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## **Summary Report of Peer Review**

(Provisional Translation)

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Place of Review:	Technologies Research Center JGC Corporation (Higashiibaraki-gun, Ibaraki Prefecture)
Date of Review:	September 3 to 5, 2003
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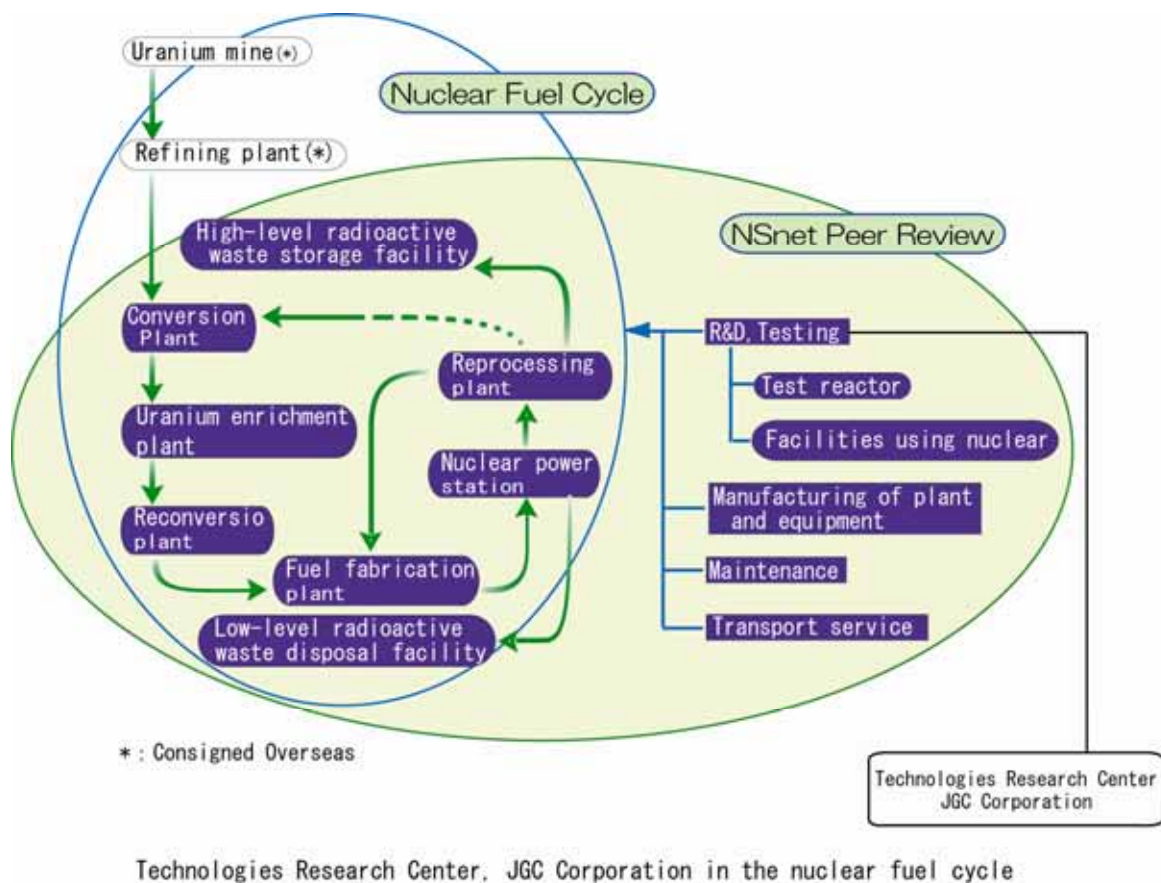
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## 1. Objectives

The purpose of the NSnet peer review (hereafter referred to as “review”) is to achieve an improvement in the “safety culture” of the entire nuclear power industry by sending review teams of member specialists to member facilities, where they conduct reciprocal evaluations on common nuclear safety subjects among members and share mutual knowledge about the horizontal progress of good practices as well as subjects that have been singled out.

