

# Overview

## 1. Introduction

This is a report on the peer review of Fuji Electric Systems Co., Ltd. (FES). The peer reviews of Japan Nuclear Technology Institute (JANTI) are conducted by review teams comprising JANTI experts and JANTI members. The review team visits the facilities of JANTI members to identify the issues and good practices of the members, which are beneficial for other members, by reviewing the activities related to nuclear safety with their full knowledge and experience. The goal of JANTI's peer review activity is to improve the safety culture of the whole nuclear power industry.

## 2. Overview of the Organization Reviewed

Fuji Electric, the predecessor to FES, was established in 1923 with the capital and technology tie-up between Furukawa Electric and Siemens, and took part in the construction of Tokai Power Station, the first commercial nuclear power plant in Japan.

The Kawasaki block of FES comprises the Kawasaki Plant - which started operation in 1925 - as well as the J-Project Head Office, Nuclear Power Administration Department, Thermal Power Administration Department, Hydropower Administration Department. and affiliated companies.

This review is for the nuclear power division of the Kawasaki block, including the J-Project Head Office, the Nuclear Power Administration Department, and the Nuclear Power Department of the Kawasaki Plant.

The nuclear power division of the Kawasaki block has carried out business in “design of high-temperature gas cooled reactors,” “handling and processing of radioactive waste,” and “handling and transport of nuclear fuel, etc. by remote operation” as its core technologies.

The equipment handled by the nuclear power division covers gas cooled reactors, fast reactors, reprocessing equipment, MOX fuel fabrication equipment, and waste processing equipment. With respect to gas cooled reactors, this division participated in the construction of the Tokai Power Station; and has manufactured nuclear reactor equipment, as well as fuel handling and storage equipment at the High Temperature Engineering Testing Reactor

(HTTR). With respect to fast reactors, the fuel handling and storage equipment, as well as waste processing equipment, for the prototype fast breeder reactor, “Monju” was manufactured by this division. As for reprocessing equipment, manufacturing of handling equipment, testing equipment, cranes and shielded containers, etc. for high-level radioactive waste vitrification buildings and solid radioactive waste storage buildings of the Rokkasho Reprocessing Plant, this was carried out through the prime contractor. Recently, the division, leveraging its experience to date, has been involved in MOX fuel fabrication facilities.

The Kawasaki block has approximately 1,100 employees (as of June 2006), of whom approximately 80 people belong to the nuclear power division (as of November 2007, excluding seconded people). The J-Project Head Office handles project management duties related to MOX fuel fabrication facilities, and the Nuclear Power Administration Department handles nuclear power equipment project management duties, duties related to engineering, design, R&D, and quality assurance, as well as management duties related to construction and maintenance. The Nuclear Power Department of the Kawasaki Plant has approximately 10 people heading manufacturing and work management, quality assurance, and testing and inspection for machinery of nuclear facilities.

### **3. Review Approach and Points**

This review focused on the design control and manufacturing management of nuclear equipment, communication between top management and employees, and initiatives in quality assurance linked to nuclear safety.

Specific review areas were “organization and management,” “education and training,” and “design and manufacturing,” as well as “human error prevention,” which is an important issue for JANTI.

#### **4. Conducting the Review**

##### **(1) Review Dates**

From Wednesday, November 28th to Friday, November 30th, 2007

##### **(2) Composition of Review Team**

Team leader: an expert from Nuclear Safety Network Division, JANTI

Team members: five members total, with four experts and the team leader

(one from Nuclear Fuel Industries, Ltd.; one from Electric Power Development

Co., Ltd.; two from Nuclear Safety Network Division, JANTI)

