50-220

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 15, 1995

LICENSEE: Niagara Mohawk Power Corporation

FACILITY: Nine Mile Point Nuclear Station Unit No. 1

SUBJECT: MEETING SUMMARY - MEETING BETWEEN NIAGARA MOHAWK POWER CORPORATION AND THE NRC TO DISCUSS PLANT-SPECIFIC CHARPY SHIFT MODEL FOR NINE MILE POINT NUCLEAR STATION UNIT NO. 1 (TAC NO. M90288)

On October 19, 1995, the NRC staff met with representatives of the Niagara Mohawk Power Corporation (NMPC) to discuss the methodology employed by NMPC in their proposal to revise Pressure/Temperature (P/T) limits. The proposal to revise P/T limits was submitted September 1, 1994, and disapproved by the NRC staff in a letter dated September 22, 1995. Attendance at the meeting is listed in Enclosure 1. The licensee's summary of the information presented at the meeting was submitted in a letter dated November 15, 1995, and is provided in Enclosure 2.

The purpose of the meeting, requested by the licensee, was to focus on the technical issues regarding the P/T limits submittal, and to discuss the basis for denial of the amendment. The licensee described the Charpy shift model, and presented details that led to the model's refinement. The model pertains solely to plates since Nine Mile Point Nuclear Station Unit No. 1 (NMP1) is a plate limited plant. The extensive literature searches and mechanistic studies that went into understanding the proposed model were discussed.

The main issues on which the licensee and the NRC have differing opinions are the standard deviation that should be used with the model, and the dependence of copper (Cu) in neutron radiation embrittlement. The standard deviation (σ_Δ) for the model is 32 °F. The licensee proposed to use the Regulatory Guide (RG) 1.99, Revision 2, value of 17 °F. The NRC staff commented that the standard deviation for the proposed model is much larger than the RG value, and the (σ_Δ) resulting from the model should be used. The licensee stated that the large scatter in the data is due to the nature of the Charpy test (i.e., uncertainty in the fracture test is the sole source of the scatter). The staff pointed out that several other factors, including fluence and chemistry, contribute to scatter and cannot be ignored.

The licensee could not see a Cu trend in the data graphed in the staff's Safety Evaluation (SE). New Atom Probe-Field Ion Microscopy (APFIM) data was presented in support of the model, specifically the lack of Cu dependence on embrittlement for low fluences. The licensee also stated that the NUREGs referenced in the staff's SE are not applicable since the fluences used in the studies were higher than fluences that NMP1 will experience. The licensee

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concluded by stating that all micro and macro mechanisms studied suggested that there is no Cu trend for the fluence range that is applicable for the model.

At the conclusion of the meeting:

a) The licensee was complimented on the extensive mechanistic and literature reviews that were conducted in support of the model.

b) The standard deviation to be used with the model and the Cu dependence were still characterized by NRC staff as a problem. The licensee was told that they had not made a compelling case for the lack of Cu dependence for their model.

c) The point was made that new data could be acquired; however, it may not change the conclusion. In addition, if the conclusion does change, it may change in the negative direction.

Suggestions as to possible actions that the licensee can take as a result of this meeting included doing a more rigorous assessment of the data to show that they fit the model. It was also suggested that the standard deviation may not go down with the addition of more data, which reinforces the need for a rigorous assessment of the data that exist. An important point was made with regard to the conclusions drawn by the licensee from the analysis of the data. Specifically, the NRC staff feels that the licensee should not take the trend line from a proposed model and apply the RG standard deviation. The staff mentioned that the Office of Research is currently assessing a potential revision to RG 1.99, and that behavior at low fluence is an issue that will be addressed in the revision.

G E Edison

Gordon E. Edison, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket No. 50-220

Enclosures: 1. List of Attendees
2. Summary of Presentation

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LIST OF ATTENDANCE

10/19/95 MEETING

WITH NIAGARA MOHAWK POWER CORP.

