

## **Overview**

### **1. Introduction**

This report summarizes the results of the peer review (hereafter referred to as "review") conducted at Mitsubishi Nuclear Fuel CO., LTD. (MNF). 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 Facility Reviewed**

MNF was founded in December 1971, with its main line of business being the fabrication of fuel for pressurized water reactor (PWR fuel), and engages in a full range of production from reconversion processing to assembling fuel assemblies, and is only domestic fuel processing manufacturer in Japan. The number of employees including contractors was approximately 500 as of May 2008. The site is locating in Tokai-mura and Naka-city, with the main manufacturing facility in Tokai-mura, whereas the production building where gadolinia-added uranium fuel is produced and the fuel processing testing building are both in Naka-city.

The processing facilities (main manufacturing facility and production building where gadolinia-added uranium fuel is produced) are licensed to handle uranium that is enriched up to a maximum of 5%, and presently handles mainly uranium enriched to 4.1% and 4.8%.

The reconversion manufacturing (i.e. processing the raw material, which is uranium hexafluoride, into uranium dioxide powder) and molding manufacturing (processing to solidify uranium dioxide powder into cylindrical shaped pieces called pellets) work is carried out 24 hours a day in three work-shifts (only two shifts for some parts of the molding manufacturing work) and the assembly work (assembling fuel rods and assembling the fuel assemblies) is done in day-shift operations only. In the production building where gadolinia-added uranium fuel is processed, the gadolinia-added uranium

fuel pellets undergo the manufacturing process and these are then inserted into the fuel cladding to assemble fuel rods. Of these processes, the pellet manufacturing process is carried out around the clock in three work-shifts (except for some parts of the molding process which is done in two work-shifts).

The MNF track record for producing fuel as of the end of May 2008 stands at 18,096 fuel assemblies and reconversion at 9,893 tons of uranium dioxide powder.

### **3. Review Viewpoint**

Including Reviews by JANTI's predecessor, Nuclear Safety Network, this is the third Review, the previous ones being in April 2000 and January 2005. For this Review, in addition to the main focus on current activities, things that have changed since the previous review and the state of endeavors toward "areas for improvement" from the last time will also be reviewed.

Furthermore, MNF has been promoting the following as foundation building activities (enhancing equipment safety and the like) aimed at the assurance of comprehensive safety (nuclear safety, industrial safety, and environmental safety) since 2005: (1) promoting motivation toward safety and systematic and continuous work improvement activities (MVP (MNF Value Plan) activities) that is consistent with the raising of product quality to an even higher plateau, (2) creating frank and vigorous atmosphere in work site to promote safety culture, and (3) promoting Corporate Social Responsibility (CSR) so as to fulfil social responsibilities expected as a member of the nuclear power industry.

Based on the above situations, following points were focused in the review.

- communicating top-management policies in the fuel production process and engineering development process
- continuous safety culture promotion activities
- training plans, skill management, qualification certification
- preventive maintenance
- endeavors in industrial safety
- work site condition and workers' performance

- criticality safety
- non-conformity management
- human error preventive measures
- risk management

Specifically, the review were conducted in the four functional areas; "organization & administration," "training," "work management & maintenance," and "radiation protection". In addition, following four items are reviewed as key issues; "criticality safety," "UF<sub>6</sub> leakage event," "non-conformity management and prevention of human errors," and "risk management."

#### 4. Conducting the Review

(1) Review dates

June 25 (Wed) to June 27 (Fri), 2008

(2) Review team composition

Team leader: from JANTI NS Net Division

Team members: team leader plus six others

(1 from JGC Corporation, 1 from Nuclear Development Corporation and 4 from JANTI NS Net Division)

(3) Allocation of Review group assignments

Group A: organization & administration, key issues

Group B: training, work management & maintenance, radiation protection

#### 5. Review Schedule

The Review was carried out over a period of three days, with the schedule for each of the groups as shown below.

		Group A (organization & administration, key issues)			Group B (training, work management & maintenance, radiation protection)		
June 25 (Wed)	AM	Meeting of the Review Team Members, etc. (60 minutes)					
		Opening (Greetings & Introduction of Members) (30 minutes)					
		Interview with Superintendent of Safety Management (60 minutes)					
		Overall		Documents (90 minutes)	Overall		Documents (90 minutes)
	PM	Event observation		event observation (15 minutes)	on-site observation		on-site observation (180 minutes)

