Nuclear Safety Network (NSnet)
Otemachi Building #437
1-6-1 Ote-machi, Chiyoda-ku, Tokyo 100-0004
Tel: +81-3-5220-2666 Fax: +81-3-5220-2665
URL: http://www.nsnet.gr.jp

NSnet document number : (NSP-RP-015)
Date of publication: September 14, 2001

Summary Report of Peer Review

(Provisional Translation)

Place of Review:	**Shika Nuclear Power Station, HOKURIKU ELECTRIC POWER COMPANY (Shika-machi, Hakui-gun, Ishikawa-pref)**
Date of Review:	**August 7-10, 2001**
Publisher:	**Nuclear Safety Network**

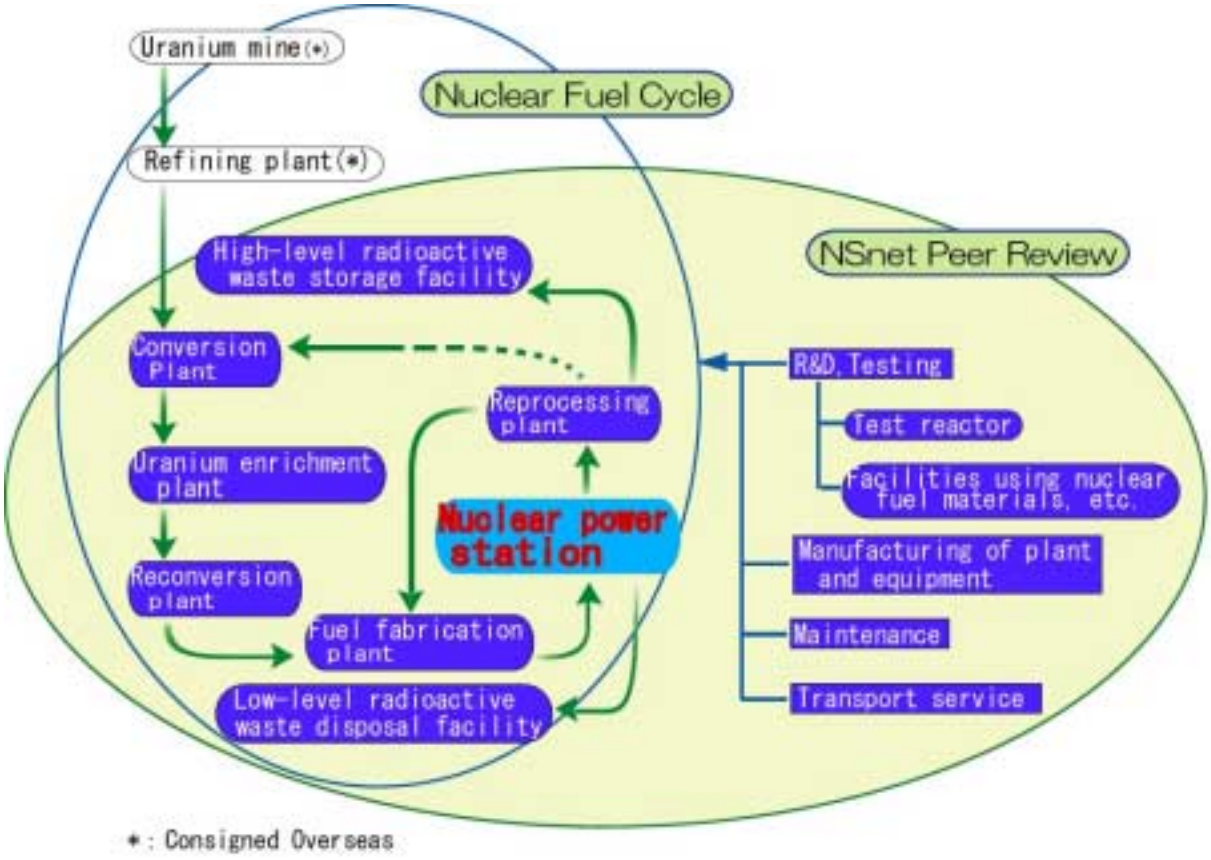
Contents

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

Hokuriku Electric Power Co., Inc. (Head Office: Toyama City) is an electric power producer who supplies electric power to Toyama, Ishikawa, Reihoku District of Fukui and a part of Gifu. The total amount of generated and incoming power in FY 2000 was 28.214 billion kWh of which nuclear energy accounted for about 22%. At present, unit 1 of Shika Nuclear Power Station is in service and unit 2 is under construction.



