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RS-14-265 10 CFR 50.90

September 11, 2014

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

LaSalle County Station, Unit 1
Facility Operating License No. NPF-11
NRC Docket No. 50-373

Subject: Response to Request for Additional Information Regarding Request for Withholding Information from Public Disclosure by Electric Power Research Institute, Inc.

References:

1) Letter from D. M. Gullott (Exelon Generation Company, LLC) to U. S. Nuclear Regulatory Commission, "License Amendment Request to Revise Reactor Coolant System (RCS) Pressure and Temperature (P/T) Curves for LaSalle County Station, Unit 1," dated December 20, 2013

2) Letter from B. Purnell (U. S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "LaSalle County Station, Unit 1 – Request by Electric Power Research Institute, Inc. to Withhold Information from Public Disclosure (TAC No. MF3270)," dated August 27, 2014

In Reference 1, Exelon Generation Company, LLC (EGC) submitted a license amendment request (LAR) to Facility Operating License No. NPF-11 for LaSalle County Station (LSCS), Unit 1. Specifically, the proposed change would revise the reactor coolant system (RCS) pressure and temperature (P/T) curves contained in Technical Specifications (TS) 3.4.11, "RCS Pressure and Temperature (P/T) Limits," Figures 3.4.11-1 through 3.4.11-3. The EGC LAR included two copies of an affidavit executed by Electric Power Research Institute, Inc. (EPRI), requesting that some information contained in Attachments 4, 5, 6, and 7 of the LAR be withheld from public disclosure pursuant to 10 CFR 2.390.

In Reference 2, the U. S. Nuclear Regulatory Commission (NRC) requested additional information to complete its review of the EPRI request for withholding information from public disclosure. Attachments 1 through 3 provide the requested information.

With the response to Reference 2, it was determined that the information previously identified in Reference 1 as proprietary to EPRI is now considered non-proprietary. The revised non-proprietary LSCS Unit 1 Pressure / Temperature Limits Report provided in Attachment 2 of this submittal supersedes the EPRI proprietary version of the report provided in Attachment 4, Enclosure 3, of Reference 1 and the non-proprietary version of the report provided in Attachment 5 of Reference 1. The revised non-proprietary response to Grand Gulf Nuclear Station (GGNS) request for additional information (RAI) #6 provided in Attachment 3 of this submittal supersedes the EPRI proprietary response to GGNS RAI #6 provided in Attachment 6, Enclosure 5, of Reference 1 and the EPRI non-proprietary response to GGNS RAI #6 provided in Attachment 7 of Reference 1. The content of the P/T limits report and RAI response has not been revised; however, the basis for withholding the information has changed.

EGC has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration that was previously provided to the NRC in Attachment 1 of Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environment assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained within this letter.

Should you have any questions concerning this letter, please contact Ms. Lisa A. Simpson at (630) 657-2815.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 11th day of September 2014.

Respectfully,

David M. Gullott
Manager – Licensing
Exelon Generation Company, LLC

Attachments:
1) Response to Request for Additional Information
2) Revised LaSalle County Station Unit 1 Pressure / Temperature Limits Report (Non-Proprietary)
3) Revised Exelon Response to GGNS RAI #6 (Non-Proprietary)

cc: NRC Regional Administrator, Region III
NRC Senior Resident Inspector, LaSalle County Station
Illinois Emergency Management Agency – Division of Nuclear Safety

ATTACHMENT 1
Response to Request for Additional Information

By letter dated December 20, 2013, Exelon Generation Company, LLC (EGC) submitted a license amendment request (LAR) to revise the reactor coolant system (RCS) pressure and temperature (P/T) curves contained in Technical Specifications (TS) 3.4.11, "RCS Pressure and Temperature (P/T) Limits," Figures 3.4.11-1 through 3.4.11-3 for LaSalle County Station (LSCS), Unit 1. The EGC LAR included two copies of an affidavit dated April 2, 2013, executed by Neil Wilmshurst of Electric Power Research Institute, Inc. (EPRI), requesting that some information contained in Attachments 4, 5, 6, and 7 of the LAR be withheld from public disclosure pursuant to 10 CFR 2.390.

By letter dated August 27, 2014, the U. S. Nuclear Regulatory Commission (NRC) requested additional information to complete its review of the EPRI request for withholding information from public disclosure. Attachments 1 through 3 provide the requested information.

NRC Question RAI-1:

By letter dated November 18, 2011, EPRI submitted Technical Report 1022850, "BWRVIP-250NP: BWR Vessel and Internals Project – Testing and Evaluation of the LaSalle Unit 1 120° Surveillance Capsule," dated October 2011. EPRI's letter states "the enclosed report is non-proprietary and is available to the public by request to EPRI." This report is publicly available in ADAMS under Accession No. ML11326A290.

The NRC staff notes that most of the information EPRI requests to be withheld from public disclosure in its April 2, 2013, affidavit was made publicly available by EPRI in Technical Report 1022850.

Provide a response to the following:

a. Explain how EPRI has held the information in confidence when it has been made publicly available by EPRI.

b. Explain how this is a type of information normally held in confidence when it has been made publicly available by EPRI.

c. Explain how release of this information would cause substantial harm to EPRI when EPRI has previously made this information available to the public.

EGC Response to NRC Question RAI-1:

EPRI agrees that some of the information requested to be withheld from public disclosure was previously published in the non-proprietary Technical Report 1022850. Therefore, the following information previously identified as proprietary has been revised to be non-proprietary:

- The ISP plate and weld heat numbers and corresponding %Cu and %Ni values listed in Attachment 4, Enclosure 3, Appendix B Table B-4.
- The ISP plate and weld heat numbers and corresponding %Cu and %Ni values listed in Attachment 6, Enclosure 5, GGNS RAI #6.
- The tables listing Best Estimate Chemistry for plate Heat C6345-1 and weld Heat 1P3571 listed in Attachment 6, Enclosure 5, GGNS RAI#6

NRC Question RAI-2:

By email dated January 31, 2011 (ADAMS Accession No. ML110310390), NRC staff issued a request for additional information (RAI) to Grand Gulf Nuclear Station, Unit 1 (GGNS), regarding its P/T limits. As noted in Exelon's application, the staff has requested that future applicants for P/T limit changes include a response to this GGNS RAI. In Attachment 6 of the application, Exelon provided the LSCS, Unit 1, responses to this GGNS RAI.

The NRC staff notes that a publicly available version of the February 23, 2011, GGNS RAI response is available in ADAMS under Accession No. ML110540540. The public information from GGNS appears to be of a similar type to some of the information which EPRI is requesting to be withheld from the public.

Provide a response to the following:

a. Explain how the information requested to be withheld is of a different type than the information contained in the GGNS RAI response.

b. Explain how this is a type of information normally held in confidence when it appears that similar information has been made public.

c. Explain how release of this information would cause substantial harm to EPRI when it appears that similar information has been made public.

EGC Response to NRC Question RAI-2:

EPRI agrees that some of the information requested to be withheld from public disclosure is of a similar type to information provided as non-proprietary by Grand Gulf Nuclear Station. Therefore, the following information previously identified as proprietary has been revised to be non-proprietary:

- The table listing the Target Vessel and ISP Representative Materials listed in Attachment 6, Enclosure 5, GGNS RAI#6
- The RG 1.99 calculated chemistry factors associated with the LSCS plate listed in Attachment 6, Enclosure 5, GGNS RAI#6

NRC Question RAI-3:

The application indicates that guidance contained in NRC Regulatory Guide (RG) 1.99, "Radiation Embrittlement of Reactor Vessel Materials," Revision 2, dated May 1988 (ADAMS Accession No. ML003740284), was used to derive certain values. EPRI has requested that some of these values be withheld from public disclosure. However, the NRC staff notes that the input used to derive these parameters appears to be publicly available in EPRI Technical Report 1022850.

Provide a response to the following:

a. Explain how release of this information would cause substantial harm to EPRI when it appears that the values can be derived from publicly available methods in RG 1.99 using information made public by EPRI.

b. Provide an estimate of the amount of effort and money it took to derive these values given that the information and methods are publicly available.

EGC Response to NRC Question RAI-3:

As discussed in responses to RAI-1 and RAI-2, EPRI agrees that some of the information requested to be withheld from public disclosure should be revised to be non-proprietary. EPRI agrees that when the methodology of RG 1.99 is applied to the newly non-proprietary information, the resultant values are non-proprietary. Therefore, the following information previously identified as proprietary has been revised to be non-proprietary:

- The RG 1.99 calculated chemistry factors associated with the Best Estimate Chemistry values, and the EPRI fitted chemistry factors for plate Heat C6345-1 and weld Heat 1P3571 listed in Attachment 6, Enclosure 5, GGNS RAI#6

- The calculation of the adjusted surveillance chemistry factor listed in Attachment 6, Enclosure 5, GGNS RAI#6

ATTACHMENT 2

Revised LaSalle County Station Unit 1 Pressure / Temperature Limits Report

(Non-Proprietary)

LaSalle County Station, Unit 1

33 pages follow

ATTACHMENT 5

LaSalle County Station
Unit 1

Pressure / Temperature Limits Report

(NON-PROPRIETARY)

Table of Contents

1.0 Purpose

LaSalle County Station (LSCS) is a participant in the Boiling Water Reactor Vessel and Internals Project (BWRVIP) Integrated Surveillance Program (ISP), currently administrated by Electric Power Research Institute (EPRI). The 120° capsule was removed from Unit 1 in February 2010 in accordance with the BWRVIP protocol of the ISP. Based on testing performed on the specimens, the limiting beltline material shift value for Unit 1 is increased, and consequently, results in an increase in the Adjusted Reference Temperature (ART) which is the initial Reference Temperature of Nil-Ductility Transition (RT_{NDT}) plus the change in RT_{NDT} (ΔRT_{NDT}) plus margin. As a result, the Unit 1 P/T curves are non-conservative for 32 Effective Full Power Years (EFPY).

The purpose of this Pressure and Temperature Limits Amendment Request is to incorporate the ISP results into revised operating limits relating to:

1. Reactor Coolant System (RCS) Pressure versus Temperature limits during Heatup, Cooldown and Hydrostatic/Class 1 Leak Testing;
2. RCS Heatup and Cooldown rates;
3. Reactor Pressure Vessel (RPV) to RCS coolant ΔT requirements during Recirculation Pump startups;
4. RPV bottom head coolant temperature to RPV coolant temperature ΔT requirements during Recirculation Pump startups;
5. RPV head flange bolt-up temperature limits.

