June 8, 2006

United States Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Serial No.   06-408
NL&OS/PRW R0
Docket Nos. 50-305
                    50-336/423
                    50-338/339
                    50-280/281
License Nos. DPR-43
                    DPR-65/NPF-49
                    NPF-4/7
                    DPR-32/37

DOMINION ENERGY KEWAUNEE, INC. (DEK)
DOMINION NUCLEAR CONNECTICUT, INC. (DNC)
VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA POWER STATION UNITS 1 AND 2
SURRY POWER STATION UNITS 1 AND 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
REQUEST FOR APPROVAL OF TOPICAL REPORT DOM-NAF-3,
GOTHIC METHODOLOGY FOR ANALYZING THE RESPONSE TO
POSTULATED PIPE RUPTURES INSIDE CONTAINMENT

In a letter dated November 1, 2005, Dominion Energy Kewaunee, Inc. (DEK), Dominion Nuclear Connecticut, Inc. (DNC) and Virginia Electric and Power Company (Dominion) requested the approval for the generic application of Topical Report DOM-NAF-3, "GOTHIC Methodology for Analyzing the Response to Postulated Pipe Ruptures Inside Containment," for Kewaunee Power Station (KPS), Millstone Power Station (MPS), North Anna Power Station (NAPS) and Surry Power Station (SPS), respectively. GOTHIC is a general-purpose, thermal-hydraulics computer code developed by the Electric Power Research Institute for applications in the nuclear power industry. The NRC has approved GOTHIC for use in containment analyses for several U.S. nuclear power plant licensees. In Topical Report DOM-NAF-3, DEK, DNC and Dominion have developed an analytical methodology using GOTHIC for performing licensing basis analyses for the containment response for pressurized water reactors with large, dry containments. Plant specific applications of topical report DOM-NAF-3 will be implemented by DEK, DNC and Dominion according to the requirements of 10 CFR 50.59 for changes to USAR/FSAR/UFSAR evaluation methodologies.

In a letter dated April 28, 2006, the NRC requested additional information in order to complete its review of the submittal. The response to the request for additional information is provided in Attachment 2. As part of the response to NRC's question 2, DEK, DNC and Dominion have provided a CD-ROM that contains information DEK, DNC and Dominion consider to be proprietary. Therefore, Attachment 1 to this letter contains a request for withholding the information provided in the enclosed CD-ROM from public release under the provisions of 10 CFR 2.390. The associated affidavit attesting to the proprietary nature of the information is also included in Attachment 1.

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If you have questions or require additional information, please contact Mr. Paul R. Willoughby at (804) 273-3572.

Very truly yours,

Eugene S. Grecheck
Vice President – Nuclear Support Services

Attachments: (2)

1. Application for Withholding and Affidavit of Eugene S. Grecheck
2. Response to NRC Request for Additional Information: Topical Report DOM-NAF-3

Enclosure: CD-ROM that contains the electronic GOTHIC input and output files from the benchmark cases in Sections 4.3, 4.4, 4.5, and 4.6 of DOM-NAF-3

Commitments made in this letter: None

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ATTACHMENT 1

APPLICATION FOR WITHHOLDING AND AFFIDAVIT OF EUGENE S. GRECHECK

DOMINION ENERGY KEWAUNEE, INC.
DOMINION NUCLEAR CONNECTICUT, INC.
VIRGINIA ELECTRIC AND POWER COMPANY
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA POWER STATION
SURRY POWER STATION

APPLICATION FOR WITHHOLDING AND AFFIDAVIT OF
EUGENE S. GRECHECK

I, Eugene S. Grecheck, Vice President – Nuclear Support Services, state that:

1.   I am authorized to execute this affidavit on behalf of Dominion Resources Services, Inc. (DRS).

2.   DRS is submitting a CD-ROM that contains the electronic GOTHIC input and output files from the benchmark cases in Sections 4.3, 4.4, 4.5, and 4.6 of Topical Report DOM-NAF-3, for NRC review. The CD-ROM contains proprietary commercial information that should be held in confidence by the NRC pursuant to the policy reflected in 10 CFR §§ 2.390(a)(4) because:

   a. This information is being held in confidence by DRS.