The position of "NUCLEAR POWER STATION" in the nuclear fuel cycle

The review was conducted at Shika Nuclear Power Station (hereafter referred to as the “Station”) located at the west shore of the central part of Noto Peninsula in the north part of Ishikawa. The site, having an area of 1,600,000 m^2, is situated at the north end of Shika-machi, on the Sea of Japan about 60 km north of Kanazawa. The

Station is the first nuclear power station of the Company having a boiling water type light water reactor (BWR) in service (unit 1). As unit 2, an advanced boiling water type light water reactor (ABWR) is under construction in the site on the boundary of the north end of unit 1.

Unit 1 has operated for 8 years since the start of its commercial operation in July, 1993 and its cumulative power generation, as of the end of March, 2001, is about 30.3 billion kWh.

The construction of unit 2 started in August, 1999 and its commercial operation is scheduled to start in March, 2006. (see the table below).

[In Operation]

Unit	Electric Output (MW)	Reactor Type	Start of Commercial Operation	Performance (total) (As of the end of March 2001)	
				Power Generated (billion kWh)	Capacity Factor[1] (%)
1	540	BWR	1993/07	30.27	83.4

[Under Construction]

Unit	Electric Output (MW)	Reactor Type	Planned Start of Commercial Operation	Start of Construction	Progress of Construction (As of the end of July 2001) (%)
2	1,358	ABWR	2006/03	1999/08	19.7

The Station has approximately 250 employees (50% are residents of Sika Town and the adjoining towns) comprised of approximately 90 employees for the direct operation department which has a system of six groups working three shifts, approximately 60 employees for the maintenance department, 60 employees for the technical support department (core and fuel management, facility management and radiation management) and approximately 40 employees for the other departments such as general affairs. Besides these, approximately 250 employees from cooperating companies are assigned to the Station to support plant operation and maintenance.

The Station shows favorable operation results as represented by a cumulative capacity factor of 83.4% since the start of commercial operation (as of the end of March, 2001).

3. Points of Review

The NSnet was established following the first criticality accident that ever occurred in Japan at the conversion test building (fuel processing facilities) of JCO on September 30, 1999 (hereafter referred to as “the JCO accident”). The NSnet peer review on operations that has nuclear fuel facilities, including fuel-processing facilities, has focused on “the prevention of fatal accidents, such as critical accidents.” In this review, in view of the recent trends in nuclear safety and accident prevention, we focused on the following five basic points in terms of both technical and social safety:

(1) Foundation to ensure nuclear safety (contain communication with cooperating companies)

(2) Relationship with the community (improving anti-disaster measures)
(3) Incorporating operating experience into the improvement of safety
(4) Reflecting and addressing lessons from the JCO accident
(5) Recent issues concerning LWRs

Review items were decided and compared with best practices in the nuclear industry by classifying individual elements of the above five viewpoints into the following six areas: ① organization/administration, ② emergency measures, ③ education/training, ④ operation/maintenance, ⑤ radiation protection, and ⑥ addressing important issues.

"(1) Foundation to ensure nuclear safety (contain communication with cooperating companies):" Safety culture should be fostered to establish an effective organization. Sufficient education and training should be provided to operators and maintenance personnel. Effective documentation of operation and maintenance administration should be promoted and complied with. Appropriate communication with subcontractors should be ensured. Radioactive waste disposal and radiation protection should be conducted appropriately.

"(2) Relationship with the community (improving anti-disaster measures):" Emergency measures should be implemented without fail. Efforts should be made to coexist (Symbiosis) with the community and promote the safety of nuclear energy through disclosure and public acceptance activities.

"(3) Incorporating operating experience into the improvement of safety:" Problems that occurred at nuclear power generation facilities in the past had been incorporated into the subject facilities in an appropriate manner to facilitate the improvement of equipment and operating methods.

