Britt T. McKinney
Sr. Vice President & Chief Nuclear Officer

PPL Susquehanna, LLC
769 Salem Boulevard
Berwick, PA 18603
Tel. 570.542.3149 Fax 570.542.1504
btmckinney@pplweb.com

ppl™

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U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop OP1-17
Washington, DC 20555

**SUSQUEHANNA STEAM ELECTRIC STATION
PROPOSED LICENSE AMENDMENT NO. 285
FOR UNIT 1 OPERATING LICENSE NO. NPF-14
AND PROPOSED LICENSE AMENDMENT NO. 253
FOR UNIT 2 OPERATING LICENSE NO. NPF-22
EXTENDEDPOWER UPRATE APPLICATION RE:
MATERIALS AND CHEMICAL ENGINEERING
TECHNICAL REVIEW REQUEST FOR ADDITIONAL
INFORMATION RESPONSES
PLA-6193**

**Docket Nos. 50-387
and 50-388**

References: 1) PPL Letter PLA-6076, B. T. McKinney (PPL) to USNRC, "Proposed License Amendment Numbers 285 for Unit 1 Operating License No. NPF-14 and 253 for Unit 2 Operating License No. NPF-22 Constant Pressure Power Uprate," dated October 11, 2006.

2) Letter, R. V. Guzman (NRC) to B. T. McKinney (PPL), "Request for Additional Information (RAI) – Susquehanna Steam Electric Station, Units 1 and 2 (SSES 1 and 2) - Extended Power Uprate Application Re: Materials and Chemical Engineering Technical Review (TAC Nos. MD3309 and MD3310)," dated April 12, 2007.

Pursuant to 10 CFR 50.90, PPL Susquehanna LLC (PPL) requested in Reference 1 approval of amendments to the Susquehanna Steam Electric Station (SSES) Unit 1 and Unit 2 Operating Licenses (OLs) and Technical Specifications (TSs) to increase the maximum power level authorized from 3489 Megawatts Thermal (MWt) to 3952 MWt, an approximate 13% increase in thermal power. The proposed Constant Pressure Power Uprate (CPPU) represents an increase of approximately 20% above the Original Licensed Thermal Power (OLTP).

The purpose of this letter is to provide responses to the Request for Additional Information transmitted to PPL in Reference 2.

The Enclosure contains the PPL responses.

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There are no new regulatory commitments associated with this submittal.

PPL has reviewed the "No Significant Hazards Consideration" and the "Environmental Consideration" submitted with Reference 1 relative to the Enclosure. We have determined that there are no changes required to either of these documents.

If you have any questions or require additional information, please contact Mr. Michael H. Crowthers at (610) 774-7766.

I declare under perjury that the foregoing is true and correct.

Executed on: 5-3-07

B. T. McKinney

Enclosure: Request for Additional Information Responses

Copy: NRC Region I
Mr. A. J. Blamey, NRC Sr. Resident Inspector
Mr. R. V. Guzman, NRC Sr. Project Manager
Mr. R. R. Janati, DEP/BRP

Enclosure to PLA-6193
Request for Additional Information Responses

Protective Coating Systems (Paints) – Organic Materials

NRC Question 1:

Based on the Update Final Safety Analysis Report (UFSAR), it is the staff's understanding that, (1) Service Level I coatings were not procured and applied according to RG 1.54 because it was not yet issued at the time most plant NSSS equipment was ordered, (2) most NSSS equipment has coatings that were qualified under ANSI N101.2 "Protective Coatings (Paints) for Light Water Nuclear Reactor Containment Facilities," (3) the amount of unqualified coatings on NSSS equipment is less than 12 kilograms (not including paint tightly covered with insulation), (4) the drywell liner and structural steel in the drywell are coated with zinc and epoxy systems qualified to ANSI N101.2, and (5) part of each suppression pool is coated with inorganic zinc qualified to ANSI N101.2. Please provide a discussion on the qualification requirements for original and repair coatings to confirm or correct the staff's understanding.

PPL Response:

PPL's program for containment coatings was described in PPL's response (PLA-5003 dated November 11,1998) to Generic Letter (GL) 98-04, "Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss of Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment." NRC closed GL 98-04 for PPL in a letter dated December 9, 1999 (TAC NOS MA4108 and MA4109) based on the response.

