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

Vogtle Electric Generating Plant – Units 1 and 2
Docket Nos. 50-424 & 50-425

Subject: Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specification 3.7.2 Limiting Condition for Operation to Remove One Main Steam Isolation Valve System

By letter dated September 30, 2021, Southern Nuclear Operating Company (SNC) submitted an application to revise the Vogtle Electric Generating Plant (VEGP), Units 1 and 2, Technical Specification (TS) 3.7.2, "Main Steam Isolation Valves (MSIVs)." By email dated January 26, 2022, the Nuclear Regulatory Commission (NRC) staff issued a request for additional information (RAI). The Enclosure to this letter provides the SNC response to the NRC staff's RAIs.

The conclusions of the No Significant Hazards Consideration and Environmental Consideration contained in the original application have been reviewed and are unaffected by this response.

If you have any questions, please contact Ryan Joyce at 205.992.6468.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of February 2022.

Respectfully submitted,

C. A. Gayheart
Director, Regulatory Affairs
Southern Nuclear Operating Company

CAG/kgl/cg

Enclosure: SNC Response to NRC RAIs
Attachment: Westinghouse Letter GP-20049 to SNC

cc: Regional Administrator, Region ll
NRR Project Manager – Vogtle 1 & 2
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Vogtle Electric Generating Plant – Units 1 and 2
Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specification 3.7.2 Limiting Condition for Operation to Remove One Main Steam Isolation Valve System

Enclosure

SNC Response to NRC RAIs

NRC ARCB-RAI-8:

Please provide the audit report which addresses Westinghouse Nuclear Safety Advisory Letter (NSAL)-06-15, or a summary of the report which addresses SGTR offsite dose consequences and the bounding assumptions which supports the above conclusion.

SNC Response to NRC ARCB-RAI-8:

The Attachment to this Enclosure communicates a summary report provided by Westinghouse which discusses the audit of the main steam system conducted to address NSAL-06-15 and specifies conservative branch line steam flow rates discovered resulting from the audit. These branch line steam flows are used to evaluate the impact of a single failure MSIV for the SGTR Margin-To-Overfill (MTO) scenario.

The Attachment also provides a discussion of the impacts to dose consequences focused on major phenomena related to post trip flashed break flow and ruptured SG steam releases. The discussion concludes that the single failure of a failed open atmospheric relief valve (ARV) results in greater post trip flashed breakflow fractions and greater steam releases from the ruptured steam generator than that resulting from a single failure MSIV. This is because the steam flow rates for the ARV are larger than that of the branch line steam flows resulting from a MSIV failure to close.

Lastly, the Attachment also includes markups to the LAR sections related to “SGTR Margin to Overfill”, and “SGTR Offsite Dose Consequences” for consistency with wording in the VEGP FSAR Section 15.6.3. The intent of this markup is to more clearly communicate that the single failure for the SGTR MTO analysis in the current VEGP AOR is still bounding, and that the single failure for the SGTR Offsite Dose Consequences analysis in the current VEGP AOR also remains bounding.

NRC EMIB-RAI-9:

Section 2.3, “Reason for Change,” on page E-2 states that:

> The reduction from two MSIV systems per steam line to one MSIV per steam line is requested to improve the design and reliability of the system. The current MSIV actuators are Rockwell A-290 hydraulic actuators. These actuators utilize a compressed nitrogen hemisphere as the motive force to push hydraulic fluid from the valve cylinder, driving the valve to the closed position. In order for the valve to remain open, adequate hydraulic pressure must be maintained at all times to overcome the force of the compressed nitrogen. As a result, there are many mechanisms by which these valves can fail closed.

There have been six plant trips at Vogtle since 2012 due to inadvertent closure of one or more MSIVs. The NRC staff reviewed the six MSIV failures provided (in the Basis for Change Table on Page E-3) that have occurred since 2012 resulting in a plant trip. Five of those failures appear to have been maintenance preventable. Three MSIV failures were due to human performance. One MSIV failure was caused by the valve stem

becoming brittle. One MSIV failure could be addressed by applying a periodic component change-out task. Only one MSIV failure was due to hydraulic pressure.

a. Please explain how the proposed reduction from two MSIVs per steam line to one MSIV per steam line will improve the design and the reliability of the system in light of the six MSIV failures.

b. Please explain how maintenance preventable failures of MSIVs (as specified in the Table on Page E-3) would be eliminated by removing one out of two MSIVs per steam line.

