Commonwealth Edison
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October 13, 1994

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

Subject: Dresden Nuclear Power Station Unit 2
Quad Cities Nuclear Power Station Unit 2
Commonwealth Edison (ComEd) Response to NRC Request for Additional Information (RAI) Regarding NRC Generic Letter (GL) 94-03, "Intergranular Stress Corrosion Cracking of Core Shrouds in Boiling Water Reactors."
NRC Docket Nos. 50-237 and 50-265

Reference: P. Piet letter to U.S. NRC, dated October 7, 1994.

Attachment A of the referenced letter included a Safety Assessment of the H2 and H3 core shroud welds for Cycle 14 operation of Dresden Unit 2. The following changes to the referenced document are required:

- On page 12, the last sentence should read: "Even with a postulated crack depth of 90% through-wall instead of the above calculated crack depth, and without taking credit for the fillet weld thickness, an operating margin of nine times the required ligament exists." This change corrects the way the margin is calculated. If the plant specific bounding crack depth (0.64 inches) is used, the margin ratio is a minimum of 65 times, as was listed in the referenced document.

- Table 2-1 incorrectly identified that the vertical movement of the shroud given the loss of the H2 or H3 weld and a SSE combined with normal operation uplift is the same as normal operation without the SSE (3.8 inches at H2 and 1.6 inches at H3). These values should be one inch higher when the SSE is combined with normal operation (4.8 inches at H2 and 2.6 inches at H3) as noted in Section 7.1 of the referenced letter. This change has no impact on the conclusions, as the main steam break scenario produces bounding vertical movements.

- In Table 3-4, the heading for the last column should read "Margin Factor [2] ", and note 2 should read "The Margin Factor is the ratio of the Operating Margin Ligament divided by the Required Ligament."

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- In the last sentence of page 29, the phrase "(2) a MSLB of a RLB" should read "(2) a MSLB or a RLB".
- In the first paragraph of Section 3.2, the units of conductivity should read "(μS/cm)."

Attachment B of the referenced letter included a Safety Assessment of the H2 and H3 core shroud welds for Cycle 14 operation of Quad Cities Unit 2. The following changes to the referenced document are required:

- Table 2-1 incorrectly identified that the vertical movement of the shroud given the loss of the H2 or H3 weld and a SSE combined with normal operation uplift is the same as normal operation without the SSE (5.0 inches at H2 and 2.6 inches at H3). These values should be one inch higher when the SSE is combined with normal operation (6.0 inches at H2 and 3.6 inches at H3) as noted in Section 7.1 of the referenced letter.
- Table 2-1 incorrectly identifies that rod insertion timing is not affected during a RLB. It should indicate that the rod insertion timing is not "Significantly" affected, as is listed for the normal operation case.

To effect the changes described above for Dresden, please replace pages 4, 5, 11, 12 and 29 in the Dresden H2/H3 Safety Assessment (Attachment A to the referenced letter) with the replacement pages (marked Revision 1) that are provided as an attachment to this letter. To effect the changes described above for Quad Cities, please replace page 4 in the Quad Cities H2/H3 Safety Assessment (Attachment B to the referenced letter) with the replacement pages (marked Revision 1) that are provided as an attachment to this letter.

We apologize for any inconvenience this may have caused the NRC staff. If there are any questions concerning this matter, please contact this office.

Sincerely,

Peter L. Piet
Nuclear Licensing Administrator

Attachments: Dresden H2/H3 SA, corrected pages
Quad Cities H2/H3 SA, corrected pages

cc: J. B. Martin, Regional Administrator - RIII
J. F. Stang, Project Manager - NRR
R. M. Pulsipher, Project Manager - NRR
C. G. Miller, Senior Resident Inspector - Quad Cities
M. N. Leach, Senior Resident Inspector - Dresden
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Table 2-1 Dresden Unit 2 Safety Assessment With Loss of H2 or H3 Weld

Design Basis Accidents	Anticpated Movement			Rod Insertion	Core Reflood	Core Spray	SBLC
	Lateral	Vertical	Moment(Tip)				
Normal Operation	None	3.8" at H2 and 1.6" at H3	None	Insertion Completed After Shroud Comes Down, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Damage Of CS Riser Or Sparger, CS delivery function not effected	No Boron Density Change
Design Basis Earthquake (SSE) Combined with Normal Operation Uplift Pressures	See Section 7.1	4.8" at H2 and 2.6" at H3	None	Rod Insertion Complete After and While Shroud Comes Down, Oscillitory Velocity Profile Timing Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Main Steam Line Break	None	14.6" at H2 and 10.1" at H3	None	Insertion Completed After Shroud Comes Down, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Recirculation Line Break	None	None Additional due to RLB	None	Rods Insert, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Damage Of CS Riser Or Sparger, CS delivery function not effected	Injection Ability Not Affected (see note)

Additional Scenarios Considered	Anticpated Movement			Rod Insertion	Core Reflood	Core Spray	SBLC
	Lateral	Vertical	Moment(Tip)				
Main Steam Line Break Plus DBE	See Section 7.1	15.6" at H2 and 11.1" at H3	None	Rod Insertion Complete After and While Shroud Comes Down, Oscillitory Velocity Profile, Timing Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Recirc. Line Break Plus DBE (Low PRA Without Adding Single Failure Criteria)	None	None Additional due to RLB	None	Rods Insert, Timing Affected	Floodable Volume Maintained	Potential Damage Of CS Riser Or Sparger, CS delivery function not effected	Injection Ability Not Affected (see note)

Note: SBLC is not designed to function during a recirculation line break.

3.0 <u>Existing Structural Margin</u>

3.1 Background

The extent of cracking that is expected at Dresden 2 is much less than that at Quad Cities Unit 1 and Dresden Unit 3. The bounding crack depth was estimated using the same analytical technique in Reference 2. Though the postulated cracking at Dresden Unit 2 is not insignificant, it has been demonstrated that there remains sufficient structural margin in the shroud to meet all of its design functions. The postulated cracking at the H2 and H3 welds is considered to be a conservative estimate of the conditions for Dresden 2 based on the justifications as provided in the following sections.

3.2 Crack Initiation and Effect of Water Chemistry on Crack Growth Rate (CGR)

There are several factors that differentiate the likelihood of cracking between the Dresden 2 and Dresden 3 Units. While it is known that Unit 2 has two more years of hot operation than Unit 3 (17 years versus 15 years), the first five cycle conductivity level for Unit 2 was significantly lower than that for Unit 3 (0.299 μS/cm versus 0.399 μS/cm). Shroud inspection data indicates a strong correlation between the first five cycle conductivity level and the likelihood of significant cracking. Consequently, the early conductivity level at Dresden Unit 2 more than compensates for the two years of additional operation over that of Unit 3. In fact, the Unit 2 first five cycle conductivity level is under the current EPRI guidelines of 0.300 μS/cm.

Another factor that differentiates the susceptibility of the units to IGSCC is that Unit 2 has been operating with hydrogen water chemistry since 1983. This provides a substantially improved environment for the shroud, which would significantly reduce the growth rates of any cracks that may have initiated in this region as compared to the growth rates experienced in Unit 3. Also, although the exact amount of protection that would be afforded is not clearly defined, the RPV Internals IGSCC Event Comparison suggests that Unit 2 is much less susceptible to IGSCC in this region than Unit 3 (see Table 3-1). Finally, the history of IGSCC in the primary coolant piping at Dresden Unit 2 is significantly less than that experienced at Unit 3.

Table 3-4 Dresden 2 Summary of Required Ligament and Remaining Margin

Weld Location	Critical Loading Case	Maximum d/t Ratio	Required Ligament t=2"	Required Ligament t=3" (fillet)	Operating[1] Margin Ligament t=2"/t=3"	Margin Factor[2] t=2"/t=3"
H2	Normal	0.9969	0.0062"	0.0093"	1.354" 2.351"	218 252
H2	SSE	0.9951	0.0098"	0.0147"	1.350" 2.345"	138 159
H2	MSLOCA	0.9936	0.0128"	0.0192"	1.347" 2.341"	105 122
H2	SSE+MSL OCA	0.9907	0.0186"	0.0279"	1.341" 2.332"	72 83
H2	SSE+RR LOCA	0.9950	0.0100"	0.0150"	1.350" 2.345"	135 156
H3	Normal	0.9972	0.0056"	0.0084"	1.354" 2.352"	241 280
H3	SSE	0.9947	0.0106"	0.0159"	1.349" 2.344"	127 147
H3	MSLOCA	0.9935	0.0130"	0.0195"	1.347" 2.341"	104 120
H3	SSE+MSL OCA	0.9900	0.0200"	0.0300"	1.340" 2.330"	67 78
H3	SSE+RR LOCA	0.9946	0.0108"	0.0162"	1.349" 2.344"	125 145

Notes:

1. Values shown are based on a crack initiation at the end of 3 EFPY and a bounding crack depth of 0.64".
2. The Margin Factor is the ratio of the Operating Margin Ligament divided by the Required Ligament.

C. Conclusion

Based on the plant specific crack growth rates at H2 and H3 as well as the bounding crack depth at the EFPY 14.04 (current status) and maximum anticipated stresses, sufficient margin exists to continue operation until the end of cycle 14. Even with a postulated crack depth of 90% through-wall instead of the above calculated crack depth, and without taking credit for the fillet weld thickness, an operating margin of nine times the required ligament exists.

7.2 Recirculation Line Break Plus SSE

For the RLB accident simultaneous with a seismic event, additional vertical and lateral forces will exist. The lateral seismic loads when combined with the asymmetric blowdown loads result in a larger tipping moment. As discussed in Section 6.2, the lateral load is small at the H2 and H3 weld locations during a RLB and thus the primary load will be due to the seismic excitation. The portion of the shroud above the H2 and H3 welds will not tip or rotate because the resisting moment due to the shroud weight is greater than the combined recirculation line break and seismic overturning moment. Vertical displacement of the shroud will be resisted by the downward force on the shroud exerted by the RLB. The vertical seismic excitation of 0.13 g is much less than gravity and thus will be offset by the combination of the pulldown force and the dead weight. Therefore, the combination of the RLB with the SSE does not result in a loading case or a motion that is more critical than what has been evaluated for the other events.

7.3 Probabilities of Events

The probabilities of the design basis and beyond design basis events were provided to the NRC in Reference 9 (question PR-1) and for your convenience are summarized below.

Event	Dresden Frequency(1)
SSE	5.0 E-5 /year
Main Steam Line Break (MSLB)	4.1 E-8/year
Recirculation Line Break (RLB)	3.0 E-4/year
SSE coincident with MSLB	5.6 E-15/year
SSE coincident with RLB	4.1 E-11/year

Note 1 - For purposes of these responses 'coincident' is defined as occurring in the same 24 hour period.

These event probabilities for the beyond design basis accidents are extremely small and thus provide substantiation to the unlikeliness of the occurrence of these combined events. The ability to detect a 360° through wall flaw at H2 and H3 during normal operation rules out the possibility of having an undetected flaw prior to these events and thus concludes that the crack would have to be initiated by the accident. The probability associated with an event that would include a (1) initiation of a through wall flaw, plus (2) a MSLB or a RLB, and (3) a full SSE, is less at H2 or H3 than at H5 because of the ability to detect a 360 degree through-wall flaw at H2 and H3.

Table 2-1 Quad Cities Unit 2 Safety Assessment With Loss of H2 or H3 Weld

Design Basis Accidents	Anticipated Movement			Rod Insertion	Core Reflood	Core Spray	SBLC
	Lateral	Vertical	Moment(Tip)				
Normal Operation	None	5.0" at H2 and 2.6" at H3	None	Insertion Completed After Shroud Comes Down, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Damage to CS Riser Or Sparger, CS Delivery Function not Affected.	No Boron Density Change
Design Basis Earthquake (SSE) Combined with Normal Operation Uplift Pressures	See Section 7.1	6.0" at H2 and 3.6" at H3	None	Rod Insertion Complete After and While Shroud Comes Down, Oscillitory Velocity Profile Timing Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Main Steam Line Break	None	14.6" at H2 and 10.1" at H3	None	Insertion Completed After Shroud Comes Down, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Recirculation Line Break	None	None Additional Due to RLB	None	Rods Insert, Timing Not Significantly Affected	Floodable Volume Maintained	Potential Damage to CS Riser Or Sparger, CS Delivery Function not Affected.	Injection Ability Not Affected (See Note (1))

Additional Scenarios Considered	Anticpated Movement			Rod Insertion	Core Reflood	Core Spray	SBLC
	Lateral	Vertical	Moment(Tip)				
Main Steam Line Break Plus DBE	See Section 7.1	15.6" at H2 and 11.1" at H3 (See Note (2))	None	Rod Insertion Complete After and While Shroud Comes Down, Oscillitory Velocity Profile, Timing Affected	Floodable Volume Maintained	Potential Failure Of CS Riser Or Sparger, Injection Into RPV Allows Long Term Cooling	No Boron Density Change
Recirc. Line Break Plus DBE (Low PRA Without Adding Single Failure Criteria)	None	None Additional Due to RLB	None	Rods Will Insert, Timing Affected	Floodable Volume Maintained	Potential Damage to CS Riser Or Sparger, CS Delivery Function not Affected.	Injection Ability Not Affected (See Note (1))

Note: (1) SBLC is not designed to function during a recirculation line break.
(2) H2 does not lift top guide