The qualification requirements for original coatings are provided in the response to NRC Question 3 herein.

The PPL Specification addressing repair and application of containment coatings for installation within the Unit 1 and 2 containments ensures that the containment coatings at SSES comply with the requirements of RG 1.54 Rev. 0, Service Level I, II, and III Protective Coatings Applied to Nuclear Plants. This specification requires LOCA Simulation Testing in accordance with ASTM D3911 (temperature/pressure transient) and Irradiation Testing in accordance with ASTM D4082 (radiological dose).

The staff's understanding of the SSES UFSAR content as described in the question is correct.

NRC Question 2:

Please discuss the conditions (temperature, pressure, radiological dose) used to qualify Service Level I protective coatings in containment for current operating conditions and whether they remain bounding for design basis accident (DBA) conditions following the extended power uprate. If the original qualification conditions were not bounding for any coatings, please discuss your plans to qualify those coatings.

PPL Response:

CPPU does not require any changes to the PPL containment coating program. The CPPU DBA-LOCA conditions in containment are within the qualification limits of the current program specified in the PPL specification. As described in response to NRC Question 3 below, testing performed on the original coatings also bounds CPPU conditions.

NRC Question 3:

According to Section 6.1.2 of the UFSAR, an in-situ DBA test was conducted on samples representing 42,100 square feet of coatings that could be qualified but were not applied using qualified procedures. Regarding this testing:

(a) The term "in-situ" (i.e., "in position," or "in its original place") seems to contradict the term, "samples representing." Similarly, the titles of the test reports referenced in the UFSAR contain the phrase, "Testing of Specimens Representing Drywell Hanger Steel Painted with Inorganic Zinc," suggesting the testing was performed on neither the actual steel nor the actual paint in service. Please provide a description of how this testing was performed and the standards that governed it.

(b) Do the conditions for the "in-situ" testing bound DBA conditions following the extended power uprate?

PPL Response 3a:

The testing described in UFSAR Section 6.1.2 involved testing representative samples of coated support steel removed from containment. Each sample of support steel was fabricated into three coupons approximately 2" by 4". The sampling program was based on the following:

- Painting within containment was conducted in a uniform, methodical manner level-by-level, quadrant-by-quadrant.
- The same personnel painted the entire containment.
- The number of samples to be removed would be proportional to the relative area of painted steel within a particular sector.

The coupons were subjected to a seven-day simulated design basis LOCA reaching a maximum temperature of 340°F.

Successful test completion of all coupons representing a sector qualified the entire sector. Unsuccessful completion would result in a reduction of the total amount of qualified paint within that sector, in proportion to the number of coupons representing that sector.

These tests were used to determine what portion of the drywell liner and structural steel coatings could be considered to meet the requirements of ANSI N101.2 and RG 1.54.

PPL Response 3b:

Yes, the "in situ" testing bounds the CPPU DBA-LOCA conditions. Details of the "in situ" testing are provided in Response 3a.

NRC Question 4:

The staff considered the following regarding the effect of coatings on the Emergency Core Cooling Systems (ECCS): (1) Power Uprate Safety Analysis Report (PUSAR) Section 4.2.6 states, "all debris sources in the drywell and suppression chamber are available for transport to the suction strainers" (more conservative than associated topical report NEDO-32686), (2) UFSAR Section 6.1.2 states, "qualified coatings are expected to remain intact following a DBA," and (3) the amount recommended for qualified coating debris in NEDO-32686 ranges from 47 lb to 71 lb. Based on these items, it is unclear to the staff what was assumed about coatings debris in the evaluation of ECCS performance during postulated DBAs. For example, it is not clear how much debris is attributed to qualified coatings or how you evaluated the unqualified paint "tightly covered with insulation" (UFSAR Section 6.1.2). In addition, the units used in the UFSAR (area) are different from those used in NEDO-32686 (weight). Please discuss your evaluation of the effects of changing to CPPU conditions on the zone of influence, the amount of coatings debris generated, and the operation of emergency cooling systems.