This report has been prepared in accordance with the Final Safety Evaluation for Boiling Water Reactors Owners' Group Licensing Topical Report (LTR) NEDC-33178P, General Electric Methodology for Development of Reactor Pressure Vessel Pressure -Temperature Curves (Reference 6.2)

2.0 Applicability

This report is applicable to the LSCS Unit 1 RPV for up to 32 EFPY.

The following Technical Specification is affected by the information contained in this report:

TS 3.4.11 RCS Pressure and Temperature (P/T) Limits

3.0 Methodology

The limits in this report were derived from the NRC-approved GEH LTR methodology (Reference 6.2), using the specific revisions listed below:

1. The neutron fluence was calculated using a combination of NRC approved methods. The first thirteen cycles of fluence were calculated in accordance with BWRVIP-126: *BWR Vessel and Internals Project, RAMA Fluence Methodology Software*, Version 1.0, EPRI, Palo Alto, CA: 2003, Technical Report 1007823, as approved by the NRC in Reference 6.1.a. The fluence subsequent to cycle 13 was calculated in accordance with the *General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation*, NEDC-32983P-A, Revision 2, January 2006, approved in Reference 6.1.b.

2. The pressure and temperature limits were calculated per *GE Hitachi Nuclear Energy Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves*, NEDC-33178P-A, Revision 1, June 2009, approved in Reference 6.2. The calculation is documented in Reference 6.4.

3. The ISP data from the LaSalle Unit 1 ISP capsule at 120° is contained in BWRVIP-250NP, "*Testing and Evaluation of the LaSalle Unit 1 120° Surveillance Capsule*", EPRI, Palo Alto, CA: 2011, Technical Report 1022850 (Reference 6.3). BWRVIP-250NP was transmitted to the NRC in Reference 6.5. The analysis of this data is documented in Reference 6.9 and in Attachment 7 of this submittal. The results of this testing and analysis, including the revised chemistry factor, are shown in Table B-4 of this submittal.

4. This revision of the pressure and temperature limits is to incorporate the following changes:

   - ISP data
   - Application of GEH Topical Report for P/T Curves

As mentioned above LSCS Unit 1 participates in the BWRVIP ISP. Unit 1 is a host plant and has removed and tested the 120° capsule. This is the second capsule removed and tested from the LSCS Unit 1 vessel. The 300° capsule was removed in 1994 and tested (Reference 6.7). The third capsule remains in the vessel, and is a Future ISP (E) Capsule, or an Extended Life Capsule, as classified by BWRVIP-86, Revision 1 (Reference 6.8).

The adjusted reference temperature (ART) values for 32 EFPY included in Appendix B are developed considering the latest ISP published surveillance data available that is representative of the applicable materials in Unit 1. The surveillance data used in the Unit 1 ART calculations is obtained from actual Unit 1 RPV test specimens. The ISP weld material has the limiting ART, and is considered in development of the P/T curves.

4.0 Operating Limits

The pressure/temperature (P/T) curves provided in this report represent steam dome pressure versus minimum vessel metal temperature and incorporate the appropriate non-beltline limits and irradiation embrittlement effects in the beltline region.

Complete P/T curves were developed for 32 EFPY. The P/T curves are provided in Figures 1 through 3, and a tabulation of the curves is included in Table 1.

The operating limits for pressure and temperature are required for three categories of operation: (a) hydrostatic pressure tests and leak tests, referred to as Curve A; (b) non-nuclear heatup/cooldown (core not critical), referred to as Curve B; and (c) core critical operation, referred to as Curve C.

Other temperature limits applicable to the RPV are:

- Heatup and Cooldown rate limit during pressure testing (Figure 1: Curve A): ≤ 20 °F/hour.
- Normal Operating Heatup and Cooldown rate limit (Figure 2: Curve B – Core Not Critical and Figure 3: Curve C – Core Critical): ≤ 100 °F/hour.
- RPV bottom head coolant temperature to RPV coolant temperature ΔT limit during Recirculation Pump startup: ≤ 145 °F.
- Recirculation loop coolant temperature to RPV coolant temperature ΔT limit during Recirculation Pump startup: ≤ 50 °F.
- RPV flange and adjacent shell temperature limit: ≥ 72 °F.

5.0 Discussion

The fluence must be calculated in accordance with fluence methodologies that comply with Regulatory Guide 1.190, and have been approved by the NRC. GEH currently has an approved fluence methodology, which is the basis for the existing P/T curves. The BWRVIP analyses are performed using the Radiation Analysis Modeling Application (RAMA) fluence methodology, which is also an NRC approved methodology, but is not the current licensing basis for LaSalle. The NRC has issued a Safety Evaluation Report for the RAMA methodology (Reference 6.1.a), which contains three conditions that must be met in order to use the methodology:

1. For plants that are similar in core, shroud and downcomer-vessel geometry to that of the Susquehanna and Hope Creek plants, the RAMA Methodology can be applied without a bias for the calculation of vessel fluence;
    a. Susquehanna, Hope Creek and LaSalle all contain 764 fuel assemblies, have a shroud with an outside diameter of 207 inches, and have 20 jet pumps in the downcomer area. Therefore, the RAMA methodology can be applied at LaSalle without bias.
2. For plants (or plant groups) with a different geometry than that of the Susquehanna or Hope Creek plants, a plant-specific application for RPV neutron fluence is required to establish the value of a bias, and
    a. Since LaSalle is similar to Susquehanna, this condition is not applicable.
3. Relevant benchmarking will be required for shroud and reactor internals applications.
    a. LaSalle is using the RAMA methodology for evaluation of the reactor pressure vessel, not the shroud or the internals of the reactor, so this condition is not applicable.

Therefore, the use of the RAMA methodology is endorsed by the NRC and all conditions of their approval have been met.

The computer codes described in References 6.1.a, 6.1.b, and 6.2 were used in the development of the P/T curves for LSCS Unit 1.

The method for determining the Initial Reference Temperature of Nil-Ductility Transition (RT_{NDT}) for all vessel materials is defined in Section 4.1.2 of Reference 6.2. Initial RT_{NDT} values for all vessel materials considered are presented in Tables B-1, B-2, and B-3 of this report.

For LSCS Unit 1, the surveillance data from the LaSalle 120° capsule (Reference 6.3), which contained weld heat 1P3571, was utilized in this analysis. The limiting surveillance material, weld heat 1P3571, was considered using Procedure 1 as defined in Appendix I of Reference 6.2. This procedure was used because the vessel material and the surveillance material are identical heats.

For LSCS Unit 1, there are six (6) thickness discontinuities in the vessel:

Discontinuities one through four (1-4) are associated with the Bottom Head Lower to Upper Torus and Bottom Head to Support Skirt; discontinuity 5 is between the Bottom Head to Shell #1, and discontinuity 6 is between Shell #1 and Shell #2.

- The temperature requirement to bound discontinuities 1 through 4 is 113.53°F for the heatup/cooldown transient. The maximum RT_{NDT} for the bottom head is 10°F, and the P/T curves defined in Section 4.3 of Reference 6.2 are based upon a temperature (appropriate for this location) of 137.9°F at 1050 psig.
- The temperature requirement to bound discontinuity 5 is 116.24°F for the heatup/cooldown transient. The maximum RT_{NDT} for the bottom head and Shell #1 is 23°F, and the P/T curves defined in Section 4.3 of Reference 6.2 are based upon a temperature (appropriate for this location) of 137.9°F at 1050 psig.
- The temperature requirement to bound discontinuity 6 is 140.24°F for the heatup/cooldown transient. The maximum RT_{NDT} for Shell #1 and Shell #2 is 80°F, and the P/T curves defined in Section 4.3 of Reference 6.2 are based upon a temperature (appropriate for this location) of 188.1°F at 1050 psig.

Therefore, the temperatures used in the development of the P/T curves bound the temperatures associated with the thickness discontinuities.

The adjusted reference temperature (ART) of the limiting beltline material is used to adjust the beltline P/T curves to account for irradiation effects. Regulatory

Guide 1.99, Revision 2 (RG 1.99) provides the methods for determining the ART. The RG 1.99 methods for determining the limiting material and adjusting the P/T curves using ART are discussed in this section.

The vessel beltline copper and nickel values, except for weld EAIB on the Low Pressure Coolant Injection (LPCI or N6) nozzles, were obtained from Certified Material Test Reports (CMTRs). The copper content of weld EAIB in the N6 nozzles was based on BWR fleet and RVID data for SMAW materials using 83 unique data points and Mean +2σ methodology. With the exception of weld 1P3571, the copper and nickel values were used with Tables 1 and 2 of RG 1.99 to determine a chemistry factor (CF) per Paragraph 1.1 of RG 1.99 for welds and plates respectively. For weld 1P3571, the adjusted CF was calculated using the fitted chemistry factor obtained from Reference 6.9. The water level instrumentation (WLI or N12) nozzle is fabricated from Alloy 600 material that does not require evaluation for fracture toughness, and was evaluated using the limiting material properties (chemistry and initial RT_{NDT}) of the adjoining plate heats.

The P/T curves for the non-beltline region were conservatively developed for a Boiling Water Reactor Product Line 6 (BWR/6) with nominal inside diameter of 251 inches. The analysis is considered appropriate for LSCS Unit 1 because the plant-specific geometric values are bounded by the generic analysis for the large BWR/6. The generic value was adapted to the conditions at LSCS using plant-specific RT_{NDT} values for the reactor pressure vessel.

The peak RPV ID fluence used in the P/T curve evaluation for Unit 1 at 32 EFPY is 8.34E17 n/cm^2. The fluence values were calculated using methods that comply with the guidelines of RG 1.190, (as discussed in References 6.1.a and 6.1.b).

The fluence is adjusted for the lower plates and associated welds based upon an attenuation factor of 0.45; hence, the peak ID surface fluence for these components is 3.76E17 n/cm^2.

The fluence is adjusted for the N6 nozzle (LPCI nozzle) based upon an attenuation factor of 0.376; hence the peak ID surface fluence used for this component is 3.14E17 n/cm^2.

The same method is applied to the N12 nozzle (Instrumentation nozzle), which has an attenuation factor of 0.287, resulting in a peak ID surface fluence of 2.39E17 n/cm^2.

