

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

March 24, 2021

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D. C. 20555

Serial No.: 21-072
NRA/GDM: R1
Docket Nos.: 50-280/281
License Nos.: DPR-32/37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
LICENSE AMENDMENT REQUEST - APPLICATION OF LEAK-BEFORE-BREAK
METHODOLOGY TO REACTOR COOLANT SYSTEM BRANCH PIPING
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION AND CLARIFICATION

By letter dated October 22, 2020 (Serial No. 20-091) [ADAMS Accession No. ML20296A623], Virginia Electric and Power Company (Dominion Energy Virginia) submitted a license amendment request (LAR) for Surry Power Station (Surry) Units 1 and 2 to permit the application of leak-before-break (LBB) methodology to auxiliary piping systems attached to the Reactor Coolant System (RCS) to eliminate the dynamic effects of postulated pipe ruptures. By email dated February 16, 2021, Mr. Vaughn Thomas, the Surry NRC Project Manager, provided a request for additional information (RAI) to facilitate NRC staff review of the LAR. Dominion Energy Virginia's response to the RAI is provided in Attachment 1 (proprietary) and Attachment 2 (non-proprietary).

In addition, by email dated February 23, 2021, the NRC requested clarification regarding two items associated with their review. The NRC's clarification request and Dominion Energy Virginia's response are included in Attachment 3. Neither the RAI response nor the additional clarification provided in the attachments affect the No Significant Hazards Consideration Determination or Environmental Assessment included in the LAR.

Attachment 1 contains information proprietary to Westinghouse Electric Company LLC ("Westinghouse"), and it is supported by an Affidavit signed by Westinghouse, the owner of the information. The Affidavit, included in Westinghouse document CAW-21-5165, sets forth the basis on which the information may be withheld from public disclosure by the Nuclear Regulatory Commission ("Commission") and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations. Accordingly, it is respectfully requested that the 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 copyright or proprietary aspects of the items listed above or the supporting Westinghouse Affidavit should reference CAW-21-5165 and should be addressed to Camille T. Zozula, Manager, Regulatory Compliance & Corporate Licensing, Westinghouse Electric Company, 1000 Westinghouse Drive, Suite 165, Cranberry Township, Pennsylvania 16066. CAW-21-5165 is included in Attachment 4.

Attachment 1 contains information that is being withheld from public disclosure pursuant to 10 CFR 2.390. Upon separation from Attachment 1, this letter is decontrolled.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Respectfully,



Mark D. Sartain
Vice President – Nuclear Engineering and Fleet Support

Commitments made in this letter: None

Attachments:

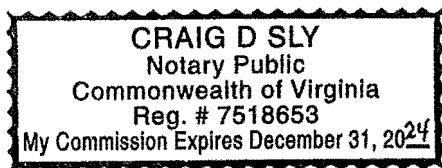
1. Response to NRC Request for Additional Information (**Proprietary**)
2. Response to NRC Request for Additional Information (Non-Proprietary)
3. Response to NRC Request for Clarification
4. Westinghouse Document CAW-21-5165 including Affidavit

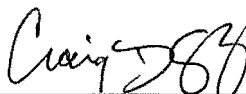
COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Mark D. Sartain, who is Vice President – Nuclear Engineering and Fleet Support of Virginia Electric and Power Company. 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 24th day of March, 2021.

My Commission Expires: 12/31/24.





Notary Public

cc: U.S. Nuclear Regulatory Commission - Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
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NRC Senior Resident Inspector
Surry Power Station

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Attachment 2

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
LICENSE AMENDMENT REQUEST REGARDING APPLICATION OF LEAK-
BEFORE-BREAK FOR AUXILIARY PIPING LINES ATTACHED TO THE
REACTOR COOLANT SYSTEM

[NON-PROPRIETARY]

**Virginia Electric and Power Company
(Dominion Energy Virginia)
Surry Power Station Units 1 and 2**

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
SURRY POWER STATION UNITS 1 AND 2
(EPID: L-2020-LLA-0255)

NRC COMMENT:

Background:

By letter dated October 22, 2020, Virginia Electric and Power Company (Dominion Energy Virginia or licensee) requested an amendment to the Surry Power Station (Surry) Units 1 and 2 operating licenses in accordance with 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit." Specifically, NRC approval is requested to permit the application of the leak-before-break (LBB) methodology to auxiliary piping systems attached to the reactor coolant system (RCS) for Surry Units 1 and 2 to eliminate the dynamic effects of postulated pipe ruptures. The licensee also submitted the non-proprietary and proprietary versions of WCAP-18491, Revision 0, "Technical Justification for Eliminating Auxiliary Piping Ruptures as the Structural Design Basis for Surry Units 1 and 2, Using Leak-Before-Break Methodology."