SNC Response to NRC EMIB-RAI-9:

a. The function of the MSIVs is to close in the event of a steam line break to prevent an uncontrolled blowdown of the steam generators. Based on successful performance of Technical Specification Surveillance Requirement 3.7.2.1 over the last 15 plus years, the MSIVs at VEGP are very reliable in performing their specified safety function. The six MSIV failures were due in part to the large number of single-point vulnerability (SPV) subcomponents associated with each valve. It is estimated that there are approximately 40 subcomponents associated with the current actuator design which if failed would result in the unplanned closure of an MSIV. These include dump solenoids, hydraulic seals, electrical connectors (Grayboots), relays, fuses, micro switches and pressure retaining O-rings. This reduction to one MSIV per steam line will improve plant reliability by preventing plant trips and/or transients associated with these SPVs.

b. Following the events specified in the table on Page E-3 of the license amendment request, SNC has changed its philosophy on SPVs and decided to take more of an “elimination” vs “mitigation” approach. The removal of the second MSIV per steam line will result in a reduction of over 300 SPV subcomponents at VEGP. Although it is unrealistic to entirely eliminate the probability of maintenance preventable failures in the MSIV design, the reduction of SPVs will have a corresponding reduction of these failures.

NRC EMIB-RAI-10:

Section 3.2, “Impacts on Physical Plant Change,” Item “Inservice Testing Program,” page E-13 states:

> Inservice Test Program and Inservice Inspection Program will be evaluated in accordance with 10 CFR 50.55a to determine what, if any, program changes are required. The programs will be updated accordingly.

The licensee is requested to specify its commitment to maintain all MSIVs in the IST Program following implementation of the LAR.

SNC Response to NRC EMIB-RAI-10:

Per 10 CFR 50.55a(f) and ASME OM Code 2004 Edition / 2006 Addenda Subsection ISTA-1100 & ISTC-1100, SNC will continue to maintain all MSIVs in the IST Program following implementation of the LAR.

NRC EMIB-RAI-11:

The proposed changes to Vogtle Units 1 and 2 TS Surveillance Requirement (SR) 3.7.2.1 adds “bypass valve.” The Frequency column states “In accordance with the INSERVICE TESTING PROGRAM.”

Please specify the newly added bypass valve(s) in the IST Program and provide the IST Program modification with all MSIVs and bypass valves identified with identification numbers.

SNC Response to NRC EMIB-RAI-11:

The MSIV bypass valves are not newly added. Currently, MSIVs and MSIV bypass valves are in the IST Program and the identification numbers are identified as:

MSIV Valves	MSIV Bypass Valves
1/2-HV-3006A&B	1/2-HV-13005A&B
1/2-HV-3016A&B	1/2-HV-13006A&B
1/2-HV-3026A&B	1/2-HV-13007A&B
1/2-HV-3036A&B	1/2-HV-13008A&B

NRC EMIB-RAI-12:

Section 3.2, “Impacts of the Physical Plant Change,” Item “Seismic, Pipe Stress, High Energy Line Break evaluation,” states:

> Pipe stress analyses are performed on the main steam line to confirm that the main steam piping and supports continue to withstand appropriate dynamic effects following the installation of the new actuator. Pipe stress analyses are also performed on the new vent line piping routed to the main steam safety relief valve vent line. Existing pipe supports for the replacement MSIV actuators are reevaluated accordingly, and small-bore piping supports are installed on the new vent line piping.

a. Please explain whether the new and modified pipe stress analyses contain any snubbers (including deleted or added snubber(s)) and the effect of the LAR implementation on the snubber(s) hot and cold settings and Snubber Inservice Examination and Testing Program.

b. Please clarify whether the results of the new and modified pipe stress analyses continue to meet the applicable ASME Section III Class 2 piping design requirements.