PPL Response:

The parameters for calculating the zone of influence are not impacted by CPPU. The amount of debris generated is not impacted by CPPU because PPL has made conservative assumptions regarding the amount of debris generated that is independent of the size of the zone of influence. Therefore, relative to the effects of containment coatings, the operation of the emergency core cooling systems is not effected by CPPU conditions.

For the suction strainer debris loading analysis, 604 sq. ft. of qualified coating in the drywell are assumed to fail due to the path of the LOCA jet. Due to the force of the jet, the coating debris will be in the form of particulate. All unqualified coatings in the drywell are assumed to fail in the form of flakes. All of the debris generated from the failed coatings in the drywell is conservatively assumed to be transported to the wetwell. All of the inorganic zinc in the wetwell is assumed to fail in the form of flakes. A small portion of the red oxide paint in the wetwell is assumed to become debris even though red oxide is expected to fail at a temperature of 240°F and the CPPU post-LOCA wetwell temperature only reaches 212°F. All of the red oxide debris is conservatively assumed to fail in the form of flakes.

Based on these assumptions, approximately 22 lbs of paint debris from the LOCA jet and approximately 640 lbs of failed unqualified coatings are conservatively assumed to be transported to the suppression pool.

During testing of settling velocities of paint chips, results indicated that settling velocity was insensitive to paint chip size and was primarily determined by paint thickness and specific gravity. To conservatively estimate paint chips deposited on the strainers, it is assumed that the paint chips were at a minimum thickness (2 mil), the ECCS pumps are immediately at rated flow, a chugging time of 85 seconds was used (maximum turbulence) and only a fraction (75%) of the pool area is used for settling to account for areas where resuspension may occur. When settling is considered, the maximum paint chip loading on an RHR strainer is 11.5% of the total paint chip debris assumed to reach the suppression pool and 7.2% of the total paint chip load for the CS strainers.

For CPPU, the current settling velocities and suppression pool chugging time remain valid. Because RHR and CS pump flow rates do not change for CPPU, the approach velocities and strainer loading in the current analysis remain valid for CPPU.

NRC Question 5:

Please discuss your requirements for inspecting, removing, and replacing degraded containment coatings, and the effects of EPU conditions on these activities.

PPL Response:

Routine preventative maintenance tasks assure walk-downs of containment coatings are performed in accordance with ASTM D5163 " Standard Guide for Establishing Procedures to Monitor the Performance of Safety Related Coatings in an Operating Nuclear Power Plant " during refueling and inspection outages. To date, no degraded conditions have been identified that required remediation. If those conditions are observed, they will be addressed via our 10CFR50 Appendix B corrective action program.

CPPU will not change the normal operating pressure and temperature conditions inside containment. Dose rates in containment during normal operation will be higher at CPPU conditions; however, the higher rates are within the requirements of the qualified coatings. Therefore, the CPPU will not have any affect on the frequency of inspections or degradation of containment coatings. No major modifications will be installed in containment as part of CPPU, which would prevent the inspection of a large quantity of qualified coatings. Therefore, the inspection, removing, and replacement of qualified coatings are not impacted by CPPU.

NRC Question 6:

Please describe the evaluations you performed, and discuss the results of those evaluations, to determine the effects of EPU conditions on the generation of hydrogen and organic gases from paints and other organic materials (such as Hypalon electrical cable insulation) in containment.

PPL Response:

Hydrogen gas generation from paints and other organic materials are temperature dependent. The amount of hydrogen that could be generated from these materials is small compared to what can be generated from the metal-water reaction of active fuel cladding, radiolysis of water, and corrosion of zinc and aluminum. (Note that zinc paint is included in the analysis of zinc and aluminum corrosion post-LOCA hydrogen generation.)

Since the temperature difference due to EPU will not be significantly higher than current temperatures, any increased hydrogen generation from these materials will be minimal.

SSES existing emergency procedures specify starting the hydrogen recombiners before hydrogen concentrations reach 2%, well below the flammability limit of 4%. Evaluations based on EPU conditions show that hydrogen concentrations will reach 2% post LOCA in just over 2 hours in the drywell and 3 hours in the wetwell. The procedural requirement to start the recombiners before the hydrogen concentrations reach 2% is a conservative approach and is not dependent on the source of the hydrogen.