NAME	ORGANIZATION
GORDON EDISON	NRC
MICHAEL P. MANAHAN, SR.	MPM RESEARCH AND CONSULTING
B. RALPH SYLVIA	EXEC V.P NIAGARA MOHAWK
CARL TERRY	V.P NUCLEAR ENG NIAGARA MOHAWK
W. DAVID BAKER	LICENSING SUPVR NIAGARA MOHAWK
DENISE WOLNIAK	LICENSING MANAGER NIAGARA MOHAWK
BILL YAEGER	MGR NMP1 ENGRG - NMPC
GARY WILSON	MANAGING COUNSEL - NMPC
GEORGE INCH	NMPC NUCLEAR ENGINEERING
CHING H. CHIEN	NIAGARA MOHAWK
SHAH N. MALIK	NRC/RES/EMMEB
ANDREA LEE	NRC/EMCB
JACK STROSNIDER	NRC/EMCB
KEITH WICHMAN	NRC/EMCB
CINDI CARPENTER	NRC/EDO
BARRY NORRIS	NRC/REGION I/DRP
BARRY ELLIOT	NRC/EMCB
ED HACKETT	NRC/EMCB
GLENN DENTEL	NRC/EMCB
CATHERINE MARCO	NRC/OGC
L. B. MARSH	NRC/DRPE
JOHN A. ZWOLINSKI	NRC/DRPE

Enclosure 1

ATTACHMENT A

TECHNICAL BASIS FOR THE DEVELOPMENT OF THE NMP-1 PLANT-SPECIFIC CHARPY SHIFT MODEL (SUMMARY)

This presentation documents the development of a plant-specific Charpy shift model for Nine Mile Point Unit 1 (NMP-1). The plant-specific model is physically based and incorporates the important microstructural damage mechanisms which are now known and well understood. At fluences below $\sim 2 \times 10^{18}$ n/cm^2 (typical Boiling Water Reactor (BWR) end-of-license (EOL) fluence), it is shown that there is no correlation of yield strength elevation or Charpy shift with bulk Cu content for the NMP-1 beltline materials. The analyses and data trends demonstrate that most BWRs operate below the fluence threshold for significant Cu precipitation. This results in a different functional form for the Charpy shift (ΔT_{30}) model than currently used in Regulatory Guide 1.99 (Revision 2) (RG1.99(2)). The Nuclear Regulatory Commission (NRC) model was based primarily on high fluence Pressurized Water Reactor (PWR) data and there were very few surveillance data available in the BWR range when the NRC model was developed. Matrix damage is expected to be the primary damage component for BWRs. Since neutron induced defects are predominantly shearable defects, the Charpy shift has been shown to be proportional to the square root of fluence.

Based on knowledge of the important radiation damage mechanisms operating in the NMP-1 reactor pressure vessel (RPV) steel, criteria were established for defining the NMP-1 plant-specific data set from the larger NRC Power Reactor-Embrittlement Data Base (PR-EDB). Application of these criteria to the PR-EDB resulted in a data set containing 37 power reactor surveillance data points in addition to the 3 from NMP-1. Regression analyses yielded an accurate linear model of ΔT_{30} as a function of the square root of fluence. Application of the plant-specific model to NMP-1 will reduce the leakage/hydrostatic test temperature by $\sim 41°F$. This will reduce the in-service leak test duration by approximately eight hours for each future startup. In addition, outage scheduling flexibility will be increased as a result of the in-service leak tests being conducted below 212°F.

concluded by stating that all micro and macro mechanisms studied suggested that there is no Cu trend for the fluence range that is applicable for the model.

At the conclusion of the meeting:

a) The licensee was complimented on the extensive mechanistic and literature reviews that were conducted in support of the model.

b) The standard deviation to be used with the model and the Cu dependence were still characterized by NRC staff as a problem. The licensee was told that they had not made a compelling case for the lack of Cu dependence for their model.

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Original signed by:

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Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

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