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10 CFR 50.90

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U. S. Nuclear Regulatory Commission
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Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Extended Power Uprate License Amendment Request – Supplement 18 Response to Request for Additional Information, Corrections and Clarifications – Extended Power Uprate

Reference:

1. Exelon letter to the NRC, "License Amendment Request - Extended Power Uprate," dated September 28, 2012 (ADAMS Accession No. ML122860201)

2. Letter from K. F. Borton (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Extended Power Uprate License Amendment request – Supplement 12 Response to Request for Additional Information," dated October 11, 2013 (ADAMS Accession No. ML13289A191)

3. Letter from K. F. Borton (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Supplemental Information Supporting Request for License Amendment Request – Extended Power Uprate – Supplement 5 (ADAMS Accession No. ML13156A368)

In accordance with 10 CFR 50.90, Exelon Generation Company, LLC (EGC) requested amendments to Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3, respectively (Reference 1). Specifically, the proposed changes would revise the Renewed Operating Licenses to implement an increase in rated thermal power from 3514 megawatts thermal (MWt) to 3951 MWt.

The attachments to this letter provide responses to Requests for Additional Information (RAIs) from the Mechanical and Civil Engineering Branch (EMCB) and Fire Protection Branch (AFPB) review of Reference 1, revisions to the response to Electrical Engineering Branch (EEEB) RAI-1, and a revised PUSAR Table 2.3.1 (Normal Maximum and Total Radiation Requirements for Rooms at PBAPS).

The attachments to this supplement are summarized as follows:

Attachment 1 – This attachment provides EGC responses to EMCB RAIs 25 through 36 which pertain to Supplement 12 to the EPU LAR (Reference 2)

Attachment 2 – This attachment provides the EGC response to AFPB RAI-4 which pertains to the revision to PUSAR Section 2.11.1.2.2 (Appendix R Fire Safe Shutdown Events) submitted in Attachment 4 to Supplement 5 to the EPU LAR (Reference 3).

Attachment 3 – This attachment provides revisions to the response to Electrical Engineering Branch (EEEB) RAI-1 and to PUSAR Table 2.3.1 (Normal Maximum and Total Radiation Requirements for Rooms at PBAPS) that are the result of the correction of errors in the pre-EPU calculations for determining post-LOCA heat-up of the HPCI pump room and radiation level increases from Hydrogen Water Chemistry system operation.

EGC has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the U. S. Nuclear Regulatory Commission in Reference 1. The supplemental information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. Further, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), EGC is notifying the Commonwealth of Pennsylvania and the State of Maryland of this application by transmitting a copy of this letter along with the attachments to the designated State Officials.

There are no regulatory commitments contained in this letter.

Should you have any questions concerning this letter, please contact Mr. David Neff at (610) 765-5631.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 31st day of January 2014.

Respectfully,

Kevin F. Borton
Manager, Licensing – Power Uprate
Exelon Generation Company, LLC

Attachments:

1. Responses to Mechanical and Civil Engineering Branch Requests for Additional Information Nos. 25 through 36
2. Response to Fire Protection Branch Request for Additional Information AFPB RAI-4
3. Revision to the Response to Electrical Engineering Branch (EEEB) RAI-1 and PUSAR Table 2.3.1 (Normal Maximum and Total Radiation Requirements for Rooms at PBAPS)

cc:	USNRC Region I, Regional Administrator	w/attachments
	USNRC Senior Resident Inspector, PBAPS	w/attachments
	USNRC Project Manager, PBAPS	w/attachments
	R. R. Janati, Commonwealth of Pennsylvania	w/attachments
	S. T. Gray, State of Maryland	w/attachments

Attachment 1

Peach Bottom Atomic Power Station Units 2 and 3

NRC Docket Nos. 50-277 and 50-278

Responses to Mechanical and Civil Engineering Branch Requests for Additional Information Nos. 25 through 36

Response to Request for Additional Information
Mechanical and Civil Engineering Branch (EMCB)

By letter dated September 28, 2012, Exelon Generation Company, LLC (EGC) submitted a license amendment request for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The proposed amendment would authorize an increase in the maximum power level from 3514 megawatts thermal (MWt) to 3951 MWt. The requested change, referred to as an extended power uprate (EPU), represents an increase of approximately 12.4 percent above the current licensed thermal power level. Supplement 12 to the license amendment request, submitted to the NRC on October 11, 2013, (ADAMS Accession No. ML13289A191) provided responses to EMCB RAI Nos. 1 through 24. In an email dated December 11, 2013, from the NRC (Rick Ennis) to Exelon (Kevin Borton and Dave Neff), the NRC provided additional RAIs seeking clarification of certain issues related to the responses in Supplement 12. A teleconference was then held on January 24, 2014, between the NRC and EGC in which EGC committed to provide responses within 30 days of the teleconference. This attachment provides responses to those RAIs.

EMCB-RAI-25

Exelon's response to EMCB-RAI-16 under "FW [feedwater] System Design" states, in part, that:

> The FW System at PBAPS does not include control valves in the main flow path. Therefore, rapid closing of control valves is not a source of fluid transient loading for the FW piping and supports.

Please provide further details on the feedwater control system design (e.g., how feedwater flow is controlled) to justify why there is reasonable assurance that flow transient loads (i.e., water hammer) at EPU conditions will not impact structural integrity of the feedwater system.

RESPONSE

The configuration of the feedwater system and its control system preclude the occurrence of water hammer. Three normally operating variable speed, turbine driven pumps provide feedwater to the reactor. The suction to the pumps is through a header taking the discharge from three FW heater strings; with the pumps discharging through a header into the two FW lines to the reactor. There are no interposing control valves which could close rapidly.

The digital feedwater control system uses 3-element control consisting of feedwater flow, main steam flow, and reactor level, to control the level in the reactor. This system controls FW pump flow to maintain reactor level and respond to changes in feedwater or steam flow by controlling the steam flow to the RFP turbines. The control system is described in UFSAR 7.10.3.4 which identifies the interaction of the controls to minimize transients in the feedwater system.

Based on the above and the response to RAI-16, there is reasonable assurance that fluid transient loads at EPU conditions will not impact the structural integrity of the FW system.

EMCB-RAI-26

Exelon's response to EMCB-RAI-16 under "Operating Experience" states that:

> RFP [reactor feed pump] trip at full power is an infrequent event. Most recently, this event occurred at Unit 3 on November 4, 2002. Based on a detailed evaluation of plant data from this event and a simulation of the event using fluid transient analysis computer modeling, the check valves functioned as intended. The check valve disc closed as designed within ~2 sec following pump trip before reverse flow could be established. The corresponding fluid transient loads were minimized.

The response does not address whether the detailed evaluation concluded that existing pipe stresses, nozzle and support loads were reviewed and found acceptable.

RESPONSE

The detailed evaluation performed following the 2002 event was a qualitative evaluation that included walkdowns of the system. It was determined there were no adverse impacts to plant systems and components. A single RFP trip is the most challenging FW transient for the system. This RFP trip event last occurred in 2002 at Peach Bottom.

As part of the EPU project, a simulation of the single pump trip event was performed using fluid transient analysis computer modeling. This fluid transient analysis computer modeling confirmed that the hydraulic loads at CLTP were negligible. The analysis model was used to evaluate transient loads at EPU conditions. The change in the hydraulic loads at EPU conditions showed little change from CLTP conditions.

