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Summary Report of Peer Review

(Provisional Translation)

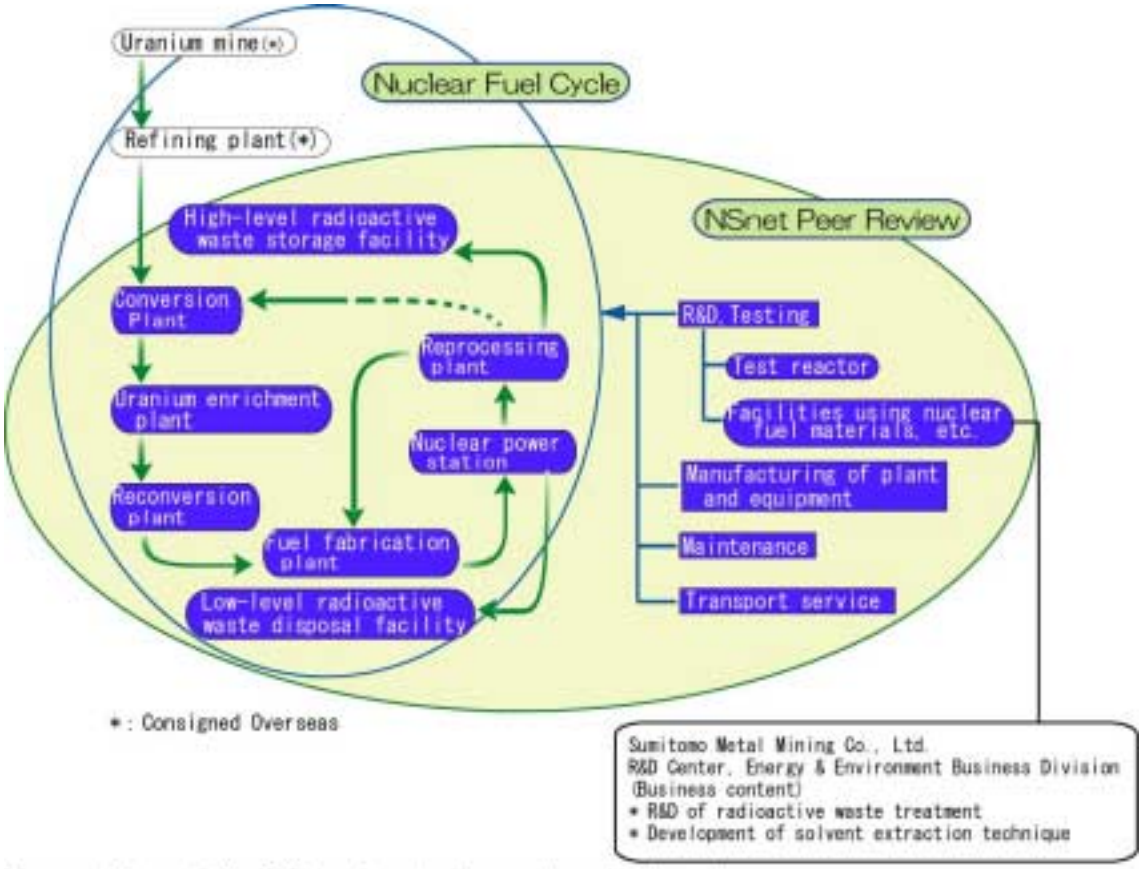
Place of Review:	R&D Center, Energy & Environment Business Division, Sumitomo Metal Mining Co., Ltd. (Tokai-mura, Naka-gun, Ibaraki Prefecture)
Date of Review:	December 11-13, 2001
Publisher:	Nuclear Safety Network

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



The position of the R&D center in the nuclear fuel cycle

Sumitomo Metal Mining Co., Ltd. initiated research and development into nuclear fuel manufacturing technologies in 1957 based on metal separation and purification technologies in nonferrous metal smelting, one of the company’s main businesses. Since then the company has been devoting its efforts into the development of technology to reconvert uranium hexafluoride (UF_6) into uranium dioxide (UO_2) by the Sumitomo

