

POLICY ISSUE
NOTATION

SECY-00-0085

April 12, 2000

FOR: The Commissioners
FROM: William D. Travers
Executive Director for Operations
SUBJECT: REVIEW OF THE TOKAI-MURA CRITICALITY ACCIDENT AND LESSONS LEARNED

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- **SUMMARY:**
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PURPOSE:

To provide, for the Commission's review, the results of the U.S. Nuclear Regulatory Commission (NRC) staff's review of the criticality accident that occurred at the Tokai-mura fuel fabrication facility on September 30, 1999, lessons learned, and implications for NRC's regulatory program. ([Attachment 1](#) ).

SUMMARY:

The staff has reviewed the information contained in various reports and briefings provided by the Government of Japan, and international and U.S. agencies, to identify the root causes of the Tokai-mura criticality accident and to develop actions to assure that a similar accident would be unlikely at U.S. commercial facilities. The staff developed and sent an information notice to all fuel cycle licensees to alert them of the event. NRC also issued a temporary inspection procedure to NRC resident inspectors at the two high-enriched uranium facilities and the two gaseous diffusion plants, to focus immediate attention on the suspected contributing causes. The NRC also issued a press release and fielded media and public questions about the likelihood of a similar accident occurring in the U.S.

The staff agrees with the Government of Japan's conclusion that the general root causes of the accident were: (1) inadequate regulatory oversight; (2) lack of an appropriate safety culture; and (3) inadequate worker training and qualification. The staff attempted to identify one or more elements, in NRC's regulatory oversight program, that would have prevented the identified deficiencies from occurring if they had been in effect at the time of the accident. As a result of that review the staff determined that the current NRC oversight program at commercial nuclear fuel fabrication, conversion, and enrichment facilities makes the possibility of a similar accident unlikely, and no revisions to NRC's oversight program are needed as a result of the lessons learned.

BACKGROUND:

On September 30, 1999, a criticality accident occurred in a precipitation tank at the JCO Inc. facility located at Tokai-mura, Japan. The accident resulted in elevated radiation exposures to several hundred workers and members of the public, including three workers who received large exposures, one of whom has since died from a radiation dose of about 16 gray (1600 rads).

As a result of the Tokaimura criticality accident, the President requested the NRC to conduct a review of U.S. commercial nuclear fuel cycle facilities, to ensure that a similar accident could not occur. The President also asked DOE to conduct a similar review of facilities within the DOE nuclear complex. The NRC committed to: (1) heighten the resident inspectors' focus on the implementation of the criticality safety programs at the high-enriched uranium facilities and the gaseous diffusion plants; (2) issue an information notice (IN) to alert licensees of the circumstances surrounding the accident; and (3) evaluate information as it became available from various sources, to determine whether improvements in NRC's existing program are necessary. In addition, the staff of the Senate Environment and Public Works Committee requested a report on the accident and the lessons learned. This paper describes NRC's actions regarding each of the above commitments.

DISCUSSION:

Based on preliminary information from the Government of Japan and open news sources, the NRC issued Temporary Instruction (TI) 2600/005, "Criticality Safety Programs at Fuel Cycle Facilities," to provide supplemental nuclear criticality safety inspection requirements to the resident inspectors at the high-enriched uranium facilities and gaseous diffusion plants.

The NRC also issued [IN 99-31](#), "Operational Controls to Guard Against Inadvertent Nuclear Criticality," to alert NRC licensees to the accident at Tokai-mura and its probable causes. The NRC staff also fielded media and public questions about the Tokai-

mura accident and the likelihood of a similar accident here in the U.S. Since issuance of the TI and IN, the staff has had the benefits of both reviewing reports issued by the Government of Japan, an early trip report from the U.S. Department of Energy, and a report on the Mission of the International Atomic Energy Agency, and the exchange of information with the Japanese regulatory authorities. As a result, the staff has determined that the information contained in the IN and the inspection requirements specified in the TI have adequately enveloped the immediate causes of the accident. The additional inspections carried out at the two high-enriched uranium fuel fabrication facilities and two gaseous diffusion plants identified no significant safety problems. DOE is conducting a similar review of nuclear criticality safety within the DOE nuclear complex.

In addition to NRC's inspection activities, the Nuclear Energy Institute (NEI) is in the process of completing its review of the criticality safety programs at all licensed fuel cycle facilities.

NEI committed to notify the NRC immediately of any significant safety problems that it identifies and to make its findings available to NRC inspectors for review on site, in a manner similar to NRC's access to Institute of Nuclear Power Operations reports. The NEI review team kept the staff informed during the reviews. No significant safety issues were identified that required immediate action.