The P/T curves for the heatup and cooldown operating conditions at a given EFPY apply for both the 1/4T and 3/4T locations. When combining pressure and thermal stresses, it is usually necessary to evaluate stresses at the 1/4T location (inside surface flaw) and the 3/4T location (outside surface flaw). This is because the thermal gradient tensile stress of interest is in the inner wall during cooldown and the outer wall during heatup. However, as a conservative simplification, the thermal gradient stress at the 1/4T location is assumed to be tensile for both heatup and cooldown. This results in the approach of applying the maximum tensile stress at the 1/4T location. This approach is conservative because irradiation effects cause the allowable toughness, K_{Ir}, at 1/4T to be less than that at 3/4T for a given metal temperature. This approach causes no operational difficulties, since the BWR is at steam saturation conditions during normal operation, well above the heatup/cooldown curve limits.

For the core not critical curve (Curve B) and the core critical curve (Curve C), the P/T curves specify a coolant heatup and cooldown temperature rate of ≤ 100°F/hr for which the curves are applicable. However, the core not critical and the core critical curves were also developed to bound transients defined on the RPV thermal cycle diagram and the nozzle thermal cycle diagrams. For the hydrostatic pressure and leak test curve (Curve A), a coolant heatup and cooldown temperature rate of ≤ 20°F/hr must be maintained. The P/T limits and corresponding heatup/cooldown rates of either Curve A or B may be applied while achieving or recovering from test conditions. Curve A applies during pressure testing and when the limits of Curve B cannot be maintained.

For LSCS Unit 1, weld 1P3571 is the limiting material for the beltline region for 32 EFPY. The initial RT_{NDT} for weld 1P3571 is -30°F. The generic pressure test P/T curve is applied to the LSCS Unit 1 beltline curve by shifting the P vs. (T - RT_{NDT}) values to reflect the ART value of 116°F for 32 EFPY. Using the fluence discussed above, the P/T curves are beltline limited above 610 psig for Curve A, and above 440 psig for Curve B.

In order to ensure that the limiting vessel discontinuity has been considered in the development of the P/T curves, the methods in Sections 4.3.2.1 and 4.3.2.2

of Reference 6.2 for the non-beltline and beltline regions, respectively, are applied.

6.0 References

6.1.a Letter from William. H. Bateman (U.S. NRC) to Bill Eaton (BWRVIP), "*Safety Evaluation of Proprietary EPRI Reports BWRVIP-114, 115, 117, and 121 and TWE-PSE-001-R-001*", dated May 13, 2005.

6.1.b *Final Safety Evaluation Regarding Removal of Methodology Limitations for NEDC-32983P-A, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation (TAC NO. MC3788)*, November 17, 2005.

6.2 *Final Safety Evaluation for Boiling Water Reactors Owners' Group Licensing Topical Report NEDC-33178P, General Electric Methodology for Development of Reactor Pressure Vessel Pressure-Temperature Curves (TAC NO. MD2693)*, April 27, 2009.

6.3 BWRVIP-250NP, "*Testing and Evaluation of the LaSalle Unit 1 120° Surveillance Capsule*", EPRI, Palo Alto, CA: 2011, Technical Report 1022850.

6.4 "*Pressure-Temperature Limits Report for Exelon Nuclear, LaSalle County Station Unit 1*", 0000-0148-2850-R2, Revision 2, January 2013.

6.5 Letter 2011-206 from Dave Czufin, Chairman, BWR Vessels and Internals Project, to Document Control Desk, *Project No. 704 – BWRVIP-250NP: BWR Vessel and Internals Project, Testing and Evaluation of the LaSalle Unit 1 120° Surveillance Capsule*, EPIR Technical Report 1022850, October 2011.

6.6 Letter RA13-002 from Peter J. Karaba, Site Vice President, LaSalle County Station, to Document Control Desk, *Evaluation of LaSalle County Station Unit 1 120° Capsule Surveillance Data,* January 10, 2013

6.7 "*LaSalle Unit 1 RPV Surveillance Materials Testing and Analysis*", GE-NE-523-A166-1294, Revision 1, June 1995, as filed in L-002872.

6.8 BWRVIP-86, Revision 1, "*Updated BWR Integrated Surveillance Program (ISP) Implementation Plan*", EPRI, Palo Alto, CA: 2008, Technical Report 1016575.

6.9 BWRVIP Letter 2012-026, "*Evaluation of the LaSalle Unit 1 120° Surveillance Capsule Data*", to Ms. JoAnn Shields, Exelon Corporation from Bob Carter, EPRI, BWRVIP Assessment Task Manager, dated January 10, 2012.

6.10 BWRVIP-135, Revision 2, "*Integrated Surveillance Program, Data Source Book and Plant Evaluations*", Final Report, October 2009, Technical Report 1020231.

Figure 1 – Bottom Head and Composite (Upper Vessel & Beltline) Pressure Test P/T Curves [Curve A] up to 32 EFPY [20°F/hr or less coolant heatup/cooldown]

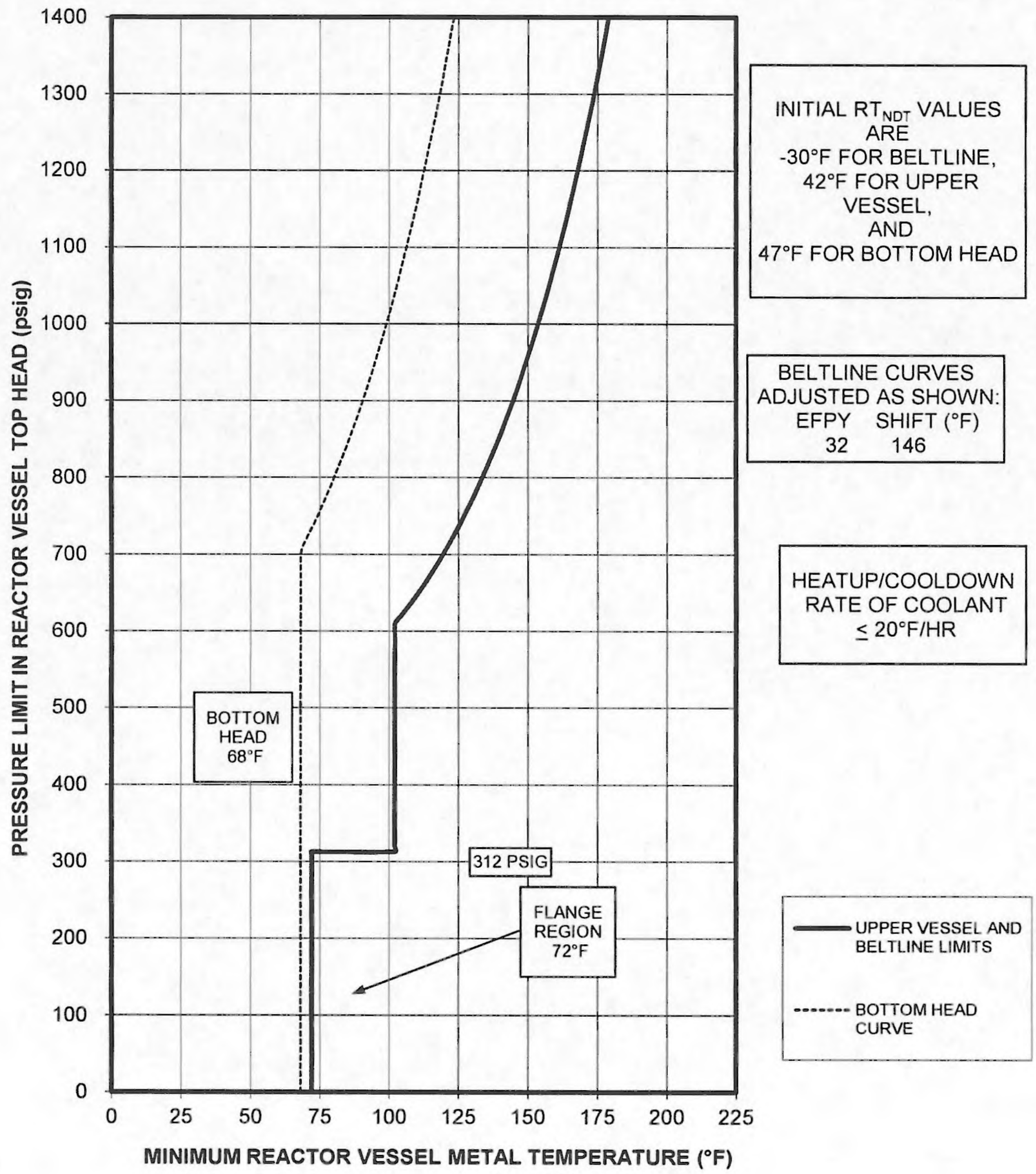

Figure 2 – Bottom Head and Composite (Upper Vessel & Beltline) Core Not Critical P/T Curves [Curve B] up to 32 EFPY [100°F/hr or less coolant heatup/cooldown]