		organization & administration key issues	management class	interview (150 minutes)			
		observation of shift handover		on-site observation (60 minutes)	observation of shift handover		on-site observation (30 minutes)
		Meeting of the Review Team Members, etc. (60 minutes)					
		Debriefing with host (confirm review results, confirm plans for day 2, etc.) (30 minutes)					
June 26 (Thu)	AM	organization & administration key issues	management class	interviews (210 minutes)	observation of meeting		on-site observation (15 minutes)
					training work management & maintenance radiation protection	management class	interviews (200 minutes)
	PM	event observation		event observation (90 minutes)	training work management & maintenance	engineer, etc.	interviews (180 minutes)
		organization & operation important issues	engineer, etc.	interviews (120 minutes)			
		Meeting of the Review Team Members, etc. (60 minutes)					
Debriefing with host (confirm review results, confirm plans for day 3, etc.) (30 minutes)							
June 27 (Fri)	AM	Meeting of the Review Team Members, etc. (30 minutes)					
		[confirm findings] (150 minutes)					
		make final adjustments with host / review final closing report documents					
	closing preparations (30 minutes)						
	PM	closing (explanation of results, etc.) (60 minutes)					

## **6. Review Method and Method of Summarizing Review Results**

### **6.1 Review Method**

#### (1) Documents Review

Facility documents such as business directions and expectations, manuals and relevant documents were explained by facility personnel and reviewed by team for each individual review item.

#### (2) Interviews

65 persons, including the company Vice President (Superintendent of Safety Management), managers, engineers and workers were interviewed. Moreover, questions based on documents review were asked to facility persons.

#### (3) Observation

In this review, along with items confirmed through document review and interviews, several activities at MNF were also observed.

In addition, review team discussed with MNF people with providing industry best practices (examples of high standard and quality) which would be good reference for MNF during document reviews, interviews and observations.

### **6.2 Method of Summarizing Review Results**

Good practices and areas for improvement were developed based on documents review, interviews and observations with regard to each Review area.

For the purpose of this discussion, "good practices" shall be defined as "examples of practices and/or processes in facility activities to ensure safety, which are especially exemplary, appropriate, effective and unique and, resulted good performance. And, these are worth to share with JANTI members and nuclear power industry. "

"Areas for improvement" shall be defined as "Suggestions to improve activities to ensure nuclear safety in the facility, which are developed by comparing best practices in

nuclear power industry in order to lead the facility to ultimate level of nuclear safety." Toward this aim, areas for improvement are sometimes made, even though the current state of activities is the same as or better than what are considered average standards throughout the nuclear power industry.

## **7. Summary of interview with Company Vice President (Superintendent of Safety Management)**

In order to understand the policies of MNF's senior management, the review team interviewed the company vice president who is concurrently the Superintendent of Safety Management. His thoughts are shown as follow.

### 1) Nuclear safety at MNF

Nuclear safety is something like a cross to be carried by corporate members of the nuclear power industry, and a company can be called a first-class company only when it sincerely endeavors to maintain safety. Superintendent said he also feels that nuclear safety is evidence of the company being able to give employees and their families peace of mind.

Insofar as this is so, he has to talk to the staff about the risks that exist day in and day out in order to preserve an attitude of nuclear safety. Safety is something that has to be acquired by each person for him/herself. Accordingly, the first thing is to obey rules, and if there is a person among us who does not obey the rules, we must make that person obey.

The Superintendent said he believes that the level of nuclear safety measures at MNF in comparison to other foreign and domestic companies in the same field is top-class.

### 2) Endeavors in the promotion and reinforce of safety culture

Indicators of safety culture are that there are no injuries, no deviations from the rules, and a self-correction mechanism.

Generally speaking, he feels that there is a three-fold difference in ability among all individual employees, and a ten-fold difference in disposition. In order to reinforce safety despite this difference in individuals, however, we must make all of the approximately 500 employees feel that they are taking one step further toward advancing safety culture. If even one person lacks that feeling, things will not go well. In order to reinforce safety

awareness among all employees, awards for blue-chip department in industrial safety were introduced and this makes each department strive for safety. Furthermore, this is mentioned in monthly safety report meeting discussions and published on the intranet safety homepage and in the company newsletter, and when trouble occurs, all employees are assembled and given direction and the like, and seizing the opportunity, endeavors are made to improve safety culture.

### (3) Strengths and confronting issues

As for strengths, in the 35 years since the company began operation, there has not been a significant accident, and the company is proud to have the solid confidence of customers. On the other hand, there is concern that it could conversely lead to a false sense of security. Other than that, another issue is that when the nuclear fuel cycle goes into effect, the level of effectiveness of safety activities will have to be raised in order for the company to continue developing. The company has got to face the challenge of how to proceed so as to head in the best direction.

### (4) State of performance

Performance can also be thought of as a battle against risks. How to manage risks is an important question. It is very important that sensitivity to risk should never fade by systematizing the management risks and the work-site risks.

