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AGENCE DE L'OCDE POUR L'ÉNERGIE NUCLÉAIRE

OECD NUCLEAR ENERGY AGENCY

FAX TRANSMISSION

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Message:

Dear Finas Coordinators,

Attached is copy, for your information, of interim report I received today from the Japanese Delegation.

This is the English translation of the original document and this is not considered as an official version.

Regards,

Barry Kaufer

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Urgent Recommendations - Interim Report

November 5, 1999

Nuclear Safety Commission

Investigation Committee

for Criticality Accident at Uranium Processing Plant

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1. Introduction

The criticality accident which occurred on September 30 1999 at JCO Co., Ltd. Tokai uranium processing plant led to the recommendation of tentative evacuation and sheltering indoors for residents living in the neighborhood. This was an unprecedented event in Japan where development and utilization of nuclear energy has been promoted on the premise that its safety is ensured. Taking these circumstances into serious consideration, the Committee was founded by Nuclear Safety Commission based on the decision by Government Task for the Accident (Oct. 4) to thoroughly investigate root causes of the accident. The Committee will completely investigate accident causes from the third party's stance with wide assistance from intellectuals to establish measures to prevent similar accidents.

The Committee, since its first meeting on October 8, has been aggressively investigating the accident causes and measures to prevent similar accidents. The Committee held five meetings so far to try to accurately understand the nature of the accident, clarifying not only direct causes but also backgrounds which had brought such an accident. More careful and deep investigation, however, are necessary to reach the final conclusion.

Under this condition, the Committee understands that it is important to take necessary countermeasures on a timely and appropriate manner, taking account of significance of the social impact of this accident. From this viewpoint, the Committee judged that it was important to recommend countermeasures that can be directly derived from the fact found until now. Therefore the Committee decided to present "Urgent Recommendation - Interim Report" by summarizing the fact found by now.

The Committee will continue to investigate direct and indirect causes of the accident, and pursue to establish the basic concept on how to ensure nuclear safety in the future taking into consideration opinions from various fields to this interim report. The Committee will prepare the final report through further investigation on structural and ethic problems which lies behind the fact.

2. Accident situation and its consequences

(1) Accident situation

On September 30, 1999 (Thursday) around 10:35 a.m., the Japan's first criticality accident occurred at JCO Co., Ltd. uranium processing plant (auxiliary conversion facility) located at Tokai-mura, Ibaraki Prefecture.

The criticality continued on and off for approximately 20 hours after the first instantaneous criticality. The criticality consisted of two periods; an initial stage where criticality changed rapidly and the following stage criticality continued relatively slowly for many hours. The total nuclear fission number is estimated to have been 2.5×10^{18}.

At 3:00 p.m., mayor of Tokai-mura issued a recommendation of evacuation to the residents living within 350 meters radius from the accident site. At 10:30 p.m., the Governor of Ibaraki Prefecture issued a recommendation of sheltering indoors to the residents living within ten kilometers radius from the plant.

From around 2:30 a.m. on October 1, JCO's personnel conducted the operation of draining cooling water surrounding the precipitation tank. The criticality ceased around at 6:30 a.m.. Then, boric acid was added to assure the end of criticality. The end of criticality was confirmed at 8:50 a.m. Upon confirmation of safety, the recommendation of sheltering to the public within 10 km radius was lifted at 4:30 pm. In addition, radiation shield was installed around the facility. The recommendation of evacuation within 350 meters radius was also lifted around 6:30 p.m. on October 2 upon confirmation of safety.

It was confirmed that 69 people including hospitalized three workers overexposed at the accident site were exposed to neutrons, although the levels of exposure were different. In addition, JCO's 24 personnel engaged in a series of operations to stop criticality were subject to planned exposure.

This accident is provisionally rated at level 4 on the International Nuclear Event Scale (INES.)

At present, the accident site is equipped with a seal to restrict external release of radioactive materials and a circulating charcoal filter to remove radioactive materials for enhancement of radiation shielding. This assures immediate safety at the least, but at the site, uranium solution that caused criticality remain in the precipitating tank and other equipments. It's necessary to decontaminate the site as well as to take other measures in order to ease residents' concern..

(2) Accident effects

There are two types of effects to the surrounding environment by the accident; one is the dose due to neutrons and gamma rays released from the precipitating tank, and the other is one due to release of radioactive materials. In this case, however, it was estimated that the former was the dominant consequences to the surrounding environment.

"Neutrons and gamma dose rates from precipitating tank"

The theoretical basic document on neutrons and gamma rays to the surrounding environment was tentatively prepared using monitoring of neutrons and gamma rays in and around the site and the fission number.

Measurement using whole body counter shows that exposure dose for a worker at the point 80 meters away from the site was lower than the value shown in the theoretical basic document. The theoretical basic document can be used to trace doses for indivisuals for the time being, but in the future this data should be improved by increasing accuracy of variables in calculations and applying models for partial shielding.

It was evaluated that the doses due to gamma dose rate released from the precipitating tank to the surrounding environment were very low.

"Doses from radioactive materials released to the environment"

Evaluation shows that doses due to radioactive materials (noble gas and iodine) released from the facility to the environment was about 0.1 mSv at maximum in the effective dose equivalent at the point near the facility.

In farm products, iodine 131 was detected to 0.0087 Bq/g (iodine 133 with short half life was 0.0038 Bq/g). This value is only about 1/50 to the legal index for food and drink ingestion limit of 2 Bq/g, the value which is confirmed not to cause any problem. Survey by Ibaraki Prefecture also shows that no artificial radionuclides potentially caused by the accident was detected.

"Social and economical effects"

With evacuation for [redacted] meters and staying indoors for about 300,000 people living within 10 kilometers recommended, transportation was stopped and schools and other cultural facilities such were temporarily closed their activities as well as private companies. The accident effect was very large socially and economically.

Residents living near the site were forced not only to live inconvenient life due to evacuation and staying indoors but also to receive mental or physical effect caused by rumors. In the future, sufficient measures including mental cares are necessary. ("Health consultation to the residents including mental cares" was decided on October 4 by the Government Task Force.)

After the accident, there are many adverse effects occurred due to rumors from misunderstanding.