(3) Responsibilities of review groups

Group A: organization and management, human error prevention

Group B: education and training, design and manufacturing

## **5. Review Schedule**

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

## Review Schedule

		Group A (Organization and Management, Human Error Prevention)			Group B (Design and Manufacturing, Education and Training)		
Wed. 11/28	AM	Peer Review Team Office Meeting, preparation Overall team meeting					
		Opening (Greeting, member introductions, etc.)					
		Interview with Site Superintendent class					
		. Organization/management	General	Documents	. Education/training . Design/manufacturing	General	Documents
	PM	. Organization/management	General	Documents	. Education/training . Design/manufacturing	Staff • Education/training • Effective design management	Interviews
			Managers • Structure of organization and responsibilities • Organization policies/objectives • Manager leadership • Quality assurance system • Developing safety culture	Interviews		Managers • Education/training • Effective manufacturing management	Interviews
			Staff • Developing safety culture, improving ethics	Interviews		Staff • Education/training • Effective manufacturing management	Interviews
		• Group meetings • Team meeting					
		• Coordination with host					
	Thu. 11/29	AM	Morning meeting	Event observation	. Education/training . Design/manufacturing	Morning meeting	Event observation
. Organization/management . Human error			General	Documents		Observation of knowledge transfer meeting	Field observation
. Organization/management			Initiatives in industrial safety Human error prevention	Documents		Managers, staff • Education/training • Effective design control	Interviews
. Human error			Risk assessment	Field observation			
PM		. Organization/management	Managers • Organization/management (continued)	Documents	. education/training . Design/manufacturing	Staff • Education/training • Effective design control	Interviews
			Staff • Organization/management (continued)	Documents		Managers • Education/training • Effective design control	Interviews
[Verification of Facts] • Group meetings, team meeting, coordination with host • Development of closing report							
Fri. 11/30		AM	[Verification of facts] Final coordination with host / final revision of closing report				
	Preparation for closing						
	PM	Closing (explanation of results, etc.)					

## **6. Review Method, Review Areas and Organization of Review Results**

The review methods, areas and organization of results are described below.

### **6.1 Review Methods**

#### (1) Document review

Work policies and procedures for each review area were explained, and related documents were shown.

#### (2) Interviews

Interviews were conducted of over 50 persons on the theme of “initiatives for nuclear safety, etc.,” including top management; namely, the General Manager of the J-Project Head Office, the General Manager of the Nuclear Power Administration Department, management level employees, and various staff. In addition, questions that arose from document review were examined during the interviews.

#### (3) Field observations

Direct observation was made in order to understand how activities in the field were being carried out, and the activities of the nuclear power division were reviewed in line with results of document review and interviews.

The peer review team, upon conducting document review, interviews and field observation, had frank discussions with the nuclear power division, providing the information and cases for reference - such as best practices in the industry.

### **6.2 Review Areas**

The three areas of “organization and management,” “education and training,” and “design and manufacturing,” were reviewed, as was the area of “human error prevention.”

### **6.3 Organization of Review Results**

For each review area, document review, interviews and field observations were carried out, and good practices and suggestions for improvement were identified.

The definition of a “good practice” is “an outstanding practice or process of the division which enhances nuclear safety with accuracy, effectiveness and originality, resulting in excellent performance; and should be shared, not only with other JANTI members, but also within the entire nuclear industry.”

“Suggestions for improvement” are “suggestions for further improvement in activities for nuclear safety in the division, achieved by comparison with the best practices in the nuclear industry, from the perspective of aiming for the highest level of nuclear safety." To that end, suggestions for improvement can be made for the activities that are above the standard in the nuclear industry.

## **7. Summary of Interviews with the top management of the nuclear power division**

A summary of the interviews with top management of the nuclear power division is as follows.

### **(1) Initiatives to develop and improve safety culture**

FES led the construction of the Tokai Power Station as a “front-runner.” This has been passed down as the DNA, or the legacy of the nuclear power division. In order to improve safety, quality and technology, the division is fully utilizing its DNA, or its legacy, as it takes initiative with a pioneering spirit. With safety as the starting point, the following initiatives are considered to be leading toward the development of a safety culture.

1) Making high-quality products, sending them out into the world, and having them used by customers. Good products are made when the maker and the user are closely connected.

2) Some projects are carried in collaboration with affiliated companies and other manufacturers. With respect to “Fugen,” “Monju,” and “HTTR” projects, the companies that joined the projects combined their strengths and supplemented each others' weakness mutually with synergistic cooperation.