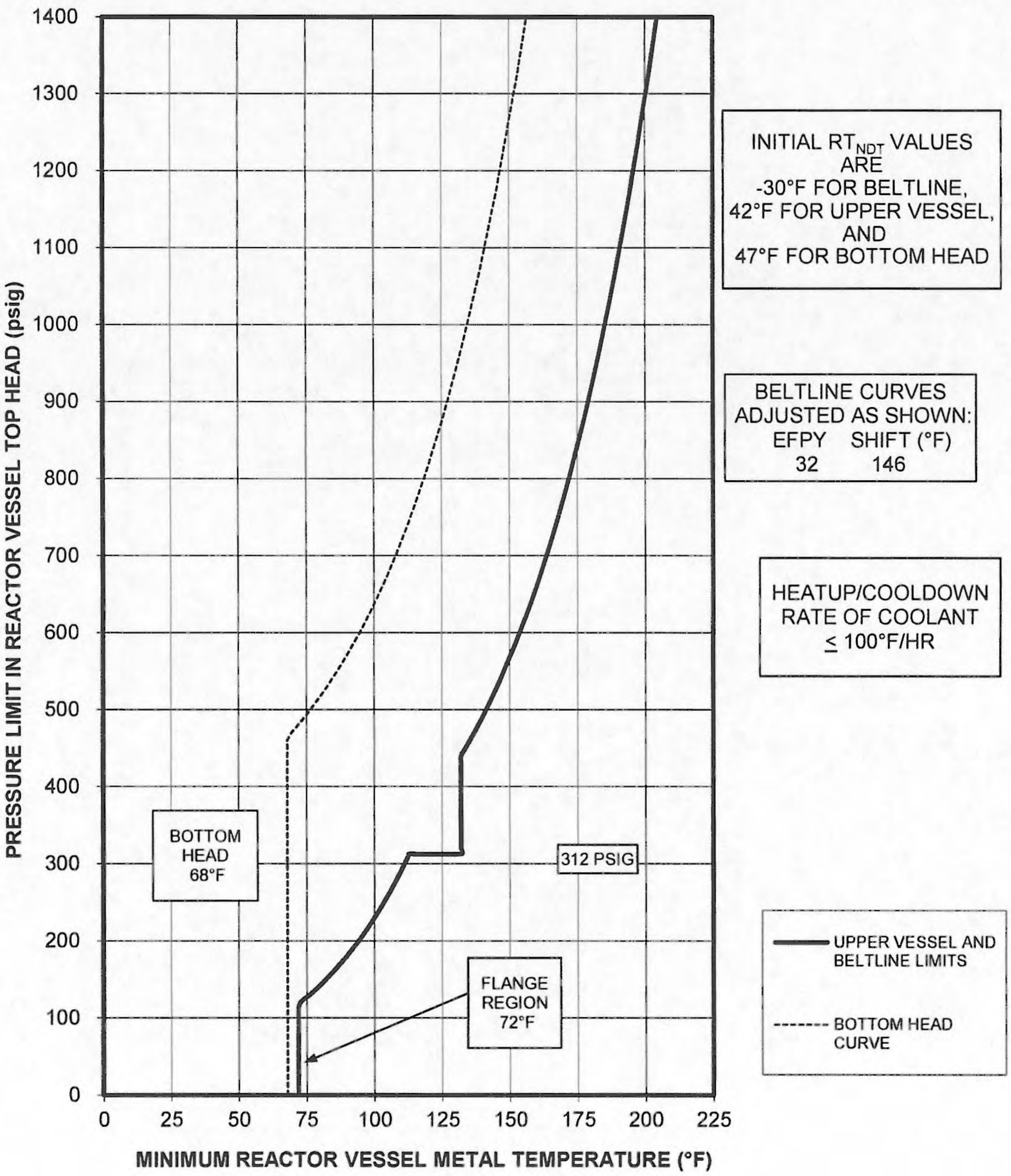

Figure 3 – Composite Core Critical P/T Curves [Curve C] up to 32 EFPY
[100°F/hr or less coolant heatup/cooldown]

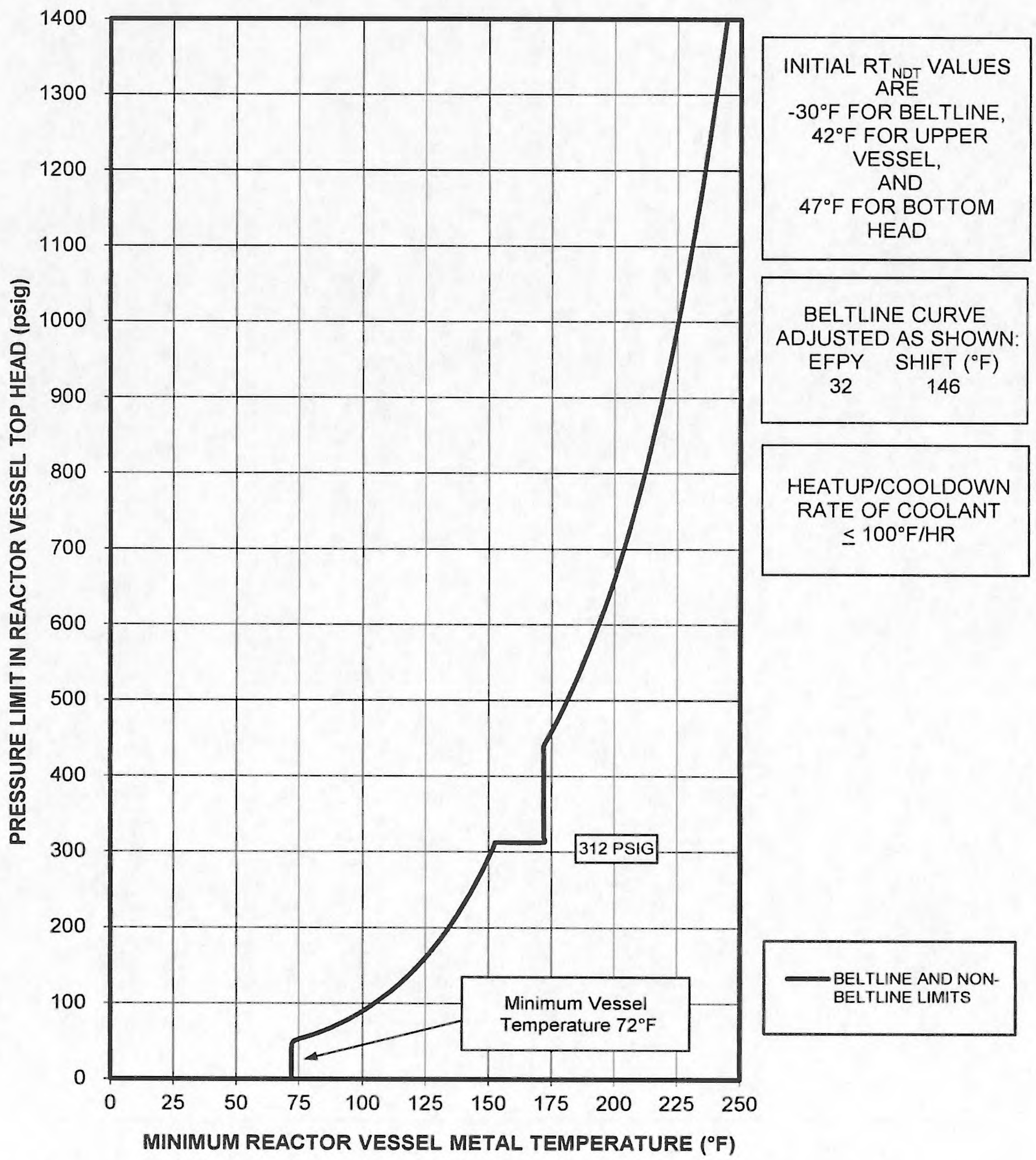

TABLE 1. LSCS Unit 1 Composite P/T Curve Values for 32 EFPY

Required Metal Temperature with Required Coolant Temperature Rate
at 100 °F/hr for Curves B & C and 20 °F/hr for Curve A

PRESSURE (PSIG)	BOTTOM HEAD CURVE A (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE A (°F)	BOTTOM HEAD CURVE B (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE B (°F)	LIMITING 32 EFPY CURVE C (°F)
0	68.0	72.0	68.0	72.0	72.0
10	68.0	72.0	68.0	72.0	72.0
20	68.0	72.0	68.0	72.0	72.0
30	68.0	72.0	68.0	72.0	72.0
40	68.0	72.0	68.0	72.0	72.0
50	68.0	72.0	68.0	72.0	73.1
60	68.0	72.0	68.0	72.0	82.0
70	68.0	72.0	68.0	72.0	89.2
80	68.0	72.0	68.0	72.0	95.2
90	68.0	72.0	68.0	72.0	100.3
100	68.0	72.0	68.0	72.0	104.8
110	68.0	72.0	68.0	72.0	108.9
120	68.0	72.0	68.0	72.7	112.7
130	68.0	72.0	68.0	76.2	116.2
140	68.0	72.0	68.0	79.4	119.4
150	68.0	72.0	68.0	82.2	122.2
160	68.0	72.0	68.0	84.9	124.9
170	68.0	72.0	68.0	87.5	127.5
180	68.0	72.0	68.0	89.9	129.9
190	68.0	72.0	68.0	92.2	132.2
200	68.0	72.0	68.0	94.3	134.3
210	68.0	72.0	68.0	96.3	136.3
220	68.0	72.0	68.0	98.3	138.3
230	68.0	72.0	68.0	100.1	140.1
240	68.0	72.0	68.0	101.9	141.9
250	68.0	72.0	68.0	103.6	143.6
260	68.0	72.0	68.0	105.2	145.2
270	68.0	72.0	68.0	106.8	146.8
280	68.0	72.0	68.0	108.3	148.3
290	68.0	72.0	68.0	109.8	149.8
300	68.0	72.0	68.0	111.2	151.2
310	68.0	72.0	68.0	112.5	152.5

TABLE 1. LSCS Unit 1 Composite P/T Curve Values for 32 EFPY

Required Metal Temperature with Required Coolant Temperature Rate
at 100 °F/hr for Curves B & C and 20 °F/hr for Curve A

PRESSURE (PSIG)	BOTTOM HEAD CURVE A (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE A (°F)	BOTTOM HEAD CURVE B (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE B (°F)	LIMITING 32 EFPY CURVE C (°F)
312.5	68.0	72.0	68.0	112.9	152.9
312.5	68.0	102.0	68.0	132.0	172.0
320	68.0	102.0	68.0	132.0	172.0
330	68.0	102.0	68.0	132.0	172.0
340	68.0	102.0	68.0	132.0	172.0
350	68.0	102.0	68.0	132.0	172.0
360	68.0	102.0	68.0	132.0	172.0
370	68.0	102.0	68.0	132.0	172.0
380	68.0	102.0	68.0	132.0	172.0
390	68.0	102.0	68.0	132.0	172.0
400	68.0	102.0	68.0	132.0	172.0
410	68.0	102.0	68.0	132.0	172.0
420	68.0	102.0	68.0	132.0	172.0
430	68.0	102.0	68.0	132.0	172.0
440	68.0	102.0	68.0	132.0	172.0
450	68.0	102.0	68.0	133.7	173.7
460	68.0	102.0	68.0	135.3	175.3
470	68.0	102.0	69.6	136.9	176.9
480	68.0	102.0	72.1	138.4	178.4
490	68.0	102.0	74.4	139.9	179.9
500	68.0	102.0	76.6	141.3	181.3
510	68.0	102.0	78.8	142.7	182.7
520	68.0	102.0	80.8	144.0	184.0
530	68.0	102.0	82.8	145.3	185.3
540	68.0	102.0	84.7	146.6	186.6
550	68.0	102.0	86.5	147.9	187.9
560	68.0	102.0	88.3	149.1	189.1
570	68.0	102.0	90.0	150.3	190.3
580	68.0	102.0	91.6	151.5	191.5
590	68.0	102.0	93.2	152.6	192.6
600	68.0	102.0	94.8	153.7	193.7
610	68.0	102.0	96.3	154.8	194.8