ADU process and has participated in R&D and designing for FBR fuel reprocessing. In 1980 “Tokai Laboratory”, the forerunner of the Energy & Environment Business Division R&D Center (hereafter referred to as R&D Center), was founded, and is the target of this review. As an experiment and research facility pertinent to atomic energy, it conducted research, development, design and full-scale verification tests on LWR fuel reprocessing based on solvent extraction technology, and developed pyrometallurgical separation technology as well as technologies relevant to radioactive waste treatment and disposal. In 1993, it was renamed to “R&D Center” as the research and development center of the Energy and Environment Division of the company and has been conducting a survey on advanced reprocessing technology to date.

The company’s nuclear division now has approximately 100 employees including 24 working in R&D Center (hereafter referred to as Center Staff) as of December 1, 2001.

R&D Center is located in the western corner of the premises of JCO. Placed in that area are such controlled area buildings as the “Uranium Test Building”, “Second Uranium Test Building”, and “Third Uranium Test Building” (only the first floor of which is specified as controlled area) as well as non-controlled buildings including the “Cold Test Building”, “Research Building” and others.

Although R&D Center is classified as a facility using nuclear fuel material, there is no need to hypothesize the occurrence of a criticality accident because it handles mainly natural uranium as the nuclear fuel materials. Even if all of those materials with permission for use were gathered into one place, there is no possibility to reach criticality. Also, Article 16-2[1] of “Enforcement Order for the Law for Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors (hereafter referred to as “the Nuclear Reactor Regulation Law Enforcement Order”) is not applicable to the R&D Center[2]; nor does it require either “Safety Regulation” or “Site Inspection”, and furthermore “the Special Measures Law for Nuclear Disasters” is not applicable either.

Since the occurrence of Japan’s first-ever criticality accident on September 30, 1999 in the conversion test building (fuel processing facility) operated by JCO, an affiliate company of Sumitomo Metal Mining(hereafter called “JCO Accident”), R&D Center has also been conducting operations to ensure safety, mainly by inspecting the entire site and reviewing their documents and regulations.

3. Points of Review

R&D Center is conducting such various technological developments as mentioned above in the Test Buildings where nuclear fuel materials including uranium are handled.

Thus this review focused on how they are conducting efforts to secure the safety relating to the new operations and operations with remodeling of the facilities in accordance with their technological development subjects, which characterize R&D center. Also, as important points, the review focused on measures to prevent serious accidents leading to fires and explosions in the facilities where nuclear fuel materials are handled.

The review was divided into six sections: 1) Organization/administration, 2) Emergency measures, 3) Education/training, 4) Operation/maintenance, 5) Radiation protection, and 6) Serious accident prevention. It was carried out as focusing on the best practices in the nuclear industry.

In the emergency measures field, although the "Special Measures Law for Nuclear Disasters" is not applicable to the R&D Center, the review focused on their emergency measures taking into account the purpose of the law enactment and cooperation with other companies.

In the serious accident prevention field, excluding criticality accidents because of the reason cited above, we reviewed how to prevent accidents such as fires or explosions. However, since the facilities are using nuclear fuel material, we reviewed how they are carrying out criticality safety[3] education and nuclear fuel material accountancy management in the fields of education/training and operation/maintenance respectively.

In the other fields, as considering the factors behind the criticality accident at the JCO uranium processing plant in September 1999 (hereafter referred to as "JCO accident"), the review focused on the safety measures on changing equipment or introducing novel procedures. The review also focused on efforts to cultivate and improve the "nuclear safety culture" which include the policies and activities of the organization, the organization's system and clarification of responsibility, worker education and training, worker knowledge and skills, the observation of written operation procedures, and the transfer of technologies. For the operating equipment and facilities, particularly adequate safety awareness and the ethics of employees' actions, as well as the company's self-checking activities that affect the safe operation of equipment and facilities, were considered as essential.