   b. This information is of a type that is held in confidence by DRS, and there is a rational basis for doing so because the information contains sensitive commercial information concerning DRS' containment analysis methodology.

   c. This information is being transmitted to the NRC in confidence.

   d. This information is not available in public sources and could not be gathered readily from other publicly available information.

   e. Public disclosure of this information would create substantial harm to the competitive position of DRS by disclosing confidential DRS internal containment analysis methodology information to other parties whose commercial interests may be adverse to those of DRS. Furthermore, DRS has expended significant engineering resources in the development of the information. Therefore, the use of this confidential information by competitors would permit them to use the information developed by DRS without the expenditure of similar resources, thus giving them a competitive advantage.

3.   Accordingly, DRS requests that the designated document be withheld from public disclosure pursuant to the policy reflected in 10 CFR §§ 2.390(a)(4).

Eugene S. Grecheck

Vice President – Nuclear Support Services

COMMONWEALTH OF VIRGINIA   )
)

COUNTY OF HENRICO   )

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Eugene S. Grecheck, who is Vice President - Nuclear Support Services of Dominion Resources Services, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this _8 ᵗʰ_ day of _June_, 2006.

My Commission Expires: _August 31, 2008_.

Margaret B. Burnett
Notary Public

(SEAL)

ATTACHMENT 2

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION: TOPICAL REPORT DOM-NAF-3

DOMINION ENERGY KEWAUNEE, INC.
DOMINION NUCLEAR CONNECTICUT, INC.
VIRGINIA ELECTRIC AND POWER COMPANY
KEWAUNEE POWER STATION
MILLSTONE POWER STATION UNITS 2 AND 3
NORTH ANNA POWER STATION
SURRY POWER STATION

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION: TOPICAL REPORT DOM-NAF-3

NRC Request for Additional Information dated April 28, 2006 [Reference 1]

By letter dated November 1, 2005, Virginia Electric and Power Company, Dominion Nuclear Connecticut, Inc. and Dominion Energy Kewaunee, Inc. (the licensees), submitted proposed Topical Report DOM-NAF-3 for the Nuclear Regulatory Commission (NRC) staff's review and approval. The licensees are requested to reply to the following questions.

NRC RAI #1:

In Section 2.2 of DOM-NAF-3, the licensees stated that "[f]or containment modeling, [it] has selected correlations that have been previously approved by the NRC and has confirmed the applicability of the models to large, dry PWR [pressurized water reactor] containments. For calculation of post-reflood mass and energy release, a simplified GOTHIC model of the reactor coolant system (RCS) and steam generator secondary side has been developed and coupled to the containment...Framatome recently received NRC approval for use of a coupled mass and energy release model..."

For all of the intended GOTHIC applications listed in Section 2.3, please identify those modeling techniques and assumptions (if there are any) that are different from what was previously reviewed and approved by the NRC staff, which requires the NRC staff's prior approval. For example, what makes your post-reflood mass and energy release model different (less conservative) from that approved for Framatome. Be specific and provide justification where appropriate.

Dominion Response:

Topical report DOM-NAF-3 [Reference 2] presents an analytical methodology for performing containment response design basis calculations with two components: 1) containment response model; and 2) simplified reactor coolant system (RCS) model for calculation of post-reflood mass and energy (M/E) releases. The containment response model is used for all applications in Section 2.3 of DOM-NAF-3. The NRC has approved GOTHIC for analyzing the containment response to loss of coolant accident (LOCA) and main steamline break (MSLB) events [References 3-8]. The analyses use models to maximize containment pressure and temperature using mass and energy releases that are generated by other NRC-approved methods and input to GOTHIC. The DOM-NAF-3 methodology for maximizing LOCA and MSLB containment pressure and temperature uses NRC-approved models for the containment response (e.g., the Direct/Diffusion Layer Model for heat transfer between passive heat sinks and the containment atmosphere in DOM-NAF-3, Section 3.3.2, and the break release droplet model with 100-micron droplets in DOM-NAF-3, Section 3.5.1).