Requests:

The NRC staff requests the following information to complete its review of the proposed change to revise the Surry Units 1 and 2 licensing and design bases to expand the LBB scope to eliminate the dynamic effects of postulated ruptures of specific portions of the auxiliary piping systems attached to the reactor coolant system (RCS).

- a. Table 7-2, "Flaw Stability Results for the Surry Units 1 and 2 RHR, Accumulator, Loop Bypass, and SI Lines Based on Limit Load and EPFM," of WCAP-18491, Revision 0 lists the piping segments that are analyzed in the WCAP report. Please describe which segments are within the scope of the amendment and identify which portions of the table address the subject piping.*

Dominion Energy Virginia Response

As stated in the License Amendment Request dated October 22, 2020 (Reference 1):

"The SI, SI accumulator, and RHR lines described above include piping segments that are isolated from the RCS during normal operation. The scope of the LAR for these systems/components is limited to the piping segments from the RCS loop to the first RCS Pressure Isolation Valve (PIV)."

Therefore, the applicable piping segments are: RHRs-I, ACC-I, BP-I, BP-II, SI-CL-I, and SI-HL-I.

Conversely, excluded segments (beyond first PIV) are: RHRs-II, RHRr2-I, RHRr3-I, ACC-II, ACC-III, SI-CL-II, and SI-HL-II.

- b. *Table 7-2 of WCAP-18491, Revision 0, indicates elastic-plastic fracture mechanics analysis is performed for piping segments SI-CL-II and SI-HL-I. Please clarify where in the WCAP report details of the fracture mechanics analysis and its results can be found or provide separate details supporting justification. If these segments are within the scope of the licensee's request, provide the elastic-plastic J-integral evaluation results for the segments (e.g., applied J integral and tearing modulus). Also, please describe the details of the critical crack size calculation using the J-integral method such as the Ramberg-Osgood parameters and the combination of axial tension and bending components, as appropriate.*

Dominion Energy Virginia Response

As confirmed for RAI (a), the analysis location for SI-HL-I remains within the scope of the LAR, while the analysis location for SI-CL-II has been excluded. As noted in Section 7.3 of WCAP-18491, Revision 0 (Reference 2), the J-integral evaluation methodology is based on the EPRI fracture mechanics handbook, report NP-1931. The evaluation considers the combined effect of both axial tension and bending loading components. For the SI-HL-I analysis location, the evaluated faulted stress (18,750 psi, per Table 5-5 of Reference 2) is below the material yield strength (18,827 psi, per Table 4-1 of Reference 2). Because the faulted total stress is less than the material yield strength, the plastic component of the J-integral evaluation will be insignificant. As such, an effective fully-elastic J-integral evaluation is performed by setting the alpha parameter to zero ($\alpha = 0$) and the n parameter to one ($n = 1$).

The resulting applied J-integral value (J_{app}) was calculated to be [],^{a,c,e} which is considerably less than the flaw initiation fracture toughness (J_{Ic}) of []^{a,c,e} (based on historical material testing by Westinghouse). Because J_{app} was found to be less than J_{Ic} , calculation of the applied tearing modulus value (T_{app}) was not required.

- c. *Please clarify where in WCAP-18491, Revision 0, how the base materials are limiting materials as compared to the weld materials or provide separate justification. Please discuss the test data or references that support the position that tensile and fracture toughness properties of the base stainless steel materials are more limiting than those of the stainless steel welds in the subject piping. Please provide the J-integral fracture toughness parameters C and n used in $J = C(\Delta a)^n$ for the base stainless steels (or equivalent fracture toughness data), as appropriate.*

Dominion Energy Virginia Response

The fracture mechanics analyses consider material properties (yield and ultimate strength) of the base metal, and not the material properties of the weld metal. The nuclear

industry, and engineering applications in general, widely accept that the base metal (piping) has more limiting material properties than the weld metal. In addition to using the limiting yield and ultimate strength of the base metals, the analyses at the critical locations also consider a Z-factor penalty. The Z-factor is consistent with the methodology of SRP 3.6.3 (References 3 and 4) and accounts for reduction of the material toughness due to the welding process used during construction. By combining the limiting yield and ultimate strength of the base metals with the Z-factor penalty of the weld, the fracture mechanics analyses ensure the results are bounding of both the weld metal and base metal.

