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Your ref: Docket No. 52-006
Our ref: DCP_NRC_003180

June 27, 2011

Subject: Shield Building Audit Questions and Responses

Per NRC request, this letter documents the verbal responses to NRC questions identified during the NRC Shield Building audit the week of June 20th at Westinghouse headquarters in Cranberry Township, Pennsylvania. The purpose of the audit was to review calculations that were performed for the shield building enhanced design. This information clarified existing information included in the shield building report and the design control document, and was reviewed with the NRC audit team and determined to be satisfactory.

As a result of the NRC review of this information during the audit and associated discussions between Westinghouse and the NRC, no changes to the DCD or Shield Building report were identified.

Correspondence with respect to the proprietary aspects of this application for withholding or the accompanying affidavit should reference AW-11-3190 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Questions or requests for additional information related to content and preparation of this report should be directed to Westinghouse Electric Company LLC. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

R. F. Ziesing
Director, U. S. Licensing

/Enclosures

D063
NRO

2011-065ljb.doc

1. AW-11-3190 "Application for Withholding Proprietary Information from Disclosure," dated June 27, 2011.

2. AW-11-3190, Affidavit, Proprietary Information Notice, Copyright Notice dated June 27, 2011

3. Shield Building Audit Question and Responses (Proprietary)

4. Shield Building Audit Question and Responses (Non-Proprietary)

cc: F. Akstulewicz - U.S. NRC
E. McKenna - U.S. NRC
P. Buckberg - U.S. NRC
B. Gleaves - U.S. NRC
T. Spink - TVA
P. Hastings - Duke Power
R. Kitchen - Progress Energy
A. Monroe - SCANA
R. Whorton - SCANA
P. Jacobs - Florida Power & Light
C. Pierce - Southern Company
D. Moore - Southern Company
R. Grumbir - NuStart

ENCLOSURE 1

AW-11-3190

APPLICATION FOR WITHHOLDING
PROPRIETARY INFORMATION FROM DISCLOSURE

Westinghouse

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Your ref: Docket No. 52-006
Our ref: AW-11-3190

June 27, 2011

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: Shield Building Audit Questions and Responses

The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and is customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.390, Affidavit AW-11-3190 accompanies this Application for Withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectively requested that the subject information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the proprietary aspects of this application for withholding or the accompanying affidavit should reference AW-11-3190 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company LLC, Suite 428, 1000 Westinghouse Drive, Cranberry Township, Pennsylvania 16066.

Very truly yours,

R. F. Ziesing
Director, U. S. Licensing

ENCLOSURE 2

AFFIDAVIT

AW-11-3190
June 27, 2011

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

Before me, the undersigned authority, personally appeared R. F. Ziesing, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

R. F. Ziesing
Director, U. S. Licensing

Sworn to and subscribed
before me this 27th day
of June 2011.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Linda J. Bugle, Notary Public
City of Pittsburgh, Allegheny County
My Commission Expires June 18, 2013
Member, Pennsylvania Association of Notaries

Notary Public

(1) I am Director, U. S. Licensing, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in attachment to DCP_NRC_003180, Shield Building Audit Questions and Responses, dated June 27, 2011 in support of the AP1000 Design Certification Amendment Application, being transmitted by Westinghouse letter (DCP_NRC_003180) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for the AP1000 Design Certification Amendment application is expected to be applicable in all license submittals referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application in response to certain NRC requirements for justification of compliance of the safety system to regulations.

This information is part of that which will enable Westinghouse to:

(a) Manufacture and deliver products to utilities based on proprietary designs.

(b) Advance the AP1000 Design and reduce the licensing risk for the application of the AP1000 Design Certification

(c) Determine compliance with regulations and standards

(d) Establish design requirements and specifications for the system.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of plant construction and operation.

(b) Westinghouse can sell support and defense of safety systems based on the technology in the reports.

(c) The information requested to be withheld reveals the distinguishing aspects of an approach and schedule which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar digital technology safety systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

COPYRIGHT NOTICE

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

ENCLOSURE 4

Westinghouse Non-Proprietary Class 3

Shield Building Audit Question and Responses
(Non-Proprietary)

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

1. *Provide a reference for the $4(f'_c)^{0.5}$ cracking threshold used for direct tension from thermal demand in RC structures.*

    - Reference ACI 209R, Equation 2-4: $f'_t = g_t[w(f'_c)]^{0.5}$
    - $g_t = 0.33$
    - w = 150 pcf for normal weight concrete
    - Substituting, the direct tension strength is $f'_t = 4(f'_c)^{0.5}$