TABLE 1. LSCS Unit 1 Composite P/T Curve Values for 32 EFPY

Required Metal Temperature with Required Coolant Temperature Rate
at 100 °F/hr for Curves B & C and 20 °F/hr for Curve A

PRESSURE (PSIG)	BOTTOM HEAD CURVE A (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE A (°F)	BOTTOM HEAD CURVE B (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE B (°F)	LIMITING 32 EFPY CURVE C (°F)
620	68.0	104.3	97.7	155.9	195.9
630	68.0	106.4	99.1	156.9	196.9
640	68.0	108.5	100.5	157.9	197.9
650	68.0	110.5	101.8	158.9	198.9
660	68.0	112.4	103.1	159.9	199.9
670	68.0	114.3	104.4	160.9	200.9
680	68.0	116.1	105.7	161.8	201.8
690	68.0	117.8	106.9	162.7	202.7
700	68.0	119.4	108.0	163.6	203.6
710	68.7	121.1	109.2	164.5	204.5
720	70.1	122.6	110.3	165.4	205.4
730	71.5	124.1	111.4	166.3	206.3
740	72.8	125.6	112.5	167.1	207.1
750	74.1	127.0	113.6	168.0	208.0
760	75.4	128.4	114.6	168.8	208.8
770	76.6	129.8	115.6	169.6	209.6
780	77.8	131.1	116.6	170.4	210.4
790	79.0	132.4	117.6	171.2	211.2
800	80.2	133.6	118.5	171.9	211.9
810	81.3	134.8	119.5	172.7	212.7
820	82.4	136.0	120.4	173.4	213.4
830	83.5	137.2	121.3	174.2	214.2
840	84.5	138.3	122.2	174.9	214.9
850	85.6	139.4	123.0	175.6	215.6
860	86.6	140.5	123.9	176.3	216.3
870	87.6	141.6	124.7	177.0	217.0
880	88.5	142.6	125.6	177.7	217.7
890	89.5	143.6	126.4	178.4	218.4
900	90.4	144.6	127.2	179.0	219.0
910	91.4	145.6	128.0	179.7	219.7
920	92.3	146.6	128.7	180.3	220.3
930	93.1	147.5	129.5	181.0	221.0

TABLE 1. LSCS Unit 1 Composite P/T Curve Values for 32 EFPY

Required Metal Temperature with Required Coolant Temperature Rate at 100 °F/hr for Curves B & C and 20 °F/hr for Curve A

PRESSURE (PSIG)	BOTTOM HEAD CURVE A (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE A (°F)	BOTTOM HEAD CURVE B (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE B (°F)	LIMITING 32 EFPY CURVE C (°F)
940	94.0	148.4	130.3	181.6	221.6
950	94.9	149.3	131.0	182.2	222.2
960	95.7	150.2	131.7	182.9	222.9
970	96.6	151.1	132.5	183.5	223.5
980	97.4	152.0	133.2	184.1	224.1
990	98.2	152.8	133.9	184.7	224.7
1000	99.0	153.6	134.6	185.3	225.3
1010	99.7	154.5	135.2	185.8	225.8
1020	100.5	155.3	135.9	186.4	226.4
1030	101.3	156.1	136.6	187.0	227.0
1035	101.6	156.5	136.9	187.3	227.3
1040	102.0	156.8	137.2	187.5	227.5
1050	102.7	157.6	137.9	188.1	228.1
1055	103.1	158.0	138.2	188.4	228.4
1060	103.4	158.4	138.5	188.6	228.6
1070	104.2	159.1	139.1	189.2	229.2
1080	104.9	159.8	139.8	189.7	229.7
1090	105.6	160.6	140.4	190.3	230.3
1100	106.2	161.3	141.0	190.8	230.8
1105	106.6	161.6	141.3	191.0	231.0
1110	106.9	162.0	141.6	191.3	231.3
1120	107.6	162.7	142.2	191.8	231.8
1130	108.2	163.4	142.8	192.3	232.3
1140	108.9	164.0	143.3	192.8	232.8
1150	109.5	164.7	143.9	193.3	233.3
1160	110.1	165.4	144.5	193.8	233.8
1170	110.8	166.0	145.0	194.3	234.3
1180	111.4	166.7	145.6	194.8	234.8
1190	112.0	167.3	146.1	195.3	235.3
1200	112.6	167.9	146.7	195.8	235.8
1210	113.2	168.5	147.2	196.2	236.2
1220	113.8	169.1	147.8	196.7	236.7

TABLE 1. LSCS Unit 1 Composite P/T Curve Values for 32 EFPY

Required Metal Temperature with Required Coolant Temperature Rate
at 100 °F/hr for Curves B & C and 20 °F/hr for Curve A

PRESSURE (PSIG)	BOTTOM HEAD CURVE A (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE A (°F)	BOTTOM HEAD CURVE B (°F)	UPPER RPV & BELTLINE AT 32 EFPY CURVE B (°F)	LIMITING 32 EFPY CURVE C (°F)
1230	114.3	169.7	148.3	197.2	237.2
1240	114.9	170.3	148.8	197.6	237.6
1250	115.5	170.9	149.3	198.1	238.1
1260	116.0	171.5	149.8	198.5	238.5
1270	116.6	172.1	150.3	199.0	239.0
1280	117.1	172.6	150.8	199.4	239.4
1290	117.7	173.2	151.3	199.9	239.9
1300	118.2	173.8	151.8	200.3	240.3
1310	118.7	174.3	152.3	200.7	240.7
1320	119.3	174.9	152.8	201.2	241.2
1330	119.8	175.4	153.2	201.6	241.6
1340	120.3	175.9	153.7	202.0	242.0
1350	120.8	176.4	154.2	202.4	242.4
1360	121.3	177.0	154.6	202.8	242.8
1370	121.8	177.5	155.1	203.2	243.2
1380	122.3	178.0	155.5	203.6	243.6
1390	122.8	178.5	156.0	204.0	244.0
1400	123.3	179.0	156.4	204.4	244.4

Appendix A: Reactor Vessel Material Surveillance Program

In accordance with 10 CFR 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements, the first surveillance capsule was removed from the LSCS Unit 1 reactor vessel in Spring 1994. The 300° surveillance capsule contained flux wires for neutron fluence measurement, Charpy V-Notch impact test specimens and uniaxial tensile test specimens fabricated using materials from the vessel materials within the core beltline region. The flux wires and test specimens removed from the capsule were tested according to ASTM E 185-82. The methods and results of testing were documented in Reference 6.7, and the irradiated Charpy data results were within the predicted values using Regulatory Guide 1.99 Revision 2. The flux wire results were used to estimate 32 EFPY fluence, and the resulting estimate was approximately 6% lower than the previous estimate of 32 EFPY fluence.

In accordance with 10 CFR 50, Appendix H, Reactor Vessel Material Surveillance Program Requirements, the second surveillance capsule was removed from the LSCS Unit 1 reactor vessel in February 2010, during refueling outage (RFO) 13. The 120° surveillance capsule also contained flux wires for neutron fluence measurement, Charpy V-Notch impact test specimens and uniaxial tensile test specimens fabricated using materials from the vessel materials within the core beltline region. The flux wires and test specimens removed from the capsule were tested according to ASTM E 185-82. The methods and results of testing are presented in References 6.3 and 6.9, as required by 10 CFR 50, Appendices G and H. These test results necessitated the revision to the Unit 1 P/T curves. The need for revised curves was communicated to the NRC in Reference 6.6.

As described in the LSCS Updated Final Safety Analysis Report (UFSAR) Section 5.3.1.6.1, *Compliance with "Reactor Vessel Material Surveillance Program Requirements*" and UFSAR Table 5.2-12, "*Reactor Vessel Material Surveillance Program Withdrawal Schedule*", the remaining surveillance capsule is slated to be removed as defined by the Integrated Surveillance Program (Reference 6.8).

Appendix B: LSCS Unit 1 Reactor Pressure Vessel P/T Curve Supporting Plant-Specific Information

Figure B-1: LSCS Unit 1 Reactor Pressure Vessel

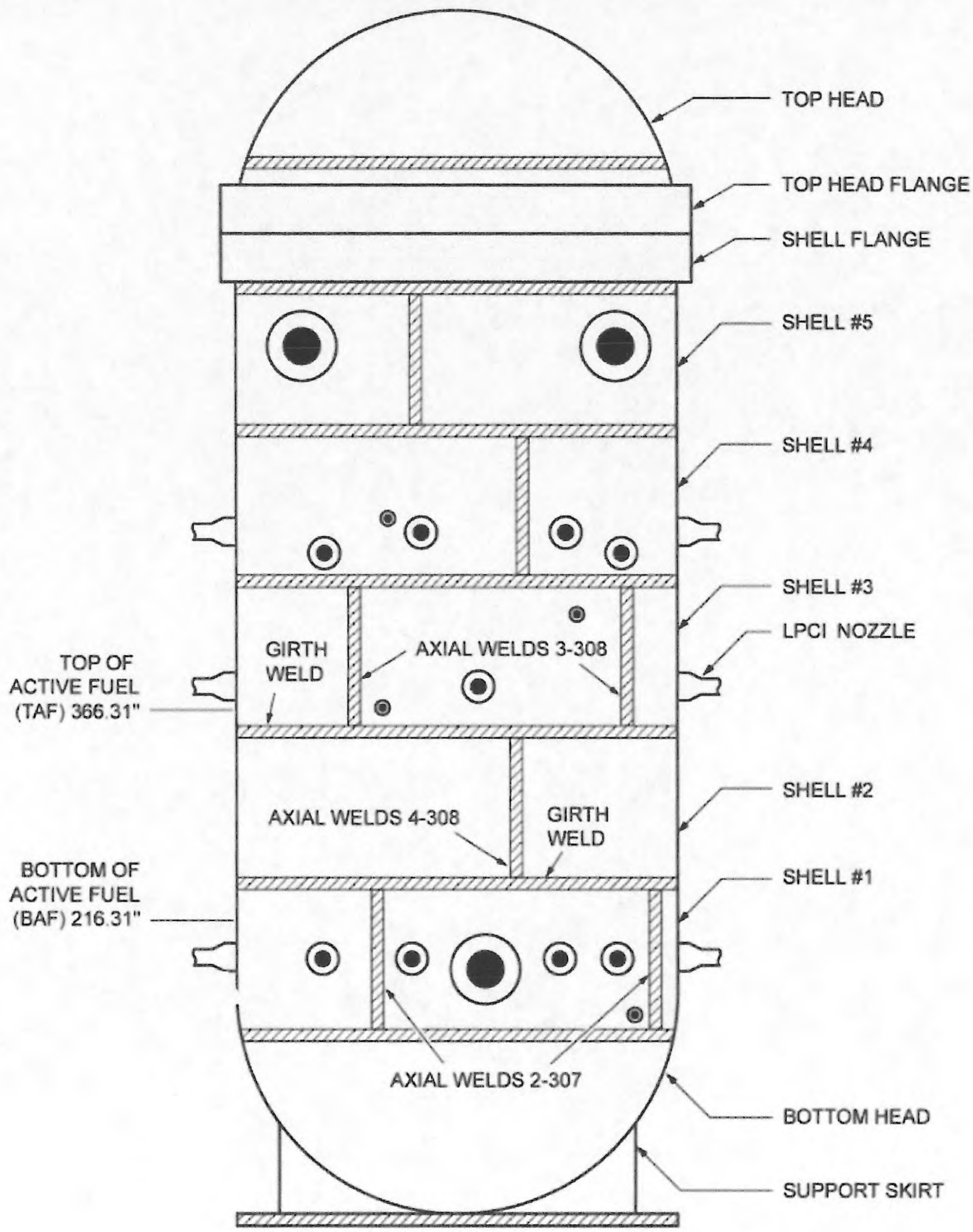

Table B-1: LSCS Unit 1 Initial RT_{NDT} Values for RPV Materials [1]
Plate and Flange Materials