3. Response to the accident (Disaster prevention related)

(1) Response to this accident

The accident was first notified to the Science and Technology Agency (STA) on September 30, 11:19 a.m. about 44 minutes after the accident occurred. Upon this notification, the site operation control staff began around 12:00 to collect information at JCO Co., Ltd. Tokai plant. Then, after 12:30 STA informed the Prime Minister Office. Around 1:00 p.m. STA dispatched personnel to Tokai-mura, who reported officially at 2:00 p.m. to the Nuclear Safety Commission.

At 2:30 p.m. STA Countermeasure Headquarters was established. At 8:00 p.m. The decision was made to establish the Accident Countermeasure Headquarters headed by the Minister for Science and Technology on the Disaster Prevention Basic Plan in accordance with Disaster Measures Basic Law. Each agency/ministry took necessary measures upon the decision of the Headquarters that they jointly deal with the disaster. At the site, at 5:00 p.m. the Local Countermeasure Headquarters was established with assistance from the nuclear specialized organizations such as Japan Atomic Energy Research Institute (JAERI) and Japan Nuclear Cycle Development Institute (JNC) and electric power utilities. At 9:00 p.m. the Government Task Force headed by Prime Minister Keizo Obuchi held a meeting.

In parallel with this response, at 3:30 p.m. the Emergency Technical Advisory Body of the Nuclear Safety Commission was convened to begin the activity.

Through the period, the local authorities decided necessary measures. At 3:00 p.m. Tokai-mura authority issued a recommendation of evacuation to the residents within 350 meters and at 10:30 p.m. Ibaraki Prefecture also issued a recommendation to the residents within ten kilometers to stay indoors.

(2 Issues on accident response

These activities are based on the Disaster Prevention Basic Plan (Chap. 10: Nuclear disaster measures) specified by the Disaster Measures Basic Law, "Disaster Measures at Surrounding Area of the Nuclear Power Plant" (Disaster Guidance) prepared by the Nuclear Safety Commission and "Disaster Prevention Work Plan" and "Emergency Response Manual at Nuclear Disaster" prepared by STA.

These plans, however, are determined for accidents at the nuclear power plants, not for criticality accidents in the fuel processing plants. The first notification by JCO who

caused the accident was delayed and the following communication was not smooth. This led to the delay of correct understandings of the situation and made the initial proper response difficult. then followed by insufficient communications between the nation, prefecture, and local authority. In addition, mutual information relay and nation's instruction and advice were not proper causing the delay in issuance of residents' evacuation and other measures.

JCO Co., Ltd, which was responsible the accident, was poor in communication and emergency responding systems. In the future, the responsibility of operators at emergency condition should be clarified.

In addition, in Japan's system, the local authority has responsibility to disaster prevention. The State is in a position to give advice and instruction only. The accident, however, made it clear that it is difficult to respond to the emergency properly, if the State, that has much expertise on nuclear energy, does not play more roles.

4. Cause of the accident and related situations

(1) Direct cause

When the accident took place, three workers called "special crew" dissolved sequentially about 2.4 kg uranium powder with 18.8 percent enrichment in the 10 liter stainless steel bucket with nitric acid and pure water (to produce uranyl nitrate.) The procedure of homogenization of uranyl nitrate was supposed to be controlled using the shape-limited narrow storage column on a one batch basis. Actually, however, the thick and large precipitation tank with a stirrer was used. Uranyl nitrate in the bucket was moved to the five liter beaker through the filter and fed into the precipitation tank with a funnel. As a result, about 16.6 kg of uranium (equivalent to 6 to 7 batches) was fed into the precipitation tank originally designed to limit 2.4 kg of uranium per one batch, which presumably caused criticality.

The operation procedure is completely different from the one by the equipment and method approved by the government, and is originally prepared by three workers without approval of their superviser. (Some say) that the workers took such new procedure upon the advice of the experts in the workplace that it would cause no problem on the safety, although this information has not been confirmed yet)

There were two reasons which supposedly caused the accident; (1) "ignorance of the operation procedure" to mix uranium solution in the precipitation tank instead of the storage column, and (2) "ignorance of criticality limit" to feed uranium which exceeded volume than that allowed on criticality control. The workers was asked from STA investigators why such illegal risky work which is unconceivable in the normal circumstances was conducted so easily and answered as follows.

No understanding of LEU vs. HEU limits

(1) Conventionally, as much as 16 kg of uranium was fed, so they considered no problems even if uranium was mixed in the precipitation tank as usual)

production pressure

(2) They wanted to finish the dissolution as early as possible because they planned to train new comers, who would join the "special crew" in October from the first phase of the waste solution process.

Human Factors - design

(3) The present facilities are improper and inconvenient for liquid products handling.)

(4) Bad working condition made them want to finish the work as early as possible.

(5) Special crew was engaged in [redacted] work. This was easily confused in working procedure.)

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This suggests following possibilities:

(1) Workers had poor knowledge on criticality, so they began to work without previous information on "risk prediction oncriticality."

(2) The company had some problems on human management such as personnel assignment and training.

(3) Because of lack of enough efforts to improve facilities, unreasonable operation had been conducted.

work around

(2) Status of JCO Co., Ltd.

"Operation management"

JCO Co., Ltd. which caused this accident prepared three classes of documents for management, (1) "Quality Assurance Plan" as a basic document to specify job assignment for each department, responsibility management, equipment management, operation management, for quality assurance activities, (2) "Procedure" to specify how to manage activities performed based on "Quality Assurance Plan", and (3) "Procedure (manual)" to specify the detailed procedures on each phase of the operation and "Instruction" to determine uranium handling volume.

Among them, "Procedure" on fuel processing for "JOYO" at the conversion building was approved and was issued in 1997 within the company. This accident occurred in the fuel manufacturing process of fabricating the nuclear fuel for the Fast Experimental Reactor "JOYO." "The Procedure" was reviewed by the quality assurance division and approved by the manufacturing division but not reviewed by the safety management division. Contents were also different from those written in the procedure approved by the government.

In addition, at this accident, the workers conducted the illegal work against "Procedure" mentioned before without their supervisor's approval.

In JCO Co., Ltd., the operation in question to feed 16 kg of uranium solution into the storage column has been regularly performed.

"Management at conversion building"

The staff number of JCO's production department is 27 in total and consists of five groups, under a group head and a foreman, with five members each of one deputy foreman.

one leader, and three operators. Among them, one team called the special crew was to be engaged in the operation at the conversion building.

