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SUBJECT: Responds to RAI re TS amend request,allowing laser welded repair of Westinghouse hybrid expansion joint sleeved SG tubes.

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November 7, 1996

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Ladies/Gentlemen:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Response to Request for Additional Information on Laser Welded Repair Technical Specification Amendment Request

References:
1) Letter from Clark R. Steinhardt (WPSC) to U.S. Nuclear Regulatory Commission (NRC) dated September 6, 1996.
2) Letter from Richard J. Laufer (NRC) to Wisconsin Public Service Corporation (WPSC) dated October 18, 1996.
3) Letter from Richard J. Laufer (NRC) to M.L. Marchi (WPSC) dated October 25, 1996.
4) Letter from M.L. Marchi (WPSC) to U.S. Nuclear Regulatory Commission (NRC) dated October 31, 1996.

By letter dated September 6, 1996, Wisconsin Public Service Corporation (WPSC) submitted a Technical Specification (TS) amendment request to allow laser welded repair (LWR) of Westinghouse hybrid expansion joint (HEJ) sleeved steam generator (SG) tubes; reference 1. WPSC discussed this proposed TS amendment request with the NRC staff in a meeting on October 10, 1996. By letter dated October 25, 1996, the NRC staff requested additional information (RAI) in order to complete their review of the proposed TS amendment; reference 3. On October 25, 1996, WPSC provided a response to the RAI with the exception of questions 1 and 7; reference 4. The attachment to this letter provides the response to questions 1 and 7. Please contact a member of my staff if you have any questions or require additional information.

Sincerely,

M. L. Marchi
Manager - Nuclear Business Group

A001 1/1

SLB
Attach.

130026

cc - US NRC Region III
US NRC Senior Resident Inspector

ATTACHMENT 1

Letter from M. L. Marchi (WPSC)

To

Document Control Desk (NRC)

Dated

November 7, 1996

Response to Request For Additional Information On Proposed Laser Welded Repair of HEJ Sleeved Tubes

NRC Question 1

Please provide a discussion (with complete photomicrographs) of the microstructural differences between laser welds for a new sleeve (LWS) and the laser weld repair (LWR) of an ex-service or laboratory aged mock-up. Include comparative weld joint tensile strength test results for LWS versus LWR. Compare the failure morphologies.

WPSC Response to Question 1

A discussion on the microstructural differences between the laser welds for a new LWS and the LWR process on laboratory aged mock-ups was previously provided on October 25, 1996 in response to Question 3. Additional photomicrographs are included with this response. Figures 1 through 4 show a typical laser weld made with a clean tube and sleeve, and Figures 5 through 8 show typical cross sections for welds made after contaminating the sleeve tube interface.

A detailed examination of the new sleeve/tube laser welds and laser welds made with contaminants show no discernible differences. In both types of welds, the weld heat input with a pulsed laser did not result in coarsening of the grain size of the base metal near the fusion boundary. The different grain sizes of the tube metal in the two welds is because the samples used tubing materials from different heats and heat treatments. All welds were structurally sound with no cracks, lack of fusion, or porosity.

A tensile test of a laser weld repaired HEJ sleeve with contaminants in the sleeve/tube interface was performed. The tensile failure occurred in the weld at a load of 6400 lbs. The weld width prior to testing was approximately 0.025 in. The tensile load was more than twice the design strength of the joint. The tensile strength of the contaminated weld joint was comparable to that of new LWS joints, as reported in WCAP-13088, with any variability being due to the weld width at the sleeve/tube interface. An examination of the weld fracture face could not be performed due to galling, as shown in Figure 10. However, as can be seen from the weld columnar dendritic structure in Figure 9, the failure was clearly ductile.

It is therefore concluded that structurally sound laser welds can be made in HEJ sleeves in the presence of contaminants that could exist at the sleeve/tube interface.

NRC Question 7

The laser weld is supposed to be located in the approximate mid-point of the existing upper HEJ hardroll expansion. What is the acceptance criteria for weld axial location? How will this be confirmed? Is there a minimum distance that must exist between the centerline of the weld and degradation of the parent tube immediately below the weld? Does this include eddy current uncertainty? How was the uncertainty derived?

WPSC Response to Question 7

The key criterion for the axial location of the LWR within the hardroll is that the centerline of the repair weld must be at least 0.38 inch away from (above) the parent tube flaw as discussed in WCAP-14685. The location of the weld and flaw will be determined using the eddy current response. The 0.38-inch value does not include eddy current measurement uncertainty.

The measurement uncertainty for inspecting the LWR configuration was determined for the mag-biased Cecco-5. Five samples were prepared with discontinuities at varied spacings from the LWR (ranging from 0.45-incb to 0.90-inch from the weld centerline) and each sample was tested three times. One sample was a corrosion test sample and included a crack in the lower transition of the hardroll. Multiple tests for each sample were used because the measurement uncertainty is a system characteristic, not solely based upon the coil. These were used to assess the measurement uncertainties. For the Cecco-5 probe the average uncertainty was 0.02 inch. This means that the Cecco-5 measurement was typically 0.02 inch longer than the actual value (i.e. the length was overestimated). The standard deviation for the population was 0.05 inch. Using two standard deviations and looking at a single sided distribution (on the conservative side), the uncertainty value to be applied to the Cecco-5 probe is 0.12 inch.

Applying the uncertainties to the structurally based acceptance criteria, the acceptance of the weld location relative to the degradation for the Cecco-5 probe is 0.50 inch (0.38 inch plus an uncertainty of 0.12 inch). The 0.50 incb acceptance criteria will be specified in the analyst guidelines.

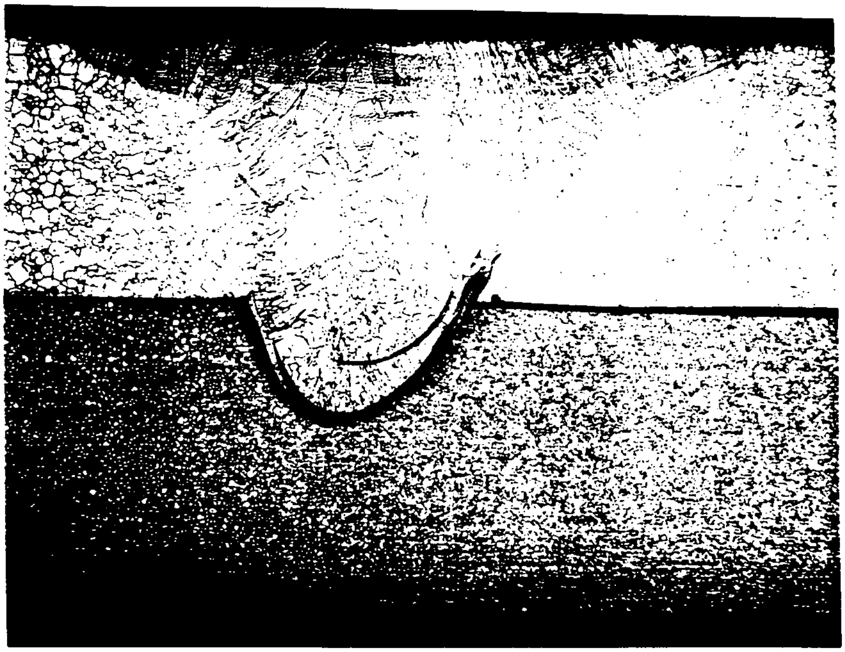

Figure 1 Cross section of LWS weld WP 06 without contaminant. Mag. 40X.

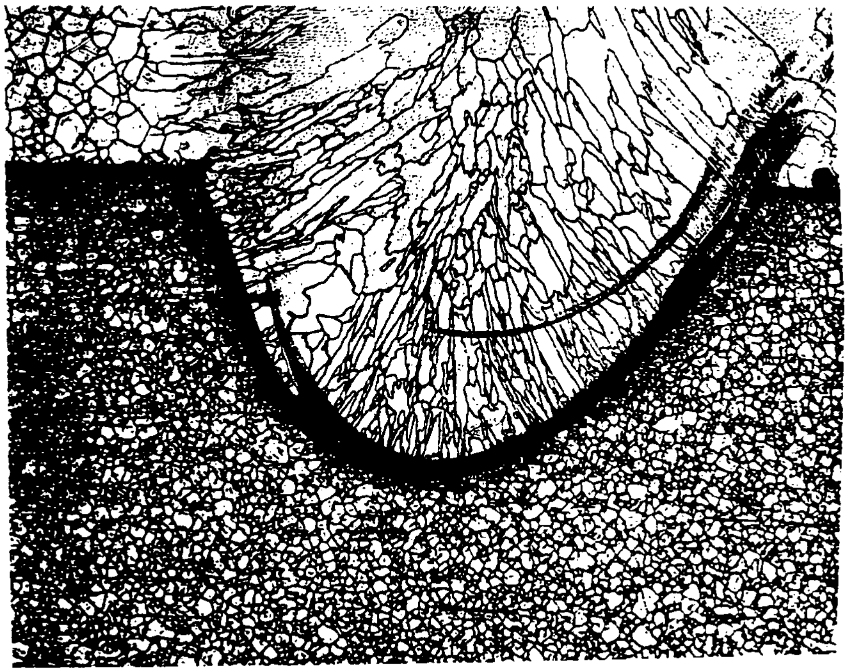

Figure 2 Cross section of LWS weld WP 06 without contaminant at a higher magnification. Tube is shown at bottom. Mag. 100X

Note - The dark areas in the photographs are because of the etching effect.

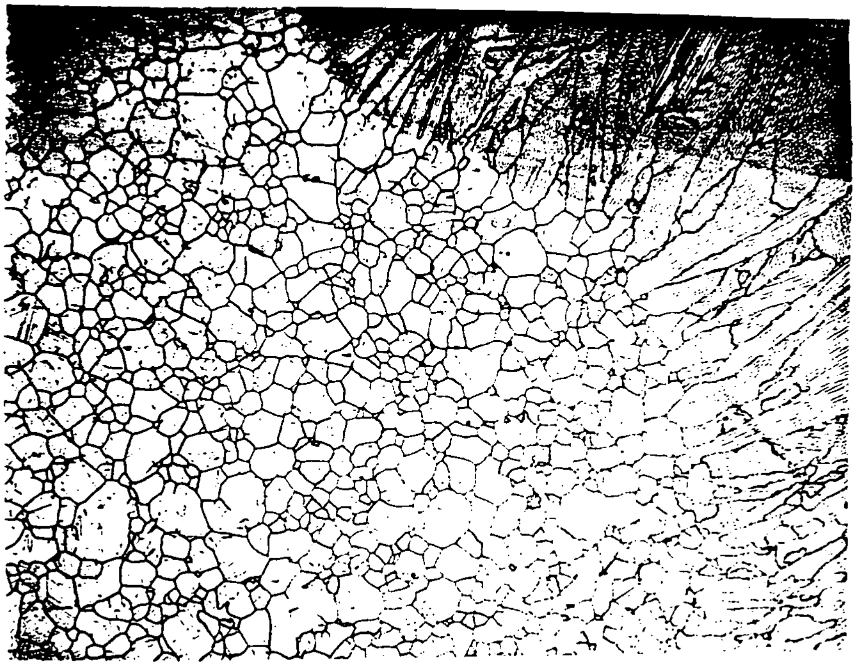

Figure 3 Cross section of LWS weld WP 06 without contaminant showing Inconel 690 sleeve near the weld fusion line. Mag. 100X.

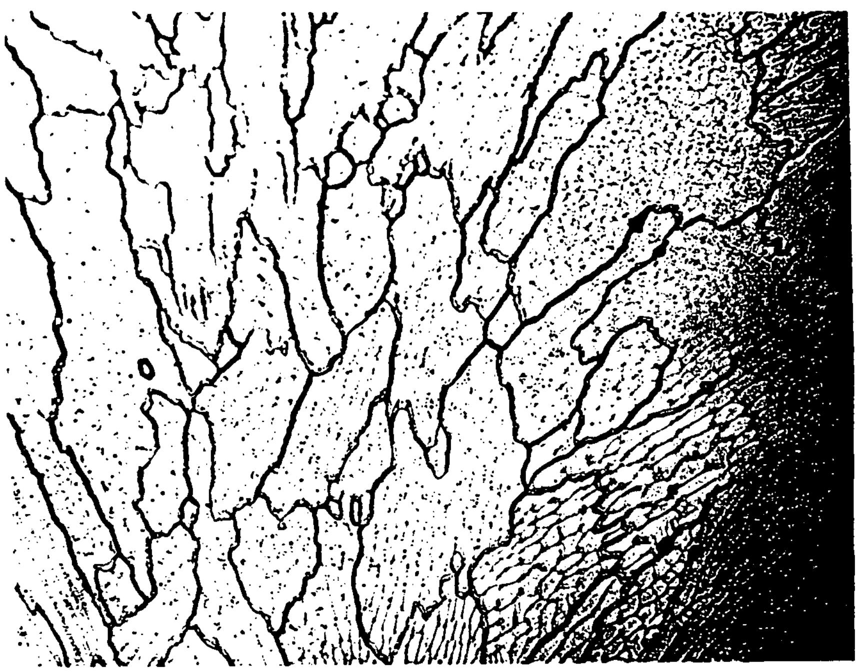

Figure 4 Cross section of LWS weld WP 06 without contaminant showing the weld columnar and interdendritic structure. Mag. 500X.

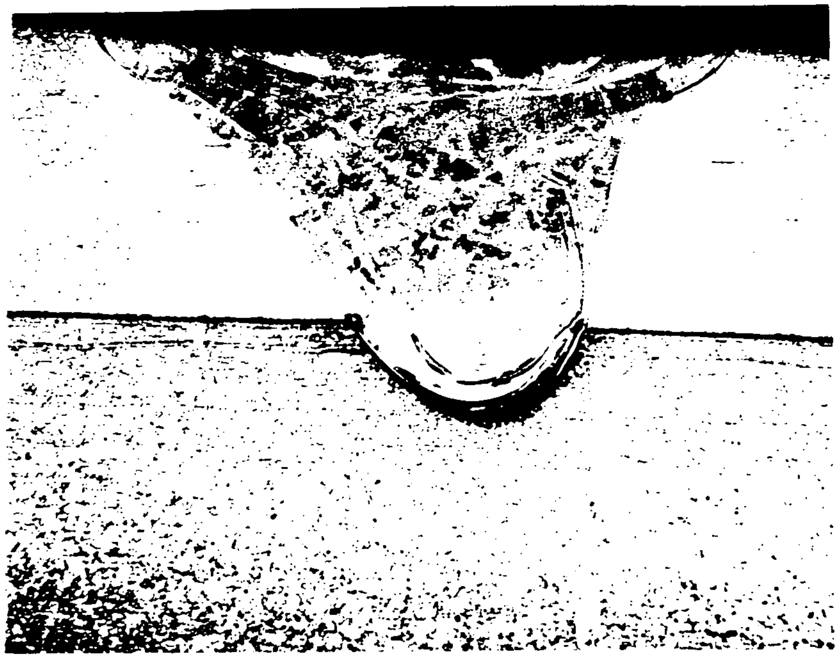

Figure 5 Cross section of LWR weld KW 2 made after contaminating sleeve tube interfaces. Mag. 40X.

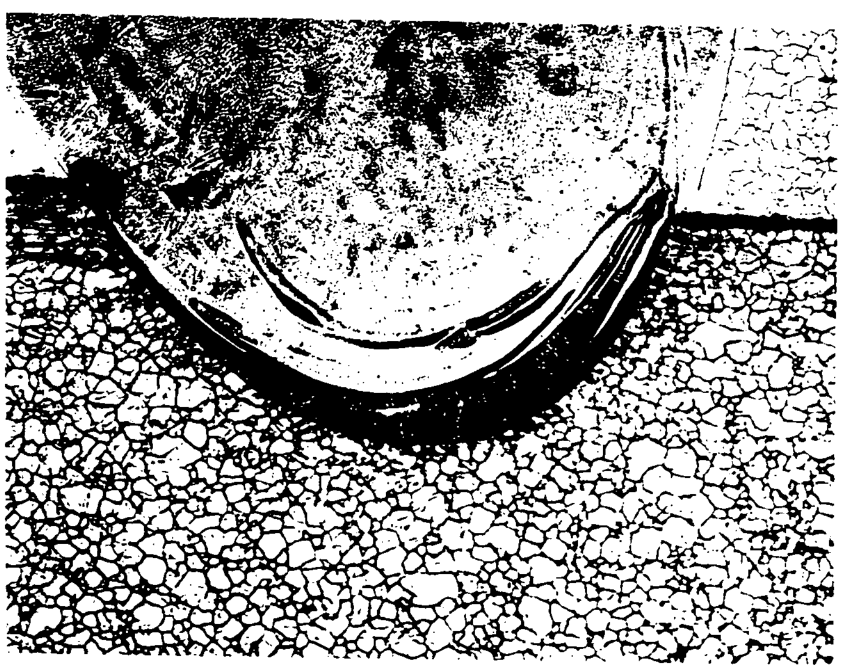

Figure 6. Cross section of LWR weld KW 2 made after contaminating sleeve tube interfaces at a higher magnification. Tube is shown at bottom. Mag. 100X.

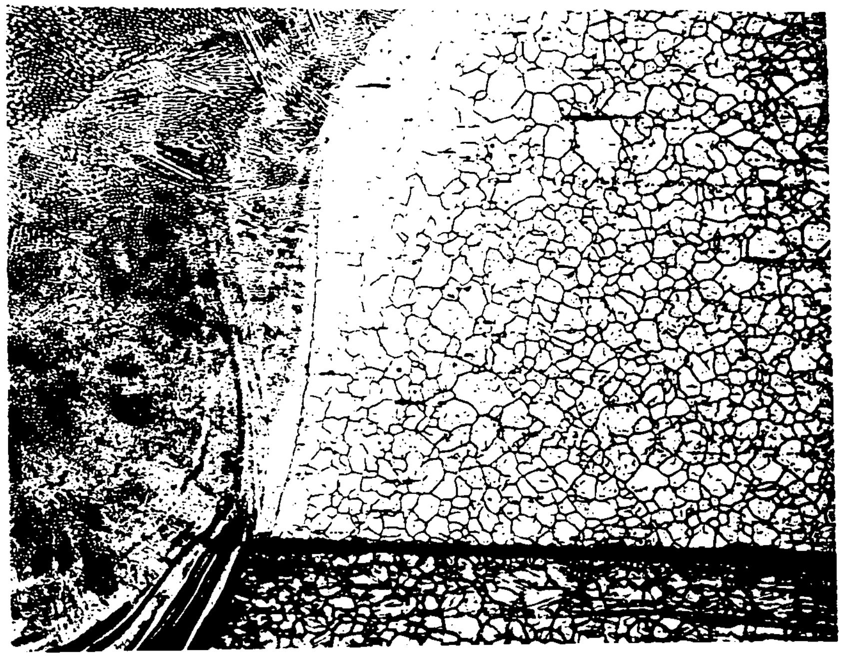

Figure 7. Cross section of LWR weld KW 2 made after contaminating sleeve tube interfaces showing Inconel 690 sleeve near the fusion line. Mag. 100X.