3) With respect to the affiliated companies, an approach of nuclear power safety first,

and compliance with this approach, is requested through auditing; also, efforts were made in guidance, improvement, and development of manufacturing processes.

(2) Strengths of, and issues facing, the nuclear power division of the Kawasaki area

This division excels in the field of remote handling technology, built up from “Fugen,” “Monju,” “HTTR” and other projects. Through large-scale national projects, everyone in this division has built up the same experience. However, a major issue is passing on such technology once the project has been completed. Currently, the nuclear power division is in the preparation period for its next major project.

(3) Status of activities of the nuclear power division

The nuclear power division has meetings, including; the Business Leader (BL) Meeting, Executive Board Meeting, and Department Chief Meeting. The work progress (costs, schedules, etc.) is confirmed in weekly or monthly meetings. Furthermore, the situation with initiatives for projects, and information on customer relations, etc. is obtained as needed.

(4) Expectations of the top management of the nuclear power division for managers

Managers are expected to pursue the dream and adventurous spirit of manufacturing so that initiatives are carried out in a positive manner. The question of “what do you want to do?” is important, and must be asked before considering “what can you do?” In conversations with managers, “what do you want to do?” is always being asked.

(5) Communicating the policies of top management of the division to front line workers in the field

FES has many businesses related to the social infrastructure; and all of its employees, from the president down, are certainly making quality the most important point, with “quality-centric business operations” set in the “basic policy of quality activities.” Based on the quality policy of the company, quality objectives for each division are set, and these quality policies and quality objectives are communicated throughout every level of the company and implemented. Implementation status is to be followed and reported on a monthly basis.

The policies of top management are conveyed at the beginning of the year, and are

reflected in individual work improvements. With respect to problems arising in the departments, the BL Meeting, Executive Board Meeting and Division Chief Meetings are held to discuss the problems and strive to elucidate the issues. Furthermore, the J-Project Head Office Division Chief meeting, held once every two weeks, determines the level of awareness and grasps the implementation status. Here, upper-level management becomes the listening side, and also plays an indirect connective role regarding the progress of improvements, problems in the cooperation with other companies, and other related problems.

Opportunities such as year-end and New Year greetings, high quality and reliability (HQR) Committee News, and greetings of the fiscal year are used to convey the thoughts of top management.

Of these opportunities, HQR News has been published since October 1999, and the thoughts of top management are conveyed on paper. Since relying solely on articles that are visually appealing leads to a drought of ideas, various approaches and initiatives in the field are made into articles and sent to the relevant persons via e-mail, so that everyone can read them. The continued publication of the HQR News is one of the company's strengths.

The fruit of these activities' effects can be seen, to an extent, in the customer's appraisal of us. At a visit with a customer for after sale care of a delivered product, their appraisal of us can be seen through their eyes.

(6) A culture of reporting (Are various problems in the field being reported?)

Upper-level management attends department meetings in all divisions as observers, and makes efforts to directly listen to opinions and requests. Furthermore, meeting minutes are circulated through upper-level management, and they receive reports on a daily basis. While reporting usually conjures images of formal meetings, at FES, the immediate reporting of problems has been established as a part of one's daily duties. In the past, reports of problems would be received the next morning; but recently, reports are being received immediately through mobile phone e-mail. With respect to reports to the president and top management, rules have been set for quick reports in case of an accident.

Furthermore, one can truly feel that they are making a real difference, because problems are reported immediately after they arise. Problems concerning people, money

or things are immediately reported. An environment with a good atmosphere and a reporting culture has been achieved.

(7) Initiatives for knowledge transfer

The J-Project Head Office and Nuclear Power Administration Department, as a measure to prevent nonconformities, have created manuals, collected instances of near-miss events, passed down error events, and more. Furthermore, a database of nonconformities experienced with company products, in construction and commissioning of the JNFL reprocessing plant, will be reflected in the design work of the next large-scale project.

