Florida Power & Light, 9760 S.W. 344 ST. Florida City, FL 33034

FPL

APR 28 2011
L-2011-084
10 CFR 50.90

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Units 3 and 4
Docket Nos. 50-250 and 50-251
Response to NRC Request for Additional Information Regarding Extended Power Uprate License Amendment Request No. 205 and Containment and Ventilation Issues

References:

(1) M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2010-113), "License Amendment Request No. 205: Extended Power Uprate (EPU)," (TAC Nos. ME4907 and ME4908), Accession No. ML103560169, October 21, 2010.

(2) Email from J. Paige (NRC) to T. Abbatiello (FPL), "Turkey Point EPU – Containment and Ventilation (SCVB) Request for Additional Information - Round 1," Accession No. ML110950084, April 1, 2011.

By letter L-2010-113 dated October 21, 2010 [Reference 1], Florida Power and Light Company (FPL) requested to amend Renewed Facility Operating Licenses DPR-31 and DPR-41 and revise the Turkey Point Units 3 and 4 Technical Specifications (TS). The proposed amendment will increase each unit's licensed core power level from 2300 megawatts thermal (MWt) to 2644 MWt and revise the Renewed Facility Operating Licenses and TS to support operation at this increased core thermal power level. This represents an approximate increase of 15% and is therefore considered an extended power uprate (EPU).

By email from the U.S. Nuclear Regulatory Commission (NRC) Project Manager (PM) dated April 1, 2011 [Reference 2], additional information regarding containment analysis and ventilation issues was requested by the NRC staff in the Containment and Ventilation Branch (SCVB) to support their review of the EPU License Amendment Request (LAR). The RAI consisted of eleven (11) questions regarding control room heating and ventilation, containment safety analyses, main feedwater system modifications, combustible gas control in containment, generic letter 96-06 overpressurization for piping between containment isolation valves, containment design basis accident analysis, and emergency core cooling system (ECCS) performance. These eleven RAI questions and applicable FPL responses are documented in the Attachment to this letter.

In accordance with 10 CFR 50.91(b)(1), a copy of this letter is being forwarded to the State Designee of Florida.

This submittal does not alter the significant hazards consideration or environmental assessment previously submitted by FPL letter L-2010-113 [Reference 1].

This submittal contains no new commitments and no revisions to existing commitments.

A084
NRR

Should you have any questions regarding this submittal, please contact Mr. Robert J. Tomonto, Licensing Manager, at (305) 246-7327.

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

Executed on April 28, 2011.

Very truly yours,

Michael Kiley
Site Vice President
Turkey Point Nuclear Plant

Attachment

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, Turkey Point Nuclear Plant
USNRC Resident Inspector, Turkey Point Nuclear Plant
Mr. W. A. Passetti, Florida Department of Health

Turkey Point Units 3 and 4

RESPONSE TO NRC RAI REGARDING EPU LAR NO. 205
AND SCVB CONTAINMENT AND VENTILATION ISSUES

ATTACHMENT

Response to Request for Additional Information

The following information is provided by Florida Power & Light (FPL) in response to the U. S. Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI). This information was requested to support License Amendment Request (LAR) No. 205, Extended Power Uprate (EPU), for Turkey Point Nuclear Plant (PTN) Units 3 and 4 that was submitted to the NRC by FPL letter L-2010-113 on October 21, 2010 [Reference 1].

In an email dated April 1, 2011 [Reference 2], the NRC staff requested additional information regarding FPL's request to implement the EPU. The RAI consisted of eleven (11) questions from the NRC's Containment and Ventilation Branch (SCVB) regarding control room heating and ventilation, main feedwater system modifications, combustible gas control in containment, generic letter 96-06 overpressurization concerns for piping between containment isolation valves, containment design basis accident analyses, and emergency core cooling system (ECCS) performance. These eleven RAI questions and applicable FPL responses are documented below.

Containment and Ventilation

SCVB-1.1 **Section 2.5.3, "Fission Product Control," of Attachment 4 (Licensing Report (LR)) to the license amendment request (LAR) dated October 21, 2010, subsection 2.5.3.1.2.2 discusses the control room ventilation system emergency operating parameters in the recirculation mode. The application states that in this mode the control room filter removal efficiency is 97.5% and the unfiltered in-leakage flow is assumed to be no greater than 115 cfm.**

However, in response to a staff RAI during the alternate source term (AST) application review, Florida Power & Light Company (FPL) revised control room filter efficiency and unfiltered control room in-leakage assumptions (see letter dated June 25, 2010 (Agencywide Document and Management System (ADAMS) Accession No. ML101800222)). Specifically, FPL reduced the credited control room filter efficiencies for elemental iodines and organic iodides from 97.5% to 95%. FPL also reduced the amount of unfiltered air in-leakage into the Control Room from 115 cfm to 100 cfm in order to preclude any encroachment on the AST LAR 196 indicated margin to the regulatory dose limits.

Explain why the filter removal efficiency and in-leakage flow parameters discussed in subsection 2.5.3.1.2.2 are different than those stated in the AST LAR.