The special crew was also engaged in the operation of a different nature to conduct a treatment of effluent other than those in the conversion building.

The deputy foreman and two workers of the special crew were involved in this accident. The two operators had no experience for the work in the conversion building and the deputy foreman had only two or three working months of experience. Other two member of the crew (leader and operator) had two to three working months of experience in the conversion building and were not anew received an education and a training.

"Chief Technician of Nuclear Fuel"

The Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors stipulates that the Chief Technician of Nuclear Fuel should be appointed among the persons who have the certificate of Chief Technician of Nuclear Fuel. In JCO Co., Ltd., one personnel was selected as the Chief Technician of Nuclear Fuel to perform the duty "including the participation in preparation of important plan on safety" specified in the safety regulation.

However, there is no mention that the Chief Technician of Nuclear Fuel should be involved in preparing reports and procedures in the document control manual for management of the operation procedure. Actually, it is not clear at the present whether the chief personnel was involved to prepare the document or not. On the other hand, it is made clear that the Chief Technician approved instructions based on the procedure different from those approved by the government.

"Financial Status, etc"

As mentioned above, it should be pointed out that JCO's safety management contains various big problems, and that the internal audit or the audit by the parent company did not function properly.

Financial status of JCO Co., Ltd. shows that the amount of sales decreased from 3.25 billion yen in 1991 to 17.2 billion yen in 1998, and the amount of production dropped from 552 tons to 365 tons during the corresponding period. The number of employees also decreased from 162 (including 34 technical staff graduated from university) to 110 (including 20 technical staff graduated from university), in particular showing the great

restructuring in the technical staff of the direct division.

On the background of this bad financial status, it was pointed out that there was severe competition increased in the international market.

(3) Regulation by the Government

Thorough review of the regulation system, which failed to point out conditions full of problems on safety management, is necessary.

There are two questions on the regulations by the government.

One is how to perform the safety review in multi-stage regulation (permit of the business, approval of the method of design and construction, and approval of on safety regulation, etc.) specified in the Law for Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors.

The other is the problem in the system checking whether operators observe laws and regulations.

"Mechanism and history of the safety regulation"

Japan Nuclear Fuel Conversion Co., Ltd, the former JCO, got a license in November 1980 to use nuclear material for fabricating uranium oxide powder with enrichment of 12% and passed the inspection for the conversion building. Then, in June 1984, a license was approved to change the processing facility to enable them to produce liquid with enrichment less than 20 percent.

, multistage license procedures by the government were divided into four stages (1) review of basic design and fundamental design policy on permit of processing operation, (2) review for permit of detailed design and construction method, (3) pre-operation facility inspection, and (4) approval of safety regulations.

Upon the permit of the business, the safety review by the Nuclear Safety Commission was conducted on technical issues (so-called double check.)

(Permit of the Business)

Before the Permit of the Business is issued, they have to make sure that "the location, structure and equipment of the fabricating facilities are such that they will cause no hindrance for preventing from accidents by nuclear fuel material", which is stipulated in Article 14 of the Law for Regulations of Reactors, etc. For this purpose, the review is

carried out based on "Basic Guideline of Safety Review for Nuclear Fuel Facilities" determined by the Nuclear Safety Commission referring "Guideline of Safety Review of Uranium Processing Facilities."

The safety review judged that there is no "possibility of criticality accident occurrence due to malfunction and other failures" required by above basic guideline 12 on the that the following four conditions should be fulfilled.

Mass

geom-partially

concentration

double batching

(1) To conduct mass control on a one batch basis at the process from the dissolving tank to the precipitation tank handling 2.4 kg uranium for the uranium with enrichment of 18.8 (amendment in the safety review),

(2) To weigh the amount of uranium before dissolving to feed to the shape limited facility,

(3) To measure concentration and liquid volume of solution before feeding to the precipitation tank, and

(4) To design facilities not to reach criticality even if uranium is doubly charged mistakenly.

"Approval of the method of the Design and Construction"

The technical standard upon approval of the method of the Design and Construction was stipulated in 1987 in "Ordinance of the Prime Minister's Office on Technical Standard with regard to the method of the Design and Construction for the Processing Facility." The Article 3 specified that prevention of criticality of nuclear fuel materials should be realized by (1) the processing facility be designed in the shape and dimensions considering nuclear safety or with other appropriate measures to eliminate possibility for nuclear fuel materials to reach criticality, and (2) the processing facility handling uranium or plutonium over the critical mass be equipped with the critical alarm device or other appropriate measures on the assumption that the critical accident could occur.

However, the Ordinance had not been issued when the alteration permit of the conversion building, where the accident occurred, was reviewed. "Regulation concerning Processing Business of Nuclear Fuel Materials," Ordinance of the Prime Minister's Office which remained in force those days, without provisions which clearly necessitates the installation of the critical alarm device, applied to the safety review. At the review, an area monitor is judged to have equivalent function as the critical alarm.

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"Checking regime"

The processing operator is not obliged to receive the periodic inspection specified by the Law for Regulations of Reactors, etc. unlike the reactor operator of the nuclear power plants, etc. The authorities can conduct an on-the-spot-inspection (Article 68 of the Law for the Regulations of Nuclear Source Material, Nuclear Fuel Material and Reactors) Actually, however, the inspection was conducted at only the case where some problems occurred. In the case problems are not realized, the inspection is usually replaced by an arbitrary survey for observance to the safety regulation on an administrative guidance basis.

Actually, JCO's Tokai plant regularly received such an arbitrary survey for observance to the safety regulation on an STA's administrative guidance basis until 1992 almost every year, but since then the survey has not been conducted. STA explains the reason that inspection of other plants including commercial reprocessing plant required by the legislation increased.

In April 1998, the Tokai Office for operation and inspection personnel was established, since then patrolling by the personnel has been conducted monthly at JCO Co., Ltd. Tokai plant. Among them, the conversion building was patrolled three times in the past. The facility was not operated at these patrols.

the safety regulation by the government has been conducted in the manner above mentioned. However, this accident, which pointed out some problems, requires investigation of the measures to improve the regulatory system. the regulation system based on lessons from this accident.

5. Urgent recommendations

(1) Safety measures to be taken at the accident site

At present, appropriate measures have been performed at the accident site to prevent the environmental effect due to radioactive materials and radiation, but uranium solution which caused critical reaction still remains. The radioactive materials in question should be treated safely and promptly as possible. The principal responsibility lies at the operator, but the government should instruct JCO Co., Ltd. and ask for cooperation from related organizations to take all possible measures.

