NUCLEAR REACTOR LABORATORY
AN INTERDEPARTMENTAL CENTER OF
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JOHN A. BERNARD
Director
Director of Reactor Operations
Principal Research Engineer

138 Albany Street, Cambridge, MA 02139-4296
Telefax No (617) 253-7300
Tel. No. (617) 253-4211

Activation Analysis
Coolant Chemistry
Nuclear Medicine
Reactor Engineering

October 15, 2002

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

Subject: Response to TAC No. MB3761, License No. R-37, Docket No. 50-20.

Gentlemen:

On 11/21/01, the Massachusetts Institute of Technology submitted a request to amend its operating license (R-37) to modify Fission Converter surveillance requirements and eliminate unnecessary procedures, in accordance with ALARA considerations. On 09/05/02, the U.S. Nuclear Regulatory Commission sent a request for additional information. Enclosed is our response to that request.

Please contact either of the undersigned should further information be required. This request has been reviewed and approved by the MIT Committee on Reactor Safeguards.

Sincerely,

Thomas Newton, P.E.
Reactor Engineer
MIT Nuclear Reactor Laboratory

John A. Bernard, Ph.D.
Director
MIT Nuclear Reactor Laboratory

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10-15-02 (Date) ____ Signature

JAB/gw

cc: USNRC - Senior Project Manager, NRR/ONDD
USNRC - Region I - Project Scientist, Effluents Radiation Protection Section (ERPS)+ FRSSB/DRSS

A020

Response to NRC request for additional information 9/5/02

1. Installation or repair of a level probe will result in the probe being placed in a non-adjustable position that will result in actuation at or above 2.1 m above the top of the fuel. Because of the probe's fixed position, a calibration requirement is not needed. All that is necessary to ensure proper operation is a functional check. The proposed TS has been modified (new provision 5) to make this explicit.

2. The float switch is bolted to the FC tank at 2.2 m above the top of the FC fuel. This determines the actuation position. Testing to date has shown no change in probe function. The functional test consists of insertion of pressurized helium into the annular space surrounding the float. This forces the coolant around the float to drop, thus activating the switch. When the helium supply is stopped, the helium is vented to the helium cover gas space of the tank, allowing the coolant around the float to rise to its normal level.

3. A loss of coolant in the FC tank during FC operation would result in loss of coolant to the intake of the coolant pumps, resulting in a low flow indication, as well as a reactor scram and CCS closure from loss of flow. A loss of coolant would also be indicated on a digital coolant level indicator. Also, it would result in increased radiation levels above the FC.

4. Removal of the tank top is very difficult and is done only when maintenance is required inside the tank. This has not happened in the two years that the tank has been in place. Functional testing of the probe with the tank lid removed is possible, but has no added advantage beyond the monthly functional check that is currently preformed.

5. Units in TS 6.6.2.6 have been changed to μS/cm.

6. Attached is a graph of H_2O and D_2O conductivity vs. pH from D. Barber and J.P. Van Berlo, "An Introduction to CANDU Chemistry," AECL CANDU, March 1994. It shows both H_2O and D_2O have similar shapes, with the D_2O conductivity slightly lower. Measurements of pH are made monthly. The data are close (i.e., within measurement error) to the calculated pH-conductivity curve for D_2O.

7. Conductivity of pure D_2O at pH 7 is about 0.013 μS/cm (0.0013 mS/cm). A measurement of 0.04 μS/cm would be a normal indication. Indications of conductivity below 0.013 μS/cm constitute the lower limit of sensitivity of the conductivity probe.