The original AST analysis for AST LAR No. 196 was revised with changes to the assumed filter efficiencies and unfiltered inleakage and resubmitted to the NRC by FPL letter L-2010-137 on June 25, 2010. The current licensing basis discussion in LR Section 2.9.2 was updated to reflect these AST changes prior to the submittal of the EPU LAR but the technical evaluation contained in LR Section 2.5.3.1 was inadvertently overlooked. LR Section 2.5.3.1 is essentially descriptive text that contains no new analytical results and only references AST LAR No. 196 and its supporting analyses. Thus, the conclusions regarding the fission product control systems and structures are not impacted.

SCVB-1.2 Section 2.7.1, "Control Room Habitability," of Attachment 4 to the LAR, Subsection 2.7.1.2.3 discusses the ability of the Control Room Ventilation System (CRVS) to maintain a mild temperature environment as required by the Equipment Qualification Program. Specifically, FPL evaluated the CRVS at EPU conditions. Provide a summary of the CRVS heat removal evaluation performed (discuss any changes in CR heat loads), and specify if the evaluations performed are qualitative or quantitative.

The CRVS evaluation was a qualitative analysis. The CRVS was evaluated to determine the impact of EPU conditions on the existing cooling capacity. The CRVS was evaluated by reviewing the pre-EPU design and examining any changes to the CRVS heat loading as a result of EPU. The heat loads in the CRVS are not a function of reactor power level, but are from electrical control equipment within the CR, ambient outside air temperatures and personnel. The EPU modifications will revise a small minority of existing Control Room indicators. The revisions to these indicators will cause a negligible impact on the overall instrument and control circuit current loading and dissipated heat experienced within the Control Room HVAC System envelope. These changes will therefore have a negligible impact on the ability of the Control Room HVAC System to maintain the required temperature less than the 120°F TS 4.7.5.a surveillance limit and the CRVS will continue to maintain a mild temperature environment as required by the Equipment Qualification Program.

Heating due to absorption of iodine by the CRVS charcoal filters was qualitatively evaluated to be negligible based on in-flow of air, iodine heat of absorption and the air handler capacity of the CRVS. The heat of decay for the CRVS charcoal filters was quantitatively evaluated and was determined to be negligible. Any increase to those heat loads due to EPU will continue to result in negligible heat loads on the CRVS.

Therefore, the CRVS's ability to provide appropriate temperature and humidity conditions for equipment during normal and emergency conditions is not impacted by the EPU.

SCVB-1.3 Section 2.3.5, "Station Blackout" of Attachment 4 to the LAR, Subsection 2.3.5.2.3 concludes that the EPU will not affect the ability to fulfill the requirements of Turkey Point's HVAC system during a station blackout (SBO) event. It is stated in this section that heat loads in the buildings have either not increased or when increased, it is minor and well within the capacity of the area ventilation. Provide the details of the evaluations performed, and compare the results with the pre-EPU conditions.

A qualitative evaluation of the effect of EPU on SBO ventilation has been performed:

Review of the SBO EDG load lists indicates that the following areas are currently provided with ventilation during an SBO event:

- Emergency Diesel Generator (EDG) Buildings
- Control Room
- Electrical Equipment Room (EER)

- Load Center and Switchgear Rooms
- Battery Room
- Containment
- Computer / Cable Spreading Room
- Auxiliary Building

Heat loads of the Unit 3 EDG Building will increase slightly due to increased EDG loads at EPU. This load change is primarily due to over/under voltage and frequency conditions and an increase in ICW pump motor horsepower as a result of increased intake cooling water salinity. Air temperature criteria are based on the EDG air intake and electrical equipment temperature requirements. EDG air intake temperature must remain below 115°F to preclude derating of the engine. Because of the location of the engine air intake, combustion air temperature remains close to outside ambient. Since EPU does not change the configuration of the EDG air intake, increases in EDG loading have little effect on the engine air intake temperature or engine performance. Further, the EDG Building environment will also remain appropriate for continuous operation of supporting electrical equipment. Therefore, the ventilation arrangement of the Unit 3 EDG Building is adequate for EPU.

The Unit 4 EDG Buildings are divided into four rooms each: Engine Room, Diesel Oil Transfer Pump Room, 4160 Bus Room, and the Diesel Control Panel Room. Ventilation is not provided to the Diesel Oil Transfer Pump Room during SBO as the day tank provides sufficient capacity for the SBO duration. Heat loads of the Transfer Pump Rooms, 4160 Bus Rooms, and Control Panel Rooms are not impacted by EPU, and therefore the ventilation configurations in these areas are adequate for EPU operation. For the Engine Rooms, the three engine radiator fans also serve as room exhaust fans. Room ventilation and radiator performance are evaluated simultaneously, and are based on the basic overload ratings of the Unit 4 EDGs. The result of the evaluation is that the room ventilation system / radiator system is adequate to support continuous EDG operation at the basic overload rating with two out of three radiator fans in service. The basic overload ratings of the EDGs bound 2000 hr ratings and SBO loading at EPU. Therefore, the Unit 4 EDG building ventilation systems will remain adequate at EPU.

