Proj. 702

FRAMATOME ANP

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Document Control Desk
ATTN: Chief, Planning, Program and Management Support Branch
U.S. Nuclear Regulatory Commission
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Interim Report of Evaluation of a Deviation Pursuant to 10 CFR 21.21(a)(2)

The following information is provided under 10 CFR 21 requiring that an interim report be submitted concerning any issue that cannot be resolved within 60 days of its discovery.

An interim report for an issue under evaluation by Framatome ANP Richland Inc. (FRA-ANP) is enclosed:

Interim Report No. 01-001 "Boron Dilution Analyses – Instantaneous Mixing and Dilution Front Models"

Those FRA-ANP customers potentially impacted by this issue are being provided a copy of this interim report.

Very truly yours,

Jerald S. Holm for

James F. Mallay, Director
Regulatory Affairs

/jap

Enclosure

cc: N. Kalyanam
J. S. Wermiel
Project No. 702

Framatome ANP Richland, Inc.

2101 Horn Rapids Road
Richland, WA 99352

Tel: (509) 375-8100
Fax: (509) 375-8402

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Interim Report (01-001)

Subject:

Interim report of evaluation of a deviation pursuant to 10 CFR 21.21(a)(2)

Title:

Boron Dilution Analyses – Instantaneous Mixing and Dilution Front Models

Identification of Basic Activity:

Calculation of the time to criticality for the boron dilution event (Standard Review Plan Event 15.4.6) for PWRs.

Basic Activity Supplied by:

Framatome ANP Richland, Inc. (FRA-ANP)

Nature of Deviation:

There are two models that may be used to analyze the boron dilution event in the FRA-ANP methodology: the instantaneous mixing model and the dilution front model. In the instantaneous mixing model the unborated water which is injected into the Reactor Coolant System (RCS) is assumed to mix instantaneously with an effective RCS volume. In the dilution front model the unborated water which is injected into the RCS is assumed to mix with the water at the injection point and then to move as a slug of water through the reactor core and then around the RCS piping back to the injection point.

In the instantaneous mixing model the change in the core boron concentration with time is continuous and homogeneous, corresponding to the increasing amount of dilution water entering the system. In the dilution front model the core boron concentration is a function of the location of the slug of dilution water as it passes through the core. The calculated time to criticality from the initiation of the boron dilution event will be about the same for both models for relatively high RCS flow rates but may be significantly different at very low RCS flow rates at the lower end of the flow range of the shutdown cooling system.

The FRA-ANP methodology for analyzing the boron dilution event for PWRs (ANF-84-73 Revision 5 Appendix B(P)(A)) states:

For operation of the shutdown cooling system (SDCS), primary coolant flow rates may be insufficient to assure a completely mixed primary coolant volume. If a completely mixed coolant volume cannot be assumed, then a dilution front approach is employed to evaluate the adequacy of margin to criticality.

The deviation is that the approach to determine which of the two models should be used for RCS flow rates that are moderately low has not been defined. That is, a quantitative criterion has not been established to define those conditions where the dilution front model is the more appropriate approach to use. The use of the instantaneous mixing model under conditions where the dilution front model is more appropriate may lead to a non-conservative prediction of the time to criticality for a boron dilution event.

Discovery Date:

February 26, 2001.

Corrective Actions to Date:

The issue was identified in Condition Report 9029, dated February 26, 2001.

A draft criterion has been developed to evaluate whether the RCS flow rate is sufficiently low that the dilution front model should be used. This criterion supports the use of the instantaneous mixing model for the current analyses where the instantaneous mixing model has been used.

The criteria is being further evaluated to determine its adequacy.

Evaluation Completion Schedule Date:

July 31, 2001.