Calvert Cliffs Nuclear Power Plant
Constellation Generation Group, LLC

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

Constellation Energy

September 29, 2005

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant; Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Independent Spent Fuel Storage Installation; Docket No. 72-8
Response to Request for Additional Information Regarding License Amendment Request for Change to the Dry Shielded Canister Design Basis Limit

REFERENCES:

(a) Letter from Mr. J. M. Sebrosky (NRC) to Mr. G. Vanderheyden (CCNPP), dated August 3, 2005, "Request for Additional Information Regarding the Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI) (TAC No. L23846)"

(b) Letter from Mr. G. Vanderheyden (CCNPP) to Document Control Desk (NRC), dated May 16, 2005, "License Amendment Request: Change to the Dry Shielded Canister Design Basis Limit Requiring NRC Prior Approval Pursuant to 10 CFR 72.48 to Support the ISFSI NUHOMS®-32P Upgrade"

By letter dated August 3, 2005 (Reference a), you requested additional information regarding Calvert Cliffs Nuclear Power Plant, Inc.'s request for a license amendment request to incorporate a change to the dry shielded canister design basis limit in support of the ISFSI NUHOMS®-32P upgrade (Reference b). Attachment (1) to this letter provides the requested information.

The Transnuclear, Inc. documents contained in the enclosures to Attachment (1) contain information proprietary to Transnuclear, Inc. Therefore, these documents are accompanied by an affidavit signed by Transnuclear, Inc., the owner of the information (Attachment 2). The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission, and addresses with specificity the considerations listed in 10 CFR 2.390(b)(4). Accordingly, it is respectfully requested that the information that is proprietary to Transnuclear, Inc. be withheld from public disclosure. There are no non-proprietary versions of these documents that can be included in this transmittal for public disclosure.

A001
NMSS01

4 Run CD's
will be placed
in NRC File Center

Should you have questions regarding this matter, please contact Mr. L. S. Larragoite at (410) 495-4922.

Very truly yours,

STATE OF MARYLAND :
: TO WIT:
COUNTY OF CALVERT :

I, Joseph E. Pollock, being duly sworn, state that I am Plant General Manager - Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP), and that I am duly authorized to execute and file this License Amendment Request on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 29th day of September, 2005.

WITNESS my Hand and Notarial Seal:

MELISSA DAWN SISK
Notary Public
NOTARY PUBLIC STATE OF MARYLAND
My Commission Expires November 1, 2007

My Commission Expires: 11-01-2007

September 29, 2005
Date

JEP/GT/bjd

Attachment: (1) Response to NRC Request for Additional Information Regarding License Amendment Request for Change to the Dry Shielded Canister Design Basis Limit

(2) Transnuclear, Inc. Proprietary Affidavit

cc: J. M. Sebrosky, NRC

(Without Attachments)
R. V. Guzman, NRC
S. J. Collins, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR CHANGE TO THE DRY SHIELDED CANISTER DESIGN BASIS LIMIT

ENCLOSURES

1. Compact Disk containing CCNPP Calculation No. CA04977, Revision 1 , Nutech Horizontal Module System (NUHOMS) 24P ISFSI Dry Shielded Canister (DSC) Structural analysis for DSC Numbers R025 and beyond. (Hopper calc. HABGE-01/99-0745, Rev. 2)
2. Proprietary Transnuclear, Inc. Calculation, "NUHOMS®-32P DSC Structural Analysis," Document No. 1095-34, Revision No. 5
3. Proprietary Compact disk containing 7 ANSYS runs
4. Proprietary Transnuclear Drawings 10950-30-1 (Rev. 3), 10950-30-2 (Rev. 3), 10950-30-3 (Rev. 5), 10950-30-4 (Rev. 6), 10950-30-5 (Rev. 3), 10950-30-10 (Rev. 6)

Calvert Cliffs Nuclear Power Plant, Inc.
September 29, 2005

Requested Information 1

Provide the detailed supporting calculations and ANSYS analyses for the NUHOMS 32-P that would substantiate the stresses listed in Table 2 of Attachment 1 to the May 16, 2005, letter.

The applicant states that, despite the fact that design internal pressure is increased from 50 psig, used for design of NUHOMS 24-P Dry Shielded Canister (DSC), to 100 psig, used for the design of NUHOMS 32-P DSC, the resulting stress values in NUHOMS 32-P DSC design are lower than the stress values for the NUHOMS 24-P DSC design, due to "structural improvement" for the 32-P design.