Heat and humidity loads on the Control Room Ventilation System (CRVS) are not a function of reactor power level, and are comprised of electrical / control equipment, outside air intake, and personnel. Revisions to a small minority of existing Control Room indicators have been identified as described in the response to SCVB-1.2, but will have negligible impact on the CRVS heat load.

Normal and emergency heat loads serviced by the Auxiliary Building EER HVAC System do not vary as a function of reactor power level. Heat sources are electrical / control equipment and outside air intake. Possible changes in heat loads from power cables are insignificant due to small changes in the current draw. Therefore ventilation provided to the EER during SBO conditions will remain adequate.

During SBO, the same ventilation and air conditioning is available to the Load Center and Switchgear Rooms as during normal operation, despite the drastic reduction in heat load. The normal ventilation and air conditioning design of these rooms bounds SBO at EPU conditions, and therefore sufficient ventilation and air conditioning will continue to be provided during SBO at EPU.

Heat loads of the Battery Rooms are not a function of reactor power level. EPU does not change the size or number of batteries in the Battery Rooms and the minimal increases in safety-related DC loading as a result of EPU will have an insignificant impact on heat loading of the battery rooms. Therefore the ventilation system will remain adequate following EPU.

NUMARC 87-00, Revision 0, Section 2.7.1 assumes containment temperatures resulting from the loss of ventilation and reactor coolant leakage inside containment are enveloped by LOCA and HELB temperature profiles. Therefore, the assurance of operability of SBO equipment inside containment is provided since safe shutdown equipment is qualified for accident environments under the plant's electrical equipment qualification (EQ) program.

Heat loads of the Computer / Cable Spreading Rooms are not a function of reactor power level. Heat sources are from electrical and control equipment and ambient outside air, none of which will measurably increase due to EPU. Possible changes in heat loads from power cables, due to small changes in the current draw, are negligible. Also, 100% capacity cooling is provided to the Computer and Cable Spreading Rooms during SBO. SBO heat loads are less than normal operation heat loads, and the system has been found to be acceptable for normal operation; therefore, heat removal capability during SBO conditions will remain adequate.

Auxiliary Building station blackout heat loads are significantly less than normal operation heat loads, and are accommodated with nearly a full complement of ventilation. The predominant source of heat load increase in the Auxiliary Building for normal operation as a result of EPU will be the elevated temperatures of the Component Cooling Water (CCW) System. A simplified, conservative analysis was performed which indicates a negligible building exhaust temperature increase (<0.05°F). Therefore, changes in SBO heat loads in the Auxiliary Building due to EPU are also negligible, and the current SBO ventilation complement in the Auxiliary Building will remain adequate.

Attachment 4 to the LAR, Section 2.3.5, page 2.3.5-6, third paragraph incorrectly states that the Auxiliary Building is allocated 100% capacity supply and exhaust fan pair during a station blackout. During SBO conditions, a single 40,000 cfm Auxiliary Building exhaust fan is utilized. Auxiliary Building supply fans are not utilized during station blackout. Analysis has shown that the flowrate from normal operation to SBO conditions is decreased by approximately 3%. With the significant reduction in heat loads associated with SBO conditions, and nearly constant ventilation allotment, the current Auxiliary Building SBO ventilation configuration will remain adequate for SBO conditions.

The above qualitative assessments conclude that the current SBO ventilation arrangement will remain acceptable for EPU.

SCVB-1.4 Section 2.6.3.2, "Mass and Energy Release Analysis for Secondary System Pipe Ruptures," of Attachment 4 to the LAR, subsection 2.6.3.2.2.1 discusses the addition of a backup isolation valve being added in the main feedwater (MFW) bypass line, which will isolate the feedline volume if a failure of the bypass line isolation valve is postulated. Is the new backup isolation valve being added to the Technical Specifications?

Yes. The six main feedwater control valves (both main and bypass) and six main feedwater isolation valves (both main and bypass) are addressed in the proposed new TS 3/4.7.1.7, Plant Systems – Feedwater Isolation. See Subsection 3.1.43 of Attachment 1 to EPU LAR No. 205 for further discussion.

SCVB-1.5 Section 2.6.3.2, "Mass and Energy Release Analysis for Secondary System pipe Ruptures," of Attachment 4 to the LAR, subsection 2.6.3.2.2.1 refers to the modified feedwater isolation valves (FIVs) as "quality-related". Is "quality-related" the same as "safety-related"?

Quality-related is not the same as safety related. The FPL quality-related program applies selected elements of 10CFR50 Appendix B criteria to structures, systems, and components (SSCs) that are required to meet regulatory commitments.

Are these valves designed under the Turkey Point 10 CFR 50 Appendix B Quality Assurance Program?

Quality related SSCs are designed, procured, and constructed to comply with selected elements of the PTN 10 CFR 50 Appendix B Quality Assurance (QA) program. QA program elements are applied with a graded approach to quality to an extent that is commensurate with an item's importance to safety. 10 CFR 21 reporting requirements are not applied to quality related SSCs.

