of this fiscal year, Hitachi-GE added "working towards the fostering of safety culture" to the "quality policy." Although efforts to manage them with QMS are moving forward, specific measures are still in the trial stages.

In order to further pursue the continuous improvement of safety, the following measures must be taken in: self-assessment of the degree to which safety culture has been fostered, participation of related divisions that provides nuclear power products, such as the Thermal Power Division, in safety culture activities.

The outstanding characteristic of Hitachi-GE is its efforts towards becoming "the world's finest MONOZUKURI company."

Hitachi-GE's MONOZUKURI is supported by "Design Competitions," which all designers take part in, participation by young manufacturing workers in the Technical Olympics (1/4 of the manufacturing division have taken part in the Technical Olympics), and technical training for new employees at "Skill Training School (shut down seven years ago, but re-opened this fiscal year)." Skill maintenance/improvement efforts like these help instill confidence in design/manufacturing workers, allowing them to actively tackle difficult jobs.

The design caravans held before outages, as well as "outage/modification 'no-trouble' activities" where pre-startup intensive inspections of the plant are carried out, may also aid in early prevention of plant problems.

Recurrence prevention measures against the "reprocessing facility seismic resistance calculation input error problem" - reported in May 2007 to the national government - are proceeding smoothly, and it is expected that they will continue into the future.

These allowed the daily efforts by our employees in securing safety, improving technology, and preventing problems to be understood, through observing Manufacturing Division activities, and interviewing managers, designers and manufacturing workers (including those who have taken part in the Technical Olympics).

Listed below are 3 good practices and 4 areas for improvement extracted as specific review results. It is noted that none of identified areas for improvement need immediate actions from the standpoint of nuclear safety.

8.1 Good practices

(Organization/Management)

● Carrying out "outage/modification 'no-trouble' activities"

Design caravan activities and intensive inspections of the plant are actively carried out, with the goal of preventing problems during outage/modification work. In 2007, these activities have been carried out for 164 departments at 12 plants during outage periods.

One of these design caravan activities is division-wide confirmation of the status of preventive measures for the earlier event taken at other plants, deliberation status of design change points, and nonconformance processing status. These are conducted before outages by a team comprised of the members of the Quality Assurance Division, project managers, and various other personnel. Their activities target all departments related to outage/modification work, including group companies.

As part of intensive field inspection activities, the completion status of work and nonconformance processing finalization status is confirmed before the plant is started up. Along with this confirmation, site inspections are conducted to monitor plant behavior confirming whether there are steam/water leakages or vibrations/odd noises.

These activities are used for the further improvement of nuclear safety through reflection in corrective actions for nonconformance for the next outage and preventive measures for the similar events at other plants.

(Training)

● Efforts toward maintaining/improving the wide variety of skills held by designers

Organization-wide efforts are being conducted towards maintaining/improving the wide variety of skills held by designers. For example, a 12-part series of "Nuclear Technology Lectures (throughout the year)" started last year, so that mid-level engineers including designers can learn about work being conducted in other departments and gain a wide variety of knowledge about nuclear power. These lectures cover a wide variety of areas, including reactor systems, reactor core/safety, seismic design, preventive maintenance, radiation protection, and reprocessing/fuel cycles. Some opinions shared by participants show that they feel these lectures are meaningful in allowing them to learn about work they are not directly involved with, that they gained a wide variety of information, and that they hope these lectures will be held again next year and beyond.

We also hold "Design Competitions," where all designers participate. These competitions test the applicants with various types of questions, in a written test which includes problems on technical basics like design drawing and buckling calculations, as well as internal rules regarding work and the "Hitachi spirit". All designers are supposed to attend once every three years, allowing designers to organize/confirm the basics.

● Maintaining/improving skills which support "MONOZUKURI"

We maintain/improve manufacturing workers skills, which is the basic of "Monozukuri". These efforts ensure the high quality of our products.