To adequately evaluate all aspects of the containment design, a simplified RCS model is used to calculate long-term M/E releases and heat removal rates from the primary and secondary systems for all LOCA applications in Section 2.3. The Dominion post-reflood M/E release model is a new application that is different from other NRC-approved applications of GOTHIC. The Framatome GOTHIC methodology report [Reference 9] is proprietary and a comparison to their long-term mass and energy release methodology (Section 5.1.2.3.2 in Reference 9) was not possible. The Framatome methodology was referenced on page 10 of DOM-NAF-3 only to point out that the Dominion method of coupling the RCS and containment models inside GOTHIC was not unique and that the NRC has approved the use of a coupled methodology previously. Dominion believes the details below provide further explanation of its use of GOTHIC which will facilitate the NRC review of Dominion's request.

Post-Reflood Mass and Energy Release Model

Surry Power Station (SPS) and North Anna Power Station (NAPS) have subatmospheric containments that are required to be depressurized following a design basis accident in accordance with the assumptions in the dose consequences analyses. The original design basis required a depressurization of the containment to subatmospheric conditions within one hour and subatmospheric conditions thereafter. The GOTHIC simplified RCS model provides margin with respect to the NRC-approved Westinghouse post-reflood methodology (WCAP-8264-P-A and WCAP-10325-P-A) that is the current licensing basis for SPS and NAPS. DOM-NAF-3, Section 4.4, shows that the GOTHIC methodology provides a reduction in containment depressurization time and a less severe pressure increase following containment spray termination, even though the integral energy release to the containment is similar between GOTHIC and LOCTIC. Both of these effects represent margin in the containment design relative to the current LOCTIC licensing basis analyses. This margin is attributed to how the post-reflood M/E release model distributes energy from the break.

The application of the post-reflood M/E release methodology for SPS and NAPS is a "Departure from a Method of Evaluation Described in the FSAR" because neither of the two criteria specified in 10 CFR 50.59(a)(2) is satisfied:

i) The method does not produce conservative or essentially the same results as the Westinghouse FROTH methodology that is the current licensing basis for SPS and NAPS. While the GOTHIC integral mass and energy releases are comparable or more conservative, the distribution of energy released to the containment is different and provides margin in the containment depressurization time. NEI-96-07, Rev. 1, Section 3.4, states "Gaining margin by revising an element of a method of evaluation is considered to be a nonconservative change and thus a departure from a method of evaluation...". Further, a comparison to the proprietary Framatome methodology was not possible.

ii) **The** method has not been "approved by the NRC for the intended application." Section 4.3.8.2 of NEI-96-07, Rev. 1, details a review process to identify if the methodology has been approved for general or specific applications. Application of the Dominion post-reflood M/E release methodology for subatmospheric containment depressurization calculations represents a new application of GOTHIC that has not been approved previously.

Calculation of NPSH Available

As described in Section 3.8 of DOM-NAF-3, long-term containment analyses are performed to demonstrate adequate net positive suction head (NPSH) margin for the recirculation spray (RS) and low head safety injection (LHSI) pumps that take suction from the containment sump following a LOCA. The calculation is performed internally in GOTHIC using an industry standard formulation for prediction of pump net positive suction head available (NPSHa). The calculation of NPSHa depends directly on transient predictions of sump temperature, sump water level, and containment pressure (SPS and NAPS credit containment overpressure in the NPSHa calculations as described in Section 3.8.1 of DOM-NAF-3). The calculation of NPSHa using the same formula was previously performed by Stone & Webster using the LOCTIC computer program.

