BWRVIP BWR Vessel & Internals Project 2001-040

February 19, 2001

Document Control Desk
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Attention: C. E. Carpenter

Subject: Request for NRC Approval of an Interim Crack Growth Rate of 2.5 x 10^{-5} in/hr for Nickel Base Austenitic Alloys in BWR Plants Under Hydrogen Water Chemistry (HWC) and Noble Metal Chemical Application (NMCA) Conditions

References:
1. Letter from J. R. Strosnider (NRC) to Carl Terry (BWRVIP Chairman), "Final Safety Evaluation of the BWR Vessel and Internals Project, BWR Shroud Support Inspection and Flaw Evaluation Guidelines (BWRVIP-38), EPRI Report TR-108823 (TAC No. M99638)," dated July 24, 2000.
2. "BWR Vessels and Internals Project, Evaluation of Crack Growth in BWR Nickel Base Austenitic Alloys in RPV Internals (BWRVIP-59)," EPRI Report TR-108710, December 1998.
3. "BWR Vessels and Internals Project, Technical Basis for Inspection Relief for BWR Internal Components with Hydrogen Injection (BWRVIP-62)," EPRI Report TR-108705, December 1998.
4. Letter from Carl Terry (BWRVIP Chairman) to Document Control Desk (NRC), "Response to NRC Request for Additional Information on BWRVIP 59," dated December 4, 2000.
5. Letter from Carl Terry (BWRVIP Chairman) to Document Control Desk (NRC), "Project No. 704 -- BWRVIP Response to the NRC Final Safety Evaluation of BWRVIP-14," dated July 11, 2000.

Summary

The NRC final safety evaluation (SE) for BWRVIP-38 (Reference 1) specifies a conservative bounding crack growth rate of 5 x 10^{-5} in/hr for nickel base austenitic alloys for normal plant operating conditions pending NRC review of BWRVIP-59 (Reference 2). The BWRVIP requests NRC approval to permit use of an interim crack growth rate of 2.5 x 10^{-5} in/hr in the depth direction for nickel base austenitic alloys under Hydrogen Water Chemistry (HWC) and Noble Metal Chemical Application (NMCA) conditions. This would only be applicable when the electrochemical potential (ECP) is equal to or less than –230 mV, SHE, and when hydrogen water chemistry availability is equal to or greater than 80%. Use of this reduced crack growth rate will allow utilities to effectively manage potential cracking problems in nickel base austenitic alloy components in BWR vessel internals during upcoming near-term outages without unnecessary

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conservatism in the crack growth evaluation and unnecessary radiation exposure. The technical basis for this request is provided below.

Technical Basis

Environmental conditions (ECP and conductivity) can have a significant effect on the crack growth rate of nickel base austenitic alloys. These issues have been extensively investigated by the BWRVIP and are documented in BWRVIP-59 (Reference 2) and BWRVIP-62 (Reference 3). BWRVIP-59 was submitted to the NRC in December 1998. A NRC Request for Additional Information (RAI) on BWRVIP-59 was issued in November 1999. The BWRVIP provided a response to the NRC RAI on BWRVIP-59 in December 2000 (Reference 4). BWRVIP-62 was also submitted to the NRC in December 1998. The NRC issued a Safety Evaluation (SE) of BWRVIP-62 on January 30, 2001. The BWRVIP is preparing a response to this SE and will discuss this subject at a meeting with the NRC scheduled for March 20, 2001.

Crack growth rates for nickel base alloys under various BWR environmental conditions were developed in BWRVIP-59. In particular, Figure 5-7 of BWRVIP-59 (attached herein as Figure 1) shows that under HWC/NMCA conditions, the maximum crack growth rate is 5×10^{-6} in/hr. This is significantly lower than the proposed interim crack growth rate of 2.5×10^{-5} in/hr.

In BWRVIP-62, it was shown that a vessel internals inspection program can be developed based on factors of improvement (FOI) for plants that have implemented either HWC or NMCA. The FOI are based on crack growth modeling and are a function of HWC availability and ECP. In particular, Figure 4-2 for BWRVIP-62 (attached herein as Figure 2) shows that for HWC availability of 80% and ECP of -230 mV, SHE, the FOI is greater than two (2). This supports at least a factor of two (2) reduction in the bounding crack growth rate of 5.0×10^{-5} in/hr specified in Reference 1.