The J-Project Head Office, which directly reports to the president, undertakes initiatives in a project structure under the supervision of a director in charge. In preparation for our next large-scale project, the J-Project Head Office and Nuclear Power Administration Department has created a map of the technology required, and has extracted the technologies that need to be transferred. Furthermore, the divisions responsible for these technologies have been confirmed, and a plan is underway to secure necessary support from the head offices of other operations as well.

The Nuclear Power Administration Department has been carrying out R&D for the division, including trial manufacturing and testing of equipment, etc., and this has become an excellent opportunity for knowledge transfer.

As for the design review, when a new design is implemented, it is a good opportunity to confirm whether one's own design is excessive or deficient, and whether past experience has been reflected; this is also very helpful in knowledge transfer.

(8) Expectations for the peer review

The peer review is to raise mutual awareness, and we want to confirm whether what we have stated is actually taking place in the field, through interviews to be conducted later. We expect to have spirited discussions, where we are on the same level and candid opinions can be given. We also want to compare the good practices being implemented by power companies and manufacturers, and see if there are any points where FES is lacking in its activities.

## **8. Overview of the Peer Review Results**

An overview of the peer review results is as follows.

The nuclear power division of the FES Kawasaki block led the construction of the Tokai Power Station as a “front-runner.” Also, while fully utilizing areas of remote handling technology in which it has excelled - built up through “Fugen,” “Monju,” “HTTR,” and other projects, the division aims to develop a corporate culture that places importance on quality, through the High Quality and Reliability (HQR) Committee and publishing the HQR News.

Because the division believes that “providing products and services with excellent safety” leads to development of a safety culture, the division has created a “Nuclear Power Division Quality Policy” and an “HQR Activity Policy.”

For example, through “knowledge transfer meetings to share the experience of the design division and manufacturing division,” “practical training for young employees called ‘the *Dojo* [training hall],” and “collection and reflection of past nonconformity events,” efforts are being made for the knowledge transfer for the next large-scale project, and steady efforts are made to send out high quality products to the world. Also, e-learning for all employees of the Nuclear Power Division is being used to carry out vigorous education, and efforts are also being made to raise awareness of safety culture.

In this way, it was confirmed that employees are striving on a daily basis to improve safety, quality and technology; in observations of technology transfer meetings, morning meetings, and with interviews with managers and staff.

Below are eight good practices and five suggestions for improvement that have been identified from review results.

Please note that, from the perspective of nuclear safety, immediate actions are not required on these suggestions for improvement.

### **8.1.1 Good Practices**

(Organization and management)

- Stimulation of communication through continuous use of HQR News

HQR News has been published on a monthly basis since October 1999, and the 100th issue is planned for January 2008. Through continuous publishing over this period,

HQR News has been improved through questionnaires; and, in addition to the initial objectives of preventing careless errors and sharing quality information, it has also effectively worked as a communication means for all personnel related to nuclear power, including those on the site of the power station, HQR News has been useful in creating an open company atmosphere.

- Enhancing employee motivation with an award system

As an award system, there is a management quality award (annual award), a special award, and a monthly MVP (monthly award). The monthly MVP of the nuclear power division is given to individuals who have achieved good results in daily work related to quality, technology, customer satisfaction, and cost reduction based on the discussion between managers and staff. Awards are given by top management at the monthly general morning meeting. The interviews in the peer review also showed that this award system was effective in enhancing employee motivation.

- Reflection of information of reprocessing plant nonconformities in the next large-scale project

A database was created of several nonconformity cases experienced with company products in construction and commissioning of the JNFL Reprocessing Plant. Currently, with the aim of preventing recurrence of similar cases, what should be reflected in the design library and the engineering manuals is being examined and organized; once the examination is complete, this information will continue to be reflected on an ongoing basis, in specific design activities of the next large-scale project.

- Raising awareness of a safety culture through vigorous use of e-learning

Raising awareness of a safety culture is being aimed for through the e-learning related to developing a safety culture, which had been taken by nearly all employees related to nuclear power (93%). From here on, all new employees will also take this course. The division thinks these awareness-raising activities are not just temporary, but the idea of safety first should be continuously instructed, and put into practice in real work.