(2) Health cares for residents and others

Health cares for residents have been conducted immediately after the accident for health survey and health consultation (including mental care) in cooperation with the government and local authorities.

In addition, for the effect of radiation on people's health, personal exposure dose rate should be promptly evaluated to conduct the proper response depending on the situation. On the improvement of the concerned system, it is important to treat the radiation influence to the health including mental cares for residents. For that purpose, the government , local authorities and operator should play each role under appropriate sharing of duties and close cooperation.

(3) Comprehensive safety securing at nuclear operators

Nuclear safety securing , even if the government applies strict regulation, is difficult to be maintained only by the regulation. The principal responsibility lies at the operator. In particular, the nuclear industry related operators occupying the most significant position in Japan's energy policy should have strict recognition on this matter. The Commission demands that the nuclear operators and related operators should, from a viewpoint of safety enhancement, make a thorough review and take an appropriate measure on the following items;

- To establish the effective audit system in the company and to secure safety through external systems such as ISO 9000 series licensing.
- To completely conduct safety education for employees and to establish qualification and licensing systems to raise personnel's ability.
- For preparation and management of the safety related documents, to employ the

checking system to be assured by responsible personnel for safety management such as chief technician of nuclear fuel,

- To prepare appropriate systems and equipments by bearing reasonably necessary costs for safety securing,
- To make the users ask safety securing as quality assurance against the supplier, and
- To establish under cooperation with the government, a system in which the whole nuclear related operators [redacted] cooperate in order to raise the safety management level.

(4) Reconstruction of the government's safety regulations

(How safety regulation should be)

The safety review should be examined so as to take fully criticality prevention measures (practice of the fail-safe concept and employee education, etc), and clarify the appropriate measures to be taken at moment of the criticality, taking into account that the criticality accident might occur by the causes other than 'error operation etc'.

For enhancement of the government's inspection function, several measures should be introduced, for example, to ensure the effective application of the inside inspection based on Article 68 of the Law for regulation of nuclear source material, nuclear fuel material and reactors, to stipulate obligation for the periodic inspection and others by adding regulating items related to processing operations, and to introduce effective inspection system regarding to the operational performance and employees education.

(Response to nuclear disaster)

At the nuclear disaster, it is essential to respond the event promptly and properly. With lessons from this accident, the following measures, as examples, should be promptly taken, so as to respond steadily the particularity of nuclear disaster.

Communication
thresholds
organization
software
Hardware

- Initial prompt action based on the collection of accurate accident information and organic combination between the government, prefectures and municipalities,
- Enhancement of government's emergency response organization reflecting particularity of nuclear disaster,
- Quick notification at the moment of the accident and clarification of operator's role for prevention of nuclear disaster, and
- Improvement of the monitoring system and telecommunication equipments..

(Improvement of the system)

For effective performance of the nuclear safety system mentioned above, necessary personnel and materials should be provided. The safety management needs without argument reasonable costs and the measures as necessary should be promptly performed.

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6. Items for the Further Investigation and Examination

Conventionally, the safety issues have been understood standing on mainly the safety engineering, but it is not sufficient that facilities and installations are safe only on an engineering basis. It is needless to say that the front line for the nuclear safety lies at the operation site. Therefore, it is very important for employees, engineers, and managers at the site to have sufficient knowledge and experience with sense of mission and tensional feeling for the safety, standing on the basic ethical sense.

This point seems to be general problem to be amplified in various fields and comprehensive study is necessary, but in particular, this should be emphasized for the nuclear related fields with potential serious hazards once the accident occurred.

Fundamentally, business activities should be focused on technical development keeping international competitive force on the major assumption that safety is first assured, but at this accident, economical effectiveness was likely to pursue at sacrifice of safety management.

These problems tend to depend on awareness of each employee, engineer, or company.

But it is no sense for the solution if this would be understood as individual problems. Reflecting the conduct that there would be comprehensive problems in companies and industries as a background why the knowledge, experiences and tensional l feeling could not be transferred and not kept in mind in the individual operator or engineer, daily learning for the removal of risk potential should be encouraged to stop the fade of "Safety Culture"(Assembly of characteristics and attitudes in organizations and individuals which establishes that , as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance).

Furthermore, it is also important to study how to promote information disclosure and proper cost bearing to create the "Safety Culture" aggressively. Those safety culture issues would not be limited to specific industry, but should be dealt with as a problem through out the nation

In addition, it should be studied how to promote drastic changes in mentality of employees and following younger generation for the nuclear related industries occupying significant position on Japan's energy policy.

In the future, this Committee will further investigate fact relevance to completely pursue root reasons of the accident. The Committee will also study deeply stepping in the structural problems involved at the back of accident to summarize the basic concept for

recurrence prevention. The problems to be studied contain how to improve the safety regulation system based on suitable assignment between the nation and operators, how to brew Safety Culture, and how to manage the nuclear industry.

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Activities by Investigation Committee for Criticality Accident at Uranium Processing Plant

October 4, 1999: Decision by the Nuclear Safety Commission of the establishment of the Committee

October 7, 1999: Decision by the Nuclear Safety Commission of items to be investigated and to be reviewed

October 8, 1999: No.1 meeting was held.

October 15, 1999: No.2 meeting was held.

October 22, 1999: No.3 meeting was held.

October 29, 1999: No.4 meeting was held.

November 5, 1999: No.5 meeting was held.

The Accident Investigation Committee additionally conducted the JCO site inspection (October 16 and others, 1999.)

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Members of Investigation Committee for Criticality Accident at Uranium Processing Plant

(Chairman) Hiroyuki Yoshikawa: Chairman of Science Council of Japan

Kiyoto Aizawa: Director of Japan Nuclear Cycle Development Institute

Michiko Abe: Special researcher at National Institute for Radiological Sciences

Michio Ishikawa: Special advisor of Nuclear Power Engineering Corporation

Eki Uekusa: Member of Science Council of Japan (professor of Toyo University Economy Faculty)

Yoichi Uehara: Honorary professor of Yokohama National University

Kohichi Okamoto: Professor of Toyo Eiwa Women's University

Shinichi Oze: Accounting officer in Ibaraki Prefecture

Hiroshi Kai: Chief engineer of Nuclear Fuel Industries Co., Ltd.