Based on the above, it has been determined that the effects of EPU conditions on the generation of hydrogen and organic gases from paints and other organic materials will be minimal and will have no impact on the response to hydrogen concentration in containment post LOCA.

Flow Accelerated Corrosion (FAC)

NRC Question 1:

According to the PUSAR, page 10-33, your FAC inspection program is based on guidelines from the Electric Power Research Institute (EPRI) in EPRI NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program." Please describe in more detail your criteria for scoping and prioritizing components in your FAC program.

PPL Response:

Scoping:

A plant System Susceptibility Evaluation (SSE) was performed to review each plant system, subsystem and line against FAC susceptibility criteria per NSAC-202L-R3 section 4.2 and CHECWORKS modeling capability. Included within the SSE is a "Non-FAC mechanism summary," which identifies locations that may be susceptible to other damage mechanisms such as cavitation, flashing and liquid droplet impingement.

FAC susceptible piping that meets CHECWORKS modeling criteria (e.g., non-socket weld, defined operating conditions, no non-condensable gases) is included in a CHECWORKS model. All other susceptible piping, including small bore (i.e., 2" or less) is included in a Susceptible Non-Modeled (SNM) program.

Prioritization:

Components in CHECWORKS modeled lines are prioritized based upon the CHECWORKS wear rate analysis results. SNM program lines are prioritized based upon rankings developed in the SNM program document. SNM lines were categorized based on consequence of failure. Lines that were determined to have potentially high consequences of failure (i.e., personnel safety, shutdown/trip, non-isolable or safety related) were further evaluated for level of FAC susceptibility (high, moderate or low) based upon:

a. Industry experience
b. Plant experience/maintenance history
c. Operating conditions

The SNM components were then prioritized using one of the following methods:

a. A CHECWORKS parametric analysis. This provides relative rankings of various component geometry types with respect to predicted wear.
b. Operating experience at SSES and within the industry.
c. Other analytical methods which are contained in a PPL analysis program such as:

1. EPRI Report NP-3944 entitled "Erosion/Corrosion in Nuclear Plant Steam Piping: Causes and Inspection Program Guidelines"
2. EPRI April 1987 seminar "Empirical KWU Model" including 1988 American Power Conference Paper "KWU update experience, etc."

NRC Question 2:

Please describe your most recent repair or replacement performed as a result of FAC. Include in your description the component replaced, the extent of degradation, actions to prevent recurrence, and whether you made any changes to your FAC program for existing or EPU conditions as a result of this experience.

PPL Response:

The most recent repair or replacement performed as a result of FAC was the replacement of three #3 Feedwater Heaters (FWH) in Unit 2 during the 2007 refueling outage. In January of 1999, degradation was first identified in a SSES FWH when a through wall leak occurred in the shell of 2E103C adjacent to the extraction steam inlet. As a result, extensive FWH inspections at the extraction steam inlet were incorporated into the FAC program. In September 2006, a shell leak developed in the 2E103B shell along the flash chamber baffle plate (well outside of the typical shell inspection area). The FAC program was revised to include this area. Prior replacements included replacing other feedwater heaters and 80% of the extraction piping on both SSES units with a more resistant material. Actions to prevent reoccurrence include using either Chrome alloy for FWH, ASTM A335 Gr. P-22 for piping or Stainless clad piping as the permanent replacement material. For EPU these permanent replacement materials will continue to be used since SSES operating experience since their first use in 1989 has shown them to mitigate FAC.

NRC Question 3:

Please discuss how components are inspected and evaluated with respect to the guidance in EPRI NSAC-202L-R2, in which suitability for continued service is based on current wall thickness, acceptable wall thickness, and predicted wall thickness at the time of the next inspection. Discuss how your acceptance criteria for minimum wall thickness are consistent with maintaining structural integrity.

PPL Response:

All components are inspected and evaluated per NSAC-202L guidelines. Components including applicable upstream, downstream and branch extensions use grid spacing that is within NSAC-202L limits. Suitability for service is based upon using the following to determine a remaining life: Current minimum measured wall thickness.

a) Previous minimum measured wall thickness.
b) Operating hours.
c) Using 'a', 'b', 'c' and NSAC-202L methods to determine a wear rate.
d) Acceptable wall thickness (i.e., code Tmin) to maintain structural integrity.
e) Predicted wall thickness, using 'a' and 'd', is greater than the acceptable wall thickness at the time of the next inspection.