## 2. Summary of Facility Operations



JGC Corporation (hereafter referred to as “JGC”) was founded in 1928 to start in the oil refining business. Subsequently, it turned into a plant engineering<sup>i</sup> business based on overseas and other technologies, and has developed its engineering business in such fields as power generation and nuclear power, centering on plant engineering in the fields of energy and chemistry, in particular, oil refining, gas chemistry, gas treatment, and petrochemistry, as well as pharmaceuticals, foods, medical and welfare, environment, and

space in the general industry and social areas.

As to the nuclear field, JGC has carried out diverse engineering work on the entire range of nuclear fuel cycle facilities, mainly in the development and construction of radioactive waste treatment disposal technologies, starting from receiving orders for the design and construction of the reprocessing facilities of the Tokai Plant of the Power Reactor and Nuclear Fuel Development Corporation (currently, the Japan Nuclear Cycle Development Institute) in 1965.

The Technologies Research Center, which is the subject of this review, was established in 1984 as a place to develop, demonstrate, and study radioactive waste treatment and disposal technologies among nuclear-related operations. To date, the Center has developed reprocessing-related technologies and conducted research into the volume reduction, solidification, incineration, and fusion of radioactive substances, effluent filtration and demineralization, and the safety evaluation of geological disposal.

In 1975, JGC established the Kinuura Laboratory in Handa-shi, Aichi Prefecture as a laboratory to study petroleum-related technologies. Following the consolidation of the research department in the Yokohama Plant with Oarai in 1997, the Kinuura Laboratory was consolidated into the Technologies Research Center in 1999, where comprehensive research and development is conducted to develop engineering businesses.

At the Technologies Research Center, presently, a total of approximately 60 personnel are engaged in process development in all industrial areas and research into component engineering technologies composing such processes. In the nuclear field, the Center continues to develop radioactive waste treatment technologies and study disposal technologies.

### **3. Points of Review**

#### **3.1 Target of review**

This review is conducted with respect to safety promotion activities in connection with nuclear-related operations (research and development) at the Technologies Research Center. These operations include coordinated operations that are entrusted by the clients of the Nuclear and Environment Division of the Industrial Project Division of the Yokohama Head Office and demonstrated and examined by the Technologies Research Center.

### **3.2 Points of Review**

The Technologies Research Center has been established as a place to conduct diverse research and development operations. The points of review were placed on how the concept of safety culture is utilized for any work that requires new processes and change of equipment according to nuclear-related research and development themes.

The review was divided into four sections: (1) Organization/Administration, (2) Education/Training, (3) Planning/Implementation/Maintenance (Research and Development), and (4) Handling of important issues. It was carried out with a focus on the nuclear industry's best practices.

Of these, the reviews were carried out with a focus on, (1) in Organization/Administration, "composition of organization and system of responsibility" and "specific activities related to fostering a nuclear safety culture and improving morale", (2) in Education/Training, "certification of qualification," "planning and implementing education and training," and "technical and skill dissemination)", (3) in Planning/Implementation/Maintenance, "control manuals and compliance therewith," "planning management," "ensuring safe work," and "systems and equipment maintenance," and (4) in the Handling of important issues, "cooperative activities related to safety with cooperating companies", "radiation management" and "emergency measures"

In addition, following the data falsification problem regarding neutron shielding materials (resins) for spent fuel transport containers in 1998 (hereafter referred to as the "Data Falsification Problem" and the "problem of voluntary inspection data falsification at a nuclear power station" and the "problem involving leakage test of reactor containment vessel" discovered in 2002 (hereafter referred to as the Voluntary Inspection Data Falsification Problem, etc.), the review also paid attention to ethics, communications, and data handling.

### **4. Period and Outline of Review**

#### (1) Date

September 3(Wed.) to 5(Fri.), 2003

#### (2) Formation of Review Teams

A group: Hokuriku Electric Power Co., Inc., Nuclear Fuel Transport Co., Ltd.

B group: Sumitomo Atomic Energy Industries, Ltd., NSnet

Coordinators: NSnet Office

(3) Fields of Responsibility

A group: Organization/Operation, Education/Training and Handling of major issues  
(activities to ensure nuclear safety)

B group: Planning/Implementation/Maintenance (research and development) and  
Handling of major issues (Emergency measures, etc.)

