NUCLEAR ENERGY INSTITUTE

Alexander Marion
DIRECTOR
ENGINEERING DEPARTMENT
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May 18, 2001

Dr. Brian W. Sheron
Associate Director for Project Licensing and Technical Analysis
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O5-E7
Washington, DC 20555-0001

SUBJECT: PWR Reactor Pressure Vessel Head Penetrations

PROJECT NUMBER: 689

Dear Dr. Sheron:

At an April 12, 2001, meeting, NEI and the Materials Reliability Program (MRP) agreed to provide the NRC staff an interim safety assessment on primary water stress corrosion cracking in PWR reactor head penetrations. The following enclosed reports (proprietary and non-propriety versions) and the associated affidavit completes this action.

- EPRI Report TP1001491, Part 2, *PWR Materials Reliability Program Alloy 600 Safety Assessment for US PWR Plants (MRP-44), Part 2: Reactor Vessel Top Head Penetrations*, (Proprietary), May 2001 (10 Copies)
- EPRI Report TP1001491 NP, Part 2, *PWR Materials Reliability Program Alloy 600 Safety Assessment for US PWR Plants (MRP-44), Part 2: Reactor Vessel Top Head Penetrations*, (Non-Proprietary), May 2001 (10 Copies)
- EPRI Affidavit (Enclosure 1)

These reports are provided for information, as part of industry's effort to address any generic implications of the PWR head penetration cracking that occurred at Oconee and ANO-1.

EPRI Report TP1001491, Part 2 contains proprietary information as discussed in the enclosed affidavit. The NRC is requested to withhold this report from public disclosure.

In an April 17, 2001, letter, you requested that the industry address several questions. The response to:

- Question 1.a, information describing the CRDM inspections performed to date, is provided in paragraph 4.3 and Table 4-1 of the report.
- Question 1.b, assessment of the circumferential flaws as they relate to those identified at Oconee, is provided in paragraph 4.2, section 5 and Figure 4-1 of the report.

- Question 1.c, information on the means utilized to detect and characterize through-wall cracks, is provided in sections 2 and 3 as a review of previously performed inspections. The interim safety assessment does not directly rely on volumetric of surface inspection methods.
- Questions 1.d and 1.e, operator actions, are addressed in section 6 and Appendix C.
- Question 2, postulated crack growth rate, is addressed in Enclosure 2 of this letter.

The report recommends that plants having fall 2001 refueling outages and considered to be within 10 effective full power years of Oconee, Unit 3, based on effective time at temperature, perform a visual inspection of the reactor vessel top head capable of detecting small amounts of leakage similar to that observed at Oconee and ANO-1. The nine plants in this grouping plan to perform the recommended inspection. Following the completion of these inspections and other MRP activities, the industry will assess the need for updating the report's recommendations.

This interim report, along with the interim report submitted on Alloy 82/182 pipe butt welds, is part of a comprehensive assessment of Alloy 600/82/182 materials in the primary system currently being conducted by the MRP. This assessment will be completed later this year, and will be used as part of industry's overall efforts to address this issue. We will keep you informed of our progress in this area.

As part of the ongoing MRP activities, a workshop on Alloy 600 issues is scheduled for June 13-14, 2001, in Atlanta, Georgia. The objective of the workshop is to update the industry on recent inspection results, CRDM repair methods, review lessons learned, and discuss near-term recommendations for Fall 2001 and Spring 2002 outages. The NRC staff is invited to attend the workshop and to present its perspective on the issue. A copy of the proposed workshop agenda and registration is provided in Enclosures 3 and 4.

If you have questions, please contact Kurt Cozens 202-739-8085, koc@nei.org or me.

Sincerely,

Alexander Marion

KOC/maa
Enclosures

c: Mr. Jack R. Strosnider, U. S. Nuclear Regulatory Commission (w/o reports)
Mr. Peter C. Wen, U. S. Nuclear Regulatory Commission (w/o reports)

Enclosure 1

POWERING PROGRESS THROUGH
SCIENCE AND TECHNOLOGY

EPRI

May 7, 2001

Document Control Clerk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Washington, DC 20555

Subject: "PWR Material Reliability Project, Interim Alloy 600 Safety Assessments for U.S. PWR Plants, Part 2: Reactor Vessel Top Head Penetrations," EPRI Report TP-1001491, Part 2, May 2001

Gentlemen:

This is a request under 10CFR2.790(a)(4) that the NRC withhold from public disclosure the information identified in the enclosed affidavit consisting of EPRI owned Proprietary Information identified above (the "Report"). Copies of the Report and the affidavit in support of this request are enclosed.

