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Activation Analysis
Coolant Chemistry
Nuclear Medicine
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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 10/15/02, the Massachusetts Institute of Technology submitted a response to the U.S. Nuclear Regulatory Commission request for additional information regarding the MIT request to amend its operating license (R-37) to modify Fission Converter surveillance requirements and eliminate unnecessary procedures, in accordance with ALARA considerations. The following are corrections to that response:

1. The unit conversion of item 7 in our response contained a typographical error. The correct statement should be "conductivity of pure D_2O at pH 7 is about 0.013 μS/cm (0.0013 mS/m)."

2. In our original submittal of 11/21/01, equation (3) of the attached memorandum contains an error. The correct equation should be:

$$\mu(\mathrm{pH}) = \lambda(H^+)x10^{-(\mathrm{pH})} + \lambda(OH^-)x10^{(\mathrm{pH}-14)} + \lambda\,(X^-)x(10^{-(\mathrm{pH})} - 10^{(\mathrm{pH}-14)}) \quad (3)$$

3. Given the slight differences in the pH – conductivity curves between D_2O and H_2O, the changes in specification 6.6.3.4 are proposed to be as follows: "The pH of the fission converter primary coolant shall be measured monthly if the average conductivity exceeds 0.10 μS/cm if H_2O is used as a coolant or 0.03 μS/cm if D_2O is used as a coolant."

Enclosed are the proposed changes to Technical Specification 6.6.3, as well as the changes to Technical Specification 6.6.2.6, as previously proposed. Please contact either of the undersigned should further information be required.

A020

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 12-10-02 _____
Date Signature

JAB/gw

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

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.

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 if H_2O is used as a coolant or 0.03 μS/cm if D_2O is used as a coolant. 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.