SNC Response to NRC EMIB-RAI-12:

a. No snubbers were added nor removed due to implementation of this LAR. Also, snubber loadings on existing snubbers were not impacted due to this LAR. The LAR implementation will have no impact on snubber hot and cold settings nor the Snubber Inservice Examination and Testing Program because the effect of the new actuators on the pipe support loads is localized and there are no snubbers on the sections of piping being modified.

b. After implementation of this LAR, pipe stresses will remain within the applicable ASME Section III Class 2 design requirements.

NRC EMIB-RAI-13:

As stated in Section 3.2 of the LAR, the licensee performed pipe stress analyses for the new and modified main steam line. The licensee stated that both before and after MSIV actuator replacement, stresses in this section of piping are sufficiently low that, with other manufacturing restrictions (material grade and inspections, etc.), the piping remains exempt from the requirements for pipe break postulation (i.e., the no-break zone piping). In Section 3.4, “Justification of Single MSIV Design,” Item “Discussion,” the licensee also stated that the no-break zone piping is designed to meet the NRC Branch Technical Position MEB 3-1 staff’s guidelines so that the piping failures need not be postulated.

a. Please clarify whether the scope of the no-break zone piping identified in the Vogtle UFSAR Section 3.6., “Postulated Piping Failures in Fluid Systems Inside and Outside Containment,” would be affected by this LAR implementation. If yes, the applicable UFSAR sections would need to be updated accordingly.

b. Please clarify whether the design provisions and the inservice examination requirements for the no-break zone piping within the scope of this requested LAR would be consistent with those applicable design criteria and the augmented inservice examination requirements set forth in the Vogtle UFSAR Section 3.6.1 and Table 3.6.1-3, “Design Comparison to NRC Branch Technical Position MEB 3-1.”

SNC Response to NRC EMIB-RAI-13:

a. Changes due to implementation of this LAR have no impact on the extent of no-break zone piping identified in Section 3.6 of the FSAR. The boundaries of the no-break zone piping remain as described and no change to the no-break zone discussion is needed.

b. Design margins for the main steam line (MSL) piping continue to meet the UFSAR requirements after implementation of the actuator replacement. Further, the configuration changes required do not impact accessibility for inspections of the MSL piping including valves and/or supports, etc. Thus, the design criteria and the augmented inservice examination requirements set forth in the VEGP UFSAR Section 3.6.1 and Table 3.6.1-3 are unaffected by this change.

Vogtle Electric Generating Plant – Units 1 and 2
Response to Request for Additional Information Regarding License Amendment Request to Revise Technical Specification 3.7.2 Limiting Condition for Operation to Remove One Main Steam Isolation Valve System

Attachment

Westinghouse Letter GP-20049 to SNC

Response to Request for Additional Information on the Steam Generator Tube Rupture Analysis for the Vogtle Main Steam Isolation Valve Technical Specification Revision

REFERENCES

1. "Request for Additional Information - Vogtle, Units 1 and 2, TS 3.7.2 LAR (EPID: L-2021-LLA-0178)" Email from John Lamb. January 2022. ADAMS Accession No. ML22026A394.
2. GP-19977, "Transmittal of LTR-CRA-21-49, Revision 1 and LTR-LIS-21-102, Revision 1, "August 2021.
3. NL-21-0845, "License Amendment Request: Revise Technical Specification 3.7.2 Limiting Condition for Operation to Remove One Main Steam Isolation Valve System," September 2021. ADAMS Accession No. ML21274A073.
4. Vogtle FSAR Section 15.6.3, Revision 23, "Steam Generator Tube Failure," March 2021.

INTRODUCTION

Per Reference 1, the United States Nuclear Regulatory Commission (US NRC) has issued the following request for additional information (RAI) related to the Vogtle Main Steam Isolation Valve (MSIV) Technical Specification Revision project and the associated license amendment request (LAR), Reference 3.