The primary feedwater isolation function during a main steam line break (MSLB) is performed by the feedwater control valves (FCVs). As a backup, the main feedwater pump discharge isolation valves also close automatically, limiting the volume of feedwater that can be discharged into containment during a main steam line break should a FCV fail to fully close.

The main feedwater pump discharge isolation valves are located a significant distance upstream of the FCVs, presenting a large volume of water that could flash to steam in the faulted loop, contributing to the mass and energy imparted to the containment atmosphere during a MSLB event. To reduce this volume for EPU, the backup feedwater isolation function will no longer be performed by the main feedwater pump discharge valves. Instead, three existing motor operated valves (MOVs) located farther downstream, closer to the FCVs, will perform the backup feedwater isolation valve (FIV) function (MOV-3/4-1407/1408/1409). The actuators for these MOVs will be modified to provide a more rapid closure than the main feedwater pump discharge isolation valves currently provide, and the closure circuits will be modified such that either train of the engineering safety feature actuation system (ESFAS) feedwater (FW) isolation signal will cause automatic closure.

The reduced volume of feedwater piping isolated by the backup FIVs, along with the faster closing stroke time, will reduce the mass and energy released into containment during the MSLB event should the FCV on the faulted loop fail to close, benefiting the analyzed peak containment pressure.

MOV-3/4-1407/1408/1409 are powered from motor control centers (MCCs) that are automatically supplied by the emergency diesel generators (EDGs) during a loss of offsite power. The FCVs are air operated valves (AOVs) that fail closed upon a loss of power or air. In addition, each FCV receives both trains of ESFAS FW isolation signals and has redundant closure solenoids. Since MOV-3/4-1407/1408/1409 perform a backup function to the FCVs in the event of a single active failure, redundant MOV power supplies are not required. Both trains of FW isolation signal will be provided only to be consistent with the FCV design but only one is required for operability.

As is the case with the main feedwater (MFW) pump discharge isolation valves, MOV-3/4-1407/1408/1409 will not perform a containment isolation function and therefore will not require seismic qualification, consistent with NUREG 0800, Section 6.2.1.4 [Reference 3]. However, the section of pipe and supports associated with the piping between these MOVs and the FCVs themselves are seismically qualified to ensure the FCV containment isolation function is not degraded during a seismic event.

SCVB-1.6 **Section 2.6.3.2, "Mass and Energy Release Analysis for Secondary System Pipe Ruptures," of Attachment 4 to the LAR, subsection 2.6.3.2.2 provides the details of the main steam line break (MSLB) analysis at the EPU conditions. Explain the differences between the current licensing basis analysis and the EPU analysis, with special attention to the hardware modifications as a result of the EPU (e.g., modified FIVs, addition of a backup isolation valve in the MFW bypass line, AFW pump modifications). In particular, discuss all changes to the inputs, assumptions, single failures, AFW flow rates, AFW pump start times, and the codes used in the analysis.**

All inputs are either plant-specific values created for the EPU or verified by FPL to be valid for the EPU. The RETRAN and GOTHIC codes that are being used for the EPU MSLB analyses are consistent with the other non-LOCA and LOCA containment EPU analyses. Below is a table that summarizes some of the key inputs to the MSLB analysis.

<table>
<tr><th></th><th colspan="2">EPU</th><th colspan="2">Pre-EPU</th><th>Basis</th></tr>
<tr><td>Primary MFW Isolation Closure Time - Stroke and Signal Delay</td><td colspan="2">9 seconds (for all power levels) - Feedwater Control Valve</td><td colspan="2">9 seconds (HFP) - Feedwater Control Valve
13 seconds (HZP) - Feedwater Control Valve</td><td>EPU changed the FCV Bypass valve actuator so it has the same closure time as the FCV.</td></tr>
<tr><td>Secondary MFW Isolation Closure Time - Stroke and Signal Delay</td><td colspan="2">30 seconds - Feedwater Isolation Valve</td><td colspan="2">90 seconds - Main Feed pump Discharge Valve</td><td>EPU modification added a fast acting isolation valve in series with the primary FCV.</td></tr>
<tr><td>Unisolable Feedline Volume</td><td colspan="2">178.31 ft^3</td><td colspan="2">238 ft^3</td><td>No physical modification but a more precise value is used for EPU.</td></tr>
<tr><td>FCV Failure Unisolable Feedline Volume</td><td colspan="2">182.40 ft^3</td><td colspan="2">1281 ft^3</td><td>EPU modification credits a secondary isolation valve closer to the containment.</td></tr>
<tr><td>Feedwater Bypass Line Isolation</td><td colspan="2">Backup isolation valve is added to the bypass line. Stroke times for the bypass line valves will mimic the stroke times for the valves in the main line. Any single failure assumed in the bypass line would be bounded by the same failure in the main line.</td><td colspan="2">Single bypass line isolation valve.</td><td>EPU modification added redundant bypass isolation valve. The MFP discharge MOV is the current backup /redundant valve to the bypass valve.</td></tr>
<tr><td rowspan="3">0% Power MFW Flowrates (limiting EPU case)</td><td>SG Pressure (psia)</td><td>Flowrate (lbs/sec)</td><td>SG Pressure (psia)</td><td>Flowrate (lbs/sec)</td><td rowspan="3">EPU modifications replaced MFW and CD pump impellers and FCV trim that increased system flow capacity.</td></tr>
<tr><td>1150</td><td>1661.5</td><td>1019.7</td><td>190.2</td></tr>
<tr><td>1000</td><td>1850.3</td><td>799.7</td><td>223</td></tr>
</table>