COMPONENT	HEAT	TEST TEMP. (°F)	CHARPY ENERGY (FT-LB)			(T_{50T}-60) (°F)	DROP WEIGHT NDT	RT_{NDT} (°F)
PLATES & FORGINGS:								
Top Head & Flange:								
Vessel Flange, 308-02	2V-659 ATF-112	10	70	68	97	-20	10	10
Closure Flange, 319-02	ACT-USS-4P-1997 Ser.118	10	92	110	91	-20	10	10
Dome, 319-05	C7434-1	10	65	76	67	-20	-10	-10
Upper Torus, 319-04	C7434-1	10	65	76	67	-20	-10	-10
Lower Torus, 319-03	C7376-2	10	65	74	73	-20	-10	-10
Shell Courses:								
Upper Shell	C5987-1	10	63	55	35	10	-10	10
305-04	C5987-2	10	76	79	51	-20	-10	-10
	C6003-2	40	65	49	50	12	10	12
Upper Int. Shell	C5996-2	10	62	71	66	-20	-10	-10
305-04	C5979-2	10	64	63	49	-18	-10	-10
	C5996-1	10	65	60	77	-20	-10	-10
Middle Shell	A5333-1	10	56	67	53	-20	-10	-10
305-03	B0078-1	10	73	49	70	-18	-10	-10
	C6123-2	10	77	60	73	-20	-10	-10
Low-Int. Shell	C6345-1	10	109	88	77	-20	-40	-20
305-02	C6318-1	10	80	66	72	-20	-20	-20
	C6345-2	10	93	94	67	-20	-40	-20
Lower Shell	C5978-1	40	53	48	48	14	10	14
305-01	C5978-2	40	62	60	41	28	-10	23*
	C5979-1	40	73	92	65	10	-10	10
Bottom Head:								
Bottom Head Dome, 306-17	C6003-3	40	36	39	40	38	40	47**
Lower Torus	C5540-1	10	54	78	82	-20	-10	-10
306-18	C5328-1	40	64	51	51	10	-10	10
	C5328-2	40	55	62	59	10	-10	10
Upper Torus	C5505-2	10	63	96	73	-20	-10	-10
306-19	C5445-3	10	70	67	70	-20	-10	-10
Support Skirt:								
309-08	5P2003 Ser.201	10	81	74	103	-20	40	40
309-06	B1042-3	10	70	61	68	-20	10	10
309-04	C7159-4	40	28	25	34	60	60	60
STUDS:						LST		
Closure Head Studs, 32-01	14716	10	45	43	43	70		
Closure Nut/Washers, 326-02/03	24632	10	38	36	39	70		

* Value of RT_{NDT} was obtained from semi curve-fit calculation using CMTR data.

** Value of RT_{NDT} is obtained from curve-fit of CMTR data.

NOTE [1]: These are minimum Charpy values.

Table B-2: LSCS Unit 1 Initial RT_{NDT} Values for RPV Materials [1] Nozzles and Stabilizer Bracket

COMPONENT	HEAT	TEST TEMP. (°F)	CHARPY ENERGY (FT-LB)			$(T_{50T}-60)$ (°F)	DROP WEIGHT NDT	RT_{NDT} (°F)
NOZZLES:								
Recirc. Outlet Nozzle	AV5840-OK9380	10	73	84	65	-20	0	0
314-02	AV5840-OK9381	10	56	84	80	-20	10	10
Recirc. Inlet Nozzle	Q2Q14VW-175W	10	30	30	43	20	40	40
314-07	Q2Q6VW-175W	10	34	36	39	12	40	40
Steam Outlet Nozzles	AV4276-9I9074	10	44	62	42	-4	30	30
316-07	AV4279-9I9236	10	84	55	80	-20	30	30
	AV4442-9J9176	10	93	97	82	-20	30	30
	AV4274-9H9176	10	69	100	71	-20	30	30
Feedwater Nozzle, 316-02	Q2Q14VW-174W-1/6	10	48	72	60	-16	40	40
Core Spray Nozzle	AV4067-9H9168	10	79	70	71	-20	30	30
316-12	AV4068-9H9169	10	45	35	76	10	30	30
RHR/LPC1 Nozzles, 316-17	Q2Q22W-569F-1/3	10	44	44	37	6	10	10
CDR Hydro Return Nozzle, 315-10	AV3142-9G9640	10	34	30	44	20	30	30
Jet Pump Nozzles, 314-12	AV3138-9F-9231B/C	10	116	90	96	-20	30	30
Closure Head Inst. Nozzle, 318-07	Q2Q23W-346J-1A	10	35	47	31	18	30	30
Vent Nozzle, 318-02	Q2Q24W-345J	10	78	109	122	-20	10	10
Drain Nozzle, 315-14	Q1Q1VW-738T	10	39	25	32	30	30	30
Stabilizer Bracket, 324-19	C4943-3	10	36	35	36	10	10	10

NOTE [1]: These are minimum Charpy values.

Table B-3: LSCS Unit 1 Initial RT_{NDT} Values for RPV Materials [1] Welds

COMPONENT	HEAT	TEST TEMP. (°F)	CHARPY ENERGY (FT-LB)			(T_{50T}-60) (°F)	DROP WEIGHT NDT	RT_{NDT} (°F)
WELDS:								
Vertical Welds:								
2-307 Bottom Shell Long Seams	21935-1092-3889	10	97	90	83	-50	-50	-50
1-308 Upper Shell Long Seams								
2-308 Upper Inter. Shell Long Seams								
1-308 Upper Shell Long Seams	12008-1092-3889	10	97	90	83	-50	-50	-50
2-307 Bottom Shell Long Seams								
1-308 Upper Shell Long Seams	305424-1092-3889	10	82	87	92	-50	-50	-50
3-308 Middle Shell Long Seams								
3-308 Middle Shell Long Seams	IP3571-1092-3958	10	40	46	46	-30	-50	-30
4-308 Lower Inter. Shell Long Seams	305414-1092-3947	10	82	66	80	-50	-50	-50
4-308 Lower Inter. Shell Long Seams	12008-1092-3947	10	92	91	92	-50	-50	-50
1-319 Closure Head Seg. Lower Torus	FOAA	10	125	124	130	-50	-50	-50
2-319 Closure Head Seg. Upper Torus								
1-319 Closure Head Seg. Lower Torus	EAIB	10	118	129	107	-50	-50	-50
Girth Welds:								
3-306 Bottom Hd. Build up for sup. Skirt	305414-1092-3951	10	66	61	62	-50	-50	-50
5-306 Bottom Hd. Dome to Side Seg,								
6-306 Bottom Hd. Low. To Up Side Seg.								
6-306 Bottom Hd. Low. To Up Side Seg.	305424-1092-3889	10	82	87	92	-50	-50	-50
4-307 Inlay in Bot. Sd for Core Sup Attch.								
9-307 Bottom Head to Lower Shell	10120-0091-3458	10	124	130	122	-50	-50	-50
3-319 Close. Hd. Torus to Close. Hd. Flg.								
9-307 Bottom Head to Lower Shell	51874-0091-3458	10	89	64	87	-50	-50	-50
3-319 Close. Hd. Torus to Close. Hd. Flg.								
6-308 Upper Vessel Shell Girth Seam								
9-307 Bottom Head to Lower Shell	51912-0091-3490	10	93	84	92	-50	-50	-50
6-308 Upper Vessel Shell Girth Seam	10137-0091-3999	10	101	108	107	-50	-50	-50
15-308 Flange to Upper Shell								
6-308 Upper Vessel Shell Girth Seam	5P5622-0091-0831	-20	95	87	86	-80	-80	-80
6-308 Upper Vessel Shell Girth Seam	2P5755-0091-0831	-10	81	80	82	-70	-70	-70
6-308 Upper Vessel Shell Girth Seam	6329637-0091-3458	10	103	65	88	-50	-50	-50
6-308 Upper Vessel Shell Girth Seam	6329637-0091-3999	10	101	108	103	-50	-50	-50
15-308 Flange to Upper Shell								
5-319 Closure Hd. Upper Torus to Dome								
4-309 Support Skirt Forging to Bot. Hd.	90099-0091-3977	10	96	97	89	-50	-50	-50
4-309 Support Skirt Forging to Bot. Hd.	90136-0091-3998	10	110	109	107	-50	-50	-50
1-313 Up. Assy to Lower Closing Seams	4P6519-0091-0145	0	98	101	102	-60	-60	-60
1-313 Up. Assy to Lower Closing Seams	4P6519-0091-0842	0	46	59	48	-52	-80	-52
1-313 Up. Assy to Lower Closing Seams	4P6519-0091-0653	-40	57	63	73	-100	-60	-60
4-319 Close. Hd. Upper Torus to Lower	606L40-0091-3489	10	96	95	77	-50	-50	-50

NOTE [1]: These are minimum Charpy values.

