NUCLEAR REACTOR LABORATORY

AN INTERDEPARTMENTAL CENTER OF
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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J.A. BERNARD, JR.
Director of Reactor Operations

July 5, 1990

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
ATTN: Document Control Desk

Subject: Item of Information Concerning Presence of a Foreign Object in the Reactor Core Tank. Facility License No. R-37, Docket 50-20.

Gentlemen:

The Massachusetts Institute of Technology hereby forwards an item of information concerning the presence of a foreign object in the core tank of the MIT Research Reactor. The material contained in this item of information is not reportable under paragraph 7.13.2(d) of the Technical Specifications. Verbal notification of this item was made to both NRC Headquarters (Mr. Al Adams) and to Region I (Dr. Robert J. Bores) on 22 June 1990 and again on 25 June 1990.

The format and content of this report are based on Regulatory Guide 1.16, Revision 1.

1. Report No.: N/A (Item of Information only)

2a. Report Date: 6 July 1990

2b. Date of Item: 19-25 June 1990

3. Facility: MIT Nuclear Reactor Laboratory
138 Albany Street
Cambridge, MA 02139

4. Identification of Item: Upon completion of an approved maintenance action, a razor blade that had been used to trim gasket material was inadvertently knocked into the reactor core tank.

5. Conditions Prior to Item: The reactor was in a shutdown condition with the reactor top shield lid removed for maintenance. A port plug for use in an upcoming experiment was being trial-fitted. Reactor coolant flow was secured except for that needed for decay heat removal.

6. Description of Item: On 19 June 1990, a newly fabricated port plug was trial-fitted in the reactor's upper shield access ring. The reactor lid rests atop this ring and the lid was therefore removed. In order to insert the new plug, it was necessary to trim some gasket material that had been installed with the original port plug. This necessitated working directly over the open core tank. The work was successfully

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completed in accordance with standard procedures which include preventive measures designed to preclude the entry of foreign objects into the core tank. Upon completion of the trial fit, the tool (a razor blade) that had been used to trim the gasket was improperly placed on top of the upper shield access ring. At 0920, the blade was inadvertently knocked off the ring and into the core tank. The blade was observed to have entered and glided across the tank to the opposite side near the tank wall. It was then lost from view. The actions taken to locate the blade are described below. Reference to Figures 1 and 2 will be of use.

(a) Reactor coolant pumps (except for the decay heat removal pump) and the blade drive motors were tagged out.

(b) The interior of the core tank, the anti-syphon valves, and the natural circulation valves were inspected using high power binoculars.

(c) The top of the core was inspected as in (b) above and with backlighting using Cerenkov radiation. Had the blade lodged in a fuel channel, it would have appeared as a dark spot against the Cerenkov glow.

(d) Inspected fuel in the fuel storage ring which is located above the core.

(e) Verified that the blade was magnetic and purchased several high strength magnets.

(f) Dropped a number of blades into a test tank. It was observed that most drifted down along the tank wall. (Note: Given the presence of natural circulation flow in the MIT Research Reactor, this tendency for the blade to move along the tank wall would be enhanced in the actual reactor.)

(g) Searched the core tank interior and each fuel storage ring position with a magnet.

At this point a meeting of the Standing Subcommittee of the MIT Reactor Safeguards Committee was convened. The Subcommittee concurred in the following actions:

(h) Installed strainers in the suction to the primary coolant pumps and in the discharge lines from the core tank.

(i) Removed each fuel element from the core one at a time and inspected the region below each element.

(j) Defueled the central region of the core so as to create an unobstructed flow path through the core.

(k) Operated the reactor coolant pumps intermittently while inspecting the strainers.

(l) Operated the coolant pumps continuously for 12 hours. The negative result of this test indicated that the blade was not in the system flow path.

(m) Reinspected all fuel storage ring positions.

(n) Repeated step (i) above and in addition used a mirror to examine the bottom of each element.

(o) Began preparations to remove the fuel storage rings. It was suspected that the blade was in the narrow space between the core tank wall and the outer wall of the fuel storage ring. During the course of these preparations, the blade was retrieved from fuel storage position #27. This occurred at 1558 on 25 June. Storage ring position #27 had been checked on previous occasions but the blade had not been found at those times because of the geometry of the position that it had entered. On this occasion, a more powerful magnet was used and it rotated the blade so that it came out through the storage ring position. Refer to Figure 2.

7. Description of Apparent Cause of Item: The cause of this item was human error.

8. Analysis of Item: No damage occurred to the reactor. Moreover, even if the blade had become lodged in a fuel channel, no problem would have resulted because (1) the decay heat load is small and (2) the uranium-aluminum fuel plates have a high thermal conductivity. The concern had been that the blade might have entered the region below the core and, had reactor operation been resumed, blocked flow to several fuel channels.