2. *Explain which thermal analyses models were used for the different regions of the SB to calculate thermal demand for the SSE + T_0 load combination.*

    - Heat transfer analyses were performed to develop the thermal demand for the SB cylindrical wall and PCS tank.
    - The SB cylindrical wall heat transfer analysis was performed using a 3D steady state ANSYS shell analysis on the NI05 model
        - The SB cylinder heat transfer analysis is documented in calculation APP-1200-S2C-126
        - Performed for summer and winter conditions
        - Shell element model
        - Results from heat transfer analysis are temperatures on inside and outside face of shell elements
        - The SB cylindrical wall thermal expansion stress analysis was performed by reading in the resulting shell element temperatures
        - The thermal expansion stress analysis is documented in calculation APP-1200-S2C-125
        - The thermal expansion stress analysis calculates forces and moments in shell elements due to the thermal gradient and average temperature
    - The PCS tank wall, floor, and roof heat transfer analysis was performed with a representative 1D analysis
        - The PCS tank heat transfer analysis is documented in calculation APP-PCS-M3C-028
        - Performed for summer and winter conditions
        - The result is a temperature on the inside face of the wall (adjacent to the water) and at the outside face of the wall (adjacent to outside air)
        - The results compare reasonably well to the 3D steady state results (when comparing overall thermal gradient)
        - The resulting inside and outside face temperatures are used as input to the heat transfer analysis performed for the PCS tank ¼ solid element ANSYS model documented in APP-1278-CCC-007

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

  - The ¼ solid model heat transfer analysis generates nodal temperatures for the solid model
  - The PCS tank thermal expansion stress analysis is performed using the nodal temperatures to obtain the ¼ solid model thermal stress
- The air inlet structure, tension ring, and roof have no significant thermal demand from ambient thermal conditions (the air outside and air inside these structures are at roughly the same temperature due to the airflow through the air inlet structure, down past the inside of the Shield Building wall, and exiting through the roof)

3. *Justify PCS tank simplifying assumption that all interior tank surfaces are at a water temperature of 40°F when the outside air temperature is -40°F. The PCS tank roof and top of walls may be cooler, generating different forces/moments than those considered in the design.*

- [ ]a,c of air space above water [ ]a,c
- Compared 3D steady state heat transfer analysis model with inside surface temperature of 40°F to similar model with a bulk air temp above the tank water of 40°F, allowing the roof and upper wall inside surface to cool from 40°F to some lower temperature
- Results show that there are changes in the forces and moments when compared to the simplified assumption, but the changes are in relatively low stress regions of the PCS tank
- Comparison shown in Figures 3-1 through 3-10
- The Loads generated in Figures 3-1 through 3-10 are representative results from the thermal analysis considering a 5.5' air gap above the water in the tank compared to the documented (APP-1200-S2C-126) assumption of a fully wetted internal surface
- From review of the SB report Table L.4-5, the maximum stress ratio in stress line 3-8 (at PCS tank roof near inner wall) is 0.56
- From review of the SB report Table L.4-4, the maximum stress ratio in stress line 3-9 (at PCS tank top of inner wall and roof) is 0.65
- Conservatively increasing the stress ratio by [ ]a,c, the resulting stress ratio remains less than 1.00
- Design is not affected

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

[ ]a,c

Figure 3-1 Top of Tank TX

[ ] a,c

Figure 3-2 Top of Tank TY

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

[ ]a,c

Figure 3-3 Top of Tank TXY

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

[ ]a,c

Figure 3-4 Top of Tank MX

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

a,c

Figure 3-5 Top of Tank MY

[ ] a,c

Figure 3-6 Bottom of Tank TX

[ ] a,c

Figure 3-7 Bottom of Tank TY

[ ]a,c

Figure 3-8 Bottom of Tank TXY

a,c

Figure 3-9 Bottom of Tank NX

[ ] a,c

Figure 3-10 Bottom of Tank NY

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

4. *Explain why contour profiles on wall of PCS tank inner surface show a change in temperature from the base up when the inside surface is assumed to be at a constant water temperature.*

   - At the base of the PCS wall FEA element, there is an intersection of the SB roof, PCS tank base, and PCS tank wall
   - The PCS tank wall FEA element bottom node input is temperature from the three intersecting elements
   - The difference in temperature between the nodes at the base of the element and top of the element shows the thermal gradient as you move up in elevation
   - However, this FEA result is not used directly in the thermal stress analysis
   - Design is not affected

5. *For the thermal analysis of winter case, the PCS tank water assumed to be at 40°F, outside air at -40°F. What is the effect if the water is at 50°F?*