EPRI desires to disclose the Report in confidence to the NRC as a means of exchanging information with the NRC staff for the purpose of supporting generic regulatory improvements related to the management of the MRP Alloy 82/182 weld integrity. EPRI welcomes any discussion with the NRC regarding the Report that the NRC desires to conduct.

The Report is for the NRC's internal use and may be used only for the purposes for which it is disclosed by EPRI. The report should not be otherwise used or disclosed to any person outside the NRC without prior written permission from EPRI.

If you have any questions about the legal aspects of this request for withholding, please do not hesitate to contact me at (650) 855-2997. Questions on the contents of the Report should be directed to Mr. Al McIlree of EPRI at (650) 855-2092.

Sincerely,

Theodore U. Marston, Ph.D.
Vice President & Chief Nuclear Officer

Enclosures

c: Licensing

CORPORATE HEADQUARTERS
3412 Hillview Avenue | Palo Alto CA 94304-1395 USA | 650.855.2000 | Customer Service 800.313.3774 | www.epri.com

EPRI

AFFIDAVIT

RE: "PWR Material Reliability Project, Interim Alloy 600 Safety Assessments for U.S. PWR Plants, Part 2: Reactor Vessel Top Head Penetrations," EPRI Report TP-1001491, Part 2, May 2001

I, THEODORE U. MARSTON, being duly sworn, depose and state as follows:

I am a Vice President at the Electric Power Research Institute ("EPRI") and I have been specifically delegated responsibility for the report listed above that is sought under this affidavit to be withheld (the "Report") and authorized to apply for their withholding on behalf of EPRI. This affidavit is submitted to the Nuclear Regulatory Commission ("NRC") pursuant to 10 CFR 2.790 (a)(4) based on the fact that the Report consists of trade secrets of EPRI and that the NRC will receive the Report from EPRI under privilege and in confidence.

The basis for withholding such Report from the public is set forth below:

(i) The Report has been held in confidence by EPRI, its owner. All those accepting copies of the Report must agree to preserve the confidentiality of the Report.

(ii) The Report is a type customarily held in confidence by EPRI and there is a rational basis therefor. The Report is a type, which EPRI considers as a trade secret(s) and is held in confidence by EPRI because to disclose it would prevent EPRI from licensing the Report at fees, which would allow EPRI to recover its investment. If consultants and/or other businesses providing services in the electric/nuclear power industry were able to publicly obtain the Report, they would be able to use it commercially for profit and avoid spending the large amount of money that EPRI was required to spend in preparation of the Report. The rational basis that EPRI has for classifying this/these Report(s) as a trade secrets is justified by the Uniform Trade Secrets Act, which California adopted in 1984 and which has been adopted by over twenty states. The Uniform Trade Secrets Act defines a "trade secret" as follows:

> "Trade secret" means information, including a formula, pattern, compilation, program, device, method, technique, or process, that:
>
> (1) Derives independent economic value, actual or potential, from not being generally known to the public or to other persons who can obtain economic value from its disclosure or use; and
>
> (2) Is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

(iii) The Report will be transmitted to the NRC in confidence.

(iv) The Report is not available in public sources. EPRI developed the Report only after making a determination that the Report was not available from public sources. It required a large expenditure of dollars for EPRI to develop the Report. In addition, EPRI was required to use a large amount of time of EPRI employees. The money spent, plus the value of EPRI's staff time in preparing the Report, show that the Report is highly valuable to EPRI. Finally, the Report was developed only after a long period of effort of at least several months.

(v) A public disclosure of the Report would be highly likely to cause substantial harm to EPRI's competitive position and the ability of EPRI to license the Report both domestically and internationally. The Report can only be acquired and/or duplicated by others using an equivalent investment of time and effort.

I have read the foregoing and the matters stated therein are true and correct to the best of my knowledge, information and belief. I make this affidavit under penalty of perjury under the laws of the United States of America and under the laws of the State of California.