9. Corrective Action: This item has been discussed with all licensed personnel, the reactor maintenance staff, and the reactor radiation protection personnel. Policies governing the use of small tools over the core tank are under review. It is anticipated that tethers or floatation devices will be required for tools of less than a certain dimension.

10. Failure Data: None

11. Additional Information: As discussed with Region I, an above average radiation level was detected in the strainer on the suction to the primary pumps. This occurred shortly after the start of the intermittent flow tests. Upon inspection of the strainer, a very tiny piece of colloidal type substance, possibly a metallic suspension containing cobalt-60, was found.

Sincerely,

Kwan S. Kwok
Superintendent
MIT Research Reactor

John A. Bernard, Ph.D.
Director of Reactor Operations
MIT Research Reactor

JAB/KSK:CRH

cc: MITRSC
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USNRC – Region I - Project Engineer, Reactor Projects Section 3A
USNRC – Senior Resident Inspector, Pilgrim Nuclear Station
USNRC – Project Manager, Standardization and Non-Power Project Directorate
USNRC – Region I - Section Chief, Effluent Radiation Protection Section

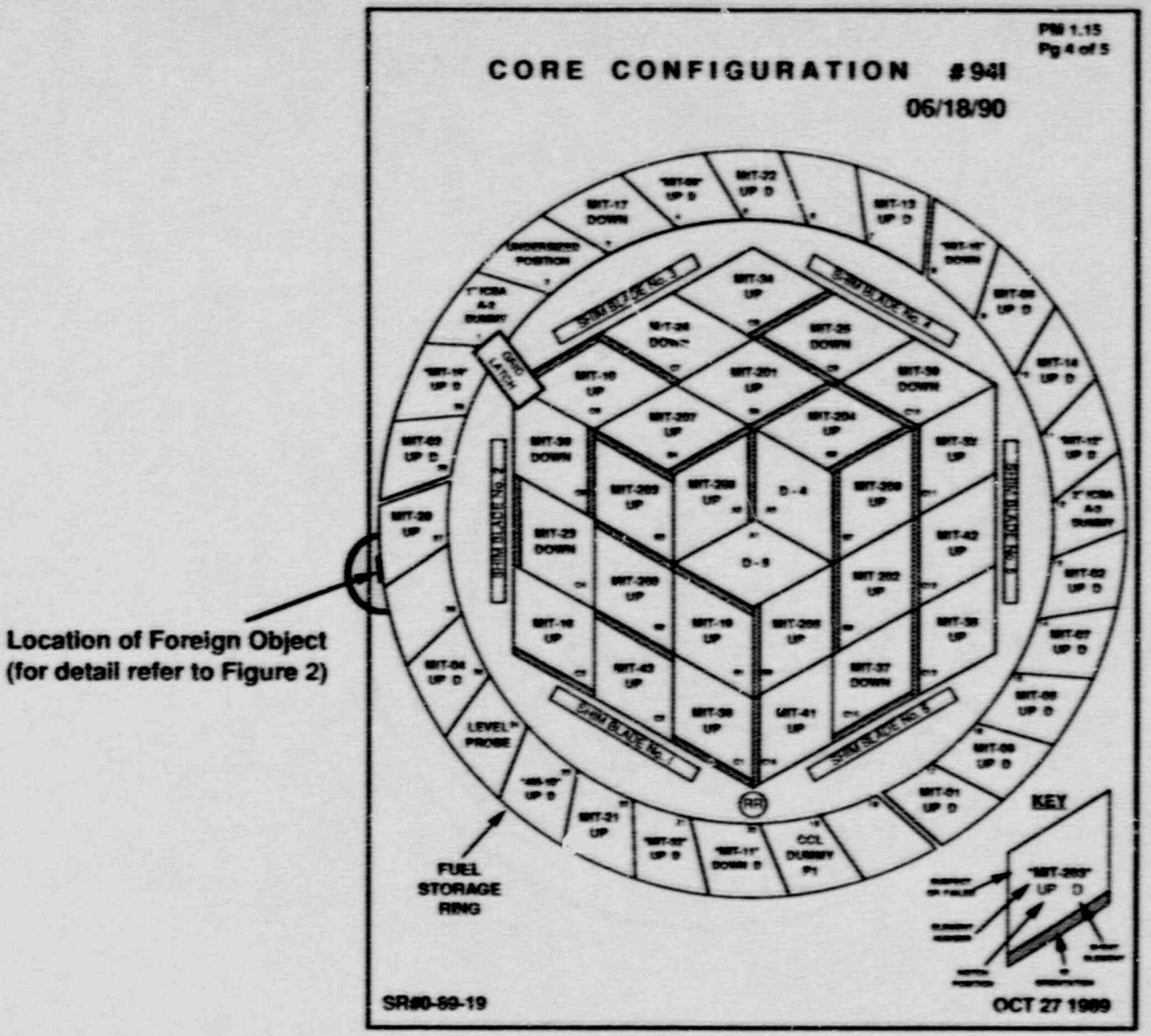

Figure 1 Horizontal Cross-Section of Core Showing Location of Foreign Object

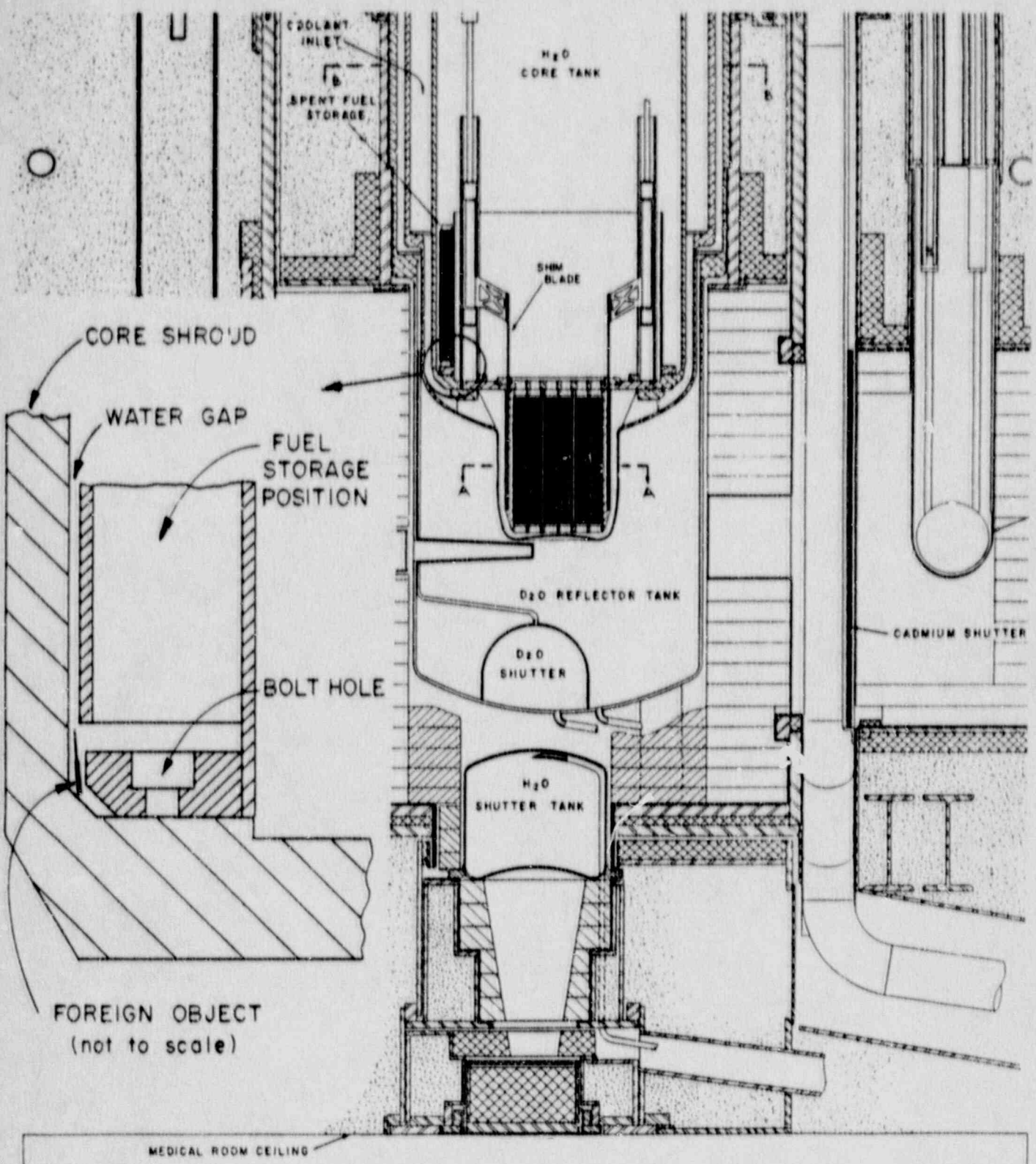

Figure 2 Vertical Cross-Section of MITR-II Showing Detail of Foreign Object Location