The Dominion calculation method uses the simplified RCS model and applies specific assumptions (e.g., complete mixing in the intact loop cold leg for pump suction breaks) to the GOTHIC containment models to ensure a conservative response compared to a maximum containment pressure analysis. Dominion concluded that the assumptions in Section 3.8 of DOM-NAF-3 apply sufficient conservatism for a transient calculation of NPSHa with GOTHIC. Section 4.5 of DOM-NAF-3 shows that GOTHIC produces slightly higher NPSHa for the Surry LHSI pump compared to LOCTIC and attributes the differences to GOTHIC's liquid/vapor heat and mass transfer model and the distribution of break energy between vapor and liquid.

The NRC has not reviewed previously this specific methodology for calculation of NPSHa. Further, the specific assumptions in Section 3.8 of DOM-NAF-3 are elements of the methodology that ensure a conservative calculation of NPSHa and these elements have not been reviewed. For example, DOM-NAF-3 specifies that a minimum containment pool area (specific to the plant being analyzed) is used to minimize evaporation for NPSH calculations, because GOTHIC's interfacial heat and mass transfer model provides a minor benefit in containment pressure compared to LOCTIC (which has no such model) and results in higher NPSH margin. In conclusion, the application of GOTHIC for NPSHa calculations is a "Departure from a Method of Evaluation Described in the FSAR" because neither of the two criteria specified in 10 CFR 50.59(a)(2) is satisfied:

i) The method does not produce conservative or essentially the same results as the Stone & Webster LOCTIC methodology. As shown in DOM-NAF-3, Section 4.5.3,

GOTHIC provides NPSH margin for the LHSI pump. NEI-96-07, Rev. 1, Section 3.4, states "Gaining margin by revising an element of a method of evaluation is considered to be a nonconservative change and thus a departure from a method of evaluation...".

ii) The use of GOTHIC with the specific assumptions in Section 3.8 of DOM-NAF-3 has not been "approved by the NRC for the intended application". Section 4.3.8.2 of NEI-96-07, Rev. 1, details a review process to identify if the methodology has been approved for general or specific applications. The specific GOTHIC methods in Section 3.8 of DOM-NAF-3 with the coupled RCS/containment model are unique and require NRC review.

GOTHIC Applications for Component Design Verification

DOM-NAF-3, Section 2.3, specifies the use of GOTHIC for long-term containment analyses that verify that FSAR containment design limits are met (Applications 1-5). The applications can be categorized into two types of containment analyses that use different model assumptions to produce either a maximum containment pressure profile (Applications 1-4) or a maximum sump temperature (Application 5). As discussed earlier, the NRC has approved the GOTHIC containment modeling techniques in DOM-NAF-3 for calculating maximum containment pressure from LOCA and MSLB events [References 3-8]. Dominion requests NRC approval of the DOM-NAF-3 methodology for calculating transient pump NPSHa.

NRC acceptance of the GOTHIC containment response calculation methodologies for containment design limits does not explicitly cover the use of GOTHIC results for component design verification. As a result, Dominion included Applications 6-9 for NRC to review and approve the use of GOTHIC output for specific component analyses. The methodology for performing pump NPSHa calculations (Application 5) produces a maximum sump water temperature, and Dominion plans to use the GOTHIC maximum sump water temperature profile for validation against component design limits. For example, the predicted sump water temperature is confirmed to remain less than acceptable limits for the recirculation spray system piping following a LOCA (Application 6).

The remaining GOTHIC applications implement assumptions that maximize containment pressure and vapor temperature, while minimizing sump water temperature. The methods for verifying that the containment liner temperature (Application 7) and equipment temperatures (Application 8) remain below their limits are incremental changes to the LOCA and MSLB peak containment pressure and temperature analyses (Applications 1 and 2). Again, since the containment modeling assumptions are biased to produce a conservative containment response, the GOTHIC results from these cases can also be used for component design verification. One example is the use of the minimum sump water temperature for determining the fluid viscosity for calculating the sump strainer head loss (Application 6).