Executed at 3412 Hillview Avenue, Palo Alto, being the premises and place of business of the Electric Power Research Institute:

May 7, 2001

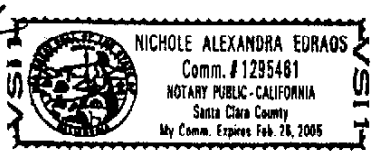
Theodore U. Marston

Subscribed and sworn before me this day: May 7, 2001

Nichole Alexandra Edraos

~~Sumi Yamashita,~~ Notary Public

Nichole Edraos



ENCLOSURE 2

RESPONSE TO NRC QUESTION 2

This response addresses Question 2 of the NRC letter (1), which states:

> *Postulated crack growth rates (CGR) were discussed during the April 12, 2001, meeting. Based on the staff's comments regarding the likelihood for an exceptionally aggressive operating environment in the CRDM housing annulus, where potentially highly concentrated borated primary water could become oxygenated, discuss the acceptability of your CGR model, and conditions under which the model was developed consistent with the conditions to which it is being applied. Include a technical basis for this CGR, including postulated times it will take to initiate and grow a through-wall crack, and the environmental factors (e.g., temperature, boron concentrations, oxygen levels, etc.) that will effect this CGR. Based on this proposed CGR, identify the frequency and scope of inspections that would be necessary to detect a circumferential flaw before it could exceed the critical size for failure of the CRDM penetration.*

Conclusive data does not currently exist to properly characterize crack growth rates of the Alloy 600 tubing material in the annular region above the J-groove weld. Some data from EdF (2) suggests that higher concentrations of boric acid, coupled with other contaminents, can cause higher crack growth rates in laboratory specimens, but the relation of this work to the environment in the head penetration annular region is unknown. Because of this, the industry interim safety assessment does not rely exclusively on crack growth rate assumptions as the basis for its conclusions.

The EPRI Materials Reliability Program is participating in several domestic and international activities to better characterize the causal factors of crack initiation and growth of the Alloy 600 penetration material, as well as the Alloy 82/182 weld material. To this end, the MRP plans to convene a panel of experts to assess available crack initiation and growth data, and to develop recommendations regarding appropriate future laboratory tests, including consideration of leakage into the annular region. We will keep the NRC informed of actions in this area.

Reference (1): Letter dated April 17, 2001 from Brian W. Sheron of NRC to Alex Marion of NEI, *Issues to be Addressed in a Generic Justification for Continued Operation of PWRs*

Reference (2): P. Berge, et al., "Chloride Stress Corrosion Cracking of Alloy 600 in Boric Acid Solutions, *Proceedings of the Eighth International Symposium on Environmental Degradation of Materials in Nuclear Power Systems - Water Reactors*, pages 189-199, ANS, 1997

Industry Workshop on MRP Alloy 600 Issue Task Group
June 13-14, 2001
Renaissance Concourse Hotel, Atlanta, Georgia

Preliminary Agenda

Workshop Objective: To update the industry on recent inspection history and repair of CRDM penetration cracking issues, discuss "lessons learned," and discuss near-term recommendations for fall 2001 and spring 2002 Outages.

Wednesday, June 13, 2001

7:30 am Registration and Continental Breakfast

8:00 am **Session I: Overview**
- Industry Overview on CRDM Head Penetration Cracking
  - Initial Experiences that lead to GL 97-01
  - Oconee Units 1,2 and 3 History
  - ANO #1 History
- EPRI MRP Alloy 600 Issue Task Group Activities
- Safety Assessment Key Results
  - Framatone ANP
  - Westinghouse Combustion Engineering

9:30 am BREAK

10:00 am **Session II: Utility Experiences & Lessons Learned**
- Oconee
- ANO
- Robinson (insulation removal)

12:00 Noon LUNCH

1:00 pm **Session II: Utility Experiences & Lessons Learned 82/182 Butt Welds**
- VC Summer
- Spring 10 Year ISI Results
- Survey Results

3:00 pm BREAK

3:30 pm **Session III: Vendor Insight into Inspection and Repair Practices**
- WesDyne
- Framatome
- GE

5:00 pm Adjourn

Thursday, June 14, 2001

7:30 am Continental Breakfast

8:00 am **Session IV: MRP Issue Task Group Committee Reports**
- NRC Perspective
- Assessment Committee
- Inspection Committee
- Repair/Mitigation

10:00 am Break

10:30 am **Session V: Future Outlook**
- Implementation of Near-term Recommendations
- Prepare for the Unknown

11:00 am **Open Discussion & Wrap up**

12:00 Noon **Workshop Adjourns**

ELECTRONIC REGISTRATION FORM

Industry Workshop on Alloy 600

June 13-14, 2001
Renaissance Concourse Hotel
Atlanta, Georgia

Name

Title

Organization

Address

City/State/Zip _____ Country

Telephone _____ Fax _____ E-mail

PLEASE CHECK THE APPROPRIATE BOX:

☐ Yes, I will attend the Workshop

☐ Check here if you have a disability and require special accommodations to fully participate

Do you have any special dietary requirements? If so, explain:

E-mail this registration form to Susan Otto-Rodgers, sjotto@epri.com, or fax to 1-704-547-6168