> *Background:*
>
> *In Section 3.3 of the LAR, under the title "SGTR [Steam Generator Tube Rupture] Transient Response and Margin to Overfill", the licensee states that in response to Westinghouse Nuclear Safety Advisory Letter (NSAL)-06-15 an audit was conducted. The audit has found that "Additionally, the analysis documented that the SGTR mass releases associated with the single failure MSIV scenario were non-limiting with respect to input to the SGTR offsite dose consequence analysis"*
>
> *In discussion of SGTR Offsite Dose Consequences, the results of this audit are relied upon to state that "the branch line steam flow (both instantaneous flow and integrated flow) resulting from a single failure of an MSIV is less than that from a single failure due to a loss of control room control of an ARV [Atmospheric Relief Valve] on the faulted steam generator.", and conclude "Therefore, the offsite dose consequences currently documented in UFSAR Section 15.6.3 resulting from a SGTR event remain bounding."*
>
> ***ARCB-RAI-8***
>
> *Please provide the audit report which addresses Westinghouse Nuclear Safety Advisory Letter (NSAL)-06-15, or a summary of the report which addresses SGTR offsite dose consequences and the bounding assumptions which supports the above conclusion.*

The Westinghouse suggested response is provided below. Information related to the Steam Generator Tube Rupture (SGTR) analysis and the continued steam flow from a failed-open MSIV is taken from Reference 2. The current SGTR section of the Vogtle FSAR is Reference 4.

SUGGESTED RESPONSE

Clarifications related to ARCB-RAI-8:

The following provides clarifications to Section 3.3 of the LAR text for the SGTR MTO and Dose Consequences sections, to ensure consistency with wording contained in FSAR Section 15.6.3:

SGTR Transient Response and Margin to Overfill

In 2006, Westinghouse issued Nuclear Safety Advisory Letter (NSAL)-06-15 advising plants with a single MSIV per steam line that they may need to consider the impact of branch line steam flows downstream of the MSIVs in a single failure MSIV scenario for a SGTR event. An audit of the main steam system was performed to identify the magnitude of branch line steam flows downstream of the MSIVs. The audit documented an analysis of a single failure of an MSIV for the SGTR MTO event in accordance with the approved methodology and consistent with the analysis discussed in UFSAR Section 15.6.3. The results of this analysis indicate the single failure MSIV is non-limiting (more margin to overfill) compared to the current AOR that assumes a loss of control room control of ~~an~~ atmospheric relief valve (ARV) on the ~~faulted~~ steam generator. Additionally, the analysis documented that the SGTR mass releases associated with the single failure MSIV scenario were non-limiting with respect to input to the SGTR offsite dose consequence analysis

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SGTR Offsite Dose Consequences

As discussed above, the branch line steam flow (both instantaneous flow and integrated flow) resulting from a single failure of an MSIV is less than that from a single failure due to a ~~loss of control room control of an~~ ARV on the faulted steam generator. Therefore, the offsite dose consequences currently documented in UFSAR Section 15.6.3 resulting from a SGTR event remain bounding.

failed-open

Response to ARCB-RAI-8:

The SGTR input to dose analysis and subsequent dose analysis are described in FSAR Section 15.6.3. With respect to addressing the MSIV failure-to-close, there are two significant assumptions that relate to the SGTR analysis. The first is that the outboard valve (former MSIV) retains the ability to be closed manually. The second is that, in the event of the inboard MSIV failure-to-close remotely, the outboard valve will be locally manually closed within 16 minutes after the attempt to isolate the ruptured SG MSIV.