Structural integrity is maintained by using the most restrictive code Tmin value. The code Tmin considers both the design circumferential stress due to pressure and the longitudinal stresses produced by pressure, thermal, mechanical or other design loading conditions. If a code Tmin value is not available, then the manufacturer's minimum tolerance on wall thickness is used as the Tmin.

NRC Question 4:

Table 10-14 in the PUSAR describes changes in the variables that affect FAC rates. However, because the FAC rate is determined by the interactions of these variables, comparing the parameters may not indicate how they affect the FAC rate. Please discuss the effect of the EPU on the FAC rates as predicted by your CHECWORKS model, for example by providing the FAC rates for several (e.g., 5 to 10) components representing the highest predicted FAC rates before the uprate and the highest rates after the uprate (i.e., two potentially different sets of components). Include the calculated corrosion rates for comparison.

PPL Response:

All CHECWORKS models are currently being revised to incorporate both the latest inspection results and the changes due to EPU. Detailed results from these analyses will be provided via separate correspondence to NRC by June 1, 2007.

NRC Question 5:

Please discuss your FAC program for small bore piping, including how it compares to the guidance in Appendix A of NSAC-202L-R2.

PPL Response:

The SSES FAC program does not distinguish small bore piping (i.e., ½' to 2") from large bore piping (i.e., up to 42"). Small bore piping is predominantly addressed in the SNM program. The SNM program as discussed in question #1, is consistent with the guidance of NSAC-202L-R3 Appendix A. Systems are screened for susceptibility and categorized based upon the consequence of failure. Those found to have significant consequence of failure are evaluated for relative level of susceptibility. The FAC mitigation approach is to replace an entire pipeline with FAC resistant material once significant wear is detected.

NRC Question 6:

Please discuss how your program addresses flow-related thinning other than FAC, such as erosion-corrosion due to high velocity fluids or suspended particles.

PPL Response:

Flow related thinning other than FAC is addressed in the System Susceptibility Evaluation (SSE) as discussed in question #1. The SSE identifies locations susceptible to other damage mechanisms. It serves to prevent components from being excluded due to other damage mechanisms (e.g., chrome-moly that would be excluded due to FAC but may be susceptible to degradation due to droplet impingement).

The SSES FAC program incorporates high velocity fluids as a part of the evaluation process. Since velocity is a part of the FAC analytical method, a high velocity shows up as a high potential for wear (i.e., shorter life). This results in the location being identified for inspection over lower velocity components in the same line.

Industry experience has shown suspended particles to not to be a problem in the clean water environment of a nuclear plant. Further, to mitigate this SSES has full flow condensate filters, which keep the entire primary water circuit clean.

Reactor Water Cleanup (RWCU) System

NRC Question 1:

Section 3.11 of the PUSAR states that the RWCU system was analyzed at a flow rate of 146,300 pounds mass per hour (lbm/hr). Based on FSAR Table 5.4-2, it is the staff's understanding that 146,300 lbm/hr is the design maximum, and that the system is operated at a lower rate. Please provide the operating flow rate or correct the staff's understanding of this issue.

PPL Response:

146,300 lbs/hr mass flow rate is the design maximum and also the operating flow rate for the RWCU system.

NRC Question 2:

Section 3.11 of the PUSAR concludes that at power uprate conditions, the RWCU system will perform adequately at the original flow rate. Please discuss the aspects of the system that were evaluated and the parameters evaluated to reach this conclusion (for example, the effects of changes in temperature, pressure, chemistry, and flow rate on heat exchanger heat transfer and materials).

PPL Response:

The evaluation performed for CPPU consisted of the following:

Reactor Water Chemistry

Estimates for the current values of feedwater insoluble iron concentration [Fx] and reactor water conductivity [K] are based on averages from both units from the most recent fuel cycle. The calculated values for CPPU are based upon the assumption that the mass transport of feedwater impurities will increase with the corresponding increase in feedwater flow.