The NRC staff has reviewed a number of reports on the criticality accident, that have been issued by the Japanese regulatory authorities, international and Federal agencies. The more significant reports included:

- Nuclear Safety Commission (NSC) "Urgent Recommendations--Interim Report," dated November 5, 1999 ([Attachment 2](#) );
- NSC's "A Summary of the Report of the Criticality Accident Investigation Committee," dated December 24, 1999 ([Attachment 3](#) );
- International Atomic Energy Agency (IAEA) "Report on the Preliminary Fact Finding Mission Following the Accident at the Nuclear Fuel Processing Facility in Tokaimura, Japan," undated ([Attachment 4](#) ); and
- U.S. Department of Energy (DOE **EXIT**) "Trip Report of Visit to Tokyo and Tokai-mura, Japan" dated February 29, 2000 ([Attachment 5](#) .

The Government of Japan released an additional report in March 2000, but the staff has not been able to obtain a copy and arrange for its translation to include in this report.

The Japanese regulatory authorities described the criticality accident, its environmental impact, and recommended the initiation of certain legislative initiatives to address weaknesses in the regulatory oversight process. The NSC reports provided detailed descriptions of the accident and emergency response actions, identified the accident's causes, and made recommendations to prevent another similar accident. The IAEA report provided preliminary information on the accident and its radiological and environmental consequences. The DOE report summarized information compiled by a team of U.S. experts and was subsequently expanded after completion of the Government of Japan's formal investigation.

The accident was a direct result of safety deficiencies at the facility and of the limited regulatory oversight of fuel cycle facilities in Japan. Had the facility managed the uranium conversion process in accordance with approved procedures, the criticality accident would not have occurred. Furthermore, had the regulatory program been more effective, it is likely that any significant deviation from the approved safety requirements would have been detected and properly addressed. The NRC staff is in general agreement with the conclusions reached by the Government of Japan, that has concluded that the general root causes of the accident were: (1) inadequate regulatory oversight; (2) lack of an appropriate safety culture because both the regulator and the operator believed that a criticality accident could not occur in that type of a facility; and (3) inadequate worker training and qualification. These general root causes encompass the seven specific root causes identified by the NSC. Similar root causes and contributing factors have been identified for other nuclear criticality accidents in the U.S. and overseas. The type and magnitude of the accident are bounded by the accidents and accident sequences used by NRC licensees in designing licensed fuel cycle facilities and in developing emergency response plans for these facilities.

The staff has carefully considered the lessons learned from the criticality accident, including root causes and contributing causal factors. For each deficiency, the staff identified one or more components of the NRC's regulatory program (e.g., licensing review, inspections), that, in the staff's view, would have prevented the deficiencies from resulting in, or contributing to, the criticality accident, had they been in effect in Japan before the accident. The NRC had previously initiated comprehensive revisions to the requirements, in [10 CFR Part 70](#), that apply to fuel facilities and to the fuel cycle facility oversight program, to make them more performance-based, risk-informed, effective, and efficient. The NRC intends to use the lessons learned from past nuclear criticality events, including the Tokai-mura accident, as part of the validation process for the revised oversight program.

CONCLUSIONS:

The current NRC oversight program at commercial nuclear fuel fabrication, conversion, and enrichment facilities in the U.S. makes an accident similar to that occurring at Tokai-mura unlikely. Therefore, no revisions to NRC's oversight program are needed in response to the lessons learned from the criticality accident at Tokai-mura.

RECOMMENDATION:

The staff recommends that the Commission provide the attached NRC report to the National Security Council, other Federal agencies, Congressional Oversight Committees, and the Japanese Science and Technology Agency.

COORDINATION:

The staff coordinated this paper with the Office of International Programs. The Office of the General Counsel has no legal objection to this paper. This paper does not raise any resource issues.

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- Attachments:
1. [NRC Evaluation of the Tokai Criticality Accident](#) 
 2. [Nuclear Safety Commission's "Urgent Recommendations - Interim Report," November 5, 1999](#) 
 3. [Nuclear Safety Commission's "A Summary of the Criticality Accident Investigation Committee," December 24, 1999](#) 
 4. [IAEA "Report on the Preliminary Fact Finding Mission Following the Accident at the Nuclear Fuel Processing Facility in Tokaimura, Japan," 1999](#) 
 5. [U.S. DOE "Trip Report of Visit to Tokyo and Tokai-mura, Japan on October 18-19, 1999](#) 