The most limiting single failure with respect to the dose analysis is a failed open ARV on the ruptured SG. The ARV capacity assumed for the input to dose analysis is 918,900 lbm/hr @ 1200 psia (255 lbm/sec – Note that this capacity is not identified in the FSAR but the resulting flow rate out the valve can be seen in FSAR Figure 15.6.3-10). Failure of this ARV causes an uncontrolled depressurization of the ruptured SG, which increases primary to secondary break flow and the steam release to the atmosphere. The lower secondary pressure also results in a higher break flow flashing fraction. In addition, the failed ARV temporarily nullifies the primary strategy of depressurizing the RCS to terminate the break flow as pressure in the ruptured SG remains below that in the primary system until the failed open ARV is isolated and recovery actions completed. The ARV is assumed to fail open when the ruptured SG MSIV is closed to isolate the ruptured SG from the intact SGs. From FSAR Table 15.6.3-2, the ruptured SG ARV fails open at 1202 seconds. The analysis assumes the operators isolate the failed-open ARV 16 minutes after it fails open. From FSAR Table 15.6.3-2, the ruptured SG ARV block valve is closed at 2162 seconds. The operators then begin the RCS cooldown 12 minutes after the ruptured SG ARV block valve is closed. From FSAR Table 15.6.3-2, the RCS cooldown begins at 2882 seconds.

The dominant SGTR dose contributors are ruptured SG steam releases and post-trip flashed break flow. From FSAR Table 15.6.3-3, the ruptured SG releases an integrated flow of 157,000 lbm of steam to the atmosphere in the first 2 hours of the event. From FSAR Figure 15.6.3-10, it is apparent the ruptured SG steam releases are dominated by the failed-open ARV. The outboard valve will be manually closed within 16 minutes after the first attempt to isolate the ruptured SG MSIV; this is the same time as was assumed for closing the ARV block valve in the failed-open ARV scenario. The continuing steam flow rate that would result from a failure-to-close of a ruptured SG MSIV due to un-

isolated downstream flow paths (164.2 lbm/sec – See below for the basis for this flow rate) is bounded by that of an open ARV (255 lbm/sec). Thus, the failed-open ARV scenario bounds the ruptured SG MSIV failure to close scenario with respect to ruptured SG steam releases.

From FSAR Figure 15.6.3-13, the break flow flashing fraction is decreasing prior to the ruptured SG ARV failing open at 1202 seconds. After the ruptured SG ARV fails open, the ruptured SG pressure drops (as seen in FSAR Figure 15.6.3-3). As a result, the flashing rapidly increases to a post-trip maximum and remains near that maximum until the ruptured SG ARV block valve is closed at 2162 seconds. As the ruptured SG pressure recovers, the flashing fraction decreases. Break flow flashing is terminated after the cooldown begins at 2882 seconds. From FSAR Figure 15.6.3-13, it is apparent that the high flashing fraction during the period that the ruptured SG ARV is failed open dominates the post-trip flashed break flow. The outboard valve will be manually closed within 16 minutes after the attempt to isolate the ruptured SG MSIV; this is the same time as was assumed for closing the ARV block valve in the failed-open ARV scenario. The continuing steam flow rate that would result from a failure-to-close of a ruptured SG MSIV (164.2 lbm/sec) is bounded by that of an open ARV (255 lbm/sec). Thus, the ruptured SG pressure response, and the resultant effects on the flashing fraction would not be more limiting than the failed-open ARV scenario. Thus, the failed-open ARV scenario bounds the ruptured SG MSIV failure to close scenario with respect to post-trip flashed break flow.

The failed-open ARV scenario bounds the ruptured SG MSIV failure to close scenario with respect to the dominant SGTR dose contributors. Thus, the failed-open ARV scenario remains the limiting single failure for input to dose and thus, the SGTR dose analysis is not impacted by the planned removal of automatic control of the outboard valves.

Basis for Failed-Open MSIV Continuing Steam Flow Rate

The basis for the failed-open MSIV continued steam flow rate of 164.2 lbm/sec used in the evaluation of the potential SGTR dose impacts of the failure is outlined below from an audit of the main steam system and summarized in Table 1.

There are several paths of continuing steam flow (i.e. leakage) in the main steam system that are considered in the MSIV failure-to-close scenario when a loss of off-site power occurs coincidently. The flow calculations conservatively assume the maximum fail-open valve position at t=0 and do not credit the time for the instrument air system pressure to degrade after the compressors are lost. The individual contributors to the total leakage are listed as follows:

- Un-isolated Steam Drain Orifices
    - Main steam system: The sum of the miscellaneous unisolated steam drains, conservatively assuming liquid phase (maximum condensation) is approximately 5.88 lbm/s at 1100 psia. This pressure corresponds to RCS temperature at no-load Tavg (557°F) which is just below the SG PORV setpoint. This flow rate is conservatively biased high.
    - High pressure supply of the main feedwater (MFW) pump turbines has two drains which can only be isolated locally. The flow rate for these drains is approximately 0.14 lbm/s for liquid phase flow.