	EPU		**Pre-EPU**		**Basis**
	900	1965.6	599.7	249.1	Pre-EPU assumed flow only through bypass line. EPU assumes flow through both main and bypass lines.
	800	2065.1	399.7	272.7	
	700	2162.7	199.7	293.9	
	600	2255.8	14.7	312.2	
	500	2347.7			
	400	2437.9			
Faulted Loop AFW Flowrate	958 gpm for the first 195.9 sec. Flow drops to 280 gpm after 195.9 sec.(1)		530 gpm for the first 120 sec. Drops to 280 gpm after 120 sec.		EPU modifications increased the AFW FCV stroke to provide minimum required flow during loss of normal FW. Increased manual operator action to gain margin.
Single Failures	Single failures and power levels are consistent with WCAP-8822 Methodology		Subset of single failures and power levels consistent with WCAP-8822 methodology		EPU analysis considered full spectrum of cases that analyzed limiting break sizes, power levels, and single failures.
AFW Pump Delay	0 seconds delay assumed		0 seconds delay assumed		No change.
Lead/Lag Function on Low Steamline Pressure	50/5		No lead/lag		EPU modification added Lead/Lag module to Low S/G pressure signal. Faster response for secondary side MSLB signals.
Low steamline pressure set-point (safety analysis limit)	581 psia		447 psia		Relaxed safety analysis limit value was calculated for EPU.

	EPU	Pre-EPU	Basis
Break Spectrum	Large double ended ruptures and split breaks	Large double ended and small double ended ruptures	EPU analysis considered full spectrum of cases that analyzed limiting break sizes, power levels, and single failures.
Protection Signal Credited	Secondary side signals for double ended ruptures and containment pressure signals for splits	Containment pressure signals for the AOR limiting case (2)	No change.
MSLB M/E Transient Code	RETRAN	LOFTRAN	
Containment Response Code	GOTHIC	COCO	

1. The AFW flowrate listed is used for the limiting EPU case. Conservative AFW flows were chosen based on the depressurization of the SG during the MSLB transient.
2. The secondary side signals were active for these cases, however, the containment pressure signal was the first signal received during the transient.

SCVB-1.7 Section 2.6.1.2.3, "Containment Response to Main Steam Line Break," of Attachment 4 to the LAR, subsection 2.6.1.2.3.5 states the limiting containment pressure case for the EPU is a 1.0 ft^2 split break of the main steamline initiated from hot zero power with a single failure of the main steamline check valve. Provide the peak containment pressure and temperature for the EPU with a 1.0 ft^2 split break of the main steamline initiated at 100% power with a single failure of the main steamline check valve?

The full power 1.0 ft^2 split break was not run for the EPU. Consistent with the method described in Section 2.3 of WCAP-8822, a Turkey Point plant-specific search to find the limiting split break for each power level was completed in the analysis. The 1.0 ft^2 split break was considered but found not to be limiting for full power. The limiting break for full power was found to be 0.63 ft^2 and is the case that is documented in the analysis.

The search finds the biggest split break that will not actuate the high steam flow/ low steamline pressure coincidence logic. The full power 1.0 ft^2 split break actuates the high steam flow / low steamline pressure signal in the first few seconds of the transient that will cause relatively early isolation of the feedwater flow and main steamline. The 0.63 ft^2 split break does not actuate the coincidence logic and relies on the containment High-1/-2 pressures to generate the protection signals. The 0.63 ft^2 split break documented in the analysis reaches containment High-1/-2 pressures at 7 seconds and 76 seconds respectively. The delayed containment pressure signals modeled with the 0.63 ft^2 split break produces much more limiting results than a larger 1.0 ft^2 split break. The limiting case with respect to peak pressure for this analysis is a hot zero power 1.0 ft^2 split break assuming a failure of the main steamline check valve. The pressure and temperature results for this case are the following: Peak Containment Pressure: 52.3 psig; Peak Containment Structural Temperature: 263.9°F.