### (5) Expectations on managers (all general managers, section managers, etc.)

Managers have to be aware that they are entrusted with their subordinates and the equipment in the performance of their jobs. MNF has an excellent track record of response when troubles occur. However, the Superintendent hopes the managers will discover symptoms of looming problems at an earlier stage, and thus be able to stave off trouble before it happens.

### (6) Reporting culture

In the Superintendent's opinion, the company earns a passing score in the eyes of the general public when it comes to reporting. However, the "reporting culture" consciousness is not something that always existed. That is because the company got its

start in a family-like atmosphere and there was really no need for it. But at the present time the importance of the "reporting culture" has become ingrained in the consciousness of all employees. Unless the reported issues are paid enough attention and responded, trust will not materialize. And without this relationship of trust, the "reporting culture" itself will not function properly. Middle managers especially need to have a sense of urgency and responsibility to deal with reported issues and must give a response. In this sense, the company still has a long way to go. In order to make the reporting culture take root, it will still take a while longer. Ideally, reports would be submitted without the need to ask for them. However, the company is still in the development stages in this respect.

(7) Making the company president's policies known at the front lines of work-sites

It is important that the top management make visits to the work sites. The President makes a visit to work sites once a week, Vice President once or twice a week, and directors almost every day, and they make effort to talk to the employees there.

(8) Endeavors in passing on skills

The transition to the next generation is a serious problem for MNF as the baby-boomers hired when the company was first established reach the age for retirement, and so a human resource development plan has been established to deal with orderly personnel training. The plan appears to be progressing on track. A plan has also been drawn up for passing down skills to the next generation and endeavors are being made toward that end.

(9) Training policies

A training program has been formulated and trainings are carried out based on this plan according to the situation at each work site. Comprehensive safety training is carried out evenly across the board for all employees actually working at the plant including employees of contractors. However, there are different levels of employees attending the training, and so questionnaire surveys were done. In addition, manager class personnel also attend training sessions outside the company.

(10) Expectations on the Peer Review Team

The work involved in fabricating nuclear fuel has its own distinct characteristics, and for



that reason, MNF employees seldom have the opportunity to learn from other companies in the same line of business or other fields of business. Through observations, interviews, and document reviews in the peer review, MNF hope to receive advice and hear about good practices that can be applied to their own company and lead to the improvement of safety culture. And the company hopes to proactively gain recognition from the general public with its endeavors aimed at improving safety culture through the company's safety activities from the standpoint of JANTI expert Reviewers.

## **8. Synopsis of Review Results**

Continuous and systematic work improvement activities (MVP activities) have been promoted since 2005 as one of the endeavors aimed at assuring total safety at MNF and the aim of these is to maintain safety motivation and lead to even higher quality products. These activities led to a reduction of the work load for on-site workers.

In addition, risk management is also implemented by employees and contractors working together as a team. Through such activities, specific measures are implemented corresponding with the degree of significance of the risk, contributing to reduce overall risk faced by the company.

Moreover, as a means of monitoring the state of plant and equipment safety, thermal image diagnosis and measurement and analysis of vibrations are actively carried out, and these are being done by the in-house staff themselves. Utilizing the results of these equipment diagnoses has proven effective in the early detection of abnormalities and the necessary maintenance such as replacement of worn parts can be carried out based on early detection.

However, in regard to specific endeavors in order for even stronger safety culture awareness to firmly take root, systematic understanding by the management class is insufficient. It is desirable to learn more about domestic and foreign activities for promoting safety culture and to make even greater and even more effective endeavors in safety culture promotion activities.

There are also the potential risks that large heavy items in the plant could move around during seismic event and possibly crash into the production line, impeding the functionality of the equipment. Temporarily stored items in the vicinity of the production line need to be fixed into place or fastened securely.

Four good practices and five areas for improvements were developed in the Review, and are listed below.

Note, however, that the areas for improvements are not necessarily matters that need to be dealt with immediately from the standpoint of nuclear safety.

## **8.1 Good Practices**

### **(Organization & Administration)**

Effective promotion of work improvement activities (MVP activities)

Continuous and systematic work improvement activities have been promoted since 2005 as one of the endeavors aimed at assuring total safety (nuclear safety, industrial health and safety, environmental preservation) at MNF and the aim of these is to maintain safety motivation and lead to even higher quality products.

Reflecting demands from the work site, one of the manifestations of the company's posture of sincerely endeavoring in these activities has been the introduction of IC tags on fuel storage bottles as a way of preventing mistaken posting of transcripts due to human error, and this has contributed to a reduction of the work load for on-site workers.