Feedwater insoluble iron average concentration for the most recent fuel cycle (prior to CPPU evaluation) is 0.782 ppb for Unit 1 and 0.508 ppb for Unit 2. The current feedwater iron concentration upper limit is 1.0 ppb. The feedwater insoluble iron concentration will remain the same for CPPU. However, the total quantity of iron going to the reactor vessel is directly proportional to the increase in feedwater flow for CPPU. For Unit 1, the total flow of insoluble iron will increase from an average of 0.0113 lbm/hr to 0.0129 lbm/hr. For Unit 2, the total flow of insoluble iron will increase from an average of 0.0073 lbm/hr to 0.0084 lbm/hr. PPL controls feedwater insoluble iron by injection of iron oxalate and thus can control the total quantity of iron going into the vessel. The total quantity of iron going into the vessel thus can be controlled to be the same as before CPPU.

Reactor water conductivity [K] is a gross indication of the quantity of soluble impurities in the reactor water. Conductivity for CPPU was estimated by taking into account the current feedwater flow and RWCU flow and the CPPU feedwater flow and RWCU flow. Average reactor water conductivity for the current fuel cycle is 0.107 μS/cm for Unit 1 and 0.13 μS/cm for Unit 2. The calculated average values will increase for CPPU to 0.115 μS/cm for Unit 1 and 0.141 μS/cm for Unit 2. The current administrative reactor water conductivity limit is 0.18 μS/cm. The calculated average reactor water conductivity for CPPU will remain within these limits.

The reactor water iron concentration is a function of the RWCU System parameters, the reactor vessel parameters, and the mass transport of impurities from the feedwater system. Based on the average feedwater iron concentration of 0.782 ppb for Unit 1 and 0.508 ppb for Unit 2, the calculated pre-CPPU average reactor water iron concentration is 11.55 ppb for Unit 1, and 7.50 ppb for Unit 2 (NEDC-32161P). The calculated values for CPPU are 13.24 ppb and 8.60 ppb for Units 1 and 2, respectively. These concentrations change slightly for CPPU because the RWCU flow has not been increased to match the flow increase of the feedwater system.

The CPPU RWCU flow rate is not increased to match the increase in FW flow, therefore, the sulfate and chloride concentrations will increase above the pre-CPPU levels. The current average levels of chlorides are 0.351 ppb for Unit 1 and 0.692 ppb for Unit 2. The expected reactor water chloride level for CPPU, considering the FW flow increase, is 0.395 ppb for Unit 1 and 0.779 ppb for Unit 2. The current average levels of sulfates are 0.831 ppb for Unit 1 and 1.19 ppb for Unit 2. The expected reactor water sulfate level for CPPU, considering the FW flow increase, is 0.935 ppb for Unit 1 and 1.34 ppb for Unit 2. The current administrative limits are 1.0 ppb for chlorides and 2.0 ppb for sulfates.

The values quoted in the discussions above do not consider improvements being made in the RWCU system. The CPPU project is modifying the RWCU filter/demineralizers in order to improve filtration and ion exchange capability. Analysis of the flow distribution within the vessels shows that the precoat may not distribute evenly with the current configuration. PPL is upgrading the baffle plate to improve the flow distribution and installing upgraded filter septa. Based on results of similar modifications performed at other BWRs, these modifications will improve the efficiency of the RWCU system. Small pressurization lines are being added to each vessel to avoid disturbing the precoat during pressurization. In order to improve cleanup capability with one RWCU demineralizer out of service, PPL is increasing the capacity of the filter demineralizer flow to 188 gpm. PPL is replacing the rubber linings in the condensate demineralizer vessels with a ceramic coating and switching to a greater cross linked resin to reduce sulfate input. PPL is also installing an additional condensate filter and an additional condensate demineralizer to maintain the same filter flux that exists prior to CPPU.

RWCU Pumps

The RWCU pumps are acceptable for CPPU operation because there is no flow increase. Pump NPSH is not affected for CPPU because the reactor pressure does not change and the pump inlet temperature does not increase for CPPU. The CLTP inlet temperature is 533°F. The CPPU inlet temperature is 531°F. It was estimated that the feedwater system pressure increase at the RWCU system connection would be approximately 10 psi. This increase is within the capability of the pump and flow control valve.