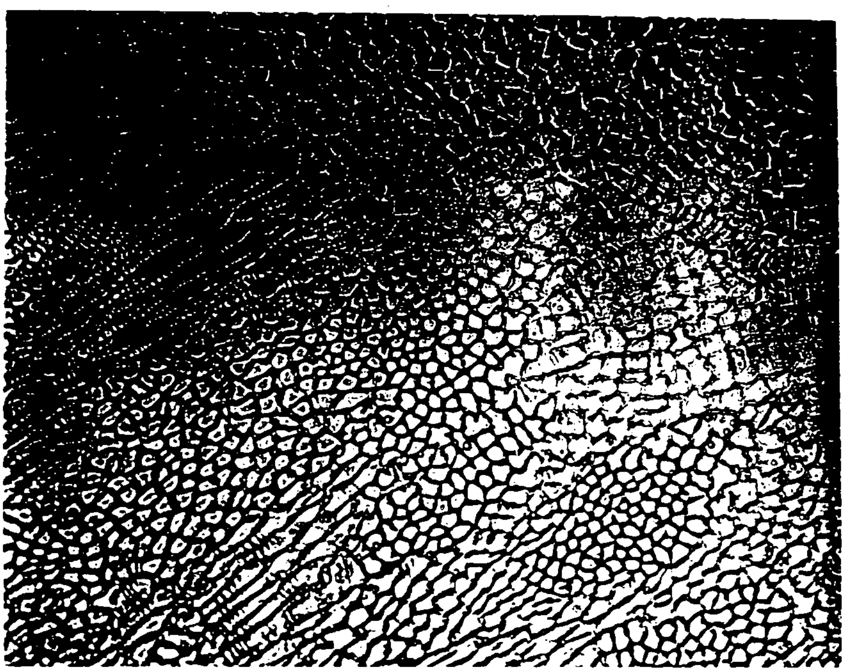

Figure 8. Cross section of LWS weld KW 2 made after contaminating sleeve showing the weld interdendritic structure. Mag. 500X.

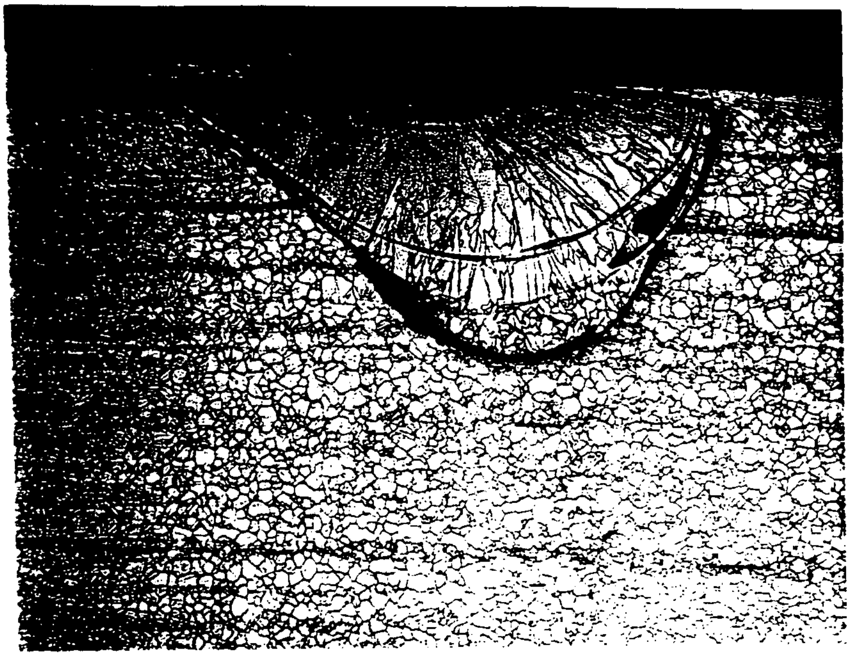

Figure 9. Cross section of weld KR 15 in the tube showing the deformation of the weld columnar structure. Mag. 100X

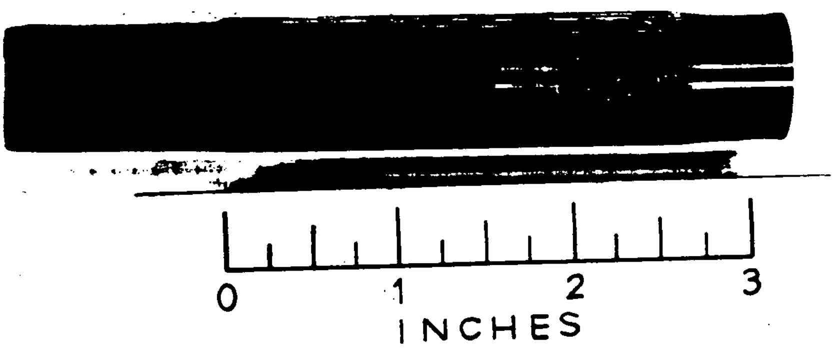

Figure 10 Fracture face of the sleeve showing galling. The cicumferential line represents the laser weld.