As shown in PUSAR Table 2.2-4b, the feedwater piping stresses have margin to allowables. The maximum stress interaction ratio of 0.937 for the faulted condition occurs at Node 33 in the 12-inch piping near the reactor vessel. When stresses from transient loads are combined with MCE seismic stresses using square root sum of the squares methodology, there would be an insignificant increase on the resulting stress. Therefore, stress interaction ratios for feedwater piping will remain below 1.0.

The EPU system evaluation included consideration of system walkdown results and fluid transient hydraulic load simulations at CLTP and EPU conditions. Because walkdown results identified no adverse impact to plant systems and components, the hydraulic load simulations resulted in negligibly small loads, and there is minimal impact on interaction ratios, a detailed evaluation of pipe stresses, nozzle and support loads is not required.

EMCB-RAI-27

The response to EMCB-RAI-4 states, in part, that:

> An evaluation was performed to assess the structural capability to withstand the increased peak compartment pressures. The evaluation concludes that no structural failures or penetration seal failures will result from the increase in

> calculated peak compartment pressures from postulated RWCU [reactor water cleanup] line breaks. The applicable structural calculations remain bounding.

Explain how "the applicable" (meaning current analysis of record) structural calculations remain bounding if the loads increased. This explanation is not sufficient, as it does not show whether the current structural analyses for compartment differential pressures (DP) contain DP loads greater than the increased DPs due to the recent analyses for RWCU line break mass and energy releases.

RESPONSE

In review of the HELB analysis for EPU, the CLB RWCU analysis was found to contain an error. As such, the RWCU HELB analysis was re-performed for CLTP to correct the error, the EPU conditions for mass and energy release were incorporated into the re-analysis to bound both CLTP and EPU conditions. The new maximum HELB pressures for each of the rooms affected were compared against each of the existing room barriers rated pressures. The rated pressures for the room barriers were found to be greater than the new maximum HELB pressures and therefore, the increases in pressure are within the available margins of the structural analysis.

EMCB-RAI-28

With respect to the response to EMCB-RAI-8, discuss and justify why it was necessary for EPU that pipe supports, originally designed to the AISC 6th edition, be reevaluated with later editions up to the 9th edition including later editions' allowables. Also, discuss whether controlled documentation exists that reconciles the 6th edition with editions up to the 9th edition (section properties and profile dimensions, equations, material properties, etc.). Also justify the acceptability of using material allowable values from later editions, such as the 9th edition, for material purchased and designed with the older editions all the way back to the 6th edition.

RESPONSE

Unrelated to EPU, the change to the design basis code to allow use of AISC 6th through AISC 9th editions was previously incorporated into the PBAPS design basis and procedures. The EPU analysis utilized the current PBAPS design basis. A code reconciliation for the 6th through 9th editions of the AISC is documented and controlled by Exelon in accordance with the Exelon QA plan and procedures. For structural steel, there have been no material allowable value changes for a given steel between the 6th and 9th editions. AISC Code allowable stress changes from edition to edition are not related to material properties of construction but instead are related to technical understanding of how those materials behave in specific configurations and loading conditions.

EMCB-RAI-29

The response to EMCB-RAI-8 shows that, prior to calculations for EPU, the current design basis calculations for the main steam piping inside containment (no mention is made for piping outside containment) utilize the construction code USAS B31.1.0-1967. For EPU, this piping was reanalyzed using the 1973 B31.1 code with stress intensity factors (SIFs) from the 1977 edition and allowable values from the 2005 Addendum of the 2004 Edition of B31.1.

As the RAI stated, the PBAPS Power Uprate Safety Analysis Report (PUSAR[1]) indicates that the proposed EPU meets the NRC-approved General Electric (GE) topical reports CLTR, ELTR1 and ELTR2 for the disposition of the structural integrity of systems, structures and components (SSCs) affected by the proposed EPU. All three topical reports require that structural integrity evaluations of SSCs for EPU show continued compliance with the construction code and standard for these SSCs (including code allowables and analytical techniques) applicable to the current plant licensing basis and that no change to comply with more recent codes and standards will be proposed due to the power uprate. With the exception of the spring safety valve addition on the main steam line line "C", there are no physical piping modifications to the main steam piping and no new material purchased to the 2005 Addendum of the 2004 Edition of B31.1. As stated in the response, the main steam piping is designed and installed to the B31.1, 1967 Edition. The licensee is requested to justify the use of later codes and later allowables for existing piping, which is contrary to the code and code allowable values requirement of the NRC-approved GE power uprate licensing technical reports.

RESPONSE

The topical reports and associated SERs allow for a plant specific disposition when deviating from the topical report generic disposition. CLTR SER Section 1.2.2, CPPU Approach (p. 6), states:

> "Deviations from the generic bases and evaluations provided in the report will be included and justified in the plant-specific submittal. The level of information to be provided for each plant-specific submittal and the format for providing that information will still be consistent with past extended power uprate submittals."

Consistent with the above, PUSAR Section 2.2.2.2.1 and the response to EMCB-RAI-9 provide a plant specific disposition. This disposition includes the Code Reconciliation performed and described in the responses to EMCB-RAI-9 and EMCB-RAI-30.

EMCB-RAI-30

With respect to the response to EMCB-RAI-9, clarify whether the response's mentioned reconciliation report is a controlled document by the station's quality assurance program. State the date of this document and the regulatory process which allows its use for safety-related piping. In addition, clarify whether this document has specifically reconciled the 2005 Addendum of the 2004 Edition of B31.1 allowable values, which for carbon steels uses SU/3.5 in lieu of SU/4 of earlier editions, to the 1967 Edition of B31.1 allowable values. The factor of safety used to establish allowable values, accounts for uncertainties in the steelmaking of the material production, fabrication, examination and testing, including welding processes and welding materials, preheat and postweld heat treatment requirements, non-destructive examination (NDE) etc. In your response, technically justify the use of lower factor of safety (3.5) than the required factor of safety (4.0) by the code of construction, for material purchased

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[1] A proprietary (i.e., non-publicly available) version of the PUSAR is contained in Attachment 6 to the application dated September 28, 2012. A non-proprietary (i.e., publicly available) version of the PUSAR is contained in Attachment 4 to the application dated September 28, 2012.

under the fabrication, erection, examination and testing requirements of the code of construction, including welding and NDE requirements and techniques.

Clarify whether the 14% increase over the design basis allowable value has been utilized in the station's current design basis structural calculations.

RESPONSE

The reconciliation report was issued March 19, 2012, as a controlled document which provides code reconciliation and applicability of later code editions and addenda in accordance with ASME Section XI IWA-4300. The Code Reconciliation specifically evaluated the use of higher allowable stress values from the ASME B31.1 2004 Edition with 2005 Addendum.

Use of the ASME 2005 Addendum allowable values is the current design basis code for MSL piping at PBAPS as it was incorporated into the PBAPS design basis independent of EPU by use of the above mentioned Code Reconciliation report. The 14% increase in design basis allowable value has been utilized in the station's current design basis structural calculations. The regulatory process which allows for this Code Reconciliation is 10 CFR 50.55a, which endorses ASME Section XI. The use of ASME Section XI for code reconciliations provides no restrictions or limitations for the use of later code editions or portions of editions.