SCVB-1.8 **Section 2.7.2, "Engineered Safety Feature Atmosphere Cleanup," of Attachment 4 to the LAR, subsection 2.7.2.2.3.1 states that the EPU impact on the ECCS ability to provide homogeneous atmospheric mixing has been evaluated in LR Section 2.6.4, "Combustible Gas Control in Containment." The staff reviewed LR Section 2.6.4 and determined that no such assessment was discussed. In accordance with the requirements of Section (b)(2) of 10 CFR 50.44 as related to combustible gas control for currently licensed reactors, confirm that the Turkey Point containment has the capability of ensuring a mixed atmosphere following a Loss-of Coolant Accident at EPU conditions. Summarize the Turkey Point's containment design that supports this assessment.**

Hydrogen is primarily generated by the zirconium-water reaction that occurs due to the high cladding temperatures while the core is uncovered prior to reflood following a Loss-of-Coolant Accident (LOCA) with delayed initiation of the Emergency Core Cooling System. The hydrogen generated will escape from the reactor vessel via the breakpoint accompanied by steam generated from residual water in the reactor vessel during core heatup. Thus the hydrogen source could originate in any of the areas through which the main reactor coolant piping is routed; i.e., primarily the reactor cavity or the steam generator, reactor coolant pump and pressurizer cubicles. The other post-LOCA sources of hydrogen (i.e., radiolytic decomposition of the post accident emergency cooling solutions and corrosion of metals by solutions used for emergency cooling or containment spray) occur over the long-term, have a significantly lower hydrogen generation rate than that associated with the zirconium-water reaction, and are dispersed throughout containment.

The assessment performed for PTN to demonstrate a mixed atmosphere in the Units 3 & 4 containments following a LOCA at EPU conditions takes into consideration the layout and arrangement of the containment internal structures, and active and passive mixing mechanisms. Active mechanisms include air circulation provided via operation of the Emergency Containment Coolers (ECCs), and mixing promoted by momentum transfer from the spray droplets to the surrounding gas resulting from operation of the Containment Spray (CS) system. Passive mechanisms include natural buoyancy driven convective flows within the containment atmosphere and molecular diffusion.

The internal design of PTN Units 3 & 4 containment structures allows air to circulate freely. The volume above the operating floor, which comprises the majority (~76.5%) of the containment net free volume, does not have significant barriers to obstruct mixing. Cubicles and compartments within the containment are provided with openings near the top as well as bottom to allow air circulation. The basement at El 14'-0" and the floors at El 30'-6", El 58'-6" are connected to each other through stairwells and other openings. The containment operating floor at El 58'-6" has large sections which are grating, whereas the floor at intermediate El 30' 6" does not extend across the entire containment. In addition, labyrinth designs provide large openings in cubicle walls below El 30'-6" to the annulus area in containment that surrounding the cubicles.

The ECC system consists of three emergency containment coolers and associated instrumentation and controls. The ECC units are located on the operating floor. The ECCs take suction locally and discharge vertically with a 100 ft throw upwards into the containment dome which is at El 170' 9-3/8". The ECCs are designed to provide a minimum of 25,000 cfm +/- 670 cfm per fan cooler during accident conditions. One of the three ECCs is assumed to operate post-LOCA, with the second being manually initiated within 24 hrs of the accident. Two of the three ECCs are automatically initiated on receipt of a Safety Injection signal.

The reactor cavity is not covered by the ECCs. However, there is a 2 inch annular opening around the reactor vessel head connecting the reactor cavity to the refueling cavity during power operations. In addition, there are annular air gaps (minimum of 2 inches) surrounding the primary coolant pipes routed through the six large diameter horizontal penetrations in the primary shield wall. Note that the insulation in the annular space around each of the reactor coolant pipes is expected to be displaced due to the force of the LOCA blowdown should it occur in the reactor cavity, thus creating even larger vent paths into the areas adjacent to the reactor cavity underneath the steam generator cubicles which is exposed to the mixing action provided by the operation of the CS system, the ECCs and the passive mixing systems discussed previously.

Along with the ECCs, forced convection in the PTN containment atmosphere will also be generated by the CS system. The spray will induce mixing by imparting momentum to the containment atmosphere. In addition, steam condensation and cooling of the containment atmosphere by the sprays will result in flow to low pressure regions. The CS system is designed to spray a minimum of 1340 gpm of borated water into the containment atmosphere. Ninety-five spray nozzles are connected to each of the two headers located at EL 154'-3 7/8. Each header splits into five parallel laterals with nozzles and headers so oriented as to ensure adequate coverage of the containment volume. The calculated geometric spray coverage fraction for the overall containment volume using a single train is ~ 0.345; the estimated geometric spray coverage is based on the conservative assumption that the entire area below the operating floor remains unsprayed. Containment spray is automatically initiated post-LOCA upon receipt of a containment high-high pressure signal. Following an ~ 5 min delay during switchover, containment sprays continue to operate in the recirculation mode for ~115 days post-accident (i.e., until containment temperature is restored to its original condition of 122°F).

For a LOCA where the break occurs outside the primary shield wall, the hydrogen gas is expected to be released via the break point in the main reactor coolant piping into the affected compartment and then be well mixed into the entire containment volume.

