NUCLEAR REACTOR LABORATORY
AN INTERDEPARTMENTAL CENTER OF
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

O.K. HARLING
Director

138 Albany Street Cambridge, Mass. 02139
(617) 253-4202

L. CLARK, JR.
Director of Reactor Operations

August 17, 1982

Mr. Ronald C. Haynes, Administrator
U.S. Nuclear Regulatory Commission, Region #1
631 Park Avenue
King of Prussia, PA 19406

Subject: Low Levels of Fission Products in Primary Coolant,
License No. R-37, Docket No. 50-20

Dear Mr. Haynes:

The following report concerning a gradual and slight increase in the levels of fission products in the MIT Research Reactor primary system is being forwarded as a matter of information. It was initially reported to Region #1 by telephone on August 9, 1982.

There is nothing in the present situation to indicate a fuel element cladding failure of the type reported to USNRC on July 2, 1979 with a followup on November 26, 1980 (Reportable Occurrence Reports No. 50-20/79-4 and 79-4A). In fact there is relatively little evidence on which to conclude that the primary coolant activity is definitely from fission products penetrating the aluminum cladding as opposed to fission products from contaminant uranium on the surface of the fuel plates.

In Report #50-20/79-4, the circumstances of a cladding were described. It was indicated that gaseous fission products increased to 20-25% of the maximum permissible concentration (MPC) and that the responsible element was subsequently identified by sipping techniques and found to have a blister on one of the plates. The present situation is substantially different, at least until this date.

Fission product activity in the MITR primary coolant may be detected by several means during reactor operation:

1) a gamma monitor on the reactor outlet piping

2) a pancake G-M detector monitoring the core purge that sweeps across the top of the core tank at about 5 CFM before it is diluted in the 5000 CFM building ventilation exhaust

3) gaseous and particulate monitors that continuously monitor the 5000 CFM building exhaust including its 5 CFM core purge component.

IE 29

4) an analysis of primary coolant samples

5) analysis of samples from the core purge gas.

When the reactor is shut down, it is also possible to analyze water samples drawn from individual elements in the core or in the storage ring that surrounds the core (method #6).

Methods #1, 2 and 3 provide continuous monitoring, with #2 being the most sensitive to changes in the fission gas content of the primary. Methods #4 and 5 permit identification of the nuclides contributing to high readings on the monitors for methods #1-3, with method #5 being the most sensitive. Method #6, in 1979 when the fission product release rate to the primary coolant was significant, provided positive identification of the responsible element.

Since instrumentation for routine identification of fission products at low levels in the core purge samples became available, it has been possible to report quantitative data on fission product releases in the range of 1% of MPC or less. Annual reports for the MITR-II have contained the following data:

Fiscal Year	Fission Product Gases as % of MPC
1978	0.97%
1979	1.15
1980	NDA
1981	0.42

It is estimated that FY82, when the data is compiled in the next week or so, will run about 1% MPC. In recent weeks the level has approached 2%.

Weekly grab samples from the core purge show only a very gradual increase since last November, nothing that can be correlated with fuel changes or other activities. Sipping of elements in the core and in the storage ring on several occasions has provided inconclusive or contradictory results, except that element no. MIT-21 has been tentatively identified as possibly having a defect that could release detectable fission product gases. It was removed from the core on July 26th, but no significant reduction in fission gas release could be identified.

Element no. MIT-21 is also suspect because several scratches 1/4" long and up to 0.007" deep were found on one of the plates upon inspection of the element. No alpha activity could be detected at that time by means of wipes or a Zn S scintillation counter, and so it is believed that the cladding was not completely penetrated. For nominal core and clad thickness dimensions there would still be 0.010" aluminum between the scratch bottom and the core,

but fabricator inspection records indicate that the cladding may have been less than nominal at some points. When this element was first inserted in the core on March 25, 1982, additional sampling of the core purge and primary was performed as a precaution, but no additional activity could be detected.

A total of 21 elements made by the present fabricator have been used in the core to varying degrees of burnup. Three elements, with burnups now in the range 25-26%, have been in the core almost continuously since February 4, 1980, with no indication of abnormal performance.

The possibility of coolant contamination by tramp uranium on the surface of an element has been considered but seems unlikely, because there have been no significant activity increases concurrent with introduction of new elements into the core.

Investigation will continue in an effort to determine whether one or more individual elements are responsible for the comparatively high activity. The activity levels are so low, however, that positive identification may be difficult. The efforts to find the one or more responsible elements will probably include recycling into the core some or all of the elements removed in recent weeks, including no. MIT-21. The same criterion for operation with a possibly faulty element in the core as was stated in Report #50-20/79-4 will be observed, i.e. when the core purge monitor and grab samples indicate total fission product levels in excess of 10% of MPC, operation will not continue with the suspect element in the core.

Please contact me if you should desire additional information at this time. We shall be pleased to notify you of any significant developments that may result from our continuing investigation.

Sincerely,

Lincoln Clark, Jr.
Director of Reactor Operations

LC/sbs

cc: MITRSC
USNRC-OMIPC
USNRC-DMB