   - If tank water is 50°F in winter conditions due to PCS system heaters, maximum % increase in ΔT is 100(90°F - 80°F)/(80°F) = 13%
   - Review of Calculation APP-1278-CCC-007 Tables 5-41, 5-43, 5-45, 5-47, 5-49 and 5-53 shows maximum stress ratio for SSE + Winter T_0 is 0.86 (see Table 5-1)
   - If the stress ratio is conservatively increased by [ ]^{a,c}, the resulting stress ratio is still less than 1.0
   - Design is not affected

Table 5-1
Outer Wall Stress Lines - Concrete Reinforcements in Hoop Direction – Seismic Load Combinations + Winter Thermal Load (from Table 5-47 from APP-1278-CCC-007)

Stress Line #	Area Required (X) [in2/ft]			Area Provided (X, see Figure 5-9) [in2/ft]		Design Ratio
	Angle	Seismic L/C	Value			
1	0°	31	0.59	1#9@6" Top 1#9@6" Bottom	2.00	0.30
2	90°	41	1.71	1#9@6" Top 1#9@6" Bottom	2.00	0.86
3	90°	41	0.79	1#9@6" Top 1#9@6" Bottom	2.00	0.40

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

6. *Explain the effect on the load combination SSE + Winter T_0 for the critical sections if compartment temperatures above 70°F are considered in the heat transfer analysis. For example, the MSIV compartment temperature may be as high as 105° when the outside air temperature is a minimum of -40°F.*
    - The SB wall adjacent to the MSIV compartment is exposed to -40°F air in the annulus above the annulus seal
    - Assuming a temperature of 105°F inside, the maximum % increase in ΔT is 100(145°F - 110°F)/(110°F) = 32%
    - Reviewing the out-of-plane demand from SB report Table L.4-2, the maximum out-of-plane shear reinforcement ratio is 0.641 in [ ]^{a,c} region
    - If the stress ratio is conservatively increased by [ ]^{a,c}, the resulting stress ratio is less than 1.00
    - Reviewing the hoop direction reinforcement required (see SB report Figure L.4-20), the maximum hoop demand in this region is less than 6.25 in^2 compared to 9.00 in^2 provided
    - If the stress ratio (6.25/9.00 = 0.69) is conservatively increased by [ ]^{a,c}, the resulting stress ratio is less than 1.00
    - The thermal demand does not appreciably increase the vertical reinforcement demand in this region
    - Review of the auxiliary building critical section locations shows that there is no critical section adjacent to heated air and outside air at -40°F
    - SB and Auxiliary Building critical section design is not affected

7. *Explain the process used for the re-analysis of the PCS tank with respect to the SB Action 21 response including hydrodynamic pressure (i.e. sloshing) and thermal demand.*
    - The PCS tank is designed using the enveloping time history (NI10 ANSYS and NI20 SASSI) accelerations at the applicable elevation resulting from dynamic analyses of the Nuclear Island
    - To justify the equivalent static accelerations to be used for the design of the PCS tank based on element member force comparisons, three different models are compared in a study:
        (1) Refined-roof NI05 model (i.e. finer mesh size in PCS tank region) with the PCS tank water represented using solid elements to represent the water
            - Response spectrum analyses performed for N-S, E-W, and Vertical directions
            - The results of these three analyses were combined using SRSS.
            - Documented in APP-1200-S2C-128

(2) Refined-roof NI05 model with the PCS tank water represented using mass elements to represent the water
    - Response spectrum analyses were performed for N-S, E-W, and Vertical directions
    - The results of these three analyses were combined using SRSS
    - Documented in APP-1200-S2C-128

(3) ¼ shell element model of the Shield Building roof based on the refined-roof NI05 model, where the hydrodynamic mass is represented using the pressure distributions per SB report Action 21
    - ¼ model developed from the same refined NI05 model used in the response spectra analyses
    - Equivalent static analyses were performed for N-S, E-W, and Vertical directions to simulate the earthquake response
    - The results of these three analyses were combined using both SRSS and the 100-40-40 method
    - Documented in APP-1278-S2C-001

- PCS tank element forces in outer tank wall are compared for each of the analyses in the study
- Element force results from the ¼ model equivalent static analyses are larger than those obtained from the response spectra analyses
- Conclusion of study is that equivalent static analysis is conservative using the angular and vertical accelerations documented in APP-1278-CCC-007
- For design, the ANSYS ¼ solid element model (FEA performed in APP-1278-CCC-007) includes the hydrodynamic mass represented using the pressure distributions per SB report Action 21
- The ANSYS ¼ solid element model FEA generates the loads for the load combination results including SSE + T_0 as reported in the SB report