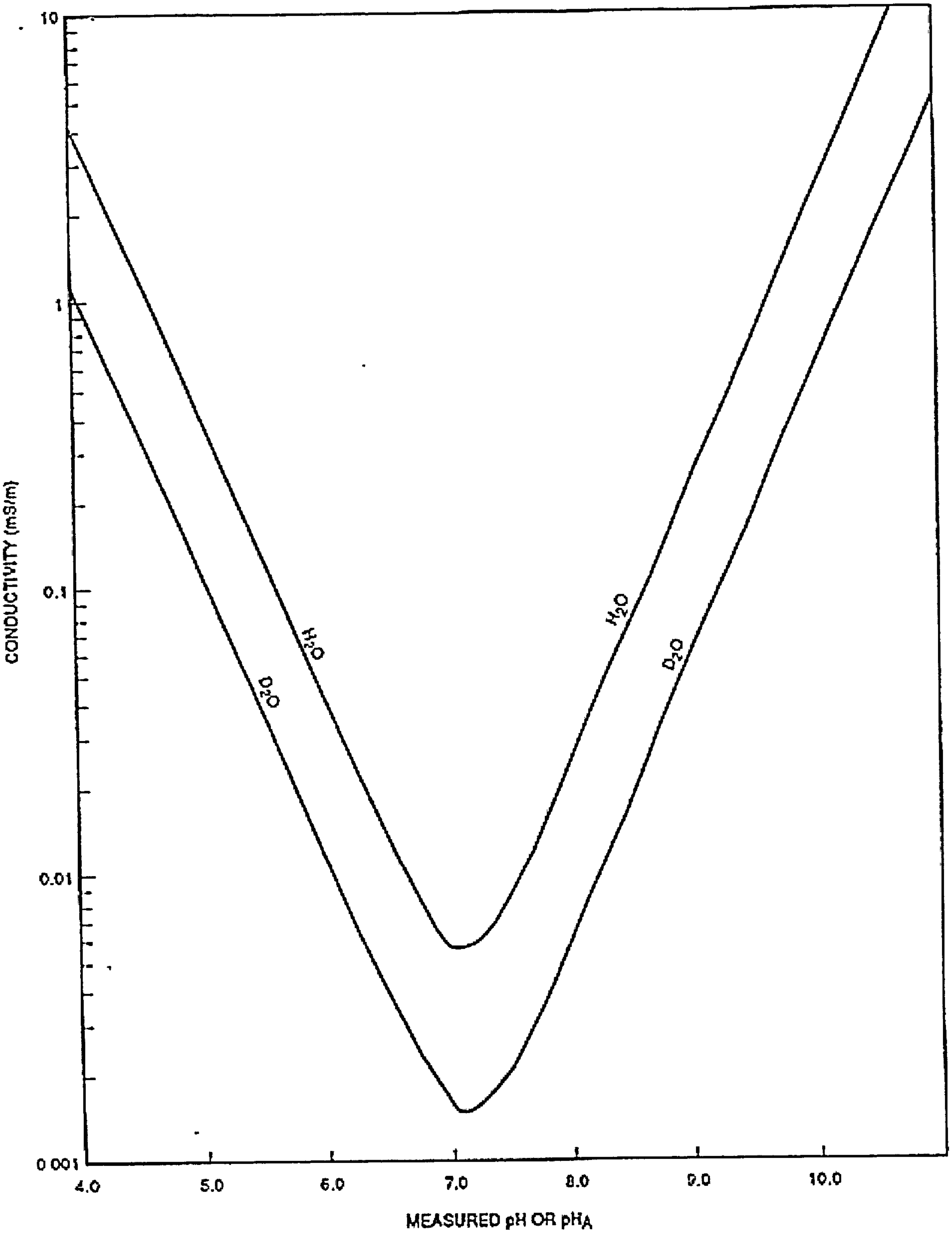

Figure 9-2

Theoretical Relationships for pH and pH_A to Specific Conductivity

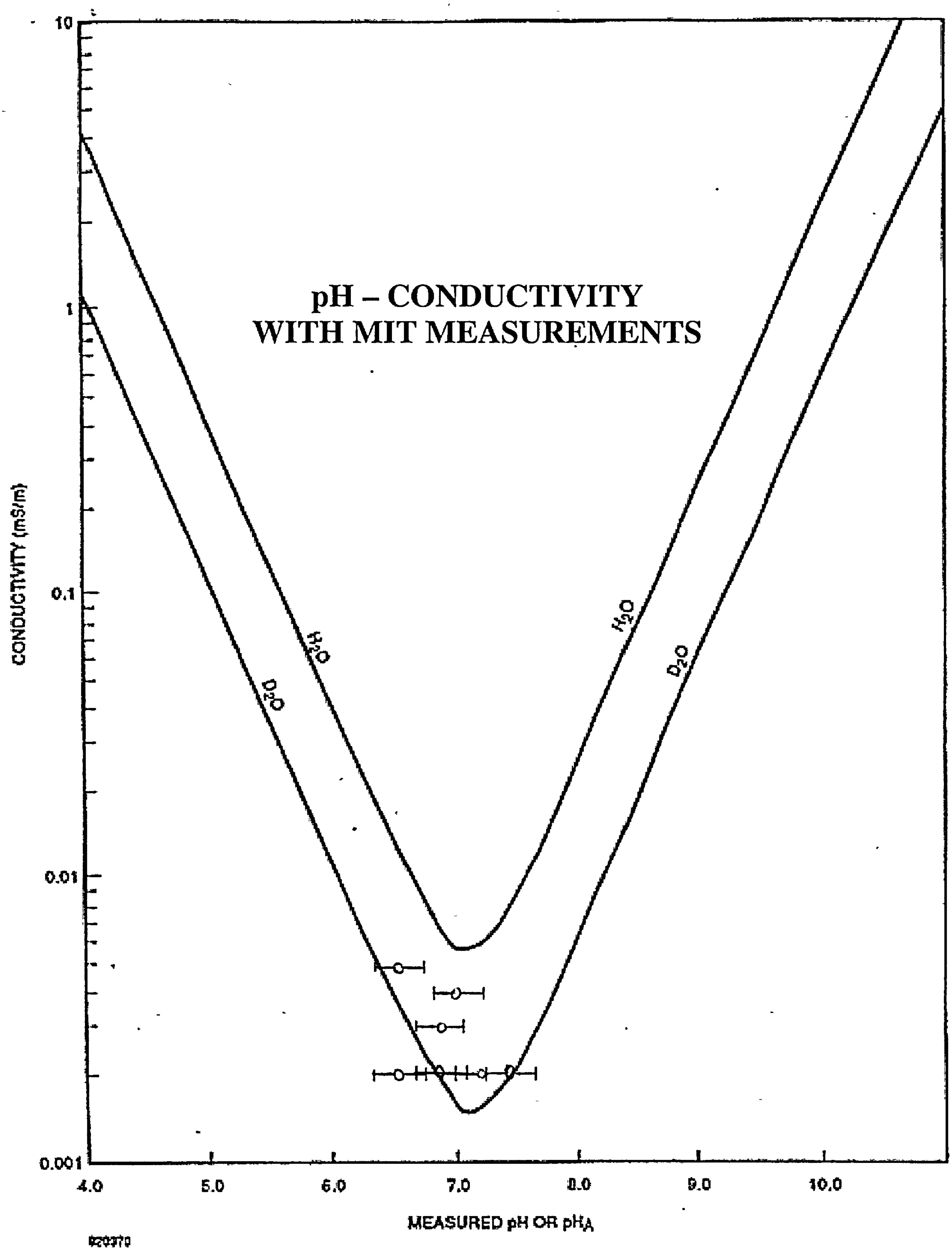

Figure 9-2

Theoretical Relationships for pH and pH_A to Specific Conductivity

a. Neutron flux level channel,

b. Primary coolant flow channel, and

c. Primary coolant outlet temperature channel.

3. The neutron flux level channel and a fission converter primary system heat balance shall be checked against each other at least annually and when design changes in the reactor and/or the fission converter are made that may affect the existing calibration result.

4. The gross β-γ activity of the fission converter primary coolant shall be determined at least monthly. The conductivity of the fission converter primary coolant shall be determined either by a continuous on-line instrument or a monthly sample. The pH of the fission converter primary coolant shall be measured monthly if the average conductivity exceeds 0.10 μS/cm. The tritium content of the coolant shall be determined quarterly if D_2O is used as the fission converter primary coolant.

5. The following instruments used in the fission converter shall be subject to a functional test when initially installed, any time that the instrument has been repaired, and at least annually:

   Fission Converter tank coolant level channel

Basis

The specification for functional tests, calibrations, and primary coolant sampling adhere to current MITR practice.

The annual frequency for performance of the calorimetric was chosen because the fission converter's power is a function of the MITR's power and the burnup of the fission converter fuel. The latter will occur very slowly. Hence, the annual performance of a calorimetric is sufficient to detect any change in fission converter power production.

Experience with the MITR primary and D_2O systems has shown that an out-of-specification chemistry condition is extremely rare. Heat fluxes present in the fission converter are too low to contribute to fuel cladding degradation in the event of out-of specification chemistry. Continued operation of the fission converter is thus permitted.

6.6.2.6 Fission Converter Primary Coolant Quality Requirements

Applicability

This specification applies to the pH, conductivity, and activity of the fission converter primary coolant.

Objective

To control corrosion of the fission converter fuel and primary coolant loop structure, and activation of impurities and leakage of fission products in the fission converter primary coolant.

Specification

1. The pH of the fission converter primary coolant shall be kept between 5.5 and 7.5, except as noted in provision (4) below.
2. The conductivity of the fission converter primary coolant shall be kept less than 5 μS/cm at 20°C, except as noted in provision (4) below.
3. Any gross ß-γ sample activity that exceeds the average of the previous monthly values (normalized by power) by a factor of three or more shall be investigated to determine the cause.
4. Operation of the fission converter with the pH or conductivity outside the limits given in (1) and (2) above is permitted provided:
    a. The pH is between 5.0 and 8.0,
    b. Any increase in conductivity is not the result of a chloride ion concentration in excess of 5 ppm,
    c. Sampling of the fission converter coolant is done at least once every eight hours, and
    d. The pH band specified in provision (1) is re-established with 48 hours,

    Otherwise, the fission converter shall not be operated.