Hajime Karatsu: Professor of Tokai University

Tomio Kawata: Deputy Director of Tokai Plant of Japan Nuclear Cycle Development Institute

Hitoshi Kume: Member of Science Council of Japan (professor of Chuo University Engineering Faculty)

Shinzo Saito: Director of Japan Atomic Energy Research Institute

Yasuto Sasaki: Director of National Institute for Radiological Sciences

Atsuyuki Suzuki: Professor of Tokyo University Postgraduate Course Research Division

Nobuhide Suda: Professor of Hosei University

Shigeru Takahashi: Professor of Hitotsubashi University Law Faculty

Isao Takeshita: Director of Nuclear Safety Research Center, Japan Atomic Energy Research Institute

Shunichi Tanaka: Deputy Director of Tokai Establishment of Japan Atomic Energy Research Institute

Fumio Nishino: Professor of Policy Research Postgraduate University

Rensei Baba: Editorialist in Yomiuri Shimbun

(Deputy Chairman) Kunio Higashi: Professor of Kyoto University Engineering Faculty

Yoshiaki Yamauchi: Attorney

Tamihito Yoshida: Member of Science Council of Japan (professor of Chuo University Literature Faculty)

Member from Nuclear Safety Commission

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Kazuo Sato (Chairman)

Kenji Sumita (Deputy chairman)

Yoshiro Aoki

Junko Matsubara

Akira Kanekawa

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Chronology of the Accident at the Conversion Building in the Nuclear Fuel Processing Plant, JCO Co. Ltd.

(from 10:35 of September 30 1999 to October 2 1999)

Science and Technology Agency (STA), Nuclear Safety Commission (NSC)	Tokai
September 30 1999	September 30 1999
	○10:35 Area alarm sounded in the Conversion Building at Tokai Plant of JCO Co. Ltd. (referred to as JCO)
○11:15 The first report of the accident from JCO to STA, suggesting "possibility of criticality accident".	
	○11:52 Three workers engaged were exposed to radiation, and were carried to National Mito Hospital by an ambulance.
○11:55 The first measurement result of the dose rate around the facility was reported from JCO to STA (a maximum gamma dose rate of 0.68 mSv/h). At 12:29, a maximum gamma dose rate of 0.84 mSv/h was reported from JCO.	
○After 12:30 STA informed a secretary of the Prime Minister of the first report of the accident and after that sent a facsimile.	○12:30 Tokai-mura started to advise residents to stay indoors.
○Around 12:40 Receiving the first report, the secretary informed the Prime Minister Obuchi of the accident.	
○Prime Minister Obuchi requested that STA should collect the information on the accident situation and should let him know every information. His request was quickly transferred to STA.	
○ Around 12:40 STA reported the accident to a	

secretary of the Chief Cabinet Secretary	
	○12:50 Japan Nuclear Cycle Development Institute (JNC) started assisting the radiation monitoring after receiving the request by STA.
○Around 12:55 STA reported the accident to both the Cabinet Information Collection Center of the Cabinet and the Cabinet Security Affairs Office.	
○Around 13:00 STA personnel headed by the Deputy Director General of Nuclear Safety Bureau were dispatched to Tokai (and arrived around 15:20).	○Around 13:00 It was reported that the three workers would be transferred to the National Institute of Radiological Science from the hospital.
	○13:08 Japan Atomic Energy Research Institute (JAERI) established the countermeasure headquarters in Naka research establishment.
	○13:10 JAERI established the countermeasure headquarters in Tokai research establishment.
	○13:23 JAERI started radiation monitoring after receiving the request by STA.
	○13:40 STA requested the organizations involved to dispatch emergency monitoring staffs.
	○13:55 STA advised Ibaraki Prefecture to let residents stay indoors as adequate measures.
○14:00 STA reported the accident to NSC.	○14:00 Mito Atomic Energy Office of STA started radiation monitoring.
○14:30 STA established its Countermeasure Headquarters .	
○15:00 The decision was made to establish the Government Accident Countermeasure Headquarters	○15:00 Tokai-mura initiated the evacuation of the residents living within a 350 meter range from the facility.

	consisting of Mr. Arima, the Minister for Science and Technology as a head and representatives from the ministries and agencies involved. The decision was informed to the Nuclear Energy Safety Division in the Ibaraki prefecture.		
○15:20	Director General of Nuclear Safety Bureau visited the Prime Minister's Office and reported the accident status and establishment of the Government Accident Countermeasure Headquarters to the Chief Secretary of the Cabinet and others.	○15:20	The STA personnel headed by the Deputy Director General of Nuclear Safety Bureau arrived at Tokai-mura. At 17:00 STA established Local Countermeasure Headquarters in Tokai Establishment of JAERI.
		○15:25	The three workers arrived at the National Institute of Radiological Sciences.
○15:30	NSC decided to convene the Emergency Technical Advisory Body.		
		○Around 16:00	^{24}Na was detected from the sample vomit of the patient transferred to the National Institute of Radiological Science.
		○16:30	JNC started neutron monitoring.
○16:50	The first meeting of the Government Accident Countermeasure Headquarters was held.		
		○ Around 17:00.	A result of neutron measurement at the facility's boundary was reported to be around 4 mSv/h.
○18:00	The first meeting of the Emergency Technical Advisory Body was started.		
○18:30	In the meeting of the Emergency Technical Advisory Body, it was decided that two members of NSC would be dispatched to Tokai.	○19.09	JCO started neutron measurement using the equipment supplied by

○19:45	Director General of Nuclear Safety Bureau visited the Prime Minister's Office and reported to the Chief Cabinet Secretary that the accident was presumably a criticality accident and that the first meeting of Government Accident Countermeasure Headquarters had been held.		JAERI.
		○Around 19:50	Mr. Inaba, the State Secretary for Science and Technology arrived at Local Countermeasure Headquarters and immediately after that met the mayor of Tokai-mura in the Village Office.
○21:00	The first meeting of Government Task Force for the Accident consisting of the Prime Minister Obuchi as a chief and ministers involved.		
		○21:40	Two NSC members Kanagawa and Sumita arrived at the Local Countermeasure Headquarters, and immediately started discussion of countermeasure against the critical state.
○22:20	State Secretary for Science and Technology advised the governor of Ibaraki Prefecture to let the residents living within a 10-kilometer range from the facility be stay indoors, as a precautionary measure.		
		○22:30	The Governor of Ibaraki Prefecture advised the residents living within 10 kilometer range from the facility to stay indoors.
○22:45	The Emergency Technical Advisory Body judged the above advice was adequate.		
○23:10	Dispatch of the Cabinet Risk Management Officer and the members of the Prime Minister's Office		
○23:15	The second meeting of the Government Accident		