The Code Reconciliation specifically evaluated the higher allowable stress values based upon the reduction in design factor from 4.0 to 3.5 as allowed by the ASME Committees and incorporated into ASME B31.1 2005 Addenda. This change to the allowable stresses in B31.1 in the 2005 Addenda is consistent with the changes in the 1999 Addenda of Section II, Part D, which applies to design of Section I power boilers, Section VIII, Division 1 pressure vessels, and Section III, Class 2 and 3 pressure vessels and piping. This change was made because the ASME Committees decided that the design factor of 4 was excessively conservative and, therefore, a new design factor of 3.5 was established to be consistent with European Codes.

For B31.1, there has been little change to the design, fabrications, and inspection requirements from the 1967 Edition to present. The majority of changes have been in clarification of application and in providing new materials of construction. The ferritic materials used in power plant construction have not changed dramatically since this edition. Review of materials since this edition show minor changes in material chemistry or manufacture.

EMCB-RAI-31

With respect to the response to EMCB-RAI-10(e), clarify the inconsistency in equation 12 faulted allowables. For example:

1) Updated Final Safety Analysis Report (UFSAR) Table C.5.7, page C.5-38, item 3, shows 2.0 x Sh;

2) PUSAR Table 2.2-4a, Service Level D, shows 2.4 x Sh; and

3) PUSAR Table 2.2-4b, Equation 12F, shows yield strength (Sy).

Clarify what the licensing basis will be for the proposed EPU.

RESPONSE

The faulted allowable of 2.0 x S_h in UFSAR Table C.5.7, page C.5-38, item 3, was used in the original design basis Main Steam piping analysis performed in 1970. The revised design basis Main Steam piping analysis from 1986 considered new load definitions for SRV discharge, and applies the B31.1 Service Level D faulted condition stress limit of 2.4 x S_h as the allowable for the SRV inlet piping.

The new Main Steam piping analysis for EPU considers a new TSV closure load definition, and also applies the B31.1 Service Level D faulted condition stress limit of 2.4 x S_h as the allowable for all re-analyzed Main Steam piping (as specified in PUSAR Table 2.2-4a provided in the response to EMCB-RAI-10). This will be the licensing basis for the Main Steam piping analysis at EPU.

In the current design basis analysis of Feedwater piping inside containment, the faulted condition stress allowable is that shown in PUSAR Table 2.2-4b (yield strength, S_y). The Feedwater piping analysis and its licensing basis remains unchanged for EPU.

EMCB-RAI-32

With respect to the response to EMCB-RAI-11, please explain why in Table 11-7 only interaction ratios are provided and no actual or allowable values have been provided for Node 80 axial stress due to bending.

The response does not include result summaries with licensing basis (LB) allowable comparisons for main steam relief valves, main steam safety valves and main steam isolation valves. UFSAR Table C.5.8 contains calculated values compared to LB allowable values. Provide a clarification whether these values have changed or not for EPU or updated loads (operational and seismic). If applicable, justify why the EPU does not affect these UFSAR listed main steam components or provide a summary of the calculated results similar to UFSAR Table C.5.8.

RESPONSE

In Table 11-7 from the response to EMCB-RAI-11, interaction ratios were provided without stress values for Node 80 because the interaction ratio is based on a combined sum of axial stresses and bending stresses in two directions which are not consistent with the format of Table 11-7. The EPU interaction ratio was calculated by applying a conservative scaling factor to the original interaction ratio for the combined stresses. The original analysis of record shows the following combined stresses:

<u>Original Analysis for Node #80:</u>
Axial Stress = 3.22 ksi vs. 26.31 ksi allowable (Interaction Ratio = 0.12)
Bending Stress (y-axis) = 4.23 ksi vs. 30.36 ksi allowable (Interaction Ratio = 0.14)
Bending Stress (z-axis) = 14.84 ksi vs. 30.36 ksi allowable (Interaction Ratio = 0.49)
Interaction Ratio from combined axial and bending stresses = 0.12 + 0.14 + 0.49 = 0.75

EPU Interaction Ratio
For EPU, the Interaction Ratio for combined axial and bending stresses is scaled up by a factor of 13.85% (maximum calculated increase in resultant force with EPU) to give a resultant EPU Interaction Ratio of 0.75 x 1.1385 = 0.85.

Qualification of Components listed in UFSAR Table C.5.8
For the PBAPS EPU there is no change to the design pressure, design temperature, operational pressure, operational temperature or seismic loads. Operation flow loads at EPU are bounded by the existing qualification basis of the MSIVs, SRVs and SSVs. Consequently, the values contained in Table C.5.8 of the PBAPS UFSAR for the main steam relief valves (SRVs), main steam safety valves (SSVs) and main steam isolation valves (MSIVs) are unchanged due to the PBAPS EPU.

EMCB-RAI-33

The response to EMCB-RAI-14 stated, in part, that:

> Seismic response spectra were regenerated. The original MS [main steam] piping analysis utilized seismic spectra that were not PBAPS plant specific and not retrievable. The revised analysis for EPU incorporates reconstituted PBAPS plant specific seismic response spectra.

The response indicates that this was a contributing factor for the required pipe support additions and modifications. The licensee is requested to respond to the following:

a) Please clarify whether the above mentioned reconstituted plant-specific spectra are the current PBAPS licensing basis spectra utilized for seismic analysis of PBAPS SSCs. In addition, explain in detail the process of reconstituting the plant-specific seismic response spectra used in the EPU main steam piping analysis.

b) Discuss whether, in addition to the main steam piping analysis prior to EPU evaluation, other safety-related SSCs or SSCs required to withstand a seismic event, including feedwater, reactor recirculation and reactor cleanup piping and supports, utilize seismic response spectra that are not enveloped by the plant-specific spectra. If affirmative, provide a technical justification for the structural adequacy of these SSCs to withstand plant-specific seismic response spectra inputs.

RESPONSE

EMCB-RAI-33(a)

Seismic response spectra were reconstituted only for the re-analyzed main steam piping because the original main steam piping seismic spectra are not retrievable. The spectra for main steam piping attachment locations were generated from seismic ground motion consistent with the current PBAPS licensing basis as discussed in UFSAR Sections C.2.2 and C.3.3.

For the main steam piping re-analysis, a two-step process was used to generate seismic response spectra at the points of interest inside primary containment. First, a mathematical model of the PBAPS Primary Structure was developed and benchmarked to match the horizontal dynamic response of the reference seismic model shown in UFSAR Figure C.3.3A. Then, using the Primary Structure mathematical model, horizontal response spectra at selected locations inside the PBAPS Primary Structure were developed using the scaled time history input motion from the 1952 Taft S69E earthquake, consistent with the current PBAPS seismic design basis.

EMCB-RAI-33(b)

Aside from the main steam piping re-analysis, no other piping systems require re-analysis for EPU, and their seismic design basis is unchanged with EPU.

EMCB-RAI-34

With respect to the response to EMCB-RAI-15, in regard to condensate storage tank cross-connect pipe stress analysis, the response states, in part, that "[t]he following table shows the calculated pipe stresses compared to the Code allowable stress values at critical locations..." Please state the code and code year edition for the piping analysis and allowable values and whether this is the code of construction for this piping.