4. Period and Outline of Review

(1) Date

December 11 (Tue.) to December 13 (Thu.), 2001

(2) Formation of Review Teams

A group: Electric Power Development Co.; Hitachi Zosen Corporation

B group: The Japan Atomic Power Company, Inc.; The Tokyo Electric Power Company, Incorporated; Ishikawajima-Harima Heavy Industries Co., Ltd.

Coordinators: NSnet Office

(3) Fields of Responsibility

A group: Organization/administration, Emergency measures, Education/training

B group: Operation/maintenance, Radiation protection, Serious accident prevention

(4) Target facilities of the review

This review, especially in relevance to operation sites, focused on the “Uranium Test Building”, “Second Uranium Test Building”, and “Third Uranium Test Building” (1^{st} floor), which are the controlled area buildings where intense operations are carried out.

5. Schedule of Review

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

<table>
<tr><td colspan="2"></td><td colspan="2">A Group</td><td colspan="2">B Group</td></tr>
<tr><td rowspan="8">12/11
(Tue.)</td><td rowspan="2">A
M</td><td colspan="4">Opening (Greetings, Members Introduction, Outline of R&D/facilities etc.)</td></tr>
<tr><td colspan="4">Presentation of the examples of safety activities by reviewers</td></tr>
<tr><td>1. Organization/
administration</td><td>-Effective organization management
- Cultivating safety culture
[Document Examination]</td><td>4. Operation/
maintenance</td><td>- Ensuring safe work
- Facilities and equipment
[Document Examination]</td></tr>
<tr><td rowspan="6">P
M</td><td rowspan="2">1. Organization/
administration</td><td>- General Manager
- Employees
[Interview]</td><td rowspan="2">4. Operation/
maintenance</td><td>- Engineering of nuclear fuel research facilities
[Document Examination]</td></tr>
<tr><td>- Reflecting problematic events and the human factor
[Document Examination]</td><td>-A responsible person
[Interview]</td></tr>
<tr><td rowspan="2">2.Emergency measures</td><td>-Emergency equipment/ resources
[Plant Observation]</td><td rowspan="2">5. Radiation protection</td><td rowspan="2">- Confinement of radioactive substances and monitoring
- Dose control
[Document Examination]</td></tr>
<tr><td rowspan="2">- Emergency plans
- Emergency training
[Document Examination]</td></tr>
<tr><td>6. Serious accident prevention</td><td>-Accidents caused by fires/explosions
[Document Examination]</td></tr>
<tr><td rowspan="8">12/12
(Wed.)</td><td rowspan="6">A
M</td><td>1. Organization/
administration</td><td>-The human factor
[Plant Observation]</td><td rowspan="2">6. Serious accident prevention</td><td rowspan="2">-Accidents caused by fires/explosions
[Document Examination]</td></tr>
<tr><td>2.Emergency measures</td><td>-Emergency equipment/ resources
[Plant Observation]</td></tr>
<tr><td>3.Education/
training</td><td>- Implementation of trainings
[Document Examination]</td><td rowspan="2">4. Operation/
maintenance</td><td>- Interlock devices
- A storehouse of nuclear fuel materials
[Plant Observation]</td></tr>
<tr><td>2.Emergency measures</td><td>-A responsible person
[Interview]</td></tr>
<tr><td rowspan="2">3.Education/
training</td><td rowspan="2">-A responsible person
[Interview]</td><td>5. Radiation protection</td><td>- Radiation monitoring panel
[Plant Observation]</td></tr>
<tr><td>6. Serious accident prevention</td><td>-Accidents caused by fires/explosions
[Plant Observation]</td></tr>
<tr><td>P
M</td><td colspan="2">Verification of Fact</td><td colspan="2">Verification of Fact</td></tr>
<tr><td rowspan="2">12/13
(Thu.)</td><td rowspan="2">A
M</td><td colspan="4">Verification of Fact</td></tr>
<tr><td colspan="4">Closing</td></tr>
</table>

6. Methods and Items of Review

6.1 Methods of Review

Targeting the various activities carried out to improve the safety promoted by the R&D Center, this review pointed out some good practices and items-to-improve, through observing the plants where the activities take place, examining and studying the documents presented by the R&D Center, and interviewing employees, as shown below.

