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10 CFR 50.90

W3F1-2018-0014

April 12, 2018

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Subject: License Amendment Request for Use of the TRANFLOW code for determining the Pressure Drops Across the Steam Generator Secondary Side Internal Components
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

Dear Sir or Madam:

Pursuant to 10 CFR 50.90, Entergy Operations, Inc. (Entergy) is submitting a request for approval for use of the TRANFLOW code for determining the pressure drops across the steam generator secondary side internal components for Waterford Steam Electric Station, Unit 3 (Waterford 3). The TRANFLOW code was developed by Westinghouse.

The proposed change has been evaluated in accordance with 10 CFR 50.91(a)(1) using the criteria in 10 CFR 50.92(c); it was determined that the changes involve no significant hazards consideration. The bases for these determinations are included in the Enclosure.

This letter contains no new commitments.

Entergy requests approval of the proposed license amendment by April 12, 2019.

If you have any questions or require additional information, please contact John Jarrell, Regulatory Assurance Manager, at 504-739-6685.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 12, 2018.

Sincerely,

JCD/JPJ/mmz

Enclosure: Evaluation of the Proposed Change

cc: Mr. Kriss Kennedy, Regional Administrator
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Enclosure to

W3F1-2018-0014

Waterford Steam Electric Station, Unit 3

Evaluation of the Proposed Change

(13 Pages)

Waterford Steam Electric Station, Unit 3
Evaluation of the Proposed Change

Subject: License Amendment Request for Use of the TRANFLOW code for determining the Pressure Drops Across the Steam Generator Secondary Side Internal Components

1. SUMMARY DESCRIPTION

Entergy Operations, Inc. (Entergy) is requesting NRC Staff review and approval of the use of the computer code, TRANFLOW, to calculate internal loads in the Waterford Steam Electric Station, Unit 3 (Waterford 3) replacement steam generators (RSGs) during a postulated steam line break (SLB).

This request for a change in the evaluation method to the use of the computer code TRANFLOW to calculate steam generator (SG) internal pressure drops across secondary side components is supported by Westinghouse Letter No. LTR-SGMP-17-107 P-Attachment, "Acceptability of the TRANFLOW Computer Code for Steam Line Break Internal Pressure Loads for the Waterford 3 Replacement Steam Generators," February 2018 (Reference 1).

TRANFLOW is the workstation version of TRANFLO, a computer code originally developed for Westinghouse in the early 1970s to determine thermal-hydraulic conditions in SGs during various transients to assist in the design and structural analyses of SGs. TRANFLOW/TRANFLO has been benchmarked against CEFLASH-4A, CEFLASH-4B, RELAP5, NOTRUMP, and CATHARE 2. Details are provided below.

2. DETAILED DESCRIPTION

2.1 <u>Background</u>

The Waterford 3 RSGs were placed in service in 2013 during restart following Refueling Outage 18. As identified in Reference 2, Entergy approved 10 CFR 50.59 Evaluation 2012-03 which evaluated the incorporation of five computer codes into the Updated Final Safety Analysis Report (UFSAR) that were used to determine the structural integrity of the Waterford 3 RSGs. One of the codes used was the TRANFLOW code. This computer code was used instead of the NRC approved computer code CEFLASH-4A as discussed in the UFSAR to determine the pressure drops across the RSG secondary side internal components. The TRANFLOW code has not been approved for use by Waterford 3 for this application. As a result, this issue was entered into the Waterford 3 Corrective Action Program.

2.2 <u>Current Licensing Basis</u>

Subsection 3.9.1.2.2.1.28 of the Waterford 3 UFSAR states that the computer code CEFLASH-4A was used to determine SG internal loads during a postulated steam line break (SLB) event in the design of the Waterford 3 original steam generators (OSGs). Instead, it has since been identified that conservative manual calculations, which are not described in the UFSAR, were utilized for the OSGs and not CEFLASH-4A to determine the pressure differentials across the secondary side components, (e.g., tube support plates, etc.) (Reference 1). As noted above, the computer code TRANFLOW is used for the RSGs.

2.3 Reason for the Proposed Change

The change in method of evaluation from the previous method to the use of TRANFLOW for the RSGs represents a departure from an approved method of evaluation because its use has not been previously approved by the NRC Staff for use to determine SG secondary side pressure drops.

2.4 Description of the Proposed Change

The proposed license amendment will incorporate into the Waterford 3 current licensing basis the use of the computer code, TRANFLOW, to calculate pressure drops in the secondary side of the RSGs during a postulated SLB event.

It is planned to delete UFSAR subsection 3.9.1.2.2.1.28, CEFLASH-4A which reads:

> "This program is used to calculate transient conditions resulting from a flow line rupture in a water/steam flow system. The program is used to calculate SG internal loadings following a postulated main steam line break.
>
> This program is used in a steam line break accident structural analysis."

The use of TRANFLOW was previously inserted into the Waterford 3 UFSAR in subsection 3.9.1.2.2.1.35, TRANFLOW. This subsection will remain as is. This subsection reads:

> "TRANFLOW is a code that solves the mass, energy and momentum conservation equations for transient thermal-hydraulic phenomena using a fully implicit backward differencing technique.
>
> The code was used for Waterford 3 replacement SG analyses for determining the detailed distribution of fluid temperatures and heat transfer coefficients for SG secondary side stress analyses and the steam line break accident, determining the pressure drops across the SG secondary side internal components."

3. TECHNICAL EVALUATION

Although UFSAR subsection 3.9.1.2.2.1.28 discusses the use of CEFLASH-4A, research has determined that in the original SG (OSG) analysis, manual calculations were used to determine the SLB internal pressure differential loads for the structural analysis (Reference 1). For each component, the load at 100% power is obtained by multiplying the differential pressure (ΔP) by the solid metal area of the component. The total load is then calculated by adding the individual component loads. The total load at four (4) times the 100% power velocity is proportional to the square of the velocity. Therefore, the total pipe rupture load is sixteen (16) times the load at 100% power conditions. The use of manual calculations to calculate SLB internal differential loads for the OSG structural analyses is not described in the Waterford 3 UFSAR.

The TRANFLOW computer code was used for the RSG thermal-hydraulic analyses. As described in Reference 1, TRANFLOW is a one-dimensional, two-phase, thermal-hydraulic code used for calculating the thermodynamic and fluid (hydraulic) behavior of SGs subject to prescribed transient conditions. The code calculates pressures, temperatures, flow rates, and heat transfer coefficients which are used as inputs for structural analyses. TRANFLOW uses an elemental volume approach in which the spatial solution is achieved by dividing the system into a discrete number of control volumes having uniform thermal and hydraulic conditions. Individual control volumes, or nodes, are interlinked by flow connectors, which are defined by flow area, diameter, length, and hydraulic resistance coefficients. Metal nodes are modeled in TRANFLOW to allow thermal energy storage and heat transfer to the surrounding fluid. Metal nodes are used to represent the SG's tubes, shell, and tubesheet. The conservation of mass, momentum, and energy equations are solved in conjunction with boundary conditions specified as functions of time. These boundary conditions include time histories of primary fluid pressure, temperature, and flow rate, in addition to steam flow rate and feedwater temperature and flow rate.

TRANFLOW accesses the American Society of Mechