PHILADELPHIA ELECTRIC COMPANY

NUCLEAR GROUP HEADQUARTERS

955-65 CHESTERBROOK BLVD.

WAYNE, PA 19087-5691

(215) 640-6000

November 16, 1992

Docket Nos. 50-352
50-353

NUCLEAR SERVICES DEPARTMENT

License Nos. NPF-39
NPF-85

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

SUBJECT: Limerick Generating Station, Units 1 and 2
Supplemental Response to Generic Letter 92-01,
Revision 1, "Reactor Vessel Structural Integrity,
50.54(f)"

REFERENCE: 1) Letter from G. J. Beck (PECo) to U. S. Nuclear Regulatory Commission, dated July 10, 1992

Dear Sir:

Attached is our supplemental response to the subject Generic Letter 92-01, dated March 6, 1992. Our original response was provided in the Reference 1 letter. Generic Letter 92-01 concerns licensee's compliance with requirements and commitments regarding reactor vessel integrity.

In the Reference 1 letter, Philadelphia Electric Company (PECo) committed to provide supplemental responses to requests 2b (2), 2b (5) and 3a for the Limerick Generating Station (LGS), Units 1 and 2. The attachment provides these supplemental responses. Also included in the attachment for LGS, Units 1 and 2 are minor corrections to responses 1, 2b (3) and 2b (6).

If you have any questions, please contact us.

Very truly yours,

230120

G. J. Beck, Manager
Licensing Section

Attachment and Enclosure

cc: T. T. Martin, Administrator, Region I, USNRC
T. J. Kenny, USNRC Senior Resident Inspector, LGS

A028

COMMONWEALTH OF PENNSYLVANIA :

: ss.

COUNTY OF CHESTER :

G. R. Rainey, being first duly sworn, deposes and says:

That he is Vice President of Philadelphia Electric Company; that he has read the supplemental response to Generic Letter No. 92-01, and knows the contents thereof; and that the statements and matters set forth therein are true and correct to the best of his knowledge, information and belief.

G. R. Rainey

Vice President

Subscribed and sworn to
before me this 16th day
of November 1992.

Notary Public

Notarial Seal
Erica A. Santon, Notary Public
Tredyffrin Twp., Chester County
My Commission Expires July 10, 1995

Request 1:

"1. Certain addressees are requested to provide the following information regarding Appendix H to CFR Part 50:

Addressees who do not have a surveillance program meeting ASTM E185-73, -79, or -82 and who do not have an integrated surveillance program approved by the NRC (see Enclosure 2), are requested to describe actions taken or to be taken to ensure compliance with Appendix H to 10 CFR Part 50. Addressees who plan to revise the surveillance program to meet Appendix H to 10 CFR Part 50 are requested to indicate when the revised program will be submitted to the NRC staff for review. If the surveillance program is not to be revised to meet Appendix H to 10 CFR Part 50, addressees are requested to indicate when they plan to request an exemption from Appendix H to 10 CFR Part 50 under 10 CFR 50.60(b)."

Response:

In our July 10, 1992 response to Generic Letter 92-01, we inadvertently provided the Limerick Generating Station (LGS), Unit 1 limiting end-of-life (EOL) reference temperature for nil-ductility transition ($RT_{ndt}$) value of 56°F which is based on calculations performed in accordance with Regulatory Guide 1.99, Revision 1, "Radiation Embrittlement of Reactor Vessel Materials." The correct $RT_{ndt}$ value is 86°F which was calculated based on Revision 2 of Regulatory Guide 1.99. The $RT_{ndt}$ value provided in our July 10, 1992 response for LGS, Unit 2 (i.e., 120°F) is the correct value.

Enclosure 1 to this attachment is a complete listing of the LGS, Unit 1 limiting values for the EOL $RT_{ndt}$ for the reactor vessel beltline plates and welds. The LGS, Unit 1 limiting values for the EOL $RT_{ndt}$ were originally submitted to the NRC in our response to Generic Letter 88-11, "NRC Position on Radiation Embrittlement of Reactor Vessel Materials and its Impact on Plant Operations," dated November 23, 1988, for only the most limiting values.

Table 5.3-5 of the LGS, Units 1 and 2 Updated Final Safety Analysis Report (UFSAR) will be revised in the next revision to the UFSAR to reflect the Unit 1 limiting values calculated in accordance with Regulatory Guide 1.99, Revision 2, as contained in Enclosure 1.

Request 2b (2):

"2. Certain addressees are requested to provide the following information regarding Appendix G to 10 CFR Part 50:

b. Addressees whose reactor vessels were constructed to an ASME Code earlier than the Summer 1972 Addenda of the 1971 Edition are requested to describe the consideration given to the following material properties in their evaluations performed pursuant to 10 CFR 50.61 and Paragraph III.A of 10 CFR Part 50, Appendix G:

(2) the heat treatment received by all beltline and surveillance materials;"

Response:

In our July 10, 1[illegible] response to Generic Letter 92-01, Request 2b (2), we stated that the specific heat treatment received by the beltline and surveillance materials for LGS, Units 1 and 2 had not yet been located in existing plant documentation and that a search of vendor records and docketed and archived plant documents would be performed to locate specific data sheet records. This review has been completed with the following results.

The heat treatment for the LGS, Units 1 and 2 beltline plate material was performed by Lukens Steel Company. The beltline plates were austenitized at approximately 1650°F for a minimum of 30 minutes per inch of thickness, water quenched, tempered at approximately 1260°F for a minimum of 30 minutes per inch of thickness, stress relieved at approximately 1150°F for one hour, and air cooled.

Test coupons were then cut from the beltline plates and stress relieved at approximately 1150°F for 50 hours, furnace cooled at a maximum rate of 100°F per hour to 600°F, and then air cooled.

During fabrication of the vessel at Chicago Bridge and Iron Corporation at Memphis, Tennessee, the beltline plates were stress relieved at approximately 1150°F for a minimum of one hour per inch of thickness after being welded together.

The surveillance welds for LGS, Units 1 and 2 were stress relieved in two stages. The first stress relief was for a period of two hours and the second stress relief was for a period of 48 hours. Each stress relief was conducted at approximately 1150°F, followed by a furnace cooling at a maximum rate of 100°F per hour to 600°F, and then air cooled.

Request 2b (3):

"(3) the heat number for each beltline plate or forging and the heat number of wire and flux lot number used to fabricate each beltline weld;"

Response:

In our July 10, 1992 response to Generic Letter 92-01, Request 2b (3), we stated that the heat number for each beltline plate or forging, and the heat number of wire and flux lot number used to fabricate each beltline weld are contained in Tables 5.3.3 and 5.3.4 of the LGS, Units 1 and 2 UFSAR. This reference to Tables 5.3.3 and 5.3.4 of the LGS, Units 1 and 2 UFSAR was incorrect. This information is contained in Tables 5.3.4 and 5.3.5 of the LGS, Units 1 and 2 UFSAR.

Request 2b (5):

"(5) the chemical composition, in particular the weight in percent of copper, nickel, phosphorous, and sulfur for each beltline and surveillance material; and"

Response:

In our July 10, 1992 response to Generic Letter 92-01, Request 2b (5), we stated that the sulfur content of the welds and base plates for both units, copper content of the girth welds of Unit 1, and the nickel content of the vertical welds for Unit 1 were not contained in Table 5.3.5 of the LGS, Units 1 and 2 UFSAR. Conservative estimates were provided for the copper and nickel contents of 0.35% and 1.00%, respectively, per Regulatory Guide 1.99, Revision 2 to verify that the upper shelf energy (USE) will not be less than 50 ft-lbs at the end of 32 Effective Full Power Years (EFPYs). Additionally, we stated that we would perform a documentation search of vendor records, and docketed and archived plant documents, to locate the additional chemistry records.

The documentation search was completed with the results being documented in Enclosure 1. Enclosure 1 provides the detailed chemical composition of copper, phosphorus, nickel and sulfur for the plates, welds, and surveillance material. Table 5.3-5 of the LGS, Units 1 and 2 UFSAR will be revised

in the next UFSAR revision to reflect the data shown in Enclosure 1.

We note that the estimated copper and nickel contents (i.e., 0.35% and 1.00%, respectively) for the vertical and girth welds for LGS, Unit 1 provided in the July 10, 1992 response were the same or conservative except for the nickel content of girth weld L83355/8411B27AD. The actual nickel content of this weld is 1.08%. The difference does not significantly impact the EOL $RT_{NDT}$ for this weld or the prediction that the USE will not be less that 50 ft-lbs at the end of 32 EFPYs.

Request 2b (6):

"(6) the heat number of the wire used for determining the weld metal chemical composition if different than Item (3) above."

Response:

In our July 10, 1992 response to Generic Letter 92-01, Request 2b (6), we stated that the heat numbers for the wire used for determining the weld metal composition is contained in Tables 5.3.3 and 5.3.4 of the LGS, Units 1 and 2 UFSAR. This reference to Tables 5.3.3 and 5.3.4 of the LGS, Units 1 and 2 UFSAR was incorrect. This information is contained in Tables 5.3.4 and 5.3.5 of the LGS, Units 1 and 2 UFSAR.

Request 3a:

"3. Addressees are requested to provide the following information regarding commitments made to respond to GL 88-11:

a. How the embrittlement effects of operating at an irradiation temperature (cold leg or recirculation suction temperature) below 525°F were considered. In particular licensees are requested to describe consideration given to determining the effect of lower irradiation temperature on the reference temperature and on the Charpy upper shelf energy."

Response:

In our July 10, 1992 response to Generic Letter 92-01, Request 3a, we stated that estimated EOL fluences for LGS, Units 1 and 2 would be calculated accounting for the additional chemistry information located during a documentation search. The calculations have been completed with the following results.

The LGS, Units 1 and 2 fluence for 32 EFPYs with the 1/4 thickness (T) lead factor is estimated to be $1.2 \times 10^{18}$

$n/cm^2$ with an upper bound of $1.5 \times 10^{18}$ $n/cm^2$. This upper bound is based on a standard deviation of 25%. Using the upper bound, the fluence accumulated below 525°F assuming the time of operation in these conditions has been estimated to be less than 1%, would be $1.5 \times 10^{16}$ for LGS, Units 1 and 2. This combination of low fluence and small deviation from the 525°F level will not significantly affect the beltline $RT_{NDT}$ or upper shelf energy (USE) predictions.

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ENCLOSURE 1

LIMERICK GENERATING STATION

UNITS 1 AND 2

RESPONSE TO GENERIC LETTER 92-01

LGS
TABLE 5.3-5
LGS BELTLINE PLATE AND WELDS EOL $RT_{NDT}$
(UNIT 1)



(PEAK EOL FLUENCE = $1.2 \times 10^{18}$ N / $CM^2$ @ 1/4 T

A. PLATES

| I.D. | Heat | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|---|
| 14-1 | C7688-1 | 0.12 | 0.011 | 0.51 | 0.015 | +10 | 70 | 80 |
| 14-2 | C7698-2 | 0.11 | 0.010 | 0.48 | 0.014 | +10 | 65 | 75 |
| 14-3 | C7688-2 | 0.12 | 0.011 | 0.51 | 0.015 | +10 | 70 | 80 |
| 17-1 (1) | C7689-1 | 0.11 | 0.007 | 0.48 | 0.014 | +10 | 65 | 75 |
| 17-2 | C7677-1 | 0.11 | 0.016 | 0.50 | 0.016 | +20 | 66 | 86 (3) |
| 17-3 | C7698-1 | 0.11 | 0.010 | 0.48 | 0.014 | +10 | 65 | 75 |

B. WELDS

1. SHOP WELDS (i.e., VERTICAL SEAMS)

| Heat / Lot | Seams Used In | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|---|
| 411A3531/H004A27A | BE | 0.02 | 0.015 | 0.96 | 0.017 | -50 | 24 | -26 |
| 06L165/F017A27A | BA, BD BB, BF | 0.03 | 0.021 | 0.99 | 0.017 | -50 | 37 | -13 |
| 662A746/H013A72A | BA, BD BE, BF | 0.03 | 0.021 | 0.88 | 0.017 | -20 | 37 | +17 |
| 3P4000/ (2) 3932-989 | BC, BB BA | 0.02 | 0.015 | 0.90 | 0.012 | -50 | 24 | -26 |
| S3986/ RUN #934 | BF | 0.05 | 0.019 | 0.92 | 0.016 | -42 | 61 | +19 |
| 1P 4218/ (1) (2) 3929-989 | BE, BA BB | 0.06 | 0.010 | 0.89 | 0.011 | -50 | 74 | +24 |
| 421A6811/ (1) F022A27A | Weld Test Plate | 0.09 | 0.018 | 0.81 | 0.016 | -50 | 110 | +60 |

TABLE 5.3-5 (Cont'd)

LGS BELTLINE PLATE AND WELDS EOL $RT_{NDT}$

(UNIT 1)



| Heat/Lot | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|
| 2. FIELD WELDS (i.e., GIRTH) | | | | | | | |
| 07L857/B101A27A | 0.03 | 0.012 | 0.97 | 0.017 | -6 | 37 | +31 |
| 402C4371/C115A27A | 0.02 | 0.009 | 0.92 | 0.014 | -50 | 24 | -26 |
| 411A3531/H004A27A | 0.02 | 0.013 | 0.96 | 0.017 | -50 | 24 | -26 |
| 09M057/C109A27A | 0.03 | 0.009 | 0.89 | 0.021 | -32 | 37 | +5 |
| 412P3611/J417B27AF | 0.03 | 0.016 | 0.93 | 0.019 | -80 | 37 | -43 |
| 03M014/C11[illegible]A27A | 0.01 | 0.012 | 0.94 | 0.015 | -34 | 18 | -16 |
| L83355/S411B27AD | 0.03 | 0.017 | 1.08 | 0.018 | -70 | 37 | -33 |
| 640892/J424[illegible]27AE | 0.09 | 0.015 | 1.00 | 0.018 | -60 | 110 | +50 (3) |
| 401P6741/S419B27AG | 0.03 | 0.013 | 0.92 | 0.014 | -60 | 37 | -23 |
| 5P6756/ | 0.08 | 0.008 | 0.96 | 0.012 | -60 | 97 | +37 |
| 3. LPCI NOZZLE WELDS (4) | | | | | | | |
| 07L669/K004A27A | 0.03 | 0.014 | 1.02 | 0.016 | -50 | 13 | -37 |
| 401Z9711/A022A27A | 0.02 | 0.021 | 0.83 | 0.017 | -50 | 24 | -26 |
| 411A3531/H004A27A | | | | | | | |
| 662A746/H013A27A | | Data Previously Provided Under "Shop Welds" | | | | | |
| 3P4000/3932-989<br>S3986/Run #934 | | | | | | | |

(PEAK EOL FLUENCE = $1.2 \times 10^{18}$ N / $CM^2$ @ 1/4 T

A. PLATES

| I.D. | Heat | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|---|
| 14-1 | B3312-1 | 0.13 | 0.009 | 0.58 | 0.016 | +10 | 75 | 85 |
| 14-2 | B3416-1 | 0.14 | 0.009 | 0.65 | 0.015 | +40 | 80 | 120 (3) |
| 14-3 | C9621-2 | 0.15 | 0.006 | 0.60 | 0.020 | +22 | 83 | 105 |
| 17-1 (1) | C9569-2 | 0.11 | 0.009 | 0.51 | 0.018 | +10 | 66 | 76 |
| 17-2 | C9526-1 | 0.11 | 0.012 | 0.56 | 0.018 | +10 | 67 | 77 |
| 17-3 | C9526-2 | 0.11 | 0.012 | 0.56 | 0.018 | +10 | 67 | 77 |

B. WELDS

1. SHOP WELDS (i. e. VERTICAL SEAMS)

| Heat / Lot | Seams Used In | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|---|
| 432A2671/H019A27A | BA, BB, BD BE, BF | 0.04 | 0.019 | 1.38 | 0.014 | -12 | 49 | +37 |
| 03R728/L910A27A | BA, BC | 0.03 | 0.020 | 0.92 | 0.016 | -50 | 37 | -13 |
| 3P4000/3933 (1) Single end / or Tandem Wire | BA, BB, BC BD, BE, BF | 0.02 | 0.014 | 0.95 | 0.012 | -50 | 24 | -26 |
| 401Z9711/A02_A27A | BB | 0.02 | 0.021 | 0.83 | 0.017 | -50 | 24 | -26 |
| 661A746/H013A27A | BC | 0.03 | 0.021 | 0.88 | 0.017 | -20 | 37 | +17 |
| 402A0462/B023A27A | BC | 0.02 | 0.021 | 0.90 | 0.018 | -50 | 24 | -26 |
| 07L669/K004A27A | BC, BD BE, BF | 0.03 | 0.014 | 1.02 | 0.016 | -50 | 37 | -13 |
| 09L853/A111A27A | BD, BE | 0.03 | 0.018 | 0.86 | 0.023 | -50 | 37 | -13 |

| Heat/Lot | Wt % Cu | Wt % P | Wt % Ni | Wt % S | ASME NB-2300 Start $RT_{NDT}$ (°F) | Regulatory Guide 1.99 (Rev 2) Extrapolation $RT_{NDT}$ (°F) | Estimated EOL $RT_{NDT}$ (°F) |
|---|---|---|---|---|---|---|---|
| 2. Field Welds (i .. Girth) | | | | | | | |
| 07L857/B101A27A | 0.03 | 0.012 | 0.97 | 0.017 | -6 | 37 | +31 |
| 402C4371/C115A27A | 0.02 | 0.009 | 0.92 | 0.014 | -50 | 24 | -26 |
| 411A3531/H004A27A | 0.02 | 0.018 | 0.96 | 0.017 | -50 | 24 | -26 |
| C .09A27A | 0.03 | 0.009 | 0.89 | 0.021 | 32 | 37 | +5 |
| 412P3611/J417B27AF | 0.03 | 0.016 | 0.93 | 0.019 | -80 | 37 | -43 |
| 03M014/C118A27A | 0.01 | 0.012 | 0.94 | 0.015 | -34 | 18 | -16 |
| L83355/S411B27AD | 0.03 | 0.017 | 1.08 | 0.018 | -70 | 37 | -33 |
| 640892/J424B27AE | 0.09 | 0.015 | 1.00 | 0.018 | -60 | 110 | +50 (3) |
| 401P6741/S419B27AG | 0.03 | 0.013 | 0.92 | 0.014 | -60 | 37 | - |
| 3. LPCI Nozzle Welds (4) | | | | | | | |
| 07L669/K004A27A | 0.03 | 0.014 | 1.02 | 0.016 | -50 | 13 | -37 |
| 432A2671/H019A27A | 0.04 | 0.019 | 1.08 | 0.014 | -12 | 17 | +5 |
| C3L46C/J020A27A | 0.02 | 0.019 | 0.87 | 0.017 | -20 | 8 | -12 |
| 422B7201/L030A27A | 0.04 | 0.013 | 0.90 | 0.018 | -40 | 17 | -23 |
| 09L853/A111A27A | 0.03 | 0.018 | 0.86 | 0.023 | -50 | 13 | -37 |
| 4P4784/3930 (5) | 0.06 | 0.012 | 0.87 | 0.013 | -50 | 25 | -25 |
| 4. Surveillance Welds | | | | | | | |
| CTY538/A027A27A | 0.03 | 0.020 | 0.83 | 0.018 | -50 | 37 | -13 |

(1) Surveillance Program Material.

(2) Submerged arc welding.

(3) The most limiting value.

(4) The shell plate and weld are subjected to fluence level in excess of $10^{17}$ $n/cm^2$; this information is given in Footnote (i) of Table 5.3-11.

(5) Single wire or tandem wire submerged arc welding.