Historic testing done by Westinghouse on representative plants, WCAP-9787 (Reference 5) and WCAP-9558, Rev. 2 (Reference 6), has shown the wrought stainless steel piping exhibits more limiting fracture toughness properties than the weld metal. This testing does not provide specific toughness parameters C and n (used in $J = C[\Delta a]^n$) but does report values of the initiation fracture toughness (J_{Ic}). The limiting J_{Ic} value of these tests []^{a,c,e} is used in the comparison of the applied J-integral value []^{a,c,e} for the elastic-plastic fracture mechanics evaluation.

d. *WCAP-18491, Revision 0, addresses fatigue crack growth (FCG) analyses. Please identify where in the report that the FCG rate equation is used in the analyses or describe the fatigue FCG rate equation that is used in the FCG analyses.*

Dominion Energy Virginia Response

Surry plant-specific FCG results (Section 8.1 of WCAP-18491, Revision 0) utilize ASME Code Case N-809 (Reference 7). This Code Case provides crack growth rates specific to austenitic stainless steel in a Pressurized Water Reactor (PWR) environment.

FCG results based on representative analyses (Section 8.2 of WCAP-18491, Revision 0) utilize the ASME Code Section XI, Appendix C (Reference 8) crack growth rate for stainless steel material in an air environment. To account for the PWR water environment, an environmental factor equal to []^{a,c,e} is conservatively applied to the crack growth rate. The environmental factor is based on a compilation of data for austenitic stainless steels in a PWR water environment (Reference 9).

References

1. Virginia Electric and Power Company Letter to the US NRC dated October 22, 2020 (Serial No. 20-091), "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, Request for NRC Approval to Apply Leak-Before-Break Methodology to Reactor Coolant System Branch Piping," [NRC ADAMS Accession Number ML20296A623].

2. Westinghouse Reports, WCAP-18491-P (Proprietary) and WCAP-18491-NP (Non-proprietary), "Technical Justification for Eliminating Auxiliary Piping Rupture as the Structural Design Basis for Surry Units 1 and 2, Using Leak-Before-Break Methodology," December 2019.
3. Standard Review Plan: Public Comments Solicited; 3.6.3 Leak-Before-Break Evaluation Procedures; Federal Register/Vol. 52, No. 167/Friday August 28, 1987/Notices, pp. 32626-32633.
4. NUREG-0800, Revision 1, Standard Review Plan: 3.6.3 Leak-Before-Break Evaluation Procedures, March 2007.
5. Westinghouse Report, WCAP-9787, "Tensile and Toughness Properties of Primary Piping Weld Metal for Use in Mechanistic Fracture Evaluation," May 1981.
6. Westinghouse Report, WCAP-9558, Revision 2, "Mechanistic Fracture Evaluation of Reactor Coolant Pipe Containing a Postulated Circumferential Through-Wall Crack," May 1981.
7. ASME Code Case N-809, "Reference Fatigue Crack Growth Rate Curves for Austenitic Stainless Steels in Pressurized Water Reactor Environments, Section XI, Division 1," ASME International, dated June 23, 2015.
8. ASME Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 and 2001 Editions.
9. Bamford, W. H., "Fatigue Crack Growth of Stainless Steel Piping in a Pressurized Water Reactor Environment," ASME Trans. Journal of Pressure Vessel Technology, Vol. 101, February 1979.