Table B-3 continued: LSCS Unit 1 Initial RT_{NDT} Values for RPV Materials [1]
Welds

Component	Heat or Heat / Flux / Lot	Test Temp (°F)	Charpy Energy (ft-lb)			(T_{50T}-60) (°F)	Drop Weight NDT (°F)	RT_{NDT} (°F)
Beltline Nozzle Welds								
N6 LPCI Nozzle Weld	ABEA	10	101	117	98	-50	-	-50
N6 LPCI Nozzle Weld	FAGA	10	120	117	116	-50	-	-50
N6 LPCI Nozzle Weld	CCJA	10	95	98	96	-50	-	-50
N6 LPCI Nozzle Weld	FOAA	10	125	124	130	-50	-	-50
N6 LPCI Nozzle Weld	EAIB	10	111	88	84	-50	-	-50

NOTE [1]: These are minimum Charpy values.

Table B-4: LSCS Unit 1 Beltline Adjusted Reference Temperatures, 32 EFPY

Lower Plate and Welds 2-307 & 1-313
Thickness in inches= 7.13
32 EFPY Peak I.D. fluence = 3.76E+17 n/cm²
32 EFPY Peak 1/4 T fluence = 2.45E+17 n/cm²

Lower-Intermediate Plates and Welds 4-308
Thickness in inches= 6.13
32 EFPY Peak I.D. fluence = 8.34E+17 n/cm²
32 EFPY Peak 1/4 T fluence = 5.77E+17 n/cm²

Middle Plates and Welds 3-308 & 6-308
Thickness in inches= 6.13
32 EFPY Peak I.D. fluence = 6.22E+17 n/cm²
32 EFPY Peak 1/4 T fluence = 4.31E+17 n/cm²

N6 LPCI Nozzle
Thickness in inches= 6.13
32 EFPY Peak I.D. fluence = 3.14E+17 n/cm²
32 EFPY Peak 1/4 T fluence = 2.17E+17 n/cm²

N12 Water Level Instrumentation Nozzle
Thickness in inches= 6.13
32 EFPY Peak I.D. fluence = 2.39E+17 n/cm²
32 EFPY Peak 1/4 T fluence = 1.65E+17 n/cm²

COMPONENT	HEAT	%Cu	%Ni	CF	Initial RT_{NDT} °F	Peak Fluence n/cm²	1/4 T Fluence[1] n/cm²	32 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	32 EFPY Shift °F	32 EFPY ART °F
PLATES:													
Lower Shell Assembly 307-04													
G-5603-1	C5978-1	0.11	0.58	74	14	3.76E+17	2.45E+17	14	0	7	14	29	43
G-5603-2	C5978-2	0.11	0.59	74	23	3.76E+17	2.45E+17	14	0	7	14	29	52
G-5603-3	C5979-1	0.12	0.66	84	10	3.76E+17	2.45E+17	16	0	8	16	33	43
Lower-Intermediate Shell Assembly 308-06													
G-5604-1	C6345-1	0.15	0.49	104	-20	8.34E+17	5.77E+17	33	0	16	33	66	46
G-5604-2	C6318-1	0.12	0.51	81	-20	8.34E+17	5.77E+17	26	0	13	26	51	31
G-5604-3	C6345-2	0.15	0.51	105	-20	8.34E+17	5.77E+17	33	0	17	33	66	46
Middle Shell Assembly 308-05													
G-5605-1	A5333-1	0.12	0.54	82	-10	6.22E+17	4.31E+17	22	0	11	22	44	34
G-5605-2	B0078-1	0.15	0.50	105	-10	6.22E+17	4.31E+17	28	0	14	28	56	46
G-5605-3	C6123-2	0.13	0.68	93	-10	6.22E+17	4.31E+17	25	0	13	25	50	40
WELDS:													
Girth													
1-313	4P6519	0.131	0.06	64	-52	3.76E+17	2.45E+17	12	0	6	12	25	-27
6-308	6329637	0.205	0.105	98	-50	6.22E+17	4.31E+17	27	0	13	27	53	3
Lower													
2-307 A, B, C	21935/3889	0.183	0.704	172	-50	3.76E+17	2.45E+17	34	0	17	34	67	17
2-307 A, B, C	12008/3889	0.235	0.975	233	-50	3.76E+17	2.45E+17	45	0	23	45	91	41
2-307 A, B, C	21935 & 12008 Tandem	0.213	0.867	209	-50	3.76E+17	2.45E+17	41	0	20	41	81	31
Lower-Intermediate													
4-308 A, B, C	305414/3947	0.337	0.609	209	-50	8.34E+17	5.77E+17	66	0	28	56	122	72
4-308 A, B, C	12008/3947	0.235	0.975	233	-50	8.34E+17	5.77E+17	74	0	28	56	130	80
4-308 A, B, C	305414 & 12008 Tandem	0.286	0.792	219	-50	8.34E+17	5.77E+17	69	0	28	56	125	75
Middle													
3-308 A, B, C	305424/3889	0.273	0.629	189.5	-50	6.22E+17	4.31E+17	51	0	26	51	102	52
3-308 A, B, C	1P3571/3958	0.283	0.755	212	-30	6.22E+17	4.31E+17	57	0	28	56	113	83
NOZZLES[7]:													
N6 LPCI Nozzle	Q2Q22W	0.10	0.82	67	10	3.14E+17	2.17E+17	12	0	6	12	24	34
N12 Water Level Instrumentation Nozzle													
G-5605-1	A5333-1	0.12	0.54	82	-10	2.39E+17	1.65E+17	12	0	6	12	25	15
G-5605-2	B0078-1	0.15	0.50	105	-10	2.39E+17	1.65E+17	16	0	8	16	32	22
G-5605-3	C6123-2	0.13	0.68	93	-10	2.39E+17	1.65E+17	14	0	7	14	28	18
N6 LPCI Nozzle Weld[2]													
	ABEA	0.04	0.98	54	-50	3.14E+17	2.17E+17	10	0	5	10	20	-30
	FAGA	0.03	0.95	41	-50	3.14E+17	2.17E+17	7	0	4	7	15	-35
	CCJA	0.02	0.86	27	-50	3.14E+17	2.17E+17	5	0	2	5	10	-40
	FOAA	0.03	1.00	41	-50	3.14E+17	2.17E+17	7	0	4	7	15	-35
	EAIB	0.12[8]	0.86	155	-50	3.14E+17	2.17E+17	28	0	14	28	56	6
N12 Water Level Instrumentation Nozzle Weld[3]	Alloy 600												
BEST ESTIMATE CHEMISTRIES:													
Plate	N/A												
Weld	N/A												
INTEGRATED SURVEILLANCE PROGRAM[4]:													
Plate[5]	C6345-1	0.14	0.54	152.4	-20	8.34E+17	5.77E+17	48	0	8.5	17	65	45
Weld[6]	1P3571	0.21	0.75	437	-30	6.22E+17	4.31E+17	118	0	14	28	146	116

[1] Fluence values for LaSalle Unit 1 for 102% EPU conditions.
[2] N6 LPCI Nozzle Weld chemistry values are obtained from LaSalle Unit 1 CMTRs. The test temperature, T_{50T} = 10°F and there is no drop weight temperature. The following equation was used to calculate the initial RT_{NDT} : T_{50T} - 60°F = 10°F - 60°F = -50
[3] The N12 Water Level Instrumentation Nozzle Weld material for LaSalle Unit 1 is Ni-Cr-Fe, Alloy 600. Since material is Alloy 600, no fracture toughness evaluation is required.
[4] Values are from BWRVIP-135 R2.
[5] Since the ISP plate material is not the same as the plant-specific material, the CF should be determined by RG 1.99 Rev 2. However, the ISP plate material is within the extended beltline and there are two irradiated data sets. Therefore, the ISP data provided in Reference 6.9 should be considered in the ART determination for the LaSalle 1 plate heat.
[6] Since the ISP weld material is the same as the plant-specific material, the 120° surveillance capsule data is included in the limiting ART calculations. The adjusted CF is calculated using the fitted CF obtained from EPRI letter 2012-026.
[7] Both the plate and weld materials are added for the fracture toughness evaluation of N6 LPCI and N12 WLI nozzles.
[8] BWR fleet and RVID data for SMAW materials was used to obtain the copper content, considering 83 unique data points and Mean + 2σ.

Table B-5: LSCS Unit 1 RPV Beltline P/T Curve Input Values

Adjusted RT_{NDT} = Initial RT_{NDT} + Shift	A = -30 + 146 = 116°F (Based on ART values in Table B-4)
Vessel Height	H = 863.3 inches
Bottom of Active Fuel Height	B = 216.3 inches
Vessel Radius (to base metal)	R = 127.0 inches
Minimum Vessel Thickness (without clad)	t = 6.13 inches

Table B-6: LSCS Unit 1 Definition of RPV Beltline Region[1]

Component	Elevation (inches from RPV "0")
Shell # 3 - Top of Active Fuel (TAF)	366.3"
Shell # 1 - Bottom of Active Fuel (BAF)	216.3"
Shell # 3 – Top of Extended Beltline Region (32 EFPY)	371.7"
Shell # 1 – Bottom of Extended Beltline Region (32 EFPY)	211.9"
Centerline of Recirculation Outlet Nozzle in Shell # 1	172.5"
Top of Recirculation Outlet Nozzle N1 in Shell # 1	197.2
Centerline of Recirculation Inlet Nozzle N2 in Shell # 1	181.0"
Top of Recirculation Inlet Nozzle N2 in Shell # 1	197.7"
Centerline of 2" Water Level Instrumentation Nozzle in Shell # 3	366.0"
Centerline of LPCI Nozzle in Shell #3	372.5"

Note [1]: The beltline region is defined as any location where the peak neutron fluence is expected to exceed or equal 1.0E17 n/cm^2.

Based on the above, it is concluded that none of the LSCS Unit 1 reactor vessel plates, nozzles, or welds, other than those included in the Adjusted Reference Temperature Table, are in the beltline region.