## 5. Schedule of Review

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

		A Group		B Group	
9/3 (Wed.)	A M	Opening (Greetings, Members Introduction, explanation of plant facilities, work summary, etc.)			
		1. Organization/ Administration	< Superintendent > <b>[Interviews]</b>	3. Planning/ Implementation/ Maintenance	- Planning management <b>[Document Examination]</b>
			- Effective organization and management <b>[Document Examination]</b>		- Ensuring safe work - Systems and equipment maintenance <b>[Document Examination]</b>
	4. Handling of important issues	- Nuclear safety <b>[Document Examination]</b>	3. Planning/ Implementation/ Maintenance 4. Handling of important issues	- Research and development department <b>[Field Observation]</b>	
	1. Organization/ Administration	- Safety culture <b>[Document Examination]</b>	4. Handling of important issues	- Nuclear safety <b>[Document Examination]</b>	
9/4 (Thu.)	A M	2. Education/ Training	- Qualification certification - Planning and implementation <b>[Document Examination]</b>	3. Planning/ Implementation/ Maintenance 4. Handling of important issues	< Manager class > < Responsible persons > <b>[Interviews]</b>
		1. Organization/ Administration 2. Education/ Training 4. Handling of important issues	< Manager class > < Responsible persons > <b>[Interviews]</b>	4. Handling of important issues	- Emergency measures - Incorporation of problems <b>[Document Examination]</b>
	P M	Verification of Facts		Verification of Facts	
9/5 (Fri.)	A M	Verification of Facts			
		Closing			

## **6. Methods and Items of Review**

### **6.1 Methods of Review**

The review looked at activities related to nuclear safety at the Technologies Research Center, and extracted good practices and suggestions for improvement through the following field observations, indicated document examinations, and discussions and interviews based on the same.

In addition, communication about nuclear safety culture took place during the review process, including exchanges of opinions based on the provision of information deemed valuable from the review teams.

#### **6.1.1 Execution of Review**

##### (1) Field observations

For the field observations, direct observations of how actual activities are implemented for the items confirmed in the interviews and documents were conducted with investigations based on the experience and knowledge of the reviewers.

##### (2) Document examinations

For the document examination, the review was conducted through requesting necessary relevant documents based on explanations regarding related documents for each review item. Following the plant and field observation, documents related to the observation were required, and more detailed investigations were carried out.

##### (3) Interviews

Interviews based on the following objectives were conducted with the superintendent, managers and responsible persons.

- (a) Examining the level of the effort and awareness about the fostering of the safety culture including nuclear safety measures
- (b) Gathering additional information not confirmed in the documentation
- (c) Questions and answers including those arising from document examination
- (d) Evaluating the level of understanding about the determined items and the responsibilities imposed on each member
- (e) Evaluating whether the determined rules are being implemented or whether they are merely carried out in name only.



## **6.1.2 Standpoint for selecting Good Practices and Suggestions for Improvement**

### (1) Good Practices

Information on good practices incorporating appropriate, effective, and unique methods into activities to ensure safety should be widely distributed to the members of the NSnet and the nuclear industry.

### (2) Suggestions for Improvement

After comparing the practices of the Technologies Research Center with the best in the nuclear industry, suggestions to improve and enhance safety activities should be implemented so as to achieve the highest level of nuclear safety.

Even if current activities are equal to or higher than general standards in the nuclear industry, suggestion is taken up in case there is still room for improvement.

## **6.2 Items of Review**

The Field observations and confirmations, document examinations, and interviews were carried out based on the review items shown below. The results were evaluated and organized in the Itemized Results, and those were summarized as the Main Conclusions.

### Section 1: Organization/Administration

Investigations were conducted from the perspective of whether organizational composition and accountability are clear, whether targets have been established related to guaranteeing nuclear safety, and whether activities are being conducted involving the fostering of safety culture and the improvement of morale (for example, ethics-related programs, systems and culture in which internal opinions are heard and accepted with sincerity).