The staff notes that, Table 1 on page 3, of Attachment 1, compares the geometries of major confinement components of the 24P, 32PT, and 32P. The shell, bottom cover plate and the top outer cover plate thicknesses are identical for 24-P and 32-P DSCs. The only change is in the composite section of the top cover plate. In the 32-P DSC the lead thickness is reduced by 3/8" and the stainless steel plate thickness is increased by 3/8" (for a total overall thickness of 6.25" in both cases).

With this minor change, Table 2 on page 4 of Attachment 1, shows that the calculated maximum ($P_L + P_B$) local membrane plus bending stress in the top cover plate is reduced from 26.5 ksi (for 24-P DSC) to 10.0 ksi (for 32-P DSC), and the DSC shell maximum stress is reduced from 59.6 ksi in the 24-P to 34.7 ksi in the 32-P. The fact that the stresses in the top cover plate decreased when internal pressure increased from 50 psig to 100 psig is plausible, since the thickness of the top cover plate doubled. However, basic cylindrical shell behavior would dictate that an increase in the stiffness of the top cover plate and an increase in internal pressure would both result in an increase in the DSC shell stresses. Therefore the staff finds the decrease in DSC shell stresses to be most unexpected.

This information is needed to satisfy the requirements of 10 CFR 72.236 (b), (c), (d), (h) and (i).

Calvert Cliffs Response

We agree with the staff, the comparison of maximum stress values in Table 2 on page 4 of Attachment 1 (Reference 1) is incorrect. These two stresses are not comparable as they were not calculated for the same load combinations. For example, the 24P maximum shell stress intensity of 59.6 ksi, reported in Table 2 is based on Table 5.5 of Calculation No. CA04977, Revision 1 (page 249, Enclosure 1). This maximum stress is calculated by combining the dead weight, 50 psig internal pressure applied to the outer pressure boundary, and top end drop. The 32P shell stress, 34.7 ksi, reported in the same table is based on Table 4-15 of Calculation 1095-34, Revision 3 (Reference 1, Attachment 4). This stress is based on an ANSYS run which combines the top end drop with 100 psig accident internal pressure applied to the inner pressure boundary. (NOTE: Based on the modeling refinements incorporated in Revision 5 of Calculation 1095-34, the 32P shell stress intensity is now 36.4 ksi [Table 6-9]. See discussion of Calculation 1095-34, Revision 5 below.)

As agreed upon during a telephone conference held with the staff on August 10, 2005, from Calculation No. 1095-34, Revision 3, we are providing ANSYS Run No. 6 instead of the detailed supporting calculations and ANSYS analyses requested. This is in addition to ANSYS Runs Nos. 8 and 10 requested in Requested Information 3 below. We are also providing the revised ANSYS runs from Revision 5 of Calculation No. 1095-34 (see discussion below). Enclosure (2) to this attachment contains Calculation No. 1095-34, Revision 5, and Enclosure (3) is a compact disc containing all the ANSYS runs mentioned above.

Calculation No. 1095-34, Revision 5 (Enclosure 2)

In Revision 5 of Calculation No. 1095-34, various modeling improvements/refinements were made to the ANSYS axisymmetric model for the 32P. These are described below.

1. In Calculation No. 1095-34, Revision 3, it was discovered that an axial coupling was applied between a node of the DSC support ring and a node of the top inner cover plate. This coupling was non-conservative for the inner pressure and top-end drop accident load cases. Therefore, the coupling between the support ring and top inner cover plate was removed and replaced by a gap element.

2. The number of coupling nodes to represent the weld between the lead plug top casing plate and shell was reduced from 3 to 2 nodes. The original model used 3 coupling nodes to represent the 0.38" weld bevel size as specified in the design drawing. However, in the calculation this weld is evaluated as a 3/16" weld. Because of its relatively small size this weld is modeled by using only two coupling nodes.

3. Per the ANSYS User's Manual, "The contact stiffness (KN) of the gap elements (used at the interface between inner and outer top cover plates) should be large enough that it reasonably restrains the model from over-penetration, yet it should not be so large that it causes ill-conditioning." After reviewing the result files of each load case, if the KN used caused significant penetration then it was revised to reduce the penetration. For example, for the top end drop with 100 psig applied to the inner boundary, the contact stiffness (KN) of the gap elements between the lead plug top casing plate and top outer cover plate was changed from $1\text{x}10^7$ lbs/in to $1\text{x}10^{11}$ lbs/in. The contact stiffness of $1\text{x}10^7$ lbs/in resulted in over-penetration and, therefore, it was increased to $1\text{x}10^{11}$ lbs/in. Since these two cover plates are immediately adjacent to each other and each is welded to the shell, they will act together to carry the pressure and drop loads.