RESPONSE

ANSI B31.1.0 - 1967 Edition is the code used for condensate storage tank cross-connect piping analysis / allowable values provided in response to EMCB-RAI-15, Table 15-4. This is the code of construction for the condensate storage tank cross-connect piping.

EMCB-RAI-35

The response to EMCB-RAI-17(b) is confusing. It is stated that the resonant, vortex shedding frequency lock-in condition, experienced by the main steam thermowell TW-142 (due to values shown on Table 17-1), which resulted in a flow-induced vibration (FIV) stress of 6,881 psi is due to less than PBAPS current licensed thermal power flow conditions. The table depicted on PUSAR page 2-48 shows that the 6,881 psi is for FIV stress at EPU main steam flow. Please discuss the apparent discrepancy and complete Table 17-1 by including values for the thermowells and probes at EPU conditions.

RESPONSE

The MSS Thermowell (TW-142) stress listed in the table on PUSAR page 2-48 is a bounding stress value which occurs at lock-in at a steam flow (core thermal power) that is less than PBAPS CLTP flow conditions, as stated in the response to EMCB-RAI-17(b). Because lock-in occurs at less than CLTP, the peak stress of 6,881 psi also bounds the stress, resulting from plant operation at EPU (1025 psi). The table on PUSAR page 2-48 is revised by this response to incorporate the footnote from the response to EMCB-RAI-17(b) as shown below:

Component Analyzed	Unit	Total Flow Induced Vibratory Stress Value at EPU	ASME Code Allowable Stress
MSS Thermowell (TW-142)	psi	6,881[(1)]	7,690 psi for Carbon Steel
FW System Thermowell (TW-140)	psi	294	7,690 psi for Carbon Steel
FW System Thermowell (TW-54)	psi	1,858	7,690 psi for Carbon Steel
FW System Sample Probe (SE-16)	psi	2,360	10,880 psi for Stainless Steel
RRS Thermowell (TW-107/145)	psi	2,834	10,880 psi for Stainless Steel

Note 1: The lock-in condition for MS Thermowell (TW-142) occurs at less than PBAPS current licensed thermal power. Evaluation of this lock-in condition, following ASME N1324.2 table N-1324.2(a)-1, resulted in a calculated FIV stress of 6881 psi, which is less than the 7690 psi acceptance criterion for carbon steel. At EPU conditions, lock-in does not occur and the calculated FIV stress is 1025 psi.

The vibratory stresses for all other analyzed components in the table on PUSAR page 2-48 are at EPU conditions. Except as noted in the footnote for MSS Thermowell (TW-142), the values given in the response to EMCB-RAI-17(b) in Table 17-1 are also at EPU conditions.

EMCB-RAI-36

The response to EMCB-RAI-22 identifies that core shroud flaw evaluations and screening criteria follow BWRVIP-76-A guidelines and includes recirculation line break (RLB) acoustic (AC) and flow-induced (drag) loads (FIL). BWRVIP-76-A contains the NRC staff safety evaluation (dated July 27, 2006) for reviewing BWRVIP-76 (dated November 1999). The RAI discussed concerns included in the safety communication SC 09-03, initially issued by GE Hitachi Nuclear Energy on August 3, 2009, and revised (to Revision1) on June, 10, 2013.

SC 09-03 identified issues concerning use of BWRVIP-76. Although BWRVIP-76 discusses the use of applicable loads including seismic and RLB AC loads, it does not specify the required loads combinations. SC 09-03, Revision 1 points out that the RLB AC loads may have not been properly considered or combined with other applicable loads and provides load combinations in addition to those that may have already been considered. BWRVIP-76 stated that "[f]or most plants, the stresses due to the earthquake will be controlling" and, therefore, because the safe shutdown earthquake (SSE) was judged to be the controlling faulted condition load, the limiting postulated RLB load was not considered in most of the cases (see SC 09-03-R1). SC 09-03, Revision 1 also points out that for plants with cracking less than 30% and stress levels of 6 ksi or less, re-inspection frequencies are provided by Table 2-1 of BWRVIP-76 without the need for a plant-specific analysis. Table 2-1 only goes as high as 6 ksi. According to SC 09-03, the 6 ksi stress was based on the assumption that the SSE load was the controlling faulted condition load. According to SC 09-03-R1, when the new load combination(s), which includes deadweight + delta pressure + (square root of the sum of the squares or absolute sum SSE+AC), is considered, the stress may be greater than the 6 ksi stress value given in Table 2-1 of BWRVIP-76. Therefore, the assumption of 6 ksi may be non-conservative.

The response states that core shroud flaw evaluations and screening criteria follow BWRVIP-76-A guidelines. Please provide a detailed discussion to show whether the concerns and corrective actions recommended in SC 09-03, Revision 1, including load combinations have been properly addressed for PBAPS Unit 2. In addition, explain why the opportunity, in the 2013 PBAPS Unit 3 refueling outage, to perform SC 09-03 corrective actions was missed.

RESPONSE

When the SC 09-03 was issued, PBAPS entered the concern into the EGC Corrective Action Program (CAP) and evaluated the impact. The evaluation determined that sufficient margin was present in the existing shroud evaluations to ensure that the shroud welds were acceptable for the duration of the 10 year ISI Program interval until the next inspections, which were due in 2012 for Unit 2 and 2015 for Unit 3.

The Unit 2 10-year ISI Program interval completed in 2012. A shroud inspection and corresponding shroud flaw evaluation were performed to support the next 10-year ISI Program interval. This current Unit 2 shroud flaw evaluation includes consideration of all applicable load combinations listed in SC 09-03, including the methodology and the applicable dynamic RLB loads. Therefore, the corrective action recommendations from SC 09-03, Revision 1, including load combinations, have been properly addressed for PBAPS Unit 2.

The Unit 3 10-year ISI Program interval will be ending in 2015. Based on the CAP evaluation of the SC 09-03 impact at Peach Bottom, the current Unit 3 shroud evaluation has sufficient margin and did not need to be revised or updated to specifically address SC 09-03 concerns prior to the end of this current 10-year interval. A revised shroud flaw evaluation will be performed in 2015 to support the next interval and will be completed in a manner consistent with the SC 09-03 corrective actions as was previously completed for Unit 2.

Attachment 2

Peach Bottom Atomic Power Station Units 2 and 3

NRC Docket Nos. 50-277 and 50-278

Response to Fire Protection Branch Request for Additional Information
AFPB RAI-4

Response to Request for Additional Information
Fire Protection Branch (AFPB)

By letter dated September 28, 2012, Exelon Generation Company, LLC (EGC) submitted a license amendment request for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The proposed amendment would authorize an increase in the maximum power level from 3514 megawatts thermal (MWt) to 3951 MWt. The requested change, referred to as an extended power uprate (EPU), represents an increase of approximately 12.4 percent above the current licensed thermal power level. Supplement 5 to the license amendment request, submitted to the NRC on June 27, 2013, (ADAMS Accession No. ML13156A368) provided revisions to PUSAR Section 2.11.1.2.2 (Appendix R Fire Safe Shutdown Events). In an email dated December 4, 2013, from the NRC (Rick Ennis) to Exelon (Kevin Borton and Dave Neff), the NRC provided an additional RAI seeking clarification of certain issues related to the information provided in Supplement 5. This attachment provides a response to this RAI.