References for Response #1

1) Letter from Stephen Monarque (USNRC) to David A. Christian (Dominion), "North Anna Power Station, Unit Nos. 1 and 2, Surry Power Station, Unit Nos. 1 and 2, Kewaunee Power Station, and Millstone Power Station, Unit Nos. 2 and 3 – Request for Additional Information (RAI) on Proposed Topical Report DOM-NAF-3 (TAC Nos. MC8833, MC8834, MC8835, MC8836, MC8831, and MC8832)," April 28, 2006.

2) Letter from Leslie N. Hartz (Dominion) to USNRC, "Dominion Energy Kewaunee, Inc. (DEK), Dominion Nuclear Connecticut, Inc. (DNC), Virginia Electric and Power Company (Dominion), Kewaunee Power Station, Millstone Power Station Units 2 and 3, North Anna Power Station Units 1 and 2, Surry Power Station Units 1 and 2, Request for Approval of Topical Report DOM-NAF-3, GOTHIC Methodology for Analyzing the Response to Postulated Pipe Ruptures Inside Containment," Serial No. 05-745, November 1, 2005.

3) Letter from Herbert N. Berkow (NRC) to Ronnie L. Gardner (Framatome), "Final Safety Evaluation for Framatome ANP Topical Report BAW-10252(P), Revision 0, 'Analysis of Containment Response to Postulated Pipe Ruptures Using GOTHIC,' (TAC No. MC3783)," August 31, 2005.

4) Letter from Anthony C. McMurtray (NRC) to Thomas Coutu (NMC), "Kewaunee Nuclear Power Plant - Issuance of Amendment (TAC NO. MB6408)," September 29, 2003.

5) Letter from John G. Lamb (NRC) to Thomas Coutu (NMC), "Kewaunee Nuclear Power Plant – Issuance of Amendment Regarding Stretch Power Uprate (TAC NO. MB9031)," February 27, 2004.

6) Letter from Alan B. Wang (NRC) to R.T. Ridenoure (OPPD), "Fort Calhoun Station, Unit No. 1 – Issuance of Amendment (TAC NO. MB7496)," November 5, 2003.

7) Letter from L. Mark Padovan (NRC) to D.N. Morey (Southern Nuclear Operating Company), "Joseph M. Farley Nuclear Plant, Units 1 and 2 – Issuance of Amendments re: Steam Generator Replacements (TAC Nos. MA4393 AND MA4394)," December 29, 1999.

8) Letter from Frank Rinaldi (NRC) to J.T. Gasser (Southern Nuclear Operating Company), "Vogtle Electric Generating Plant, Units 1 and 2 Re; Issuance of Amendments (TAC Nos. MB5046 AND MB5047)," June 4, 2003. ADAMS Accession No. ML031600761.

9) Abdelghany, J. M., et al., "Analysis of Containment Response to Postulated Pipe Ruptures Using GOTHIC," Framatome ANP report BAW-10252(NP), Revision 0, July 2004.

NRC RAI #2:

Provide nodal diagrams that show the GOTHIC control volumes, junctions, etc., described in Section 4.2.1 for the demonstration analyses performed for Surry Power Station, Unit Nos. 1 and 2.

Dominion Response:

Dominion did not provide the GOTHIC nodal diagrams with DOM-NAF-3 because they are proprietary materials and Dominion desires to keep the topical report non-proprietary. Further, the nodal diagrams are difficult to interpret without the detailed system and component descriptions that are included in the GOTHIC input file. To answer the RAI, Dominion has provided the NRC with a proprietary CD-ROM that contains the electronic GOTHIC input and output files from the benchmark cases in Sections 4.3, 4.4, and 4.5 of DOM-NAF-3. One main steam line break GOTHIC model is included from Section 4.6 (the nodal diagram is the same for all cases presented). The CD-ROM includes a Microsoft WORD file that explains the file formats and requirements for viewing (GOTHIC Version 7.2 is acceptable for the .GTH files).