Countermeasure Headquarters was held (and decided that schools and nursery schools should be closed if the accident status was not improved).	
October 1 1999	October 1 1999
	○01:40 The first meeting of the Local Countermeasure Headquarters was held and the situation of accident was explained.
	○Around 02:30 JCO started taking pictures of the inside of the Conversion Building and then a series of operation to drain cooling water from the precipitation tank was started to terminate the critical state.
	○Around 04:00 it was confirmed that the neutron dose rate at the site boundaries decreased, and around 06:30 the neutron dose rate fell below the detection limit.
○04:30 The third meeting of the Government Accident Countermeasure Headquarters was held (and confirmed that schools and nursery schools should be closed if the accident status was not improved).	○05:45 STA informed Ibaraki Prefecture of the outcomes of the third meeting of the Government Accident Countermeasure Headquarters.
	○05:30 The second meeting of the Local Countermeasure Headquarters was held and the situation of accident was explained.
○08:00 The fourth meeting of the Government Accident Countermeasure Headquarters was held and the situation of accident was	

explained.	○From around 08:30 JCO started injecting boric acid water into the precipitation tank.
○09:00 Meeting of the Emergency Technical Advisory Body was restarted.	○08:50 The third meeting of the Local Countermeasure Headquarters was held and the situation of radiation monitoring within the 10 kilometer range from the facility was explained.
○09:20 The chairman of NSC announced that "the criticality had ended for the time being."	
○14:25 The Emergency Technical Advisory Body judged it adequate to lift the recommendation for the residents living within a 10 kilometer range from the facility to stay indoors.	[redacted] The fourth meeting of the Local Countermeasure Headquarters was held and [redacted] the residents living within a 10 kilometer range to stay indoors.
○15:05 The Chief Cabinet Secretary showed the government viewpoint that there would be no problem about the lifting of the recommendation for the residents living within a 10 kilometer range to stay indoors.	○16:00 The fifth meeting of the Local Countermeasure Headquarters was held and the radiation monitoring within the 350 meter range from the facility was discussed.
	[redacted] the residents living within a 10 kilometer range to stay indoors.

October 2 1999	October 2 1999
	○07:55 JCO started arranging shielding bags shielding containing aluminium fluoride (The arrangement was finished at 10:05).
	○Around 09:30 the Local Countermeasure Headquarters discussed about the shielding after receiving the detailed monitoring results within the 350 meter range from the facility
	○09:40 The sixth meeting of the Local Countermeasure Headquarters was held and the situation of accident was explained.
	○Around 14:00 Detailed radiation monitoring was started by the Local Countermeasure Headquarters within a 350 meter range from the facility.
○14:20 Meeting of the Emergency Technical Advisory Body was resumed.	
	○15:30 Piling of sandbags was started (and was finished by 23:00).
	○15:45 One of those three workers, who was in serious condition, was transferred to the hospital in the University of Tokyo from the National Institute of Radiological Science. (Around 15:30 October 4 1999, another worker was transferred to the Institute of the Medical Science of the University of Tokyo.)
○16:05 The fifth meeting of the Government Accident Countermeasure Headquarters was held and the situation of accident was explained.	
○16:30 The Emergency Technical Advisory Body advised the lifting of the evacuation of the residents living within a 350 meter range from the facility	
	○17:50 The seventh meeting of the Local

			Countermeasure Headquarters was held and decided that the lifting of all the evacuation based on the results of detailed radiation monitoring
○18:30	Mr. Nonaka, Chief Cabinet Secretary, showed the government viewpoint that there would be no problem about the lifting of all the evacuation of the residents living within a 350 meter range from the facility	○18:30	The Governor of Tokai-mura announced the lifting of all the evacuation of the residents living within a 350 meter range from the facility.
○19:15	The sixth meeting of the Government Accident Countermeasure Headquarters was held and the situation of accident was explained	○21:40	The eighth meeting of the Local Countermeasure Headquarters was held (the first stage of the accident was almost ceased.)

Reference 2

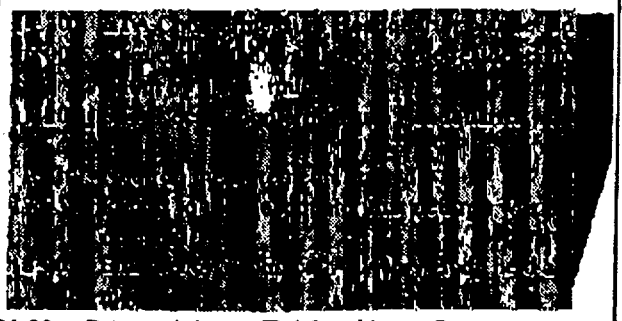
Main Actions and Environmental Dose Rate

Main Actions

Area monitor in the Conversion Building gave the alarm

11:19 1st report from the JCO Tokai Works

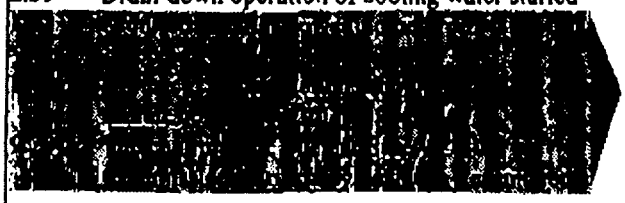
12.41 No entry in 200m zone



21:00 Prime minister official residence:Government Countermeasure Headquater Meeting

22:30 Recommendation to the citizens in 10km area to stay in house

2:35 Drain-down operation of cooling water started

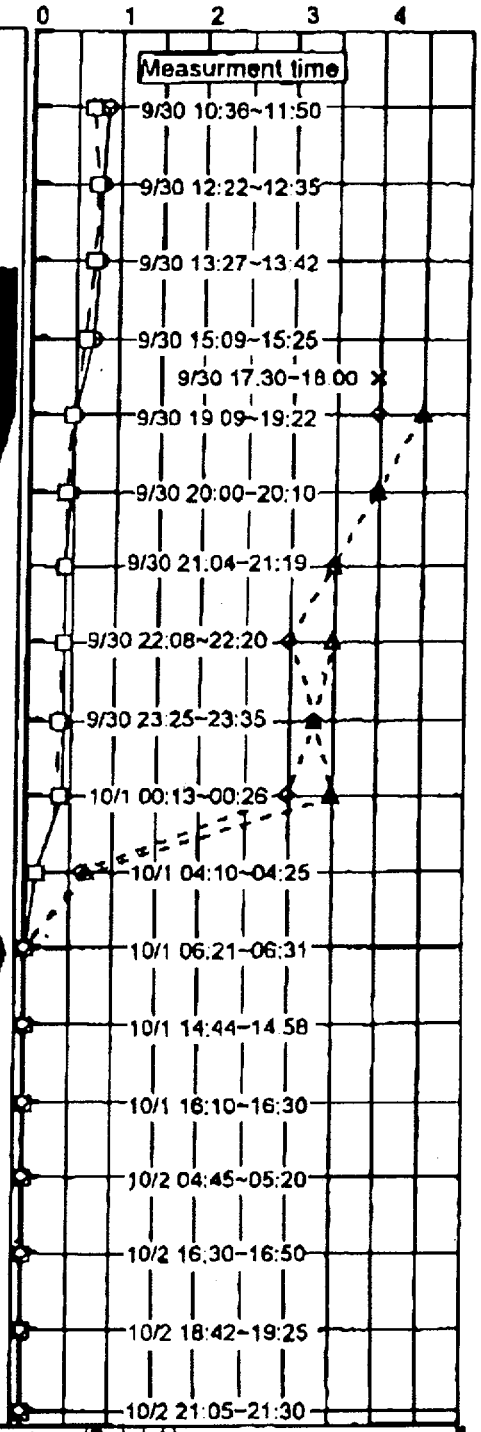


16:30 Removal of in-house sheltering request (except 350m zone)

7:30 Shielding by TAICON added fluoro-alminium for the south boundary was determined

18:30 Removal of in-house sheltering request in 350m zone

Dose Rate (mSv/hr)