Natural convection flows within the PTN containment atmosphere will be developed due to the break effluent resulting from core heat-up and subsequent generation of steam and hydrogen. Buoyancy forces will cause the released steam to rise. This upward steam flow will entrain air and engender containment mixing. Natural convection due to density differences (buoyant effects) is another source of mixing in the containment atmosphere. Gas flow occurs whenever there is a temperature difference between the wall and the bulk atmosphere. The presence of large heat sinks in the containment, such as internal walls, together with localized heat sources, such as hot equipment surfaces, will be expected to set up large-scale natural circulation cells. These circulation cells will help decrease any stratification that may occur in areas with the absence of jet induced or forced convection flows. Molecular diffusion is another mechanism that would provide mixing within the containment following a postulated LOCA. Diffusion occurs due to concentration gradients. The highly diffusive property of hydrogen facilitates its dispersion in containment. While the rate of diffusion is too slow to result in mixing of large containment volumes in short times by itself, molecular diffusion would add to the other mixing processes previously discussed.

In addition, enhanced mixing will occur as a result of the high mixing rates generated by the operation of the CS system and the ECCs. Based on the results of a plant specific post-LOCA containment volume mixing assessment performed using computer code GOTHIC, an approximate turnover rate of ~ 14 containment volumes per hour is estimated for the limiting case of one train of CS and 1 ECC operating. A turnover rate of 1 per minute is estimated between the volume below the operating floor (assumed to be unsprayed) to the unsprayed volume above the operating floor. Taking into consideration the very high mixing rate between the sprayed and unsprayed region above the operating floor (estimated to be 990,000 cfm), it is reasonable to conclude that the hydrogen concentration in containment is nearly uniform during spray operation.

In summary, the PTN assessment demonstrates that containment design allows air to circulate freely, and that passive mechanisms such as convective mixing in conjunction with active systems such as containment spray and operation of the ECC system ensure a mixed atmosphere inside containment thus precluding accumulation of a combustible or explosive mixture within a compartment or cubicle.

SCVB-1.9 The applicability of NRC Generic Letter (GL) 96-06 as it relates to Turkey Point was addressed in Section 2.5.4.3, "Reactor Auxiliary Cooling Water Systems (Component Cooling Water System)." Specifically, discuss fluid contained in penetrations between containment isolation valves and if any additional measures are required as a result of the EPU.

EPU does not create new piping configuration that has the potential to overpressurize due to thermal expansion of fluid. During FPL's initial GL 96-06 evaluation, a majority of the isolated pipe sections were determined to be not susceptible to thermal overpressurization based on one or more of the following criteria:

a) Pipe sections inside containment equipped with thermal reliefs or relief valves.
b) Pipe sections containing at least one pneumatically operated or solenoid valve that would lift when higher than design pressures are applied under the seat.
c) Pipe sections isolated by gate valves with flexible or spring loaded parallel discs on which one of the disc sealing surfaces would leak when pressures higher than design are applied.
d) Pipe sections free to discharge to a component not subject to thermal overpressurization.

Some pipe sections were identified during FPL's initial GL 96-06 evaluation that did not either have self relieving capabilities or are not drained / partial filled. Modifications were made to these pipe sections by installing thermal relief valves, partially draining the piping system, or modifying valves to prevent entrapped water from causing an overpressurization condition due to external heat. EPU will not require any modifications to these pipe sections. Further, EPU will not create any new configurations, nor change existing procedural controls that will result in overpressurization of piping during accident conditions.

All CCW system branch lines that penetrate containment (i.e. inlet and outlet) and feeding the emergency containment coolers, normal containment coolers, reactor coolant pump bearing/thermal barrier coolers and the excess letdown heat exchanger are either isolated or may be isolated during an accident, making them susceptible to GL 96-06 concerns. Therefore, thermal relief valves have been installed or relief valves were verified to be installed to protect these CCW system branch lines. These relief valves will continue to protect these CCW system branch lines from overpressurization after EPU. No new piping configurations that penetrate containment and have the potential to overpressurize due to thermal expansion of the fluid have been created by EPU.

SCVB-1.10 Section 2.6.3.1, "Mass and Energy Release Analysis for Postulated Loss-of-Coolant Accident," of Attachment 4 to the LAR, subsection 2.6.3.1.2.1.3 discusses the evaluation model used for the long-term LOCA M&E release calculations. Westinghouse discovered that the computer code (EPITOME) used to generate the M&E inputs for the containment peak pressure analysis contains an error which could result in an increase in the containment pressure and temperature for the double ended pump suction LOCA, including a maximum increase in the peak containment pressure of up to 5 psi and temperature of up to 5.5 deg F. Since FPL used the EPITOME code in its EPU analysis for Turkey Point, provide information on how this code error affects Turkey Point's containment response analysis for a LOCA, specifically regarding the calculated peak pressure and peak temperature.

The Turkey Point EPU analysis is impacted by the EPITOME error. FPL is currently evaluating the extent of the impact to the LOCA containment response analysis and developing a revision to the analysis that will demonstrate acceptable results. Once this revised analysis is completed FPL plans to supplement the EPU LAR to provide a revised LOCA containment response analysis and address all the areas impacted. FPL will provide this LAR supplement by July 29, 2011.

