OPPD
Omaha Public Power District
444 South 16th Street Mall
Omaha, Nebraska 68102-2247

September 28,1998
LIC-98-0124

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Station P1-137
Washington, D.C. 20555

References:
1. Docket 50-285
2. Letter from NRC (L.R. Wharton) to OPPD (S.K. Gambhir), dated June 23, 1998
3. Letter from OPPD (S.K. Gambhir) to NRC (Document Control Desk), dated October 13, 1997 (LIC-97-0159)

Subject: Response to Request for Additional Information Related to Generic Letter 92-01, Revision 1, Supplement 1

In the Reference 2 letter, the NRC requested additional information associated with the Reference 3 submittal from Omaha Public Power District. This requested information is provided in the attachment to this letter.

Please contact me if you have any questions regarding this information.

Sincerely,

S.K. Gambhir

S.K. Gambhir
Division Manager
Nuclear Operations

KCH/tcm

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c: E.W. Merschoff, NRC Regional Administrator, Region IV
L.R. Wharton, NRC Project Manager
W.C. Walker, NRC Senior Resident Inspector
Winston and Strawn

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Omaha Public Power District (OPPD)
Fort Calhoun Station
Response to Request for Additional Information Related to
Generic Letter 92-01, Revision 1, Supplement 1

(Note: References noted in the following responses are listed on Page 5.)

Request 1:

The limiting material for the Fort Calhoun RPV changed from the 3-410 tandem weld heat 27204/27204 to the tandem heat 27204/12008 as a result of the licensee's evaluation of the new CEOG RVWG data. The letter dated October 13, 1997 indicates that the RT_{PTS} value of the limiting material increased from 267 °F to 269 °F. The docketed information which the licensee supplied in response to GL 92-01, Revision 1 cited 249 °F as the current RT_{PTS} value for the limiting material. The docketed information received to date does not account for the change in the RT_{PTS} value from 249 °F to 267 °F. In order to have accurate values for assessing RPV embrittlement complete the attached Table for each RPV beltline weld material. Include a reference for the fluence value that was used in the new assessment. The information provided will be used in updating the Reactor Vessel Integrity Database (RVID).

Response:

OPPD's October 23, 1997 Generic Letter 92-01, Revision 1, Supplement 1 submittal for Fort Calhoun Station (FCS) (Reference 1), stated that there would be a projected end of life 10 CFR 50.61 RT_{PTS} increase of approximately 2°F (from 267°F to 269°F). This change was a result of utilizing revised/updated data from Reference 2 to re-establish the 10 CFR 50.61 based limiting Chemistry Factor (CF) for the 3-410 welds. All three 3-410 welds are treated as being the same in terms of chemical composition and material properties with this limiting "weld" identified as conservatively being comprised of the revised/updated tandem arc weld wire heat combination of 27204/12008 rather than the previously limiting combination of 27204/27204. The reported value of "269°F" was conservatively rounded up from 268.08°F to the next integer value. In an effort to analytically gain additional margin for the EOL RT_{PTS}, as contained in this response, OPPD has chose to utilize a 10 CFR 50.61(c)(iii) Equation 2 definition of the Margin term of "twice the root sum square of σ_U and σ_Δ." This value is 65.51°F, instead of 66°F as previously reported.

The FCS three axial 3-410 welds, located at 60°, 180°, and 300°, are comprised of the three weld wire heats of 27204, 13253 and 12008; however, as discussed in previous submittals, reactor vessel (RV) fabrication records do not provide the details for which tandem arc heat combinations were used at each (or any one) of the RV inner surfaces and at what depth other tandem combinations were used. As a result, OPPD has conservatively chosen to use the limiting combination of heat numbers that produce the largest CF for the entire 3-410 weld depth and consequently the largest value of RT_{PTS}. Only weld wire heat combinations qualified for use in vessel fabrication at the Combustion Engineering (CE)-Chattanooga facility were considered for evaluation of the 3-410 weld. These possible combinations are 27204/27204, 27204/12008, 13253/13253, and 13253/12008; these are addressed in the CEOG RVWG Report (Reference 2). Prior to completion of the CEOG RVWG task, existing data available indicated that the 27204/27204 combination had the greatest CF with a value of 229.00°F. Following completion of the CEOG RVWG data searches of the CE-Chattanooga weld deposit records, this CF was revised/updated from 229.0°F to 226.81°F. The CF of the previously non-limiting combination of 27204/12008 increased from 215.6°F to 231.06°F, making it the most limiting combination based on CF. The net effect for the limiting 3-410 weld was an increase in CF of 229.00°F (for 27204/27204) to 231.06°F (for 27204/12008). The subject Reference 1 letter from OPPD to the NRC (dated October 13, 1997) addresses the net effect of this 2°F CF increase rather than the change associated with any individual tandem arc weld combination.

Reference 3 indicates that the OPPD docketed information from the response to Generic Letter 92-01, Revision 1 cited a RT_{PTS} value of 249°F for the 3-410 weld. A review of the associated correspondence by OPPD did not find any direct quotation of this temperature; however, using the References 4 and 5 fluence data and the CF for the 27204/12008 weld presented in References 6 and 7 does result in a RT_{PTS} value of 249°F. Reference 8 provided the most current assessment including the fluence analysis with the ENDF/B-VI cross-section library with 27204/27204 being the limiting weld combination. OPPD recognizes that the RT_{PTS} value for the 27204/12008 weld combination has changed from the previous (i.e., pre-Reference 2) non-limiting value. The intent of Reference 1 was to inform the NRC that, based on Reference 2, the previously limiting tandem arc weld combination of 27204/27204 had become less limiting and that the combination of 27204/12008 is now the most limiting. The Reference 1 updated projection for RT_{PTS} was based on the most recent fluence analysis (Reference 8), which used the ENDF/B-VI cross-section library (consistent with Draft Regulatory Guide DG-1053). Reference 1 also assumed the August 9, 2013 expiration date of the Operating License, actual plant capacity factor data since performance of the fluence analysis, and a future capacity factor projection of 85% beyond Cycle 14. The Reference 5 fluence analysis was based on the use of the ENDF/B-IV cross section library. The effects of the Reference 8 fluence reanalysis are increases from 1.49E19 n/cm^2 to 1.526E19 n/cm^2 for the 3-410 and 2-410 axial welds and from 2.4E19 n/cm^2 to 2.408E19 n/cm^2 for the 9-410 circumferential weld and plate material.

As requested, the attached table summarizes the FCS RV weld information.

<u>*Request 2:*</u>

Note that RPV integrity analyses utilizing newly identified data could result in the need for license amendments in order to maintain compliance with 10 CFR 50.60, 10 CFR 50.61 (pressurized thermal shock, PTS), and Appendices G and H to 10 CFR Part 50, and to address any potential impact on low temperature (LTOP) limits or pressure-temperature (P-T) limits. If additional license amendments or assessments are necessary, please provide a schedule for such submittals.

Response:

OPPD is utilizing extreme low radial leakage fuel management, including the use of hafnium flux suppression rods, to minimize the RV embrittlement associated with fast neutron leakage to the limiting RV welds (which are the 3-410 welds located at 60° and 300°) . The 3-410 weld located at 180° is not limiting (see Reference 8). This type of fuel management was implemented in Cycle 14 and is expected to be used for the remainder of plant life at FCS. This type of fuel management has been very effective for reducing the fast neutron flux to the RV. Analyses related to Reactor Vessel Integrity (RVI) prior to Cycle 14 used higher neutron fluence values typical of the fuel management in effect at that time and also a greater CF value of 234°F for the 3-410 weld. Both of these inputs bound current projected fluence values as well as CF (see attached table).

10 CFR 50.60 addresses the RV fracture toughness requirements as set forth in 10 CFR 50 Appendices G and H. These requirements continue to be met with no reanalysis required due to the approximately 3°F conservatism in the CF used in the analyses of record, as well as the large conservatisms in fluence between the present low radial leakage fuel management employed beginning in Cycle 14 and that projected from the previous higher fluence type of fuel management.

10 CFR 50.61 addresses the PTS related requirements of maintaining the limiting values of RT_{PTS} for beltline axial welds less than 270°F and circumferential welds less than 300°F. As shown in the Table, the EOL RT_{PTS} increased only slightly as a result of revising the 3-410 weld CF, with the projected EOL value remaining less than the screening criterion limit of 270°F for axial welds. Due to the changes in most of the weld chemistry compositions, OPPD intends to update the Reference 9 PTS Rule submittal within six months following the completion of the NRC review and acceptance of Reference 8. OPPD also recognizes that future updates may also be warranted with the pending acceptance by ASTM of the E900 standard, "Standard Guide for Predicting Neutron Radiation Damage to Reactor Vessel Materials," its incorporation by NRC into Reg. Guide 1.99, and subsequent revision to 10 CFR 50.61.

As discussed above, the existing FCS P-T and LTOP limits were developed based on a more conservative CF and fluence. Thus, the present curves, denoted as being valid for 20 EFPY, are in actuality valid for 30 EFPY, based on current fluence projections even without crediting the 3°F CF difference between the analysis of record and the weld chemistry data presented in the attached table. No further actions are necessary in this regard for FCS. The requirements of 10 CFR 50 Appendix G address fracture toughness requirements which primarily consist of maintaining the RV weld and plate material with EOL upper shelf energy (USE) values greater than 50 ft-lbs, and P-T limits established that are conservative with respect to those derived using methods consistent with ASME Section XI, Appendix G. In Reference 5, OPPD submitted the projected EOL USE values to the NRC. Upon further discussion, OPPD agreed to use a generic initial USE value of 75 ft-lbs for the EOL USE limited weld combination of 13253/12008 for the 3-410 weld. This resulted in an EOL USE of 49 ft-lbs. OPPD then submitted an equivalent margins analysis in Reference 11 which the NRC approved in Reference 12.

The current status of EOL USE values for the FCS RV beltline welds is summarized in Reference 6. Following issuance of Amendment No. 158 to the FCS Operating License, a CEOG task was performed to define generic initial USE values for Linde 0091, 124, and 1092 RV welds. The NRC issued an SER accepting these generic initial USE values in Reference 10. Based on (1) this increase of generic initial USE from 75 ft-lbs to the NRC-approved 95/95 tolerance limit of 98 ft-lbs (for Linde 1092 welds) and (2) no change in copper content per Reference 1, OPPD has concluded that the EOL USE of all FCS RV welds will remain greater than 50 ft-lbs. However, OPPD is conservatively not requesting withdrawal or retraction of Reference 11. The primary factors in predicting EOL USE are fluence and copper content. The fluence has increased by a small amount between References 5 and 8, and copper content has remained constant or decreased for all welds except the 27204/12008 combination (Reference 2). The resulting conclusion is that the analyses of record remain bounding, except for the 27204/12008 combination, and that adequate margin exists to ensure that this weld will retain an EOL USE greater than 50 ft-lbs. As previously discussed, the existing P-T and LTOP curves remain bounding. Thus it is concluded that no changes are required to maintain compliance with 10 CFR 50 Appendix G.

The requirements of 10 CFR 50 Appendix H address the RV surveillance testing program and reporting of the surveillance capsule results. It is concluded that no changes are required to maintain compliance with 10 CFR 50 Appendix H as a result of these reported RV weld property data results.

In conclusion, the only change planned as a result of the acquisition and evaluation of the CEOG RVWG weld properties evaluation task is to prepare and transmit a revised FCS PTS Submittal within six months following NRC approval of the Reference 8 fluence analysis.

REFERENCES:

1. Letter from OPPD (S.K. Gambhir) to NRC (Document Control Desk), dated October 13, 1997 (LIC-97-0159).
2. CE NPSD-1039, Revision 2, "Best Estimate Copper and Nickel Values in CE Fabricated Reactor Vessel Welds," June 1997.
3. Letter from NRC (L.R. Wharton) to OPPD (S.K. Gambhir), dated June 23, 1998
4. Enclosure 2 of Letter from OPPD (T.L. Patterson) to NRC (Document Control Desk), dated April 21, 1995 (LIC-95-0097).
5. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk), dated October 15, 1993 (LIC-93-0258).
6. Letter from NRC (S.D. Bloom) to OPPD (T.L. Patterson), dated May 19,1994
7. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk), dated June 17, 1994 (LIC-94-0135).
8. Letter from OPPD (S.K. Gambhir) to NRC (Document Control Desk), dated January 30, 1998 (LIC-98-0009).
9. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk), dated August 12, 1993 (LIC-93-0200).
10. Letter from NRC (G.C. Lainas) to CEOG (D.F. Pilmer), "Safety Evaluation of Report CEN-622, Generic Upper Shelf Values for Linde 0091, 124, and 1092 Reactor Vessel Welds," June 1995; "Supplemental Information to C-E Owners Group Report CEN-622," June 1996, dated September 25, 1996.
11. Letter from OPPD (W.G. Gates) to NRC (Document Control Desk), dated October 27, 1993 (LIC-93-0270).
12. Letter from NRC (S.D. Bloom) to OPPD (T.L. Patterson), dated December 3, 1993

Table of Fort Calhoun Station RPV Weld Information

RPV Weld Wire Heat	Best-Estimate Copper (w/o)	Best-Estimate Nickel (w/o)	EOL ID Fluence ($x 10^{19}$)	Assigned Material Chemistry Factor (CF) (°F)	Method of Determining CF	Initial RT_{NDT} (°F)	σ_U (°F)	σ_Δ (°F)	Margin (°F)	RT_{PTS} at EOL (°F)
51989[1]	0.170	0.165	1.526	89.03	table	-56	17	28	65.51	108.95
20291[2]	0.216	0.737	2.408	188.41	table	-56	17	28	65.51	242.53
13253/ 13253[3]	0.221	0.732	1.526	189.05	table	-56	17	28	65.51	220.67
13253/ 12008[3]	0.210	0.873	1.526	208.68	table	-56	17	28	65.51	242.59
27204/ 27204[3]	0.203	1.018	1.526	226.81	table	-56	17	28	65.51	262.84
27204/ 12008[3]	0.219	0.996	1.526	231.06	table	-56	17	28	65.51	267.59

[1] 2-410 axial weld
[2] 9-410 circuferential weld
[3] 3-410 axial weld