8. *Explain the meaning of the statement in Section 4.3 of the PCS tank design calculation APP-1278-CCC-007 regarding stresses on walls falling below hydrostatic pressure at high seismic accelerations.*
    - Hydrodynamic loads on PCCS walls due to seismic input have been evaluated following the concept of impulsive and convective components of pressure
    - The theory of impulsive and convective contributions is valid in the field of relatively small oscillations
    - For larger oscillations, it is possible for the water to move away from the wall surface, generating negative pressures at the interface
    - Similarly, if the water moves away from the floor of the tank, it is possible for negative pressures to be generated at the interface

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

- Both the walls and floor of the tank have reinforcement for positive and negative bending moments so that wall/floor bending due to negative pressure is accommodated
- The design of the PCS tank wall and tank floor is not affected because the potential negative pressure effects are secondary when compared to the pressures generated due to the impulsive pressure

9. *Provide explanation justifying the use of the 100-40-40 combination technique of the three seismic components (N-S, E-W, and Vertical) used in the PCS tank analysis.*
    - The 100-40-40 method was compared to the SRSS method in the inner and outer wall of the PCS tank
    - There are instances where the SRSS results are higher
    - A comparison is shown in Table 9-1
    - However, the provided reinforcement is greater than the required reinforcement for all locations

Table 9-1

Outer Wall Stress Lines - Concrete Reinforcements in Hoop Direction – Seismic Load Combinations + Summer Thermal Load (from Table 5-48 of APP-1278-CCC-007)

Stress Line #	Area Required (X) [in2/ft]				Area Provided (X, see Figure 5-9) [in2/ft]	
	Angle	Seismic L/C	100-40-40 Value	SRSS Value		
1	0°	7	[ ]a,c	[ ]a,c	1#9@6" Top 1#9@6" Bottom	2.00
2	90°	17	[ ]a,c	[ ]a,c	1#9@6" Top 1#9@6" Bottom	2.00
3	90°	21	[ ]a,c	[ ]a,c	1#9@6" Top 1#9@6" Bottom	2.00

Response to Questions in Support of Shield Building Calculation Audit
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10. *Demonstrate that the design of the SB roof close to the PCS tank knuckle region is not affected by the combination of SSE + T_0 when considering the thermal gradient in the roof due to the proximity of the PCS tank water.*
    - The thermal demand on the roof due to the PCS tank water dissipates relatively quickly away from the knuckle region
    - The SB conical roof has been evaluated for the SSE + T_0 combination, which includes the roof close to the knuckle region
    - There is no additional thermal demand at the tension ring and air inlet structure due to the PCS tank water; the demand dissipates prior to reaching the edge of the conical roof
    - Referring to Table 2-27 of APP-1278-CCC-001 (see Table 10-1), the maximum stress ratio in the reinforcing bar is 0.76
    - Per Figure 10-1, the maximum stress from the thermal demand is 62 ksf, or approximately 0.5 ksi
    - The 0.5 ksi increase in stress on the reinforcing bar results in an insignificant increase in the stress ratio (0.5 ksi/60 ksi + 0.76 = 0.77)
    - Referring to Table 2-27 of APP-1278-CCC-001 (see Table 10-1), the maximum stress ratio in the steel roof beam is 0.33
    - The 0.5 ksi increase in stress on the steel roof beam results in an insignificant increase in the stress ratio (0.5 ksi/36 ksi + 0.33 = 0.34)
    - The roof beam and reinforced concrete roof slab design is not affected by the additional thermal gradient due to proximity to the PCS tank

Response to Questions in Support of Shield Building Calculation Audit
June 20-24, 2011

Table 10-1

Conical Roof – Summary of Composite Section Verification – Stress Line 7 (from Table 2-27 of APP-1278-CCC-001)

Stresses on Steel Beam due to Concrete Pouring			
Steps	Steel Beam Stresses ksi		Reinforced Concrete Stresses ksi
	Axial + Bending		
	Value	Design Ratio	
			-
			-
			-
			-

a,c

Stresses on Composite Section due to Seismic Load Combinations of Table 3-2									
Seismic L/C	Steel Beam Stresses ksi			Reinforced Concrete Stresses ksi					
	Flange			Concrete			Rebar		
	Lower	Upper	Design Ratio	Lower	Upper	Ratio	Lower	Upper	Ratio

a,c

Response to Questions in Support of Shield Building Calculation Audit
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[ ]a,c

Figure 10-1 Von Mises Stress in SB Conical Roof from Winter Thermal Demand Considering the Thermal Gradient in the Roof Due to Proximity of PCS Tank Water