Attachment 3

RESPONSE TO NRC REQUEST FOR CLARIFICATION
**LICENSE AMENDMENT REQUEST REGARDING APPLICATION OF LEAK-
BEFORE-BREAK FOR AUXILIARY PIPING LINES ATTACHED TO THE
REACTOR COOLANT SYSTEM**

**Virginia Electric and Power Company
(Dominion Energy Virginia)
Surry Power Station Units 1 and 2**

RESPONSE TO NRC REQUEST FOR CLARIFICATION
SURRY POWER STATION UNITS 1 AND 2
(EPID: L-2020-LLA-0255)

NRC Request #1

Clarify whether the loads in the LBB analysis consider the plant's stretch and measurement uncertainty recapture power uprates. If not, explain the reason.

Dominion Energy Virginia Response

Surry Units 1 and 2 were originally licensed with a core rated thermal power of 2441 MWt. A stretch power uprate to 2546 MWt rated thermal power was approved by the NRC in License Amendments 203/203 in August 1995 (Reference 1), and a measurement uncertainty recapture (MUR) power uprate to 2587 MWt rated thermal power was approved by the NRC in License Amendments 269/268 in September 2010 (Reference 2). Both uprates were considered in the LBB analysis documented in WCAP-18491 for Surry Units 1 and 2.

The applicable piping analyses used as input for the loads in the LBB analysis are the run of record analyses performed prior to the uprates. These original analyses were performed for T_{hot} and T_{cold} temperatures that envelope the revised Reactor Coolant Loop (RCL) temperatures from the 4.3% stretch power uprate. The subsequent 1.6% MUR power uprate resulted in a decrease in T_{cold} and an increase in T_{hot} . The MUR program analyzed a maximum T_{hot} of 609.1°F, which was not bounded by the original structural analyses. However, engineering evaluations performed for the MUR program concluded there was no significant impact to the RCL and branch line piping analysis as a result of this small temperature increase. No reanalysis was required for any of the branch lines in the scope of the LBB LAR. It was concluded the maximum T_{cold} of 542.9°F for the MUR power uprate program remained bounded by the T_{cold} value assumed in the original RCL and branch line piping analyses.

NRC Request #2

In addition, confirm whether or not the subject piping within the scope of the license amendment request has a relevant indication that could be a potential source of pipe rupture.

Dominion Energy Virginia Response

Examination results performed on Surry Units 1 and 2 Class 1 piping by our ASME Section XI Inservice Inspection (ISI) Program from the second 10-year ISI Interval to present were reviewed, and no relevant indications were identified that had been analyzed and left in service. There are no known relevant indications in Class 1 piping at Surry Power Station.

References

1. Letter from the US NRC to Virginia Electric and Power Company dated August 3, 1995, "Subject: Surry Units 1 and 2 - Issuance of Amendments Re: Up-rated Core Power (Serial No. 94-509) (TAC Nos. M90364 and M90365)."
2. Letter from the US NRC to Virginia Electric and Power Company dated September 24, 2010, "Subject: Surry Power Station, Unit Nos. 1 and 2, Issuance of Amendments Regarding Measurement Uncertainty Recapture Power Uprate (TAC Nos. ME3293 and ME3294)."

Attachment 4

WESTINGHOUSE DOCUMENT CAW-21-5165 INCLUDING AFFIDAVIT

**Virginia Electric and Power Company
(Dominion Energy Virginia)
Surry Power Station Units 1 and 2**

COMMONWEALTH OF PENNSYLVANIA:

COUNTY OF BUTLER:

- (1) I, Camille T. Zozula, have been specifically delegated and authorized to apply for withholding and execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse).
- (2) I am requesting the proprietary portions of LTR-SDA-II-21-13-P be withheld from public disclosure under 10 CFR 2.390.
- (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 10 CFR 2.390, 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 and is not customarily disclosed to the public.
 - (ii) The information sought to be withheld is being transmitted to the Commission in confidence and, to Westinghouse's knowledge, is not available in public sources.
 - (iii) Westinghouse notes that a showing of substantial harm is no longer an applicable criterion for analyzing whether a document should be withheld from public disclosure. Nevertheless, 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 technical evaluation justifications 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.

- (5) Westinghouse has policies in place to identify proprietary information. 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.

- (6) The attached documents are bracketed and marked to indicate the bases for withholding. The justification for withholding 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 (5)(a) through (f) of this Affidavit.

I declare that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

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

Executed on: 12 Mar 2021

Camille Zozula
Camille T. Zozula, Manager
Regulatory Compliance & Corporate
Licensing