Manufacturing workers receive skill training at in-company schools, so they may gain basic skills such as machine work, assembly, and welding plate working before starting work at plants. These skill training courses are held at the "Hitachi Technical School" or the "Skill Training School." New employee technical training at the "Skill Training School" has been temporarily shut down seven years ago, but was re-opened this fiscal year as

effective training for basic skills.

Also, as part of efforts for skill improvement, young manufacturing workers may be selected to receive 1 to 3 years of training before taking part in the Technical Olympics. Starting with the 1st Domestic Contest/12th International Contest (1963), Hitachi-GE and Hitachi Works offices have sent workers every year for a total of approximately 200 past participants. 1/4 of the manufacturing workers presently at Hitachi-GE have taken part in the Technical Olympics. Taking part in the Technical Olympics aids skill and knowledge improvement/transfer, instills confidence in design/manufacturing workers, and allows them to actively tackle difficult jobs.

(Design/manufacturing)

N/A

(Key Issue: nonconformance management and human error prevention)

N/A

8.2 Areas for improvement

(Organization/Management)

● **Further improvement of activities to foster safety culture**

Numerous activities, such as sending out the president's message on "Fundamentals and Righteousness," holding "Fundamentals and Righteousness Reinforcement Rallies," "engineering ethics training," and holding "Business Partner Safety/Quality Assurance/Quality Control Exchanges" with suppliers have been undertaken. Also, the quality policy states that "we must be aware that ensuring nuclear safety is the social responsibility of this company, work towards the fostering of safety culture, and hold the securing of nuclear safety as the highest priority in all our activities."

With the objective of advancing the PDCA cycle for activities to foster safety culture and thus increase its effectiveness, efforts to manage these activities with the QMS are moving forward. Additional, new system action plans are being studied, organizing various individual activities from the past.

It is desirable for the following items to be taken into consideration for the above efforts:

- (1) Take in measures for self-evaluation of the degree of safety culture fostered or signs of deterioration as a future issue, though the state of safety culture is measured by "Preventive Ethics Studies (test)" and "Workplace Attitude Surveys".
- (2) Have measures for fostering safety culture take place in relevant divisions that provides nuclear power products like the Thermal Power Division.

● **Efforts to prevent industrial accidents within the factory**

Various measures for industrial safety have been introduced in the factories, such as work procedure danger prediction activities (*), installation of tools proposed as an error prevention, and posting injury examples within

all Hitachi offices. However, there have still been two consecutive accidents this fiscal year.

There were a number of high-risk work activities and possible improvements in site environment seen during site observation. There should be further active efforts toward the eradication of industrial accidents in the factory, such as swift response to items pointed out during safety patrol and reduction of workplace risk.

(*): Activities to prevent disasters by identifying vulnerabilities in major work steps and foreseeable dangers/risks, and then developing active measures.

(Training)

N/A

(Design/manufacturing)

N/A

(Key Issue: nonconformance management and human error prevention)

● Effective use of nonconformance as lessons within the factory

Nonconformances discovered within the factories are categorized and registered into areas such as welding defects and mechanical defects. Trend management is then carried out on these issues. For workplaces which manufacture products that are relatively more mass-produced, nonconformance causes are compiled monthly to monitor trends.

Activities to gain nonconformance causes for workplaces which only manufacture one large-scale product are also carried out, but monitoring trends are not. Efforts should be carried out to monitor trends for causes as part of improvement activities, in addition to monitoring trends for issues currently being carried out.

● Further improvement of human error analysis

NZD (nuclear zero defect) materials are created for serious nonconformances as part of efforts toward securing nuclear safety/improving reliability. To this end, root cause investigation, recurrence prevention measures, and lateral development will be carried out. In order to carry out these measures more effectively, major nonconformances caused by human error should be compared against analysis methods approved within the industry and the academic world when deliberating recurrence prevention measures for NZD materials. This will allow for further use of root cause analysis.