"(4) Reflecting and addressing lessons from the JCO accident:" Critical safety control[2] at new fuel storage warehouse, spent fuel storage pool, and so on should thoroughly be ensured. In-core fuel management have been carried out appropriately to ensure neutronics safety[3]. Activities should be promoted to foster and improve the nuclear safety culture in view of factors that have caused accidents.

"(5) Recent issues concerning LWRs:" Quality control should be enhanced to prevent the problem of data manipulation in inspections of piping welds, spent fuel transportation containers, and MOX fuel[4]. Activities should be promoted to develop measures to prevent human error and ensure safety at reactor shutdown and aged plants.

4. Period and Outline of Review

(1) Date
August 7 (Tuesday) to August 10 (Friday), 2000
(2) Formation of Review Teams
1st group: Mitsubishi Materials Corporation; The Japan Atomic Power Company, Inc.
2nd group: The Kansai Electric Power Company, Inc.; Fuji Electric Co., Ltd.
3rd group: Nuclear Development Corporation; NSnet Office
Coordinators: NSnet Office
(3) Fields of Responsibility
1st group: Organization/administration, emergency measures, education/training

2nd group: Operation/maintenance
3rd group: Radiation protection, Addressing important issues

(4) Facilities to be Reviewed

The review was conducted at unit 1 of Sika Nuclear Power Station. In the area of education and training, "Nuclear Technology Training Center" (hereafter referred to as the "Training Center") and its activities were also included in the scope of the review.

5. Review Schedule

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

<table>
<tr><th colspan="2"></th><th>1st Group
Organization/administration, emergency measures, education/training</th><th>2nd Group
Operation/maintenance</th><th>3rd Group
Radiation protection, Addressing important issues</th></tr>
<tr><td rowspan="7">Aug. 7 (Tue.)</td><td>AM</td><td colspan="3">Opening (Greetings, Introductory outline of station/facilities, etc.)</td></tr>
<tr><td rowspan="2">AM</td><td colspan="3">Plant Tour
[Main control room, etc.]</td></tr>
<tr><td>Document examination
(1. Organization/ administration)</td><td>Document examination
(4.1 operation administration</td><td>Document examination
(5. Radiation protection)</td></tr>
<tr><td>PM</td><td colspan="3">Presentation the useful examples of activities in the power station
[by a reviewer from KEPCO]</td></tr>
<tr><td rowspan="3">PM</td><td rowspan="2">Document examination
(1. Organization/ administration)</td><td>Document examination
(4.1 operation administration</td><td>Document examination
(5. Radiation protection)</td></tr>
<tr><td>Field observation
[Main control room]</td><td rowspan="2">Field observation
[Drum yard, etc.]</td></tr>
<tr><td rowspan="4">Aug. 8 (Wed.)</td><td rowspan="2">AM</td><td>Document examination
(2. Emergency measures)</td><td>Document examination
(4.1 operation administration</td><td rowspan="2">Document examination
(6.1 Neutronics safety)</td></tr>
<tr><td>Interview
[Responsible personnel]</td><td>Interview
[Managers]
[Operators]</td></tr>
<tr><td rowspan="2">PM</td><td>Field observation
[Technical Support Center]</td><td rowspan="2">Document examination
(4.2 Maintenance administration</td><td>Interview
[Responsible personnel]</td></tr>
<tr><td>Interview
[General manager]
[Managers]</td><td>Field observation
[Radioactive waste treatment facility, Main control room, Reactor building]</td></tr>
<tr><td rowspan="3">Aug. 9 (Thu.)</td><td rowspan="2">AM</td><td>Document examination
(3. Education/training)</td><td>Document examination
(4.2 Maintenance administration</td><td rowspan="2">Document examination
(6.2 Reflecting past problematic events)</td></tr>
<tr><td>Field observation
[Nuclear power plant training center, etc.]</td><td>Interview
[Managers]
[Maintenance personnel]</td></tr>
<tr><td>PM</td><td>Verification of Fact</td><td>Verification of Fact</td><td>Verification of Fact</td></tr>
<tr><td>Aug. 10 (Fri.)</td><td>AM</td><td>Verification of Fact</td><td>Verification of Fact</td><td>Verification of Fact</td></tr>
<tr><td colspan="2"></td><td colspan="3">Closing (Explanation results)</td></tr>
</table>

6. Methods and Items of Review

6.1 Review Methods

The review was conducted on activities for the promotion of improvement of safety in the Station. In the review, investigation was conducted through observation of the site where the activities are practiced, verification of the documents presented by the Station, and discussion based on the documents and interviews with the employees. Then, the results were evaluated to select examples of good practices and items to be improved.