In the process of review, the review teams also introduced useful examples of activities by the companies by which the reviewers are employed, such as the philosophy of education/ training in the nuclear power department based on a learning valuable lesson from the JCO accident. This facilitated nuclear safety cultural exchange.

6.1.1 Execution of Review

(1) Plant observations

For the plant 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 experiences 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 operation observation, documents related to the observation were required, and more detailed investigations were done.

(3) Interviews

Interviews based on the following objectives were conducted with General Manager, and employees(researchers) in charge of research and testing.

(a) Examining the level of the effort and awareness about nuclear safety measures
(b) Gathering additional information not confirmed in the documentation
(c) Questions and answers including ones arising from document examination

(d) Evaluating the level of understanding about the determined items and the responsibility 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 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

The plant 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.

<u>Section 1: Organization/administration</u>

In this section, the review focused on the issue of ensuring nuclear safety, and examined whether the manpower required for safe operations was secured, whether "safety culture" that always prioritizes safety, was fully recognized, and whether adequate studies were given to problematic events and human-factors.

(Review Items)

(1) Effective Organization Management

a. Clarifying the line-organization and system of responsibility

b. Justifying the operation system
c. Setting up new goals of the organization
d. The leadership of middle to upper managers

(2) Cultivating Safety Culture
a. Creating a work environment where every person in the organization gives priority to safety

(3) Problematic Events and Human Factor
a. Reflecting past problematic events
b. Further consideration of the human factor

Section 2: Emergency Measures

The Special Measures Law for Nuclear Disasters is not applicable to the R&D Center. An emergency here means a disaster is likely to occur or has occurred at the facility due to an earthquake or a fire or an abnormal leakage of nuclear fuel materials has occurred or workers engaging in radiation work have been exposed beyond a certain dose limit.

The review was conducted to clarify the plan for cooperating with other operators and whether training has been implemented without fail, in view of the purpose of enacting the Special Measures Law for Nuclear Disasters.

(Review Items)

(1) Emergency Plans
a. Adoption of emergency plans
b. Information dissemination to employees

(2) Emergency Training
a. Execution of accident trainings

Section 3: Education/Training

Based on the idea that improvements in the level of safety awareness and skills of employees increased accident prevention, the review examined whether effective education and training systems had been maintained, whether systems of qualification etc, had been introduced, and whether those systems were actually being carried out.

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

(Review Items)

(1) Implementation of Trainings

a. Systems of education and trainings (including Technology (know-how) transfer)

Section 4: Operation/maintenance

At facilities that mainly conduct testing research and technology developments like the R&D Center, “safe operation” means “safe work” in testing and research, while “safe maintenance” means “safe work” in facility maintenance. These were collectively reviewed as safe work.

The review was conducted to examine whether a high-level of safety is ensured with each work item. Namely, the review focused on, with respect to people, whether documents such as work procedures and manuals have been developed and observed without fail, and with respect to equipment, whether safety functions are clearly classified and are under favorable control. As a consolidated effort, whether nuclear fuel materials are appropriately controlled was also examined.

(Review Items)

(1) 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

(2) Facilities and equipment

a. Facilities and equipment interlocks[4]
b. Facilities and equipment inspections

(3) Engineering of nuclear fuel cycle research facilities

a. Nuclear fuel material control
b. Radioisotope control
c. Chemical substances control
d. Radioactive waste control

Section 5: Radiation Protection

This section evaluates the strategies and conditions of implementation from the perspective of the confinement of radioactive substances, prevention of leakage into the environment, and employee dose control.

(Review Items)

(1) Confinement of Radioactive Substances and Monitoring
   a. Appropriate administration of negative pressure[5]
   b. Radiation Monitoring

(2) Dose Control
   a. Employee dose control

Section 6: Serious Accident Prevention

In view of the above-mentioned points of review, the review was conducted with regard to accidents involving fires and explosions to clarify whether systems that may cause accidents have been identified, whether multiple measures have been taken to prevent accidents that may cause serious impacts on the facility and its peripheral area, or whether the system ensures quick detection of accidents when they occur.