RWCU Heat Exchangers

The RWCU heat exchangers are not affected by CPPU because the shell and tube side flow rate is not changed for CPPU. The shell and tube side velocities, pressure drops and heat duty remain the same as the CLTP values discussed in NEDC-32161P. Thus CPPU has no detrimental effect on the heat exchanger material or heat transfer characteristics.

RWCU Filter/Demineralizers

The current design flow rate for each filter/demineralizer vessel is 1 gpm/ft^2 to 4 gpm/ft^2. For the CPPU flow rate of 146,300 lbm/hr (148.5 gpm), the filter/demineralizer flow rate is 1.1 gpm/ft^2. Thus there is no change to the filter/demineralizer flow rate for CPPU.

An increase in the reactor water conductivity and other levels of impurities will not change the resin efficiency, but it will reduce resin life due to the additional solubles and insolubles processed by the resins. This will result in a slight increase in the backwash frequency. However, due to the many variables, an exact increase cannot be estimated. The batch amount of effluent created during each backwash cycle and discharged to the Radwaste system will not change for CPPU since there is no change to the precoat material, application rates or precoat amount.

RWCU Flow Control Valves

The flow control valves have sufficient capability for operation under CPPU conditions with the slight feedwater system pressure increase (see the RWCU pump discussion). The slightly higher operating pressure due to the feedwater system pressure increase will require the flow control valves to operate in a slightly more open position.

NRC Question 3:

According to PUSAR Section 3.11, the concentration of iron in the reactor water is expected to increase from 11.55 ppb to 13.24 ppb in Unit 1, and from 7.5 ppb to 8.6 ppb in Unit 2, but that these changes are within the design chemistry limits and do not affect performance of the RWCU system. Please quantify the significance of this change by comparing the expected iron level and the design limit.

PPL Response:

There is not a specific design limit for reactor water iron. The reactor water iron concentration is a function of the RWCU System parameters, the reactor vessel parameters, and the mass transport of impurities from the feedwater system. Based on the average feedwater iron concentration of 0.782 ppb for Unit 1 and 0.508 ppb for Unit 2, the calculated pre-CPPU average reactor water iron concentration is 11.55 ppb for Unit 1, and 7.50 ppb for Unit 2 (NEDC-32161P). The calculated values for CPPU are 13.24 ppb and 8.60 ppb for Units 1 and 2, respectively. These concentrations change slightly for CPPU because the RWCU flow has not been increased to match the flow increase of the feedwater system. The Unit 1 values are higher than Unit 2 because of several excursions that skewed the overall average. The longer-term Unit 1 average concentration is expected to be closer to that of Unit 2. PPL controls feedwater insoluble iron by injection of iron oxalate and thus can control the total quantity of iron going into the vessel. The total quantity of iron going into the vessel can be controlled to be the same as before CPPU.

The PPL goal is to continue to maintain the feedwater iron concentration within the limits of 0.1 to 1.0 ppb, as recommended in BWR-VIP-130 BWR Water Chemistry Guidelines – 2004 for optimum fuel performance and primary system radiation control.

NRC Question 4:

PUSAR Section 3.11 states that the effect of increased feedwater line pressure was included in the Section 4.1 containment isolation assessment. Section 4.1.3 states that the "capabilities of isolation actuation devices to perform during normal operations and under post-accident conditions have been determined to be acceptable." Please describe in quantitative terms how you evaluated the effects of EPU conditions on the performance of the RWCU system containment isolation valves and determined the valves will perform their intended function.

PPL Response:

Consistent with Section 4.1 of the CLTR, primary containment and reactor pressure vessel isolation valves were examined for potential impact due to CPPU. Their capability to perform the required isolation function was evaluated using engineering judgment, which considered valve functional characteristics and potential changes to operating requirements associated with CPPU. Those valves evaluated are included in the Generic Letter 89-10 Program and were evaluated per Section 4.1.4 of the PUSAR.

