



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

February 18, 2016

MEMORANDUM TO: Istvan Frankl, Branch Chief
Corrosion and Metallurgy Branch
Division of Engineering
Office of Nuclear Regulatory Research

FROM: Greg Oberson, Materials Engineer */RA/*
Corrosion and Metallurgy Branch
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: Letter to Electric Power Research Institute on the use of Periodic
Partial Unloading Data by the Primary Water Stress Corrosion
Cracking Expert Panel

Attached to this memorandum is a letter that I transmitted to my counterpart at the Electric Power Research Institute (EPRI), Mr. Paul Crooker, concerning the Primary Water Stress Corrosion Cracking (PWSCC) Expert Panel. The terms of agreement between the Office of Nuclear Regulatory Research and EPRI on the PWSCC Expert Panel activities are set forth in an addendum to the Memorandum of Understanding on "Cooperative Nuclear Safety Research," entitled "Primary Water Stress Corrosion Expert Panel Activities," (ML14279A001) which covers the period from November 5, 2014 until September 30, 2016.

The purpose of sending the letter to Mr. Crooker was to document my observations and provide some recommendations concerning the use of periodic partial unloading (PPU) data by the PWSCC Expert Panel. As discussed by in the letter, this is an issue on which it has been challenging for the panelists to reach a consensus position, with the majority in favor of excluding the ranking and scoring of PPU data, and a minority suggesting that it may be appropriate to score the data in some cases. The recommendations communicated in this letter propose that panelists or observers may request that certain PPU data be ranked and scored, provided that a strong technical basis can be provided to describe their correlation with constant load test data. The letter also acknowledges that EPRI may choose whether or not to follow the recommendations. In either case, NRC will continue to observe the Expert Panel deliberations and ultimately make an independent determination on the use of the PPU data at such time as the final Expert Panel product is submitted to NRC for review.

Any Inquiries regarding the PWSCC Expert Panel should be directed to Greg Oberson at Greg.Oberson@nrc.gov or (301) 415-2183.

Enclosure:
Letter from G. Oberson (RES) to
P. Crooker (EPRI), dated February 12, 2016

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February 12, 2016

Mr. Paul Crooker
Principal Technical Leader, Materials Reliability Program
Electric Power Research Institute
3420 Hillview Avenue
Palo Alto, CA 94304

Dear Mr. Crooker,

I'm addressing this letter to you with regard to a technical issue currently under consideration by the Primary Water Stress Corrosion Cracking Expert Panel. I would like to begin by commending you, your contractors at Dominion Engineering, Inc., and the panelists themselves for the excellent progress towards achieving the goals set forth when the Panel was chartered. The benefits of clear communication and coordination, as envisioned in the Memorandum of Understanding for this activity, have been apparent to me throughout this process. The issue to which I am referring is the ranking and scoring of periodic partial unloading (PPU) crack growth rate data by the Data Evaluation Group of the Expert Panel. This is one of the most challenging deliberations that the Expert Panel has encountered, and I recognize strongly held positions by a number of members. Nevertheless, I feel that one aspect of my role as an observer is to provide you my thoughts about how decisions made now could affect the U.S. Nuclear Regulatory Commission (NRC) review of the eventual Expert Panel product and, when possible, to provide recommendations that could bring better alignment between the respective parties.

As the Expert Panelists have already thoroughly documented their technical positions in several of the previous meetings, and in written correspondence, I will not attempt to restate those in detail here. In short, the primary disagreement concerns whether, in some cases, PPU crack growth rate data should be ranked and scored by the Data Evaluation Group, according to a similar approach as used for the constant load data. This would follow the precedent from the Materials Reliability Program (MRP) reports MRP-55 and -115, where PPU data meeting certain test criteria were included in the disposition curves for Alloys 600, 82, and 182. It has been suggested that sometimes PPU data may give a better measure of the crack growth rate than constant load data because of off-plane cracking, low engagement, or other phenomena that are not readily identified by direct current potential drop (DCPD) instrumentation in constant load. It is not thought that all PPU data should be ranked and scored, but it may be justified on a test-by-test basis. The majority position of the panel, however, is that a periodic load cycle could artificially accelerate the crack growth rate in Alloys 690, 52, and 152, in a manner which is not representative of the constant load response. The Panelists believe that this effect is much more significant at the very low crack growth rates measured for the resistant materials than it is for Alloys 600, 82, and 182. Further, because the degree of acceleration seems to vary from test to test, no well-founded technical model has yet been developed to justify the correlation between the crack growth rate measured by PPU and that expected under constant load.

While I respect the majority vote of the Expert Panel and understand the underpinning rationale, I feel it prudent to let you know that when NRC staff reviews the final Expert Panel product, we will independently determine whether and how PPU data should be considered in the context of evaluating crack growth in Alloys 690, 52, and 152. If there are divergent opinions articulated by the Panelists, NRC is obligated to weigh the merits of each to ultimately reach a regulatory decision. That being said, before closing any further deliberation on the use of PPU data, I have

a set of recommendations which I hope might form the basis of a compromise position to which all of the Expert Panel members could agree. I believe that these preserve the intent and integrity of the majority opinion while also acknowledging the concerns that have been raised. The recommendations are as follows:

1. Permit a panelist or observer to present PPU data to the Expert Panel and request that it be ranked and scored.
2. Give an opportunity to the individual to provide to the Expert Panel their reasoning for requesting that the data be ranked and scored, as well as his/her interpretation of the PPU data, including an explanation of factors that would influence the correlation of the PPU data with constant load data.
3. Direct the Data Evaluation Group to rank and score the PPU data using, to the extent practicable, the same criteria that were applied to constant load data.
4. Provide the Data Applications Group with sufficient information to support the rationale for ranking and scoring the PPU data, such that it could be given appropriate consideration for their activities.

Following these recommendations could afford a number of benefits. First, the level of additional effort for the Expert Panel should be much less than if all PPU data were required to be ranked and scored. By considering the data on a test-by-test basis, and only then at the discretion of the panelist or observer, I envision that the amount of work that this entails could be rather limited. Second, I believe that the PPU data of greatest interest are likely to be associated with tests where there is the greatest uncertainty in the interpretation of the test results, for instance where it seems that the crack growth rate measured by DCPD is difficult to rationalize based on the extent of crack growth measured on the fracture surface or the crack morphology. If the constant load crack growth rates for a specimen are scored poorly by the Expert Panel, the PPU data may be an appropriate substitute if they are determined to be reliable. Finally, for specimens or testing conditions where there are a lack of constant load data, the consideration of PPU data may increase the statistical confidence of the analysis.

To be clear, I am making these recommendations only in my role as an observer to the Expert Panel, and they may be considered at your discretion. Regardless of how you decide to proceed, I'll continue to observe the deliberations and, as stated above, NRC will ultimately make an independent determination on the use of the PPU data at such time as the final Expert Panel product is submitted to NRC for review. Should any part of this letter be unclear, or if you feel the need for further discussion, please feel free to contact me at your convenience. Your attention to these recommendations prior to the next meeting of the Data Evaluation Group is kindly requested.

Sincerely,

/RA/

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