(Education and training)

- Knowledge Transfer with “The *Dojo*”

A system of practical instruction, “The *Dojo* [training hall]” is carried out in the Nuclear Power Department of Kawasaki Plant to transfer technical skills to young employees, as part of technical skill transfer activities for the plant overall. Transferees (trainees) and transferors (trainers) are determined, and the technical skills that the company needs are transferred in a systematic manner.

(Design and manufacturing)

- Steady management of duties using the “Product Realization Plan and Action Check Sheet”

In the nuclear power division, a “Product Realization Plan and Action Check Sheet” is developed to plan tasks and follow the status of projects, which covers the contract, design, procurement, manufacturing and construction. This sheet is used by all divisions, including the design division, the development division and the engineering division. By checking the implementation status of each step, projects are steadily managed, so as to avoid omitting or skipping a work step. Moreover, the format is not rigid, and improvements have been continuously introduced, such as adding check items, etc.

- Improving level of completion of a nuclear power product using SVP (Self Verification Point)

In addition to the inspections by the manufacturing division in charge of quality assurance, the design or engineering division carry out inspections independently, from the customer’s perspective, prior to customer inspection. This practice improves the completion level of the product and contributes to preventing nonconformities in the customer inspection.

(Preventing human error)

- Effective use of hiyari-hatto (near-miss) cases in the manufacturing division

Near-miss cases in testing and inspection of important equipment of the Nuclear Power Department of the Kawasaki Plant are collected from daily reports and are put into a database. This contributes to the prevention of similar nonconformities reoccurring, by reflecting such information in testing and inspection procedures when manufacturing

similar equipment in the future.

### 8.1.2 Suggestions for Improvement

(Organization and management)

- Systematic collection and effective use of event information

While information on events outside the company - including overseas events - are collected by each department, through meetings of the Japan Electrical Manufacturers' Association, from newspapers, and the websites of other companies, there is room for improvement in sharing the information with related divisions. Consolidated management for obtained event information is desired, so as to utilize the information more effectively.

- Direct dialogues between top management and staff of the nuclear power division

The top management of the Nuclear Power Division communicates its policies, etc. through documents and meetings, and their policies are reported from managers regarding the implementation status of improvement activities based on the policies. These policies are also known by the staff; however, there are few opportunities for mutual communication through direct dialogue. Since the scandals to date of other companies were caused by the lack of continual direct dialogue between staff and top management, an increase in the opportunities of direct dialogue between top management and staff would be desired, considering the next large-scale project..

(Education and training)

- More effective use of the knowledge transfer meeting

A knowledge transfer meeting is jointly held by the Design Division and Nuclear Power Division every month to share design information and bring about effective management; for example, by reflecting good design experience in manuals, etc. With the participation of divisions in addition to the Design Division and Nuclear Power Division, and improvement of themes and management, the experience and knowledge of other divisions could be shared more widely. An examination into expanding the technology transfer meeting on a developing basis is desired.

(Design and manufacturing)

- Swiftly obtaining information related to revisions of laws, ordinances and codes  
Information related to revisions of laws, ordinances and codes is obtained and managed by the Quality Assurance Division. With respect to revisions of laws, ordinances and codes, it is necessary to obtain such information in a timely manner, and it is desired that efficient methods for swiftly obtaining the latest information be evaluated.

- Collaboration between the Nuclear Power Administration Department and Nuclear Power Department

Although the Nuclear Power Department of the Kawasaki Plant and the Nuclear Power Administration Department are separated within the organization because of their differing functions, these departments are sharing information with each other. For example, the Nuclear Power Administration Department participates in the “Nuclear Power QR Subcommittee” held by the Nuclear Power Division; and, the Nuclear Power Department participates in design reviews of the Nuclear Power Administration Division and knowledge transfer meetings. Looking toward the next large-scale project, it is desired to have further collaboration, such as participation of the Nuclear Power Department in the “HQR Subcommittee” held by the Nuclear Power Administration Department.