AFPB-RAI-4

Reduced Time Margin for CR and Alternative Shutdown Fire Scenarios

Section 2.5.1.4.2, "10 CFR 50 Appendix R Fire Event," of the Power Uprate Safety Analysis Report (PUSAR[2]) states, in part, that four shutdown methods defined in the PBAPS Fire Protection Report were reanalyzed under EPU conditions. Information regarding operator actions for Appendix R fire safe shutdown events was provided in Section in 2.11.1.2.2 of the PUSAR. Revisions to the information in PUSAR Section 2.11.1.2.2 was provided in Attachment 4 to Supplement 5 to the EPU license amendment request dated June 27, 2013.

The NRC staff notes that under EPU conditions: (1) for Appendix R shutdown method "A," no change to the current operator action time is required to support the EPU Appendix R analysis; (2) for Appendix R shutdown Method "B," no details have been provided in the amendment request; (3) for Appendix R shutdown methods "C" and "D," there is reduction in time margin for the operator to perform the actions to achieve and maintain safe-shutdown conditions.

The licensee did not provide a specific justification for the reduced margin for the various operator manual actions that are needed for fires in different fire areas. Method "D" includes alternative shutdown actions to be performed outside of the CR.

The NRC staff requests the licensee provide a technical justification that shows that the reduced time margins continue to ensure the capability to achieve and maintain safe-shutdown conditions, especially when the times to perform operator manual actions are considered. The NRC staff requests the reduced time margin for Method "D" be assessed with specific consideration for manual action related to alternative shutdown actions outside of the CR. This technical justification should include a discussion of the treatment from the information provided in PBAPS EPU Supplement 5, dated June 27, 2013, Attachment 1, Table 1-1, which summarizes the new Appendix R operator manual actions that impact emergency or abnormal procedures of the plant at EPU conditions.

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[2] A proprietary (i.e., non-publicly available) version of the PUSAR is contained in Attachment 6 to the application dated September 28, 2012. A non-proprietary (i.e., publicly available) version of the PUSAR is contained in Attachment 4 to the application dated September 28, 2012.

Response

There are no time reductions for operator actions performed outside the CR to achieve and maintain safe shutdown using Fire Safe Shutdown (FSSD) Methods A, B and C. For FSSD Method D, line items 9 and 10 of Table 1-1 in Attachment 1 of Supplement 5 involve reduced time margins to operator actions outside the CR. Technical justifications for items 9 and 10 are provided below that demonstrate that the capability to achieve and maintain safe-shutdown conditions using FSSD Method D is maintained with the reduced time margins.

<u>Line Item 9</u>
For Method D Shutdowns, the time for an operator to initiate RPV depressurization from the ASD panel without a SORV is decreased from 5 hours to 3.5 hours.

This is acceptable for Method D shutdowns because the operator actions that are required to be completed prior to initiating depressurization of the units can be performed in less than 2 hours. This conclusion is based on past operator experience in simulator training for the actual time required to complete the required actions. A review of the timeline analyses for Fire Area 25 confirmed that no time challenges exist that would prevent completion of these actions in the required time.

<u>Line Item 10</u>
For Method D Shutdowns, the time for an operator to initiate SPC from the ASD Panel with a SORV is decreased from 4 to 2.5 hours, while without a SORV the time is decreased from 3 to 2.5 hours.

SPC is initiated at the ASD panels which are manned by operators immediately upon evacuation of the CR. These time reductions are acceptable because, for a Method D shutdown, the operator actions that are required to be completed prior to initiating depressurization of the units can be performed in less than 2 hours. This conclusion is based on past operator experience in simulator training for the actual time required to complete the required actions. A review of the timeline analyses for Fire Area 25 (Main Control Room) confirmed that no time challenges exist that would prevent the operator from initiating SPC in the required time.

Attachment 3

Peach Bottom Atomic Power Station Units 2 and 3

NRC Docket Nos. 50-277 and 50-278

Revisions to the Response to Electrical Engineering Branch (EEEB) RAI-1 and PUSAR Table 2.3-1

Revision to the Response to Electrical Engineering Branch (EEEB) Request for Additional Information and PUSAR Table 2.3.1

By letter dated September 28, 2012, Exelon Generation Company, LLC (EGC) submitted a license amendment request for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The proposed amendment would authorize an increase in the maximum power level from 3514 megawatts thermal (MWt) to 3951 MWt. The requested change, referred to as an extended power uprate (EPU), represents an increase of approximately 12.4 percent above the current licensed thermal power level.

The NRC reviewed the information supporting the proposed amendment and by letter dated April 26, 2013, (ADAMS Accession No. ML13106A126), the EEEB requested additional information. EGC provided responses in Supplement 4 to the EPU LAR by letter dated June 4, 2013 (ADAMS Accession No. ML13156A368). Subsequent to the submittal of Supplement 4, EGC identified deficiencies unrelated to EPU associated with the radiation doses and maximum temperatures for certain rooms containing environmentally qualified electrical equipment. These deficiencies were in the pre-EPU calculations and were primarily associated with the determination of the post-LOCA heat-up of the HPCI pump room and radiation level increases from Hydrogen Water Chemistry system operation. The corrections to these calculations are incorporated into revisions to the following EPU LAR documents provided in this Attachment.

- Tables 1, 3, and 4 in the response to EEEB-RAI-1, regarding EQ Environmental Parameters, Temperatures, and TID (revised and provided in Enclosure A to this Attachment). The revisions to Table 4 include any increases in EQ TID greater than one percent.

- Table 2.3-1, regarding EQ of Electrical Equipment (replaced/revised and provided in Enclosure B to this Attachment). The more than minor changes in PUSAR Table 2.3-1 are reflected in the revisions to the response to EEEB-RAI-1.

The peak recalculated room temperature and TID levels at EPU conditions are below the Qualification Limits with positive margin. Therefore, the conclusions of the EQ electrical equipment evaluation provided in PUSAR Section 2.3.1 and the response to EEEB-RAI-1 remain valid.

Additions to the response to EEEB-RAI-1 are indicated by **bolded** characters and deletions with ~~strikethrough~~ markers. PUSAR Table 2.3-1 is replaced in its entirety without revision markers.

Revised Response to Request for Additional Information

Electrical Engineering Branch

EEEB RAI-1

In Table 2.3-1 of Attachment 4 to the application dated September 28, 2012, the licensee provides the normal, design-basis accident (DBA) and total radiation requirements for rooms at PBAPS. For the environmental qualification (EQ) zones/areas, provide, in table form, a list of components and their respective qualification levels and parameters (i.e., temperature, pressure, humidity, chemical spray, submergence, and radiation) that shows that the EQ limits remain bounding under EPU conditions for normal operation, accident (loss-of-coolant accident (LOCA), main steam line break (MSLB)/high-energy line break (HELB)), and post-accident. Include the existing EQ limits in your response and show how EQ margins (e.g., temperature, pressure, radiation, etc.) are being maintained. Provide more detail with regard to the statement made on page 2-124 of Attachment 4 to the application dated September 28, 2012, about the margin evaluation complying with the Institute of Electrical and Electronics Engineers (IEEE) 323-1974 (Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations).

RESPONSE

Table 1 summarizes the changes to EQ environmental parameters due to EPU. Changes are discussed in more detail below.