During the review, the review team appropriately showed useful examples of activities, such as efforts used to ensure safety by the companies by which the reviewers are employed. This facilitates exchange of nuclear safety culture.

6.1.1 Review Procedures

(1) Field Observations

Direct observation was made with regard to actual activities on the spot compared with the items confirmed through document examinations and interviews. Findings were compared with reviewers' knowledge and experience.

(2) Document Examination

With regard to each review item, documents were examined while receiving explanation on them and requesting relevant documents as the need arises. In-depth examination was conducted, asking for relevant documents after observing field facilities and activities.

(3) Interviews

Interviews were conducted with respect to the general manager, managers, operators, and maintenance personnel with the following objectives:

a. Collecting additional information that cannot be verified through documents
b. Questions and answers on problems identified during document examination
c. Grasping the degree of understanding of determined items and responsibilities imposed on each individual
d. Understanding the compliance status of determined items and whether such items have become dead letters
e. Understanding the attitude and awareness toward nuclear safety

6.1.2 Standing point to select 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 station's practices 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, there is still room for improvement.

6.2 Items of Review

Field observations, document examinations, and interviews were conducted based on the review items identified in "3. Points of Review." Results were evaluated and itemized. They were then summarized in "7. Main Conclusions."

Section 1: Organization/Administration

To ensure nuclear safety, the review was conducted to check whether the necessary personnel are assigned to ensure safe operation, whether "safety culture" that always prioritizes safety is fully recognized, whether effective communication with subcontractors is maintained, and whether public acceptance activities for the local community are promoted through disclosure.

The issue of data manipulation was examined in terms of quality control enhancement and morality.

(Review Items)

(1) Effective organization management
   a. Clarifying the line-organization and the system of responsibility
   b. Setting up goals of the organization
   c. The leadership of the managers
(2) Activities to promote safety culture and improve morality
   a. Specific activities to promote "safety culture"
   b. Specific activities to improve morality
   c. Public acceptance activities for the local community
(3) Quality control
   a. Effective audit system
   b. Preventing data manipulation
   c. Improving documents associated with the revision of safety regulations

Section 2: Emergency Measures

Considering the enforcement of the Nuclear Disaster Special Measures Law in June 2000 (hereafter referred to as the "Nuclear Disaster Law"), the review was conducted to examine whether emergency plans and equipment are in place and whether training is carried out responsibly.

(Review Items)

(1) Emergency plans
   a. Drawing up emergency plans
   b. Improving emergency organizations (including notification and liaison systems)
   c. Developing emergency procedures
   d. Keeping employees well informed
(2) Emergency facilities, equipment, and resources
   a. Inspection and maintenance of facilities, equipment, and resources
(3) Emergency training
   a. Implementation of training (actual results)

Section 3: Education/Training

Based on the idea that improving technical skills and safety awareness among employees contributes to improving nuclear safety, the review was conducted to examine whether effective education and training systems, including the systems of subcontractors, have been developed, whether credential certification systems have been introduced, and whether they have been implemented responsibly.

How the accumulation and transfer of technical know-how is incorporated in the education and training system was also included in the review items.

(Review Items)

(1) Qualifications
    a. System of certificate qualifications
    b. Evaluation criteria
(2) Training plans and implementation
    a. Education and training plans
    b. Implementation of education and training plans
(3) Technical transfer
    a. Operators
    b. Maintenance personnel

Section 4: Operation/Maintenance

The review was conducted to check whether high-level safety is ensured with regard to various items concerning operation and maintenance administration. Regarding the Operation and Maintenance Departments, it was examined to clarify the appropriateness of personnel and organizations as well as the establishment and compliance with documents and manuals as common items. In addition, the review focused on compliance with operating limits in the area of operation administration and functional classification of individual systems and equipment as well as corresponding maintenance and inspection in the area of maintenance administration. Paying attention to shortened annual inspection, moreover, it was examined whether inspection periods are not shortened disregarding safety.