4. In addition, supplemental evaluation was performed to address modeling uncertainties and potential non-conservatisms in the ANSYS axisymmetric model. The result of this evaluation is documented in Calculation No. 1095-34, Revision 5 as Appendix A. The following refinements were considered in Appendix A:

   - All the non full penetration welds (including the inner and outer closure welds) were modeled as pinned connections. This assumption is reasonable based on the relatively small size of these welds. This assumption is also conservative for the cover plates because it maximizes the plate bending stresses. In addition, per Table NB-3217-1 for vessels with flat heads (such as the 32P DSC) the Code allows stresses at the juncture of the cover plate to the shell to be classified as secondary if the moment connection is not required to maintain stresses at the center of the cover plate within acceptable Code limits.
   - In main body of the Calculation 1095-34, Revision 5, elastic material properties of the lead are used for the analyses (except for the following four cases: 100 psig applied to outer boundary, 100 psig applied to outer boundary combined with top end drop, 100 psig applied to outer boundary combined with bottom end drop, and thermal stress runs). In these supplementary analyses dynamic material properties are used. For pressure and static loads, the lead material is assumed to be bilinear with 1% strain hardening modulus. Under pressure or static loads, lead will creep at higher temperature. Therefore, assumption of elastic–plastic material behavior of lead subjected to sustained static load is more reasonable. For the drop load cases, dynamic material properties are used.

- In the elastic-plastic analysis, a strain hardening modulus of 5% of the elastic modulus is used for the stainless steel material. A high strain hardening modulus is conservative because it maximizes stresses in a stress-based Code evaluation.

The following eight bounding load cases are rerun and results including weld stresses are documented in Calculation 1095-34, Revision 5, Appendix A.

Run No. 5: 100 psig applied to inner boundary + bottom end drop
Run No. 6: 100 psig applied to inner boundary + top end drop
Run No. 8: 100 psig applied to inner boundary
Run No. 10: 100 psig applied to outer boundary
Run No. 11: 100 psig applied to outer boundary + top end drop
Run No. 12: 100 psig applied to outer boundary + bottom end drop
Run No. 15: Top end drop without internal pressure
Run No. 16: Bottom end drop without internal pressure

Additional ANSYS runs are made in Appendix A to qualify the welds for levels A, B, and C load combinations. These load combinations are described in Sections A5.4 and A5.5 of Appendix A. These results are listed in Tables 5-17 and 5-18 of Appendix A.

Summary and Conclusion

Tables 6-1 through 6-12, in Section 6 of Calculation No. 1095-34, Revision 5 (see Enclosure 2) summarizes the results of all the evaluations as described above. The maximum stress intensities presented in these tables are the bounding results from the revised analyses (main body of Calculation 1095-34, Revision 5) and the additional analyses presented in Appendix A. The calculated component stress intensities are acceptable for all of the design loading combinations. The stress due to top end drop without internal pressure is the bounding load case for top end drop with pressure or without pressure. Therefore, in addition to the revised ANSYS Run Nos. 6, 8, and 10, we are providing ANSYS Run No. 15 in Enclosure 3. (NOTE: Since Revision 5 contains two analyses for each run (main body and Appendix A), only the ANSYS runs for the bounding analysis are provided in Enclosure 3.)

Requested Information 2

Provide justification for considering the shear load produced by internal pressure acting on the inner cover plate to be the only load acting on the top end pressure boundary weld as described in Section 4.2.4 of Attachment 4 of the May 16, 2005, letter.

Section 4.2.4 of Attachment 4 to the May 16, 2005, letter, provides an analysis of the top end pressure boundary weld for the case of pressure applied to the inner cover plate. However, pressure is also applied to the DSC shell which causes the shell to rotate and displace radially at the location of the top end pressure boundary weld. The top end pressure boundary weld and the top cover plate groove weld form a force couple, which resists the bending moment and the radial shear forces that are developed in the DSC shell at this location due to internal pressure. The radial tension force developed in the top end pressure boundary weld due to internal pressure acting on the DSC shell has not been included in the calculation of the maximum stress in the top end pressure boundary weld. The staff performed an independent calculation and found that when this additional force is included, the ASME [American

Society of Mechanical Engineers] code allowable weld stress for Service Level C at the design temperature is exceeded.