Table 1
Summary of EPU Impact on EQ DBA Environmental Parameters (Note 1)

Environmental Parameter	IMPACT OF EPU	
	Inside Containment	Outside Containment
Temperature, Normal	No change	No change
Radiation, Normal	Increased by scaling factor of 1.1423	Increased by scaling factor of 1.1423
Temperature, Accident	No change in peak temperature (340°F); change to post-DBA temperature profile described below	No change except for RWCU **and HPCI** rooms (Note 2)
Pressure, Accident	Changed from 47.8 to 48.7 psig	No change
Humidity, Accident	No change	No change
Spray, Accident	No Change	N/A
Submergence, Accident	No Change	No change
Radiation, Accident	Increased by scaling factor of 1.1423	Increased by scaling factor of 1.1423

Notes:

1) 'Accident' means loss of coolant accident (LOCA), main steam line break (MSLB), or high energy line break (HELB), as applicable to each area.
2) During the reviews performed for EPU, ~~a deficiency was~~ **deficiencies were** noted in the RWCU HELB analysis~~, The RWCU HELB analysis was~~ **and the post-LOCA heat-up analyses of the HPCI pump room. These analyses were** therefore re-performed using bounding values that enveloped both current (pre-EPU) and EPU operating conditions. Table 3 shows that the equipment qualification limit bounds the DBA peak temperature in these rooms.

DBA Temperature inside Containment

Figure 2.3-1 of Attachment 4 to the application shows the current Drywell EQ temperature profile and revised EPU Drywell temperature profile for 101 days post-accident. The profiles differ only during the first three hours where the EPU profile duration at peak temperature of 340°F increased. All equipment and commodities have been re-evaluated and remain qualified for the EPU Drywell temperature profile. The EPU EQ temperature evaluation does not affect the Current Licensed Thermal Power (CLTP) margins. EPU does not affect the peak temperature requirement and therefore, the EQ temperature margins at CLTP conditions are maintained.

DBA Pressure inside Containment

Figure 2.6-6 of Attachment 4 to the LAR application shows the bounding EPU drywell pressure profile. Peak pressure increased from 47.8 psig (62.5 psia) to 48.7 psig (63.4 psia). All equipment and commodities were re-evaluated with respect to the EPU peak pressure of 48.7 psig. The evaluation determined that EQ qualification post-EPU was maintained and the remaining margins exceeded the required IEEE-323-1974, 10% margin. Table 2 shows that the qualification limit bounds the postulated accident pressure with sufficient margin.

Table 2: Evaluation of Pressure Qualification of EQ Equipment and Commodities in the Drywell

Equipment	Qualification Limit [psig]	Margin (Note 1)
AVCO Solenoid Valves	62	27%
NDT International Acoustic Monitors	61.3	25%
PYCO RTDs and Thermocouples	115	136%
Pyle National Plug Connectors	105	115%
General Atomic Radiation Detectors	77	58%
GE Electrical Penetrations	124	154%
Buchanan Terminal Blocks	113	132%
GE Terminal Blocks	103	111%
Weidmuller Terminal Blocks	113	132%
Amp Terminal Lugs	74	51%
GE SIS Cable	104	113%
ITT Surprenant Power Cable	113	132%
Okonite Power Cable	112	129%
Rockbestos Cable	105	115%
Patel Conduit Seals	100	105%
H2/O2 Analyzer	68	39%
EGS Grayboot Connectors	81	66%
Insulated Splices (Raychem Kits)	66	35%
EGS Quick Disconnects	77	58%
Limitorque Motor Operated Valves	79.1	62%
Namco Position Switches	70	43%
ASCO Solenoid Valves, Trip Coils, and Pressure Switches	110	48%
UCI Electrical Tape	62	27%
Brand-Rex Cable	100	105%

Notes:

1) Margin is calculated based on gauge pressure relative to the modified EQ pressure requirement of 48.7 psig (63.4 psia).

DBA Temperature Outside Containment

Because the PBAPS EPU is a constant pressure EPU, the consequences of postulated HELBs remains unchanged. However, during the reviews performed for EPU, ~~a deficiency was~~ **deficiencies were** noted in the RWCU HELB analysis **and the post-LOCA heat-up analysis of the HPCI pump room.** ~~The RWCU HELB analysis was~~ **These analyses were** therefore re-performed using bounding values that enveloped both current (pre-EPU) and EPU operating conditions. Table 3 identifies the rooms with EQ equipment impacted by these deficiencies and presents both the peak EPU accident temperature and the qualification temperature limit for EQ equipment and commodities located in the room**s**. Table 3 shows that the qualification limit bounds the postulated accident temperature.

Table 3-LOCA/HELB Temperature Evaluation Outside Containment

Room Number	Room Name	Qualification Limit (°F)	Peak EPU Accident Temperature (°F)
400 (Unit 2)	RWCU Valve Compartment	340	213
403 (Unit 2)	Operating Area	207	177
444 (Unit 3)	Operating Area	207	177
447 (Unit 3)	RWCU Valve Compartment	340	213
6 (Unit 2) **48 (Unit 3)**	**HPCI Pump Rooms**	**227**	**165**

Radiation Environment Inside & Outside Containment

Table 4 identifies each type of equipment and commodity included in the PBAPS EQ Program along with the EPU EQ total integrated dose (TID) for relevant plant locations and the qualification limit. The EPU EQ TID is the sum of the normal dose, accident dose, and 10% margin on accident dose (in accordance with IEEE-323-1974 recommendations). The difference between the qualification limit and the EPU EQ TID reflects available excess margin. Table 4 shows that all equipment and commodities remain qualified for EPU operating conditions.

Table 4: Evaluation of Radiation Qualification of EQ Equipment and Commodities

Equipment	Rooms (Note 1)	EPU EQ TID [rads] (Note 2)	Qualification Limit [rads]
AVCO Solenoid Valves (U02, U06, and U14 series)	PC/OC	1.50E+08	1.56E+08
AVCO Solenoid Valves (models 6910-010, 6910-020, C-54505 only)	PC/OC	8.73E+07	1.07E+08
Rosemount Trip Units	OC	1.02E+05	2.20E+05
Rosemount Pressure Transmitters (Model 1153B)	OC	~~3.88E+06~~ **1.86E+07**	2.62E+07
GE Control Station	OC	1.14E+07	3.9E+07
Agastat Relays	OC	1.02E+05	2.0E+05
Static-O-Ring Pressure Switches	OC	3.90E+06	1E+07
Cutler Hammer MCC	OC	2.89E+05	1.4E+06
NDT International Acoustic Monitors	PC	1.87E+08	2.00E+08
	OC	1.02E+05	5.35E+05
Target Rock Solenoid Valves (76EE series only)	OC	2.90E+05	2.27E+07
Target Rock Solenoid Valves	OC	4.48E+07	4.80E+07
PYCO RTDs and Thermocouples	PC	1.92E+08	2.2E+08
	OC	4.36E+07	1E+08
ITT Barton Differential Pressure Switches (580A/583A series only)	OC	4.36E+07	5.00E+07
ITT Barton Differential Pressure Switches (Model 764/352 only)	OC	4.36E+07	5.0E+07
ITT Barton Differential Pressure Switches (Models 288/ 289A only)	OC	1.37E+05	3.0E+06