(Review Items)

(1) Accidents Caused by Fires/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

7. Main Conclusions

In summing up this review of R&D Center, Energy & Environment Business Division of Sumitomo Metal Mining Co., Ltd., we have not found any item that would lead to a serious accident unless immediate remedies were taken in the nuclear safety field.

The center supported JCO for several months after the JCO accident to remedy that situation. Based on this experience, every member of Center Staff and the head of R&D Center have been thoroughly reviewing their own measures for security, understanding “why it has to be done” and realizing “it must be done by me”. An

initiative was expressed by the head of the Center that “Our business cannot continue if we are not able to secure safety and coexist with the local community. It is the continued improvement of safety that underlies all our operations”. Under this initiative, it was understood that everyone in the center must unite in striving to reinforce nuclear safety by doing safety management for the facility, making efforts toward risk management, and acting to sustain ISO 14001 certification as well as expanding other activities with the aim of fostering a culture where the staff can naturally face up to safety based on “clarified system/responsibility and observance of rules”.

It is hoped that R&D Center will continue further voluntary efforts with the aim of cultivating safety culture, maintaining the consciousness of the pursuit of safety held by individual Center Staff now, and considering how to hand it down to others.

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.

- Preparation of a “Safety Management Plan” for every operation, including the gist of the danger and counter measures for assumed troubles

When conducting an operation that has not been implemented for the past one year, they are to prepare a “Safety Management Plan” for each operation. The “Safety Management Plan” undergoes deliberations by the “Expert Committee of safety”, an examination by an examiner nominated by the head of the Center, and approval by the head of R&D Center. Then it is published and training is given to the persons concerned before starting the operation. Its format includes filling in assumed troubles and countermeasures thereof, and the gist of knowing the danger in advance. Moreover, if necessary, an operational procedure manual can be attached to it so that the adequacy of the procedure can be deliberated as well.

- Company-wide use of database relevant to accidents

Any case of accident or traffic accident resulting in injury or death that took place within Sumitomo Metal Mining group is registered in real-time in the database managed

by the Safety & Environment Control Dept. in Head Office. It is accessed and viewed by Center Staff through a bulletin board on the in-house LAN. Especially, when a serious accident or a minor incident or a series of analogous accidents have occurred within the group, an e-mail is sent from the Safety & Environment Control Dept. via the head of the Division to the managing person in each branch office to draw attention or give instruction on how to prevent any similar accident.

- Centralized purchase and storage of chemical substances (reagents) through database

Since December 2000, they have implemented a centralized management system of chemical substances (reagents) through a database. This management system restrains the center from overstocking chemical substances by controlling quantities of the substances, each of which has a quantitative restriction by law (specified quantities of dangerous objects). It also designates the reagents classified as poisonous/deleterious, and chemical substances that are "specified reagents" and controls the purchase, stock and depository of even slight amounts of them together with non-specified reagents. This system ensures that they can comply with the "Pollutant Release and Transfer Register Law: PRTR Law". This law, which came into effect as of fiscal 2001, binds us to register the release and transfer of specified chemical substances.

- Operation of the original "Doorway Monitoring System"; identifying persons entering a controlled area from inside

An original "Doorway Monitoring System" running on PCs is used to control radiation workers and temporal workers going in and out the controlled area. This system is available on the in-house LAN system, which can be accessed and viewed from PCs within R&D Center. If a fire occurs in the controlled area, the system can be used to identify persons inside the area.

Meanwhile, we offer several proposals to further improve the security activities in the center. The main proposals follow.

- To clarify the ranking of provisions establishing a relationship between super- and sub-ordinate provisions

Regulations and provisions have been certainly put in order. However, it is desirable, whenever necessary, to clarify the ranking of provisions by specifying a superordinate provision in a purpose-of-preparation item of a subordinate provision so that they can be used more easily.