This FOI approach is consistent with the July 11, 2000 BWRVIP response to the NRC final Safety Evaluation of BWRVIP-14 (Reference 5) wherein the BWRVIP proposed the application of a factor of two (2) reduction in the BWRVIP-14 K-independent crack growth rate as an interim crack growth rate applicable to Stainless Steel for plants operating under hydrogen water chemistry (HWC) or Noble Metal Chemical Application (NMCA).

Based on the above, the BWRVIP believes that a factor of two (2) reduction in the crack growth rate in the depth direction from 5×10^{-5} in/hr to 2.5×10^{-5} in/hr for nickel base alloys under HWC/NMCA conditions is conservative and justified pending USNRC review of BWRVIP-62 and the closure of BWRVIP-59.

In order to support near term component inspections and analytical evaluations, the BWRVIP appreciates a timely response from NRC. In the meantime, please do not hesitate to contact Rich Ciemiewicz of Exelon Corporation (BWRVIP Assessment Committee Technical Chairman) by telephone at 610.765.5963 if you have questions or need further information.

Sincerely,

Carl Terry
Niagara Mohawk Power Corporation
Chairman, BWR Vessel and Internals Project

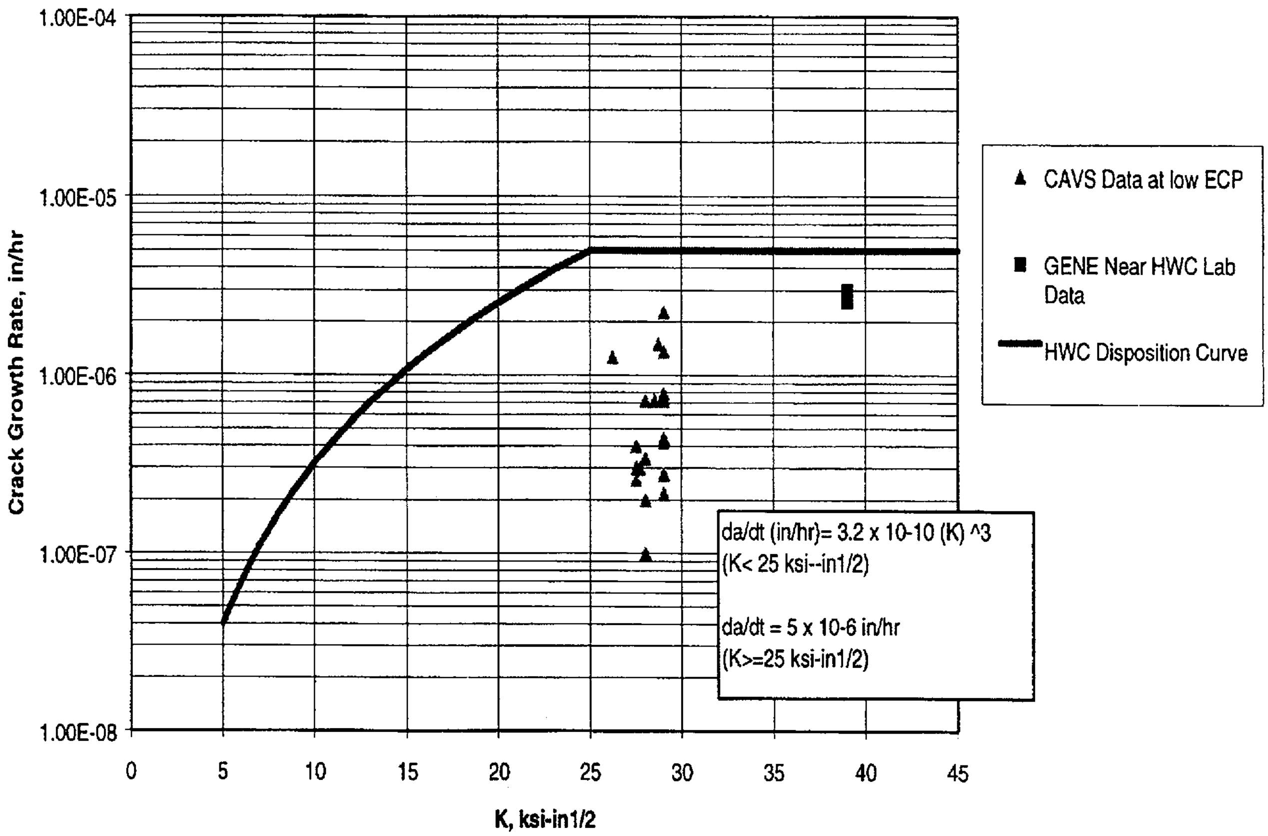

Figure 1. HWC Disposition Curve Compared with CAVS and Lab Data Under HWC Conditions (Figure 5-7 of Reference 2)

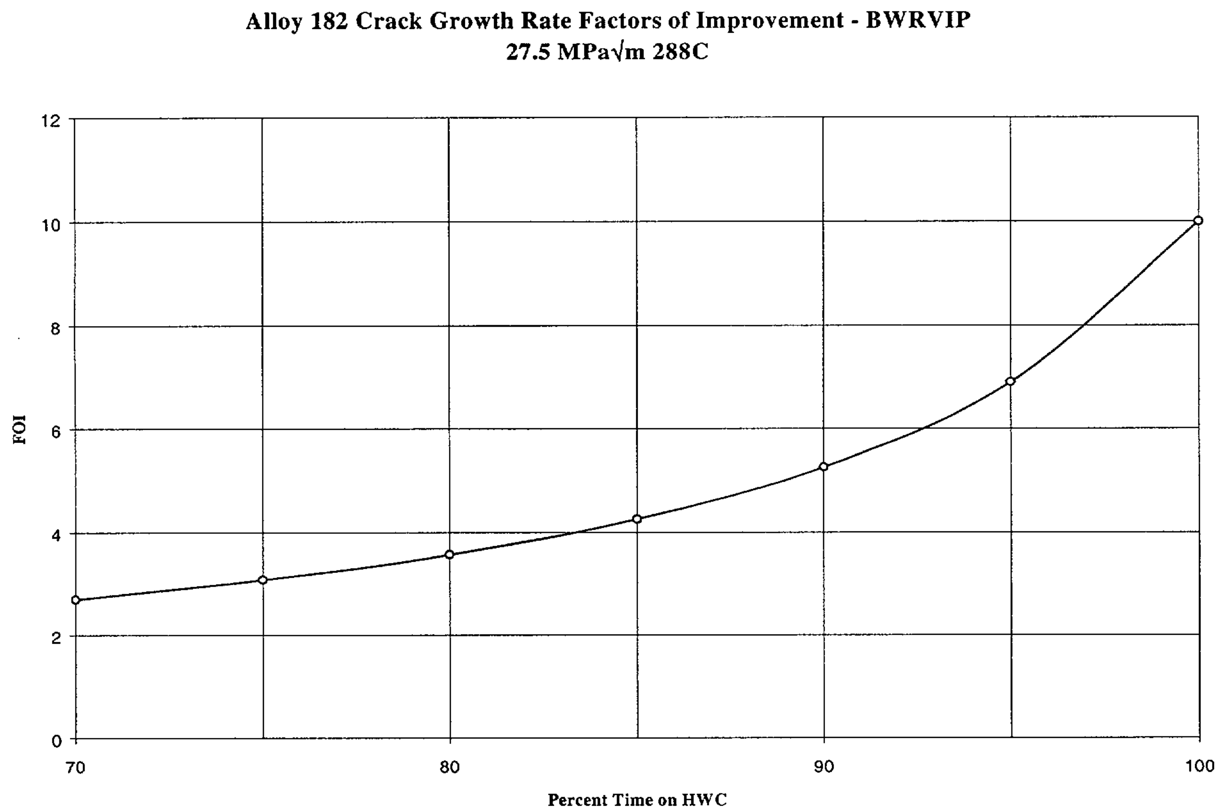

Figure 2. Plot of Alloy 182 Crack Growth Rate Factors of Improvement (FOI) based on HWC Availability at an ECP of –230 mV(SHE) (Figure 4-2 of Reference 3)