Key evaluation assumptions include:

- Based on the final Reactor Heat Balance results as presented in Section 1.3 of the PUSAR, the normal-operating-environment conditions of isolation valves are not expected to change significantly after CPPU
- Based on the operability effects of an insignificant or "no change" in system process parameters within the system design bases then valve operability is unaffected by CPPU if system functional requirements do not significantly change.
- Post-accident, transient and ATWS responses at CPPU which were considered were evaluated per Sections 4 and 9 of the PUSAR

The table on the following page provides a summary of the evaluation results for the valves in the RWCU supply and return penetrations.

	Valve Number	Valve Type	Description	Containment Isolation Valve / 89-10 MOV Analysis Results
RWCU Return Path	HV-14182A/B	G/L 89-10 Gate MOV	RWCU Return Isolation	Basis for Design Basis DP (reactor steam dome pressure) is unchanged by the CPPU; therefore, no impact.
	HV-141F039A/B	Check	Feedwater Isolation	CPPU does not affect functional characteristics of check and manual valves, i.e., check valves provide an isolation function based on reverse or excess flow conditions that are not affected by CPPU and manual valves are not adversely affected by CPPU because closure is performed by means independent of power level (e.g., 'manual" operation) or under conditions not affected by CPPU.
	141-F010A/B, 141818A/B and HV-141F032A/B	Check	Feedwater Isolation	CPPU does not affect functional characteristics of check and manual valves, i.e., check valves provide an isolation function based on reverse or excess flow conditions that are not affected by CPPU and manual valves are not adversely affected by CPPU because closure is performed by means independent of power level (e.g., 'manual" operation) or under conditions not affected by CPPU.
	HV-155F006	G/L 89-10 Gate MOV	HPCI Injection Shutoff Valve	Feedwater temperature increases; however, differential pressure does not change, so small change in temperature has a negligible effect on required thrust.
	155038	Manual	HPCI Injection Bypass Valve	CPPU does not affect functional characteristics of check and manual valves, i.e., check valves provide an isolation function based on reverse or excess flow conditions that are not affected by CPPU and manual valves are not adversely affected by CPPU because closure is performed by means independent of power level (e.g., 'manual" operation) or under conditions not affected by CPPU.
	HV-149F013	G/L 89-10 Gate MOV	RCIC Injection Valve	Basis for Design Basis DP (lowest nominal SRV setpoint plus tolerance) is unchanged by the CPPU; therefore, no impact.
	149020	Manual	RCIC Injection Bypass Valve	CPPU does not affect functional characteristics of check and manual valves, i.e., check valves provide an isolation function based on reverse or excess flow conditions that are not affected by CPPU and manual valves are not adversely affected by CPPU because closure is performed by means independent of power level (e.g., 'manual" operation) or under conditions not affected by CPPU.
RWCU Supply Path	HV-144F001	G/L 89-10 Gate MOV	RWCU Inboard Containment Isolation Valve	Basis for Design Basis DP (normal operating reactor pressure) is unchanged by the CPPU; therefore, no impact
	HV-144F004	G/L 89-10 Gate MOV	RWCU Outboard Containment Isolation Valve	Basis for Design Basis DP (normal operating reactor pressure) is unchanged by the CPPU; therefore, no impact]]

NRC Question 5:

According to Section 3.11 of the PUSAR, the proposed power uprate would cause an increase in the filter/demineralizer backwash frequency. Section 3.11 also indicates in qualitative terms that the increase is negligible. Please quantify the amount of the increase in solid and liquid waste from the RWCU system relative to the capacity for processing liquid and solid radwaste.

PPL Response:

An increase in the reactor water conductivity and other levels of impurities will not change the resin efficiency, but it will reduce resin life due to the additional solubles and insolubles processed by the resins. This will result in a slight increase in the backwash frequency. The CLTP RWCU filter/demineralizer backwash frequency of 5.25 days is projected to increase to 4.61 days for CPPU. On average, CPPU will add 490 gallons per day (gpd) to the CLTP input of 47,358 gpd to liquid radwaste (LRW). This is <30% of the normal LRW system capacity of 172,800 gpd. RWCU input is a small portion (~50gpd) of the 490 gpd total CPPU increase. Each RWCU filter demineralizer backwash generates approximately 2.75 ft^3 of resin sludge to the RWCU Phase Separator that has a holding capacity of 100 ft^3 of resin sludge.