Equipment	Rooms (Note 1)	EPU EQ TID [rads] (Note 2)	Qualification Limit [rads]
Atkomatic Solenoid Valves	OC	2.12E+06	2.68E+06
Reliance ECCS Fan Motors	OC	4.36E+07	1.0E+08
Brown Boveri Load Centers	OC	2.89E+05	1E+06
Valcor Solenoid Valves	OC	4.27E+07	5.9E+07
GE Radiation Elements	OC	1.68E+03	1.7E+05
General Atomic Radiation Detectors	PC	1.92E+08	2.0E+08
GE Electrical Penetrations	PC	~~8.70 E+07~~ **9.29E+07**	1E+08
Foxboro Pressure Transmitters	OC	2.90E+05	3.0E+06
HPCI System Equipment	OC	6.89E+06	8E+06
Masoneilan Electropneumatic Transducer	OC	1.95E+06	1.12E+07
Manual Transfer Switch	OC	1.02E+05	2.9E+05
Y-Panels and Associated Transformers	OC	1.02E+05	1.2E+06
Barksdale Pressure Switch	OC	3.88E+06	4.4E+06
H2/O2 Analyzer	PC/OC Components in contact with PC air	~~1.92E+-8~~ **1.98E+08**	2E+08
	Components in contact with SC air	~~3.86E+06~~ **3.98E+06**	6.1E+06
GE 4 kV Pump Motors & Associated Cables	OC	4.36E+07	4.6E+07 (motor) 1.0E+08 (cable)
Fuses and Fuse Holders	OC	6.89E+06	1.0E+07

Equipment	Rooms (Note 1)	EPU EQ TID [rads] (Note 2)	Qualification Limit [rads]
Limitorque Motor Operated Valves	PC/OC	1.22E+08	1.96E+08
Namco Position Switches	PC/OC	~~1.14E+-8~~ **1.23E+08**	2E+08
ASCO (Solenoid Valves and Trip Coils only)	PC/OC	1.50E+08	2.00E+08
ASCO (Pressure Switches only)	OC	4.27E+07	2.0E+08
Pyle National Plug Connectors (Note 3)	PC	1.92E+08	2.0E+08
Buchanan Terminal Blocks (Model NQB, Series 100) (Note 3)	PC	1.94E+08	2.0E+08
Buchanan Terminal Blocks (Models 416 and 430) (Note 3)	OC	2.89E+05	3E+05
GE Terminal Blocks (Note 3)	PC	1.92E+08	2.2E+08
Marathon Terminal Blocks (Note 3)	OC	4.48E+07	2.5E+09
Weidmuller Terminal Blocks (Note 3)	PC	1.42E+08	2.0E+08
Amp Terminal Lugs (Note 3)	PC	1.92E+08	2.59E+08
Scotch Insulating Tape (Note 3)	OC	4.36E+07	6.2E+07
GE SIS Cable (Note 3)	PC/OC	1.00E+08	1E+08
ITT Surprenant Power Cable (Note 3)	PC	1.92E+08	2.56E+08
Okonite Power Cable (Note 3)	PC	1.92E+08	2.0E+08
Rockbestos Cable (Firewall III) (Note 3)	PC	~~1.17E+08~~ **1.23E+08**	2.0E+08
Rockbestos Cable (coaxial cable, Pyrotrol, and SR) (Note 3)	PC	1.94E+08	2.0E+08
Patel Conduit Seals (Note 3)	PC	1.94E+08	2.0E+08

Equipment	Rooms (Note 1)	EPU EQ TID [rads] (Note 2)	Qualification Limit [rads]
Jefferson Coaxial Cable (Note 3)	OC	~~1.05E+07~~ **1.30E+07**	2E+08
Anaconda Instrument and Power Cable (Note 3)	OC	2.89E+05	3.0E+07
EGS Grayboot Connectors (Note 3)	PC	2.05E+08	2.08E+08
Insulated Splices (Raychem Kits, NMCK-8 only) (Note 3)	OC	4.48E+07	5E+07
Insulated Splices (Raychem Kits except NMCK-8) (Note 3)	PC	1.92E+08	2.0E+08
EGS Quick Disconnects (Note 3)	PC	1.92E+08	2.0E+08
UCI Electrical Tape (Note 3)	PC	1.92E+08	2.0E+08
Brand-Rex Cable (Note 3)	PC	1.92E+08	2E+08

Notes:

1) 'PC' indicates primary containment. 'OC' indicates Outside Primary Containment. 'SC' indicates Secondary Containment
2) The EPU EQ TID is the sum of the normal dose, accident dose, and 10% margin on accident dose.
3) Items marked by this note are commodity items that are qualified for various plant areas based on the worst-case location (either Drywell, worst-case Reactor Building room having EQ equipment, or specific applications).

<u>Margin</u>

The EPU EQ evaluation applied the IEEE-323-1974 margin recommendations for relevant environmental parameters. The recommended margins (10%) on pressure and accident dose are specifically accounted for as discussed previously. The EQ evaluation applied IEEE-323-1974 recommended temperature margin of either +15°F degree or other alternate means. The EPU EQ evaluation applied a 10% margin to the post accident operating time.

Conclusion:

EQ for safety related electrical equipment is based on MSLB outside containment, HELB and /or LOCA conditions and their resultant temperature, pressure, humidity, submergence and radiation consequences. All equipment remains qualified for post EPU parameters.

Table 2.3-1 Normal Maximum and Total Radiation Requirements for Rooms at PBAPS

			Normal Operating Dose			DBA Integrated Dose		Total Integrated Dose		
AREA			40 Year Rerate Dose	60 Year Rerate Dose	60 Year EPU Dose	DBA LOCA Dose	EPU DBA LOCA Dose	40 Year Dose + DBA LOCA	60 Year Dose + DBA LOCA	60 Year EPU Dose + EPU DBA LOCA
			A	B[1]	C[2]	D	E[3]	F[4]	G[5]	H[6]
Unit 2	Unit 3	Description	(RADS)			(RADS)		(RADS)		
Primary Containment										
		Suppression Chamber	5.63E+03	8.45E+03	9.65E+03	4.88E+07	5.57E+07	4.88E+07	4.88E+07	5.57E+07
201	246	CRD Area	2.70E+06	4.05E+06	4.63E+06	4.57E+07	5.22E+07	4.84E+07	4.97E+07	5.68E+07
202 402	247 443	Drywell	2.07E+07	3.11E+07	3.55E+07	4.57E+07	5.22E+07	6.64E+07	7.67E+07	8.77E+07
Reactor Building										
1	37	Torus Compartment	5.63E+03	8.45E+03	9.65E+03	3.40E+07	3.88E+07	3.40E+07	3.40E+07	3.88E+07
2 3 4 5	38 39 40 41	RHR Pump Rooms	5.45E+05	8.18E+05	9.34E+05	3.40E+07	3.88E+07	3.45E+07	3.48E+07	3.98E+07
101 102 103 104	156 157 158 159	RHR Pump Rooms	5.45E+05	8.18E+05	9.34E+05	3.40E+07	3.88E+07	3.45E+07	3.48E+07	3.98E+07
6	48	HPCI Pump Room	9.05E+05	1.36E+06	1.55E+06	1.24E+07	1.42E+07	1.33E+07	1.38E+07	1.57E+07
7	47	RCIC Pump Room	5.18E+05	7.77E+05	8.88E+05	6.43E+06	7.34E+06	6.95E+06	7.21E+06	8.23E+06
8	46	Reactor Sump Pump	5.63E+03	8.45E+03	9.65E+03	3.08E+06	3.52E+06	3.09E+06	3.09E+06	3.53E+06
9 10 11 12	42 43 44 45	Core Spray Pump Rooms	9.39E+02	1.41E+03	1.61E+03	3.08E+06	3.52E+06	3.08E+06	3.08E+06	3.52E+06
105	162	Cooling Water Equipment Room	9.39E+02	1.41E+03	1.61E+03	1.44E+03	1.64E+03	2.38E+03	2.85E+03	3.25E+03
107 108	160 161	Vacuum Breaker Areas	9.39E+02	1.41E+03	1.61E+03	3.08E+06	3.52E+06	3.08E+06	3.08E+06	3.52E+06
24		Stairwell	1.91E+04	2.87E+04	3.27E+04	3.33E+04	3.80E+04	5.24E+04	6.19E+04	7.07E+04
	25	Stairwell	4.64E+03	6.96E+03	7.95E+03	7.08E+04	8.09E+04	7.55E+04	7.78E+04	8.89E+04
203 204	248 249	Isolation Valve Rooms	3.75E+04	5.63E+04	6.43E+04	3.40E+07	3.88E+07	3.40E+07	3.41E+07	3.89E+07