This information is needed to satisfy the requirements of 10 CFR 72.236 (b), (c), (d), (h) and (i).

Calvert Cliffs Response

The weld stress from the pressure load was calculated by hand in Section 4.2.4 of Attachment 4 (Reference 1). This reported weld stress was calculated by assuming that the entire 100 psig internal pressure is carried by the 3/16" weld between the shell and the lead plug top casing plate/shield plug assembly with no credit taken by the contribution in carrying the pressure load from the ½" weld between the shell and the top outer cover plate. In reality, these two DSC components are adjacent to each other and, therefore, they act together in carrying the pressure load.

The hand calculation approach with the simplifying assumption as described above ignored the stress due to the radial tensile force developed in the weld due to internal pressure acting on the DSC shell. To incorporate the effect of the radial tensile force, the weld stresses are evaluated based on the results from the ANSYS axisymmetric model of the 32P DSC (Enclosure 2) which includes the composite lead plug top casing plate/shield plug assembly, the outer top cover plate, and the associated welds to the shell.

For the 100 psig pressure on the inner boundary, the stress for the inner boundary weld (weld between the lead plug top casing plate and DSC shell) is computed as shown below.

From Enclosure (2), Appendix A, Run No. 8, the radial and axial forces at node 457 (the coupled node between the lead plug top casing plate and the DSC shell) are:

Node Number	FX (Radial Force, lbs)	FY (Axial Force, lbs)
457	0.4758×10^6	-0.2653×10^6

The weld stress due to combined radial and axial forces is calculated as follows:

Weld Force $= [(FX)^2 + (FY)^2]^{1/2} = [(0.4758 \times 10^6)^2 + (-0.2653 \times 10^6)^2]^{1/2}$
$= 0.5448 \times 10^6$ lb

Weld Area $= \pi\ (D)\ (3/16) = \pi\ (66.0)\ (3/16) = 38.88\ in^2$

Weld Stress, $f_s = 0.5448 \times 10^6 / 38.88 = 14.0$ ksi

The canister is designed and fabricated per ASME Code Case N-595-2. Therefore the code case joint efficiency factor is used to calculate the weld stress allowables.

The maximum temperature for the vent blocked accident condition is 575°F at the center portion of the shell. The maximum temperature at the top and bottom end of the canister is 475°F. Therefore the allowable weld stress is taken at 475°F. Please note that the 100 psig pressure is due to the blocked vent condition which also conservatively assumes 100% of the fuel rods have ruptured. According to NUREG-1536, Chapter 4, Section 5(b), page 4-8, the blockage of inlet and outlet vents is an accident condition. Therefore, Level D accident condition allowables are used for weld stresses. This is a change from the 24P analysis where Level C allowables are used.

The Level D accident allowable weld stress at 475°F for the inner weld is 33.43 ksi. Therefore, the margin of safety based on the Level D allowable is:

M.S. = (33.43/14.0) - 1 = 1.39

Requested Information 3

Regarding Attachment 4 to the May 16, 2005, letter, provide the following references listed on page 32 of 97, and the ANSYS computer files listed on page 34 of 97:

Reference 1: CCNP calculation No. CA04977, Rev. 1, Nutech Horizontal Module System (NUHOMS) 24P ISFSI Dry Shielded Canister (DSC) Structural analysis for DSC Numbers R025 and beyond. (Hopper calc. HABGE-01/99-0745, Rev. 2).

Reference 2: TN Drawings 10950-30-1 (Rev. 3), 10950-30-2 (Rev. 3), 10950-30-3 (Rev. 5), 10950-30-4 (Rev. 6), 10950-30-5 (Rev. 3), 10950-30-10 (Rev. 6).

ANSYS Run No. 8, Files p32_acc_press100.db, rst

ANSYS Run No. 10, Files p32_100psi_outer_bound_inelastic_db, rst

The requested references and the ANSYS analyses are necessary in order for the staff to complete its review.

Calvert Cliffs Response

Enclosure (1) of this attachment contains Calculation No. CA04977, Revision 1. As indicated above, all the requested ANSYS runs for both Revision 3 and Revision 5 of Calculation 1095-34 are provided in compacted disks in Enclosure (3). Enclosure (4) contains Transnuclear Drawings 10950-30-1 (Rev. 3), 10950-30-2 (Rev. 3), 10950-30-3 (Rev. 5), 10950-30-4 (Rev. 6), 10950-30-5 (Rev. 3), and 10950-30-10 (Rev. 6).