SCVB-1.11 Section 2.6.6, "Pressure Analysis for ECCS Performance Capability." Provide the minimum containment pressures calculated during reflood for the current licensing basis and for the proposed EPU.

The minimum containment pressures calculated by the COCO computer code through the entirety of the transient are included in Figure 1 for both the current licensing basis and the EPU BELOCA analyses.

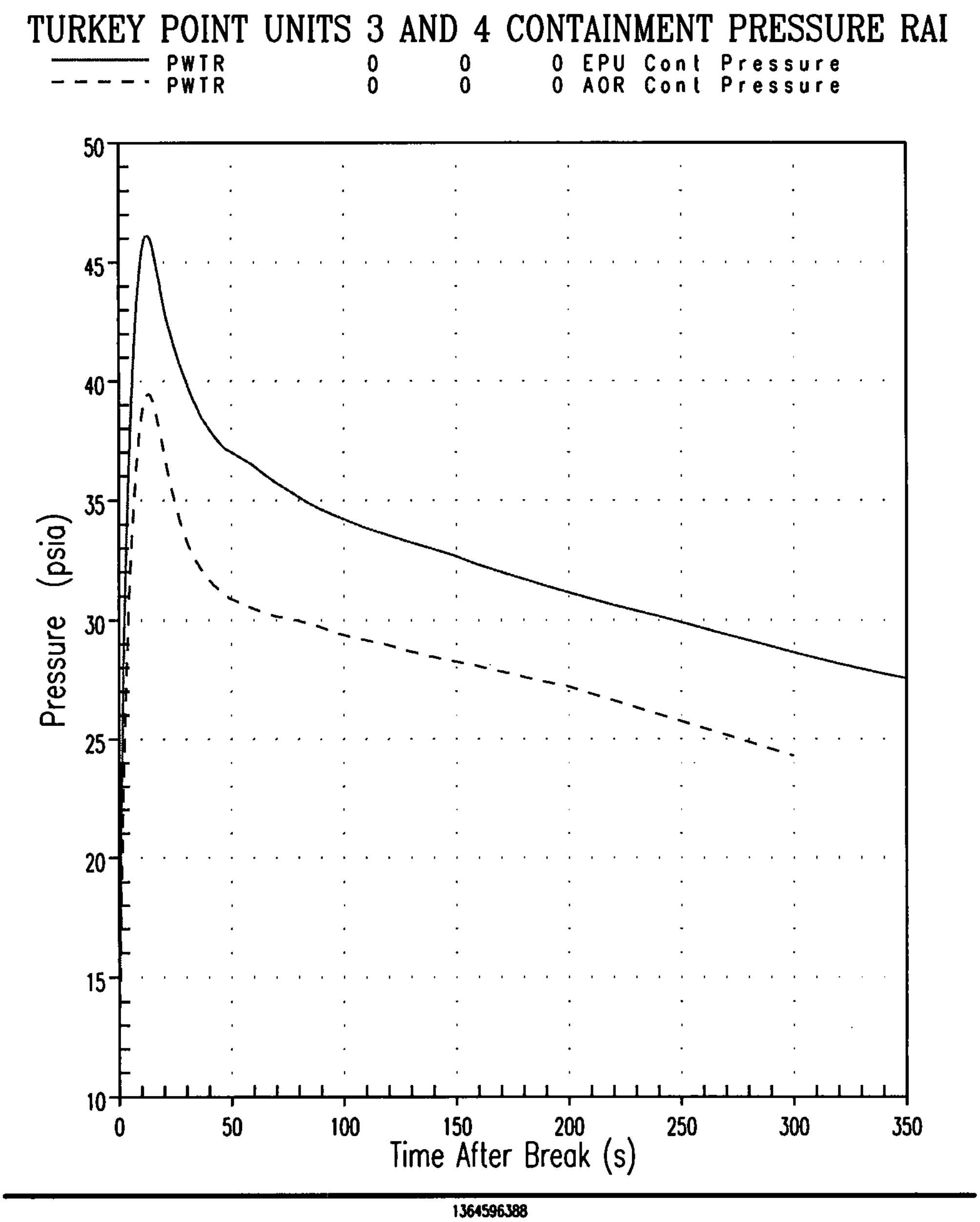

Figure 1: Calculated Minimum Containment Pressure for CLB and EPU BELOCA Analyses.

References

1. M. Kiley (FPL) to U.S. Nuclear Regulatory Commission (L-2010-113), "License Amendment Request No. 205: Extended Power Uprate (EPU)," (TAC Nos. ME4907 and ME4908), Accession No. ML103560169, October 21, 2010.
2. Email from J. Paige (NRC) to T. Abbatiello (NRC), "Turkey Point EPU – Containment and Ventilation (SCVB) Request for Additional Information - Round 1," Accession No. ML110950084, April 1, 2011.
3. NUREG 0800, Rev. 2, "Mass and Energy Release Analysis for Postulated Secondary System Pipe Ruptures".