AREA			Normal Operating Dose			DBA Integrated Dose		Total Integrated Dose		
			40 Year Rerate Dose	60 Year Rerate Dose	60 Year EPU Dose	DBA LOCA Dose	EPU DBA LOCA Dose	40 Year Dose + DBA LOCA	60 Year Dose + DBA LOCA	60 Year EPU Dose + EPU DBA LOCA
			A	B[1]	C[2]	D	E[3]	F[4]	G[5]	H[6]
Unit 2	Unit 3	Description	(RADS)			(RADS)		(RADS)		
205 212	250 257	CRD Equipment Areas	3.75E+04	5.63E+04	6.43E+04	3.05E+04	3.48E+04	6.80E+04	8.68E+04	9.91E+04
207	253	Drywell Access	1.58E+05	2.37E+05	2.71E+05	3.05E+04	3.48E+04	1.89E+05	2.68E+05	3.06E+05
208	254	Steam Tunnel	2.88E+06	4.32E+06	4.93E+06	6.43E+06	7.34E+06	9.31E+06	1.08E+07	1.23E+07
209	252	Corridor	9.37E+02	1.41E+03	1.61E+03	2.29E+05	2.62E+05	2.30E+05	2.30E+05	2.63E+05
210	255	Neutron Monitoring	1.39E+10	2.09E+10	2.38E+10	3.05E+04	3.48E+04	1.39E+10	2.09E+10	2.39E+10
400	447	RWCU Valve Compartment	1.23E+06	1.85E+06	2.11E+06	3.40E+07	3.88E+07	3.52E+07	3.58E+07	4.09E+07
403	444	Operating Area	1.87E+02	2.81E+02	3.20E+02	2.29E+05	2.62E+05	2.29E+05	2.29E+05	2.62E+05
404 405 498	445 446 499	RWCU Pump Rooms	1.23E+06	1.85E+06	2.11E+06	3.05E+04	3.48E+04	1.26E+06	1.88E+06	2.14E+06
407	448	Regenerative Heat Exchanger Room	1.26E+06	1.89E+06	2.16E+06	3.05E+04	3.48E+04	1.29E+06	1.92E+06	2.19E+06
408 409	449 450	Non-Regenerative Heat Exchanger Room	4.31E+05	6.47E+05	7.38E+05	3.05E+04	3.48E+04	4.62E+05	6.77E+05	7.73E+05
410	452	Transfer Pump Room	2.08E+07	3.12E+07	3.56E+07	3.05E+04	3.48E+04	2.08E+07	3.12E+07	3.57E+07
430	453	Backwash Receiving Tank	2.16E+08	3.24E+08	3.70E+08	3.05E+04	3.48E+04	2.16E+08	3.24E+08	3.70E+08
472 473	476 477	Valve Compartments	1.18E+06	1.77E+06	2.02E+06	2.96E+04	3.38E+04	1.21E+06	1.80E+06	2.06E+06
500 505	514 515	Holding Pump Compartments	3.38E+05	5.07E+05	5.79E+05	3.05E+04	3.48E+04	3.69E+05	5.38E+05	6.14E+05
501	517	Laydown Area	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
502	518	New Fuel Storage	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
504	522	Source Storage and Cal	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04

AREA			Normal Operating Dose			DBA Integrated Dose		Total Integrated Dose		
			40 Year Rerate Dose	60 Year Rerate Dose	60 Year EPU Dose	DBA LOCA Dose	EPU DBA LOCA Dose	40 Year Dose + DBA LOCA	60 Year Dose + DBA LOCA	60 Year EPU Dose + EPU DBA LOCA
			A	B[1]	C[2]	D	E[3]	F[4]	G[5]	H[6]
Unit 2	Unit 3	Description	(RADS)			(RADS)		(RADS)		
506	520	RX BLDG Ventilation Equipment	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
507	519	Steam Separator and Drier Laydown Area	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
508	523	Steam Separator and Drier Laydown Area	9.39E+02	1.41E+03	1.61E+03	2.29E+05	2.62E+05	2.30E+05	2.30E+05	2.63E+05
509	516	Filter Demln Compartment	1.99E+08	2.99E+08	3.41E+08	3.05E+04	3.48E+04	1.99E+08	2.99E+08	3.41E+08
510 511	525 526	Pre and HEPA Filter Compartment	9.97E+03	1.50E+04	1.71E+04	3.05E+04	3.48E+04	4.05E+04	4.55E+04	5.19E+04
529	530	RX Building Fan Room	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
601 603	611 613	Laydown Area	9.39E+02	1.41E+03	1.61E+03	3.05E+04	3.48E+04	3.14E+04	3.19E+04	3.64E+04
604	614	Washdown area	3.75E+04	5.63E+04	6.43E+04	3.05E+04	3.48E+04	6.80E+04	8.68E+04	9.91E+04
605	612	Shower Room	1.87E+02	2.81E+02	3.20E+02	3.05E+04	3.48E+04	3.07E+04	3.08E+04	3.52E+04
Radwaste Building										
33	33	SGTS Equipment Compartment	2.27E+03	3.41E+03	3.89E+03	5.02E+06	5.73E+06	5.02E+06	5.02E+06	5.74E+06
206	258	MG Set Room	1.87E+02	2.81E+02	3.20E+02	3.19E+01	3.64E+01	2.19E+02	3.12E+02	3.57E+02

Notes for Table 2.3-1
Note 1: 60 year dose is 1.5x the 40 year dose. (A x 1.5 = B)
Note 2: 60 year EPU dose is 1.1423x the 60 year dose. (B x 1.1423 = C)
Note 3: The EPU DBA LOCA dose is 1.1423x Rerate DBA LOCA dose. (D x 1.1423 = E)
Note 4: F = A + D
Note 5: G = B + D
Note 6: H = C + E