- To institute "the Gist of Measures" to cope with matters of inadequacy identified in the inspection of facilities and equipment

Facilities and equipment are regularly inspected by Center Staff or an external institution. However, if matters of inadequacy are identified, how to cope with them is not specified in any document. Thus it is advisable to summarize "the Gist of Measures" in a document and institute it in order to cope with inadequate matters quickly in the future.

- To consider fire fighting training for guards in the case that a fire occurs during the night or on a holiday

Currently, if a fire occurs during the night or on a holiday, the guard is not supposed to fight the fire in its initial stage, nor do the regulations mandate that the guard guide a public brigade to the site. In the future, on the supposition that a fire could occur during the night or on a holiday, it is advisable to consider training for the guards to further ensure that a fire will be extinguished in its initial stage and the public brigade be guided to the site.

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

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[1] Article 16-2 of the Ordinance for the Enforcement of the Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors: A provision of the ordinance that defines nuclear fuel materials pursuant to Sub-clause 1 of Article 55-1 (Facility Inspections) and Sub-clause 1 of Article 56-3 (Safety Regulations) of the Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors. Based on the criteria whether the volume of enriched uranium and so on that are handled at the facility requires the consideration of criticality, the criteria is set forth in this provision whether the facility requires the preparation of safety regulations, prior approval, and facility inspections in accordance with the above-mentioned law. Regarding the handling of enriched uranium, the volume of ^{235}U is prescribed: 1.2 kg for enrichment levels

below 5% and 0.7 kg for enrichment levels equal to or over 5% and below 20%. If uranium with different enrichment levels is stored, the Regulations are applicable when the sum of the ratio of each enrichment level to respective criterion is equal to or larger than 1. Safe masses of enriched uranium are 24 kgU for enrichment levels below 5% and 3.5 kgU for enrichment levels equal to or over 5% and below 20%.
The volume of storage permitted at the Center is below these criteria, which does not require the preparation of safety regulations, prior approval, and facility inspections in accordance with the above-mentioned law. This also indicates that if the whole volume of enriched uranium in the facility is put together, it will not cause criticality.

[2] Reason for not hypothesizing a criticality accident: Figures for the minimum critical mass under the harshest conditions are presented in the "Nuclear Safety Guide TID-7016, Revision 2" (NUREG/CR-0095, ORNL/NUREG/CSD-6), based on empirical measurements of critical mass and logical extrapolation from them. The value for a solution of 100-percent enriched 235U is 0.63 kilograms. In addition, a relaxation coefficient in the event of a lower degree of enrichment is derived and applied to obtain minimum critical mass values at any degree of enrichment. In TID-7016, Revision 2, the corresponding values are 25 kilograms-U for an enrichment of less than 5 degrees and 4 kilograms-U for one of 5 - less than 20 percent.
The mass of enriched uranium (with an enrichment of less than 5 percent) which the R&D Center is permitted to utilize is far less than even half as much as this minimum critical mass, and could not produce criticality. Furthermore, almost all of the nuclear fuel materials utilized at the Center consist of natural uranium, and the "Rinkai Anzen Handbook" (Criticality Safety Handbook; JAERI 1340, published by the Japan Atomic Energy Research Institute in March 1999) indicates that criticality cannot be reached with a degree of enrichment equivalent to natural uranium for all ranges of concentration.

[3] Criticality safety: To safely control facilities, such as nuclear fuel processing plants and spent fuel reprocessing plants which handle fissile substances in a way so that such fissile substances do not reach a criticality state, causing criticality accidents (excerpted from "Nuclear Dictionary: The Nikkan Kogyo Shimbun Ltd.")

[4] interlocks; Mechanical and electrical locking systems enabling the commencement of prescribed operation for certain equipment only when certain conditions for components in serial or parallel linkage are fulfilled (cited as synonymous with the Japanese "intarokku" in "Dictionary of Nuclear Science and Technology", published by Nikkan Kogyo Shimbun, Ltd.)

[5] Control by negative pressure; A means of containing radioactive substances by controlling the flow of air through reduction of the internal air pressure to a level below the external air pressure.