Sharing safety information via the in-house network "MINES"

A website known as MINES (MNF Information Network System) was set up on the in-house network in March 2006 to communicate safety information to plant employees. In addition to this network conveying in-house standards, information on activities related to safety quality management systems, information from outside (government, JANTI, etc.), information on non-conformities, integrated safety analysis (ISA) information, information from other companies in the same field, and others are also posted on in-house bulletin boards. Since information concerning a particular job can be obtained from the easy-to-use search function, all employees make use of it on a routine basis, which contributes to improved work quality and in-house sharing of information.

Proactive endeavors in risk management activities

Risk management is implemented by employees and contractors working together as a team. Employees and contractors reduce risks using "risk assessment sheets" and sort them into 18 risk categories such as management, operation, natural disaster and the like, and countermeasures are implemented in accordance with the degree of significance of the risk. Since this activity has been in effect, the number of assessed risks has increased annually, with approximately 200 risks assessed in FY 2007, and in cases when necessary

they are made known via the in-house intranet. As an example of addressed risks, equipment used in the zilcaloy cutting process, for which there is potential risk of catching fire, was modified to improve safety, contributing to the overall reduction of risks throughout the company.

(Training)

Nothing in particular

(Work management & maintenance)

Making use of equipment diagnosis skills

Thermographic measurement of all electric parts contained in the production line equipments, extra high voltage transformer substation and emergency diesel generator, as well as vibration analysis of centrifuge bearings and air conditioners bearings are all done in-house by MNF staff. Making use of the equipment diagnosis analysis results has been effective in the early detection of abnormalities in order to perform the necessary maintenance for replacing worn out parts.

(Radiation protection)

Nothing in particular

(Key issues)

Nothing in particular

## **8.2 Areas for Improvement**

**(Organization & Administration)**

### **Further enhancement of activities to promote safety culture**

Activities for improving the reliability and safety of products and production equipment are thoroughly put into practice in the routine daily safety activities of legal compliance consciousness, smooth communication, and rapid reporting. In regard to specific endeavors needed for even stronger safety culture awareness to firmly take root, however, systematic understanding by the management class is insufficient, and several instances of endeavors that lacked coordination were observed.

Toward this end, it is desirable to learn more about domestic and foreign activities for promoting safety culture, formulate a more decisive common consciousness as an

organization, and make more effective endeavors to promote safety culture.

### **(Training)**

#### **Continuous improvement of comprehensive safety training**

All employees including those of contractors undergo comprehensive safety training that includes corporate ethics and compliance with laws. This practice raises the sense of unity among all employees and helps to raise the level of awareness of safety activities. The year before last, opinions and impression of the trainees in regard to the training were collected and analyzed, and making use of this feedback from trainees, efforts are being made seeking to raise the effectiveness of the training, but it is still desirable to make even further enhancements to the training that reflects the opinions and impressions of the trainees.

### **(Work Management & Maintenance)**

#### **Fixing into place and fastening down articles in anticipation of earthquakes**

The storage location for temporarily stored items throughout the plant have been specified, but the methods for fixing into place or fastening down have not been decided, and some big, heavy items that were not fixed into place or fastened down were observed in close proximity to equipment that is essential to the production line. Because of this situation, there is potential risk that these large heavy items may move around during seismic event and crash into production line equipment, thereby impairing the functionality of the equipment. Accordingly, temporarily stored articles in the vicinity of the production line should be securely fastened down or fixed into place.

#### **Management of supplementary operating aids**

Operation aids are posted on all sorts of equipment throughout the plant indicating the method of operation and management criteria written in the manuals, but among them, there are some hand-written memos and some that are not being clearly managed. Therefore, if the manuals were to be revised or method of operation changed, it would not be possible to assure reliable update management, and thus there is concern about human errors arising during actual operation. As a result, it is desirable that some mechanism be considered to assure that reliable update management can be carried out for these

unmanaged memos.

(Radiation protection)

None in particular.

**(Key Issues)**

**Making more effective use of minor non-conformities**

Minor non-conformities for which measures can be taken rather easily are called Grade II non-conformities and it is not necessary to file an "incident and countermeasures concerning safety-related non-conformities report" (S-UNDR) for these. All others are handled as Grade I, for which an S-UNDR must be submitted, the circumstances investigated, a countermeasures plan drafted, and corrective steps must be taken. There are several tens of Grade I non-conformities every year, most of which are items noticed during inspections and deficiencies in records.

Information concerning most of the Grade II non-conformities are written in the logs, but are not entered into a database, so there is no statistical analysis or systematic improvement activities based on the results of such analysis. It is desirable to engage in voluntary improvement activities by making more effective use of Grade II non-conformities.