Appendix C: LSCS Unit 1 Reactor Pressure Vessel P/T Curve Checklist

Parameter	Completed	Comments/Resolutions/Clarifications
Initial RT_{NDT}		
Initial RT_{NDT} has been determined for LSCS Unit 1 for all vessel materials including plates, flanges, forgings, studs, nuts, bolts, welds. Include explanation (including methods/sources) of any exceptions, resolution of discrepant data (e.g., deviation from originally reported values).	☒	With the exception of weld 4P6519, all Initial RT_{NDT} values used are consistent with the NRC Reactor Vessel Integrity Database (RVID) Initial RT_{NDT} values. For weld 4P6519, the value used was determined using CMTR data and the NRC-approved methodology defined in Section 4.1.1.3 of the GEH LTR.
Appendix B contains tables of all Initial RT_{NDT} values for LSCS Unit 1	☒	
Has any non-LSCS Unit 1 initial RT_{NDT} information (e.g., ISP, comparison to other plant) been used?	☒	No.
If deviation from the LTR process occurred, sufficient supporting information has been included (e.g., Charpy V-Notch data used to determine an Initial RT_{NDT}).	☒	
All previously published Initial RT_{NDT} values from sources such as the GL88-01, RVID, FSAR, etc., have been reviewed.	☒	
Adjusted Reference Temperature (ART)		
Sigma I (standard deviation for Initial RT_{NDT}) is 0°F unless the RT_{NDT} was obtained from a source other than CMTRs. If σ_I is not equal to 0, reference/basis has been provided.	☒	
Sigma Δ (standard deviation for ΔRT_{NDT}) is determined per RG 1.99, Rev. 2	☒	

Parameter	Completed	Comments/Resolutions/Clarifications
Chemistry has been determined for all vessel beltline materials including plates, forgings (if applicable), and welds for LSCS Unit 1. Include explanation (including methods/sources) of any exceptions, resolution of discrepant data (e.g., deviation from originally reported values).	☒	The chemistry values for copper and nickel listed for many of the materials differ from the values listed in RVID, but in all cases the chemistry values used are consistent with the currently licensed P/T curve values.
Non-LSCS Unit 1 chemistry information (e.g., ISP, comparison to other plant) used has been adequately defined and described.	☒	
For any deviation from the LTR process, sufficient information has been included.	☒	
All previously published chemistry values from sources such as the GL88-01, RVID, FSAR, etc., have been reviewed.	☒	
The fluence used for determination of ART and any extended beltline region was obtained using an NRC-approved methodology.	☒	
The fluence calculation provides an axial distribution to allow determination of the vessel elevations that experience fluence of 1.0E17 n/cm^2 both above and below active fuel.	☒	
The fluence calculation provides an axial distribution to allow determination of the fluence for intermediate locations such as the beltline girth weld (if applicable) or for any nozzles within the beltline region.	☒	
All materials within the elevation range where the vessel experiences a fluence ≥1.0E17 n/cm^2 have been included in the ART calculation. All initial RT_{NDT} and chemistry information is available or explained.	☒	

Parameter	Completed	Comments/Resolutions/Clarifications
Discontinuities		
The discontinuity comparison has been performed as described in Section 4.3.2.1 of the LTR. Any deviations have been explained.	☒	
Discontinuities requiring additional components (such as nozzles) to be considered part of the beltline have been adequately described. It is clear which curve is used to bound each discontinuity.	☒	
Appendix G of the LTR describes the process for considering a thickness discontinuity, both beltline and non-beltline. If there is a discontinuity in the LSCS Unit 1 vessel that requires such an evaluation, the evaluation was performed. The affected curve was adjusted to bound the discontinuity, if required.	☒	
Appendix H of the LTR defines the basis for the CRD Penetration curve discontinuity and the appropriate transient application. The LSCS Unit 1 evaluation bounds the requirements of Appendix H.	☒	
Appendix J of the LTR defines the basis for the Water Level Instrumentation Nozzle curve discontinuity and the appropriate transient application. The LSCS Unit 1 evaluation bounds the requirements of Appendix J.	☒	

ATTACHMENT 3

Revised Exelon Response to GGNS RAI #6

(Non-Proprietary)

LaSalle County Station, Unit 1

3 pages follow

GGNS RAI #6

Provide the surveillance data and the analysis of the surveillance data used to determine ART from BWRVIP-135, "BWR Vessel and Internals project Integrated Surveillance Program (ISP) Data Source Book and Plant Evaluations", as required by NEDC-33178P-A.

Response

BWRVIP-135, Revision 2 (Reference 6.10) defines the representative Materials for LSCS Unit 1.

Excerpt from BWRVIP-135, Revision 2 (used by permission)

Target Vessel Materials		ISP Representative Materials
Weld	1P3571	1P3571
Plate	C5978-2	C6345-1

The results from the testing of the LaSalle Unit 1 120° Surveillance capsule have not yet been incorporated into BWRVIP-135. BWRVIP Letter 2012-026 (Reference 6.9) provides the LaSalle Unit 1 surveillance data considered in determining the chemistry and any adjusted Chemistry Factors (CF) for the beltline materials.

Plate
For LaSalle Unit 1, the Integrated Surveillance Program (ISP) representative plate, heat C6345-1, is not the target plate, but is a heat in the LaSalle Unit 1 beltline region, and therefore the data reported in Reference 6.9 was considered in the evaluation of that vessel plate. The Best Estimate Chemistry for plate C6345-1 is 0.14% Cu and 0.54% Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is 97.3°F. A fitted CF of 152.42°F was determined based on the testing documented in Reference 6.9. The maximum scatter in the fitted data is within the 1-sigma value of 17°F for plates given in Regulatory Guide 1.99 Revision 2.

Because there are two irradiated data sets for this plate that fall within the 1-sigma scatter band, the ISP surveillance data was used to revise the projected ART value for vessel plate heat C6345-1, with a reduced margin term (Regulatory Guide 1.99 Revision 2 Position 2.1). Although this material was considered in determining the limiting ART for the P/T curves; this is not the limiting material.

Best Estimate Chemistry of Available Data Sets for Plate Heat C6345-1

Cu (wt%)	Ni (wt%)	P (wt%)	S (wt%)	Si (wt%)	Specimen ID	Source
0.14	0.56	0.015	—	—	B-417	Reference A-7-2
0.14	0.47	—	—	—	B-417	Reference A-7-1
0.14	**0.515**	**0.015**	—	—	**Average B-417**	—
0.12	0.49	0.015	—	—	B-433	Reference A-7-2
0.14	0.57	—	—	—	B-433	Reference A-7-1
0.13	**0.53**	**0.015**	—	—	**Average B-433**	—
0.11	0.50	0.016	—	—	B-435	Reference A-7-2
0.18	0.60	—	—	—	B-435	Reference A-7-1
0.145	**0.55**	**0.016**	—	—	**Average B-435**	—
0.15	**0.56**	—	—	—	**B-411**	Reference A-7-2
0.13	**0.51**	—	—	—	**B-4J1**	Reference A-7-2
0.15	**0.57**	—	—	—	**B-436**	Reference A-7-2
0.15	**0.57**	—	—	—	**B-437**	Reference A-7-2
0.13	**0.50**	—	—	—	**B-4J5**	Reference A-7-2
0.13	0.50	—	—	—	B-4JC	Reference A-7-2
0.14	0.54	—	—	—	B-4JC	Reference A-7-1
0.135	**0.52**	—	—	—	**Average B-4JC**	—
0.15	0.58	—	—	—	B-4J6	Reference A-7-2
0.15	0.56	—	—	—	B-4J6	Reference A-7-1
0.15	**0.57**	—	—	—	**Average B-4J6**	—
0.14	**0.56**	—	—	—	**B-43B**	Reference A-7-2
0.13	**0.51**	—	—	—	**B-413**	Reference A-7-2
0.14	**0.55**	**0.011**	—	—	**CE**	Reference A-7-2
0.14	**0.54**	**0.014**	—	—	**←Best Estimate Average**	

<u>Weld</u>
For LaSalle Unit 1, the ISP representative weld, 1P3571, is identical to the target weld and therefore the data reported in Reference 6.9 was considered in the evaluation of the vessel weld. The weld heat in the LaSalle Unit 1 vessel for weld 1P3571is 0.283% Cu and 0.755% Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is 212°F. The Best Estimate Chemistry for weld 1P3571 is 0.21% Cu and 0.75% Ni; the CF from Regulatory Guide 1.99 Revision 2 for this chemistry is 188.75°F. A fitted CF of 388.47°F was determined based on the testing documented in Reference 6.9. The maximum scatter in the fitted data is within the 1-sigma value of 28°F for welds given in Regulatory Guide 1.99 Revision 2.

Because the representative weld material is the same heat number as the target weld in the LaSalle Unit 1 reactor, and because there are two irradiated data sets for this weld, the ISP surveillance data was used to determine an Adjusted Surveillance CF.

$$\text{Adjusted Surv. CF} = \left(\frac{\text{Table CF}_{\text{Vessel Chem.}}}{\text{Table CF}_{\text{Surv. Chem.}}} \right) * \text{CF}_{\text{Fitted Data}}$$

Therefore, the adjusted surveillance CF = (212 / 188.75) * 388.47°F = 437°F, which is used for the ISP weld material evaluation with a reduced margin term (Regulatory Guide 1.99 Revision 2 Position 2.1). The weld material 1P3571 is the limiting material for LaSalle Unit 1.

Best Estimate Chemistry of Available Data Sets for Weld Heat 1P3571

Cu (wt%)	Ni (wt%)	P (wt%)	S (wt%)	Si (wt%)	Specimen ID	Source
0.2	0.73	—	—	—	44U	Reference B-8-2
0.22	0.73	—	—	—	44M	Reference B-8-2
0.18	0.64	—	—	—	44M	Reference B-8-1
0.20	0.685	—	—	—	Average 44M	—
0.2	0.74	—	—	—	4LD	Reference B-8-2
0.2	0.75	0.017	—	—	443	Reference B-8-2
0.19	0.69	—	—	—	443	Reference B-8-1
0.195	0.72	0.017	—	—	Average 443	—
0.22	0.75	—	—	—	444	Reference B-8-2
0.2	0.76	0.016	—	—	44A	Reference B-8-2
0.18	0.7	—	—	—	44A	Reference B-8-1
0.19	0.73	0.016	—	—	Average 44A	—
0.22	0.79	—	—	—	447	Reference B-8-2
0.21	0.8	—	—	—	45K	Reference B-8-2
0.21	0.8	—	—	—	45M	Reference B-8-2
0.22	0.8	—	—	—	45D	Reference B-8-2
0.23	0.82	0.014	—	—	45E	Reference B-8-2
0.18	0.69	—	—	—	45E	Reference B-8-1
0.18	0.64	—	—	—	45E	Reference B-8-1
0.197	0.717	0.014	—	—	Average 45E	—
0.22	0.83	—	—	—	44F	Reference B-8-2
0.19	0.71	—	—	—	44F	Reference B-8-1
0.205	0.77	—	—	—	Average 44F	—
0.21	0.78	0.015	—	—	CE	Reference B-8-2
0.21	0.75	0.016	—	—	← Best Estimate Average	