The total leakage maximum expected from the unisolated steam drains is therefore: 5.88 lbm/s + 0.14 lbm/s = 6.02 or approximately **6 lbm/s.**

- Air Operated Valves in MFW Pump Turbine Branch

Two air operated valves in the main feed pump turbine inlets are noted to fail open with loss of instrument air. The valves themselves are a two-inch control valve per the system diagram, supplied and discharged through one inch schedule 160 piping. The flow rate for each of these at 1200 psia (the assumed reference pressure for the SG PORV) is estimated by assuming critical flow through a one-inch diameter orifice using the Henry-Fauske relationship.

Donor pressure: 1200 psia

Stagnation enthalpy (at 1200 psia dry-saturated steam): 1184.8 btu/lbm

The corresponding mass flux from the H-F relationship is: 2430.7 lbm/s-ft^2

Assumed flow area based on 1 inch dia: 0.0055 ft^2

The mass flow rate is therefore: **13.4 lbm/s** per valve.

- Air Operated Steam Supply Valve to the Gland Seal System

There is a three-inch pressure regulating supply valve for the gland seal system noted to fail open with loss of instrument air due to loss of off-site power. These valves have a 2-5/16 inch (2.3125 inch) port size. The flow rate is estimated at 1200 psia by assuming critical flow through a 2.3125 inch diameter orifice using the Henry-Fauske relationship as follows:

Donor pressure: 1200 psia (x=1.0)

Stagnation enthalpy (at 1200 psia dry-saturated steam): 1184.8 btu/lbm

The corresponding mass flux from the H-F relationship is: 2430.7 lbm/s-ft^2

Flow area for 2.3125 inch dia: 0.0292 ft^2

The mass flow rate is therefore: **71 lbm/s.** Note that this conservatively neglects downstream losses in the piping and the turbine packing glands.

- Auxiliary Steam

Although infrequently used, the auxiliary steam supply to the neighboring unit is a possibility that is conservatively included. The flow rates are based upon the pressure control valves at the receiving unit for the main supply and the trim. Since these valves are assumed to be in normal, pressure regulating mode, no correction for inlet pressure is necessary.

The auxiliary steam main valve capacity is 172,265 lbm/hr = **47.8 lbm/s** and the auxiliary steam trim valve capacity is 10,000 lbm/ hr = **2.8 lbm/s.**

- Steam Jet Air Ejectors

There is one set of steam driven air ejectors in service at any given time. These ejectors have a motive steam flow rate of 3500 lbm/hr or ~ **1 lbm/s.**

- Main Condenser Steam Sparger

Although infrequently used, steam sparging in the main condenser can be in operation and is conservatively included. The flow rate is 31,841 lbm/hr = **8.8 lbm/s.**

- Other

Other valves and components of the main steam system that were part of the review but determined to not present a source of significant continued steam flow, or to be closed, included steam sampling lines, low point drain motor operated valves, low point drain orifices, turbine stop valves, steam dump valves, and auxiliary steam system motor operated valves.

Table 1 – Summary of Failed-Open MSIV Continuing Steam Flows

Component	Flow	Notes
Drain Orifices	6 lbm/s	Liquid flow rate conservatively assumed
Drain Valves in Main Feed Pump Turbine Supply	13.4 lbm/s per valve (2x)	Failed open flow
Gland Seal System	71 lbm/s	Failed open flow
Aux Steam – Main Supply	47.8 lbm/s	Normal supply
Aux Steam – Trim Supply	2.8 lbm/s	Normal supply
Steam Driven Air Ejectors	1 lbm/s	Normal supply
Main Condenser Hotwell Steam Sparger	8.8 lbm/s	Normal supply
Total	**164.2 lbm/s**	