REFERENCE

1. Letter from Mr. G. Vanderheyden (CCNPP) to Document Control Desk (NRC), dated May 16, 2005, License Amendment Request: Change to the Dry Shielded Canister Design Basis Limit Requiring NRC Prior Approval Pursuant to 10 CFR 72.48 to Support the ISFSI NUHOMS®-32P Upgrade

ATTACHMENT (2)

TRANSNUCLEAR, INC. PROPRIETARY AFFIDAVIT

AFFIDAVIT

STATE OF MARYLAND }
}
}
}
COUNTY OF HOWARD }

Before me, the undersigned authority, personally appeared Tara Neider who, being by me duly sworn according to law, deposes and says that she is authorized to execute this Affidavit on behalf of Transnuclear, Inc. and that the averments of fact set forth in this Affidavit are true and correct to the best of her knowledge, information, and belief:

Tara Neider
TARA NEIDER

Sworn to and subscribed
Before me this 16th **day**
of September, **2005.**

Arleastrice V. Taylor

My Commission Expires 10 / 14 / 2008

(1) I am Vice President of Transnuclear, Inc. and my responsibilities include reviewing the proprietary information sought to be withheld from public disclosure in connection with the licensing of spent fuel transport cask systems or spent fuel storage cask systems. I am authorized to apply for its withholding on behalf of Transnuclear, Inc.

(2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the commission's regulations and in conjunction with the Transnuclear application for withholding accompanying this Affidavit.

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

(4) The following information is furnished pursuant to the provisions of paragraph 10CFR 2.790(b)(4) to determine 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 Transnuclear.

(ii) The information is of a type customarily held in confidence by Transnuclear, is not customarily disclosed to the public and is transmitted to the commission in confidence.

(iii) The information sought to be protected is not now available in public sources to the best of our knowledge and belief and the release of such information might result in a loss of competitive advantage as follows:

(a) It reveals the distinguishing aspects of a storage system where prevention of its use by any of Transnuclear's competitors without license from Transnuclear constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a component or material, the application of which secures a competitive economic or technical advantage.

(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.

(5) The information is being transmitted to the commission in confidence and, under the provision of 10CFR Section 2.790, it is to be received in confidence by the Commission.

(6) The information sought to be protected is not available in public sources to the best of our knowledge and belief.

(7) The proprietary information sought to be withheld in this submittal is that which is contained in the proprietary version of:

Transnuclear Calculation 1095-34, Revision 5.

ANSYS Computer Run No. 6: P32_ted_100psi.db, rst (top end drop + 100 psig applied to inner boundary)
ANSYS Computer Run No. 8: P32_acc_press100.db, rst (100 psig applied to inner boundary)
ANSYS Computer Run No. 10: P32_100psi_outer_bound_inelastic.db, rst (100 psig applied to outer boundary)
ANSYS Computer Run No. 6: ted_100psi_inner_1a.db, .rst (top end drop + 100 psig applied to inner boundary)
ANSYS Computer Run No. 8: p32_100psi_inner_1a.db, .rst (100 psig applied to inner boundary)
ANSYS Computer Run No. 10: p32_100psi_outer.db, .rst (100 psig applied to outer boundary)
ANSYS Computer Run No. 15: (Appendix A) p32_ted.db, .rst (top end drop without internal pressure)

Transnuclear Drawing 10950-30-1, revision 3.
Transnuclear Drawing 10950-30-2, revision 3.
Transnuclear Drawing 10950-30-3, revision 5.
Transnuclear Drawing 10950-30-4, revision 6.
Transnuclear Drawing 10950-30-5, revision 3.
Transnuclear Drawing 10950-30-10, revision 6.

(8) This information should be held in confidence because it provides details of materials qualification programs that were developed at significant expense. This information has substantial commercial value to Transnuclear in connecting with competition with other vendors for contracts.

The subject information could only be duplicated by competitors if they were to invest time and effort equivalent to that invested by Transnuclear provided they have the requisite talent and experience.

Public disclosure of this information is likely to cause substantial harm to the competitive position of Transnuclear, because it would simplify design and evaluation tasks without requiring a commensurate investment of time and effort.