#### Review items

##### (1) Effective organizational and management

- a. Organizational composition and responsibility system
- b. Securing of appropriate personnel
- c. Organizational policies and targets
- d. Leadership of managers

##### (2) Activities involving the fostering of safety culture and improving morale

- a. Concrete activities related to fostering safety culture
- b. Concrete activities related to improving morale
- c. Activities for creating harmony with local communities

## Section 2: Education/Training

Investigations were conducted from the perspective of whether, for technicians and engineers involved in research and development, a qualification certification system was established and operational, and whether skill improvement, nuclear-safety-related education and training, and technical and skill dissemination were being conducted appropriately.

### Review items

- (1) Qualification certification
  - a. Qualification certification system and qualification standards
- (2) Planning and carrying out education and training
  - a. Planning of education and training
  - b. Carrying out education and training
  - c. Technical and skill dissemination

## Section 3: Planning/Implementation/Maintenance (Research and Development)

The review was conducted to check whether effective planning management, test equipment installation management, safety work, and systems and equipment maintenance is carried out appropriately together with the preparation of manuals.

### Review Items

- (1) Effective planning management
  - a. organization
  - b. Manuals and compliance therewith
  - c. Implementation of planning management
  - d. Test equipment installation management
- (2) Ensuring safe work
  - a. Development of documents and manuals
  - b. Methods for developing, checking, approving, and revising documents and manuals
  - c. Consistency with approved items (contents)
  - d. Ensuring safe work
- (3) Facilities and equipment
  - a. Facilities and equipment interlocks
  - b. Facilities and equipment inspections

#### Section 4: Handling of important issues

Investigations, as efforts related to important issues of nuclear safety, were conducted on cooperative activities related to safety with cooperating companies, quality assurance program, prevention of human error, and activities to prevent reoccurrences of nonconformities.

#### Review items

##### IV-1 Efforts toward nuclear safety

- (1) Cooperative activities related to safety with cooperating companies
  - a. Appropriate communication with cooperating companies (relating to the promotion and improvement of safety culture)
  - b. Evaluation of cooperating companies
- (2) Quality assurance
  - a. Establishing a quality assurance system
  - b. Effective auditing system
  - c. Handling of the data falsification issue and so on
- (3) Radiation management
  - a. Management of radioisotopes and radioactive waste
  - b. Confinement of Radioactive Substances and Monitoring
    - 1) Appropriate control of negative pressure
    - 2) Radiation Monitoring
  - c. Employee dose control
- (4) Labor safety

##### IV-2 Emergency measures

- (1) Preventing fires and explosions
  - a. Procedures, equipment, and instruments that can cause fires/explosions
  - b. Administrative methods for the prevention of fires/explosions
  - c. Detection of fires/explosions at the time of an accident and methods of alleviating the problem
- (2) Emergency plans
  - a. Drawing up emergency plans
  - b. Keeping employees well informed
  - c. Implementation of training

##### IV-3 Incorporation of examples of problems concerning safety work

- a. Activities for the prevention of human error
- b. Activities to prevent the recurrence of problems

## 7. Main Conclusions

In summing up this review of the Technologies Research Center, we have not found any item in the nuclear safety field that would lead to a serious accident unless immediate remedies were taken.

At the Technologies Research Center, each and every one of the directors and employees is required to act with a high sense of ethics, in accordance with the JGC Group's action guidelines as the epitome of common sense of values: "The development of corporate business with (1) a high sense of ethics and compliance with laws, (2) fair and transparent corporate activities, (3) enterprising spirit and open-heartedness, and (4) establishing customer satisfaction and social trust and social outreaching. In view of its operations, moreover, action manuals have been laid down with the aim of realizing accident-free research and development as well as understanding and complying with laws and regulations peculiar to the Technologies Research Center.

To fully disseminate such a compliance program among its employees, compliance consciousness educational activities and the carrying of booklets are required by the Compliance Administration Office of the Head Office. In FY 2002, employees from major overseas and domestic bases attended training sessions, in which the level of dissemination was studied by means of a questionnaire survey, aiming to raise the level of understanding higher.

As to labor safety activities, the company-wide "Safety and Sanitation Basic Policy" and the Technologies Research Center's "Internal Safety Goals" have been laid down. In addition, safety patrol activities are carried out once a month by the Safety and Sanitation Committee within the Technologies Research Center and managers equal to or higher than group leaders. At the "Engineering Development Department Meeting" held on the same day, the results of the safety patrol are presented and the timeframe for studying safety themes is set, thereby carrying out highly effective safety promotion activities.

When conducting new research and development, several steps are taken to ensure that research and development pays more attention to safety, such as internal checks and reviews based on the "Basic Flow of Internal Test Equipment Management" and examinations by the Safety and Sanitation Committee.

Internal safety education is offered once a year for all personnel including employees from cooperating companies [radiation safety education (the Radiation Hazard Prevention Law), the handling of dangerous substances (the Fire Services Law), the handling of high-pressure gas (the High-Pressure Gas Regulation Law), the handling of test reagents (the Poisonous and Powerful Agents Control Law), etc.] and education for new employees is also offered from time to time.

As described above, the Technologies Research Center has endeavored to promote safety culture and has the excellent record of having no accidents whatsoever for the 20 years since its establishment.

The Technologies Research Center became affiliated with the Nuclear Establishment Safety Cooperation Agreement (hereafter referred to as the “Tokai NOAH Agreement”)<sup>ii</sup> to provide mutual support by, for example, dispatching personnel in cases of emergency situations at member operations. The Technologies Research Center also signed the “Memorandum on Technical Support for PR Activities in the Event of Nuclear Accidents and Fire-fighting Activities in the Nuclear Operations in the Oarai District<sup>iii</sup>” with Oarai-machi in which the Center is located, thereby carrying out collaborative activities, such as dispatching specialists to the municipal government under mutual coordination with other nuclear operations in the municipality. In this regard, the Technologies Research Center periodically conducts liaison drills and fire drills by the self-defense fire brigade consisting of its employees.

In the future, the Technologies Research Center is expected to continue its voluntary efforts to further improve its safety culture, rather than being satisfied with the current status.

In addition, it is expected that the results obtained from the review will be disseminated not only within the Technologies Research Center, but also to cooperating companies.

In this review, we have found some good practices that should be introduced not only to other NSnet members, but also widely to the nuclear industry. The good practices are described below.

- Disseminating corporate ethics via the compliance program

The compliance program specifies the “Basic Principles of the JGC Group” as “Corporate Principles” and the “Action Guidelines of the JGC Group” as “Codes of Conduct” and lays down the “JGC Action Manual,” so that employees can act with a specifically high sense of ethics. In view of its operations, the Technologies and Business Development Division has prepared the “Action Manual of the Technologies and Business Development Division” to be disseminated to the staff members of the Division. This program in its booklet form is required to be carried by all personnel. Education and training courses are organized periodically by the Compliance Administration Office, after a questionnaire survey is carried out to determine the degree to which it has been put into effect.

- Opening the “JGC Techno-College”

The “JGC Techno-College” has been open since September 2001, offering 160 courses covering a wide range of subjects. For a period of approximately two years to date, 100 courses have already been held.

All employees enthusiastic about learning are entitled to attend these courses regardless of the fields they are engaged in. Employees themselves serve as lecturers for most of the courses, which is appreciated as a very effective education system.

In the future, the “JGC Techno-College” is expected to improve the technical ability of the employees and contribute to handing down skills developed over many years within the company.

- Reliable management using the “Basic Flow of Internal Test Equipment Management”

When a test is conducted within the Technologies Research Center, a reliable management is ensured by using the “Basic Flow of Internal Test Equipment Management,” which prescribes the flow of checking documents (notifications and permits) and their contents which are necessary for confirming whether the test is conducted according to the test plan common to controlled and non-controlled areas, together with matters concerning the safety of testing in proper processes, while clarifying the competent department/section and the persons responsible and giving approval at each stage. This flow can be confirmed easily over the internal network and matters concerning safety are discussed at the Safety and Sanitation Committee and the Radiation Safety Committee.

- Indicating dangerous sections and expressing emergency measures while test equipment adjacent to a controlled area is in operation

Test equipment is installed adjacent to a building in a controlled area. In particular, it is a requirement to indicate dangerous sections on the equipment in operation in the pilot area<sup>iv</sup>, such as “Operating High Temperature and High Pressure” and “Inflammable Gas.” In addition, emergency measures are classified into three categories depending on the level of danger, thereby thoroughly ensuring the safety control of equipment adjacent to the building in the controlled area. The status is periodically checked by the Safety and Sanitation Committee.

- Recycling the water used in controlled areas by the closed effluent treatment system

The volume of test effluent and hand-washing water used in controlled areas is minimized to the extent possible and a closed system is employed in which effluent is recycled to the controlled area after applying such treatment as ion exchange and filtration. As a result, no used water is discharged out of controlled areas.

- Sharing safety information with researchers in non-nuclear fields

One of the features of the Technologies Research Center is that there are researchers in both nuclear and non-nuclear (materials, chemistry, biotechnology, etc.) fields and researchers from all fields participate in the Safety and Sanitation Committee. In approving a test plan, it is checked from the viewpoint of the non-nuclear field at the Safety and Sanitation Committee, allowing safety information to be shared across research areas.

The following represent proposals toward the further improvement of the safety activities of Takasago Equipment Plant.

- Reconsidering the adequacy of manuals

It was observed that changes in organizations, laws, and regulations had not been incorporated in the “Internal Safety Control Manual,” the “Organizational Chart of the Technology and Business Division,” and so forth. These are standards for quality and safety control and need to be considered as important in terms of compliance. It is desirable to check the contents of manuals with appropriate frequency and update them properly.

- Preparing on-site data registers for confirming the weight of radioactive isotopes to ascertain reliability

Before and after using radioisotopes, workers accurately weigh the isotopes by the gravimetric method, making note of them on the spot, and transfer the data to the control registry. However, to ensure a greater degree of reliability, it is desirable to prepare designated data registers on-site.

- Collecting information on and classifying human errors and HIYARI-HATTO<sup>v</sup> practices

Activities to prevent internal HIYARI-HATTO (near-misses) and human errors are planned in the future. It is desirable to begin extensively collecting as early as possible information on past instances and experiences within the Technologies Research Center, including those of employees from cooperating companies and classifying them while they are still remembered. In doing so, it is desirable to work out methods, so that such instances can be pointed out and registered easily.

Other details concerning this report may be found on the Japanese website.

## Annotation

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<sup>i</sup> **Engineering:** “A series of activities” that make the results of design, component procurement, and engineering work operation with respect to a system, in which personnel, materials, equipment, and machines are consolidated, appropriately achieve the objectives assigned (by the Engineering Advancement Association of Japan).

In other words, engineering is the scientific and technical activities of gathering and consolidating “human wisdom” in multiple fields and achieving certain tasks (from the JGC Homepage Engineering Glossary).

<sup>ii</sup> **Nuclear Establishment Safety Cooperation Agreement(Tokai NOAH Agreement) :** “NOAH” is an acronym standing for the cities and towns in which 21 nuclear operators that entered into the Nuclear Establishment Safety Cooperation Agreement are located, including the village of Tokai-mura, and starting with the towns of Naka-cho, Oarai-cho, Asahi-machi and Hitachinaka city. This agreement is also called the “Tokai NOAH Agreement.”

<sup>iii</sup> **Memorandum on Technical Support for PR Activities in the Event of Nuclear Accidents and Fire-fighting Activities in the Nuclear Operations in the Oarai District:** A memorandum for carrying out cooperative activities, such as dispatching specialists to the municipal government under mutual coordination between Oarai-machi and nuclear operations in the municipality, including the JGC Technologies Research Center.

<sup>iv</sup> **Pilot Area:** A place for operating new research and development demonstration systems located in the research ward of the Technologies Research Center.

<sup>v</sup> **HIYARI-HATTO:** Precedents of latent dangers that do not come to the surface, such as those which are “frightening,” “startling,” or “disturbing” and lurk in the daily workplace.