× M

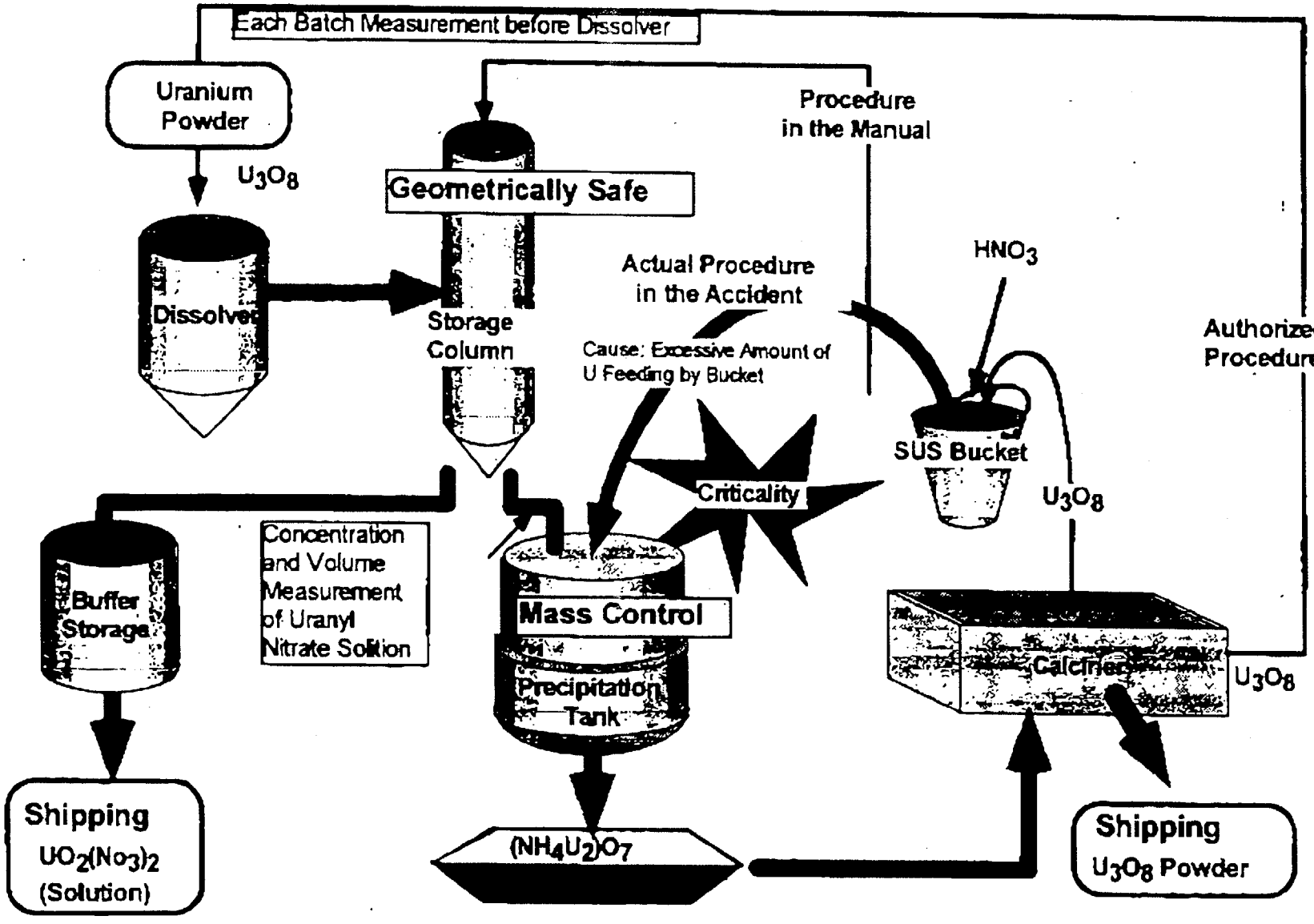
Gamma (Point A):Measured by JCO

Gamma (Point B):Measured by JCO

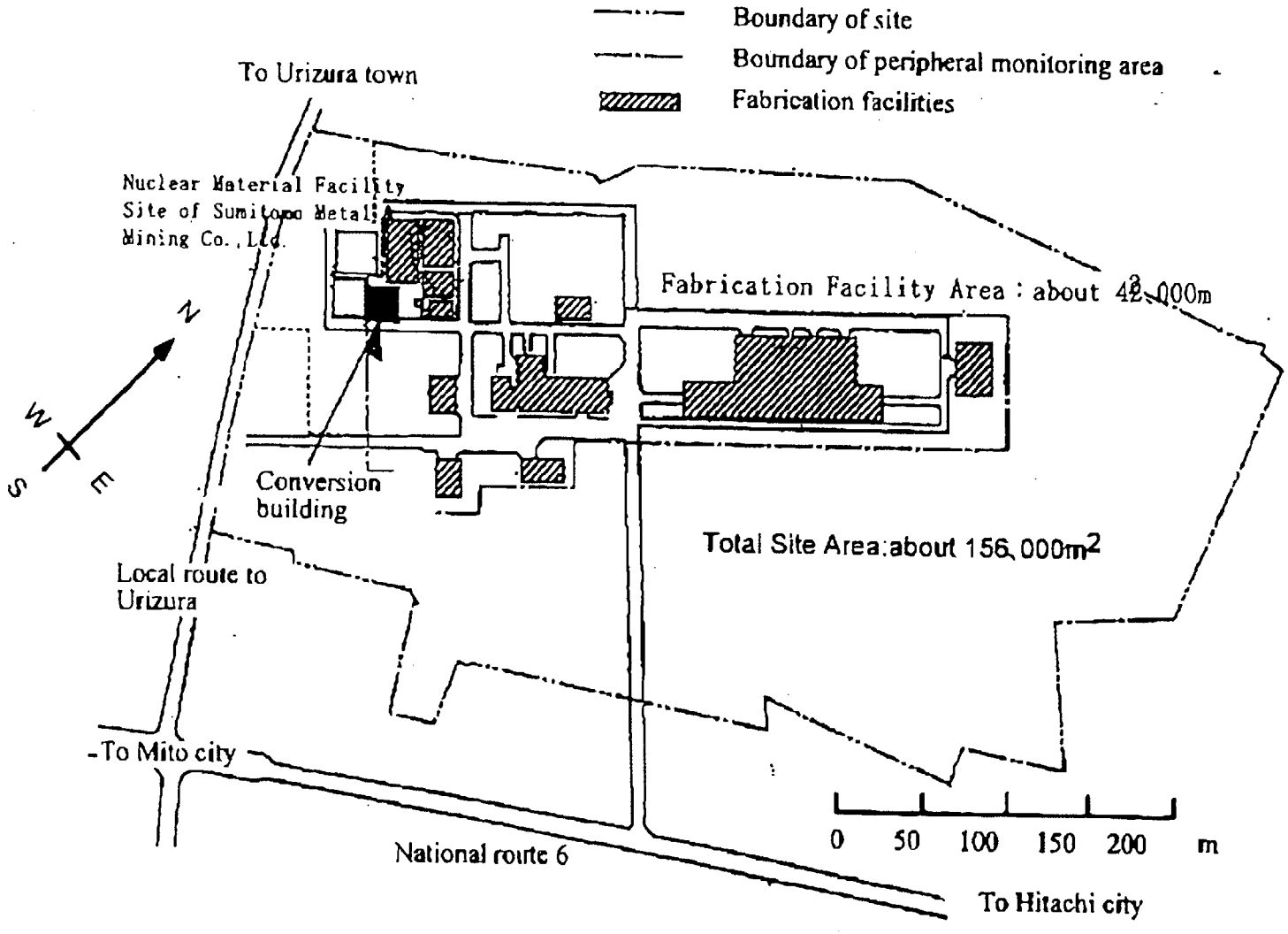
—△— Neutron (Point A) (Measured by JCO with supplied instruments from JNC)

- - ○ - - Neutron (Point B) (Measured by JCO with supplied instruments from JNC)

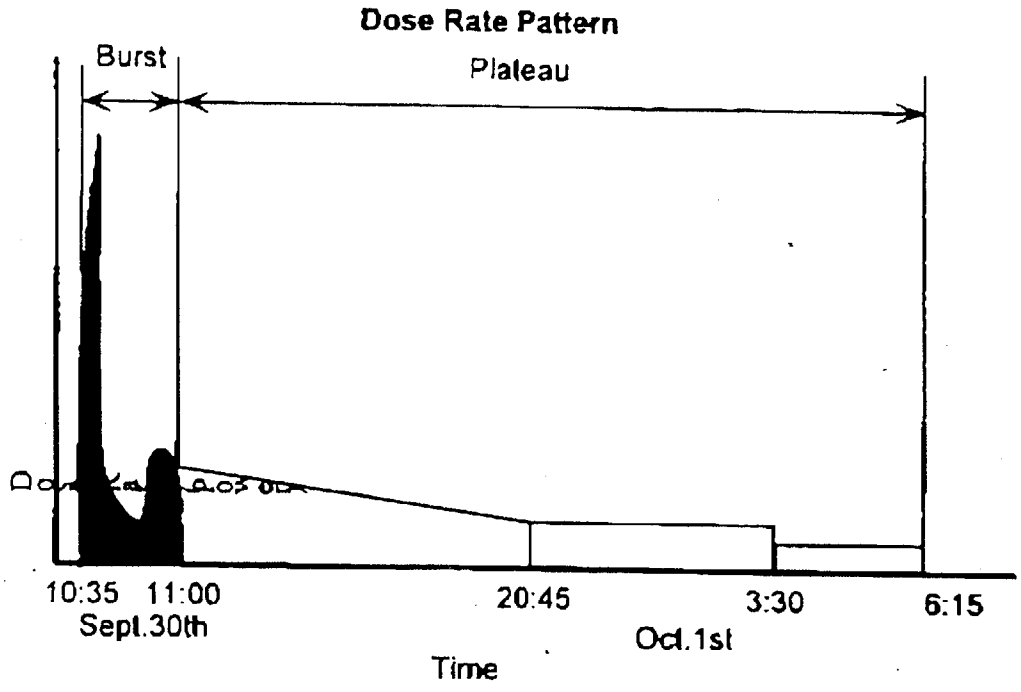
Figure 1-1 Conversion Process Diagram



Boundary of the Processing Facilities and Peripheral Monitoring Area



Reference 4



Refference 5