(Review Items)

(1) Effective operation administration
    a. Operation organization
    b. Operating books and manuals, and compliance with them
    c. Design control (compliance with operating limits)

(2) Effective maintenance administration
    a. Maintenance organization
    b. Maintenance documents and procedures, and compliance with them
    c. Maintenance systems and equipment
    d. Work plans and administration

Section 5: Radiation Protection

To ensure adequate dose control for employee based on the idea of ALARA[5], monitoring of radiation dose outside the controlled area, and disposal and reduction of radioactive waste, various measures and their implementation status were reviewed.

(Review Items)
(1) Dose control for employees engaging in radiation related tasks and ALARA plans
(2) Monitoring radiation dose
    a. Monitoring radiation dose in normal and accident situations
(3) Disposal and reduction of radioactive waste
    a. Radioactive waste disposal
    b. Reducing the generation of radioactive waste

Section 6: Addressing Important Issues

Each step of nuclear safety was examined from the acceptance of new fuel, fuel loading/operation/removal to spent fuel storage and transportation to extend criticality safety at nuclear fuel facilities to nuclear power stations. In addition, activities concerning risk evaluation were examined, such as accident management (AM)[6] measures.

The review also focused on the system and record reflecting problematic events that have occurred at domestic and overseas nuclear facilities in the past.

(Review Items)
Section 6.1: Activities for nuclear safety
(1) New and spent fuel management
(2) In-core fuel management
(3) Shutdown safety measures
(4) Activities concerning risk criteria
Section 6.2: Reflecting past problematic events
(1) Modifying and improving systems and operating methods
(2) Emergency response
(3) Measures to prevent fuel leakage and fuel integrity monitoring
(4) Fire and explosion prevention

7. Main Conclusions

Summarizing the results from the review of Shika Nuclear Power Station of the Hokuriku Electric Power Co., Inc., no problematic items were identified of a nature which could cause a severe accident unless nuclear safety improvement measures were taken immediately. In addition, it was confirmed that at the Station, all employees, including the General Manager and employees of cooperating companies, are seriously endeavoring to continue to enhance nuclear safety.

The Station, a relatively new plant that started commercial operation in July 1993, has sufficiently learned to perform its operation and maintenance from experiences of preceding nuclear power stations already in service. At the same time, it has established and promoted “Safety Culture Fostered in the Climate of Sika” among the local residents.

In order to diffuse the key word “safety” throughout the Station, a matter that is difficult to express verbally, steady performance such as care to prevent oversights in periodical patrol gauge reading is emphasized at the site in daily work activities. Additionally, active effort is made for maintaining and improving moral consciousness of the employees, the basis of safety. These activities substantiate the security and the quality assurance under the General Manager’s policy “ No nuclear power without safety.”

It is expected that the Station will continue its voluntary safety efforts, aiming to further improve its safety culture, rather than being satisfied with the current status. It is also expected that the fruitful results from the review will be incorporated into operations by the cooperating companies of the Station.

The following major good practices were identified during the review, which should be introduced extensively to other members of the NSnet and the nuclear industry:

- Development of Overall Safety Culture Promoting Activities by SQUP Committee
  "SQUP (Safety and Quality Up) Committee" was established shortly after the JCO accident to develop such various subcommittee activities as consciousness reformation and education and training. As a part of the above activities, "Declaration of Action in the Nuclear Department of Hokuriku Electric Power Co., Inc." was instituted to promote safety culture and to maintain and improve moral consciousness of the employees, and effort has been made for its dissemination among the employees.
- Practice of the Format for Investigation, Examination, and Processing of Data on Operation Parameters
  From the viewpoint of preventive maintenance, data (approximately 2,000 points) on important parameters for operation monitoring have been periodically (once every 3 months) acquired to survey the long-term trend. In cases where deviation is found in comparison with the preceding data, the "Format" is utilized for the sharing of information with relevant sections and for investigation, examination, and processing. Effective application of this format is expected to aid in the early detection of signs of abnormality and to provide measures for preventive maintenance.
- Various Devices for Reduction of Radioactive Waste
  Miscellaneous solid waste is classified into 30 categories in conformity with "Table of Classification of Miscellaneous Solid Waste" and contained in separate vinyl bags. A "Tag for Miscellaneous Solid Waste" (made of copy-paper and showing the material contained within the bag, title, dose rate, date of generation etc.), is attached to the vinyl bag, and a tally is kept in the Safety Management Section. The tags are color-coded according to the level of dose rate (low, medium or high). The information is stored in the form of a database and is used for analysis of the source of the waste and for improvement of efficiency of disposal by incineration. This system is already being put into practice and will be effective the reduction of radioactive waste.
- Establishment of "Information on Problem Cases" database on the house LAN
  Domestic and overseas cases of problems are examined and the progression of events, causes, measures taken and extracted cases to be incorporated into the Station are compiled in "Problem Case Information Management Sheet" and "Problem Cases Reflecting Practice Report." The contents of the above documents, stored in the form of a database on the home LAN, are retrieved and distributed to the employees and utilized for education and case study before the start of work.

On the other hand, several suggestions are made to improve the activities to ensure safety at the Station. The major proposals are as follows:

- Further Recommendation of "Suggestion Box System"
  As a part of the activities for further promotion of safety culture, some proposal systems have been established. In order to collect proposals without regard to category, a "Suggestion Box System" was introduced, but the number of proposals is small. It is desirable to devise a means to increase diversity in the methods of collecting proposals other than the existing mailbox system, for example, addition of an in-house LAN system.
- Expansion of the Service Range of Computerized Operational Information
  In the Station, a "Staff Journal for Changeover" between crew leaders has been computerized to effectively accomplish sharing and prompt transmission of information and increased working efficiency. It is desirable to expand the service range of the computerized information so as to apply it to "Plant Startup and Shutdown Curve (Result)."
- Further Promotion of Information Exchange on Radiation Management with Cooperating Companies
  A "Radiation Management Meeting" has been established aiming at the reduction of exposure. The meeting, including as members the responsible persons of the cooperating companies for radiation management deliberates on the all aspects of radiation management. This meeting is held once a month in the course of periodic inspection and once for every two months in the other terms, but the present frequency is not necessarily practical because of possible changes in the condition of the system or the backlog of work during the inspection. In order to better ascertain the target of the meeting, it is desirable to make effort for more frequent information exchange with the employees of the cooperating companies by such practices as increased meeting frequency according to the extent of the work backlog.

Itemized reports are published on the Japanese homepage.

---

[1] Capacity factor (%): [total power generation (kWh)] x 100 / [licensed output (kW) x total hours of operation (h)]

[2] Critical safety control :To ensure safety so that fissile substances must not reach criticality to cause critical accidents in facilities handling fissile substances, such as nuclear fuel processing plants and spent fuel reprocessing plants (excerpted from "Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.")

[3] Neutronics safety: Referring to the safety of nuclear facilities against nuclear accidents. A nuclear accident at a nuclear reactor means an accident in which reactivity increases sharply due to failure or breakdown of equipment that affects reactivity (e.g. reactivity control system), causing the thermal output of the reactor to increase rapidly, which in turn causes the fuel to overheat (excerpted from "Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.")

[4] Mixed-Oxide Fuel: Nuclear fuel that contains fissile nuclides composing of two or more types of oxides. Generally, it refers to nuclear fuel mainly composing of uranium oxide and plutonium oxide (excerpted from "Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.")

[5] ALARA stands for as low as reasonably achievable. It is the basic concept for conducting radiation protection recommended by the International Commission on Radiological Protection (ICRP).

[6] AM : Measures to be taken to mitigate the effect of severe accidents caused by an event exceeding the scope of design standard events (events that may lead nuclear facilities to the

abnormal status and are determined to be considered when evaluating the safety design of nuclear facilities) to cause significant damage to the reactor core (excerpted from “1998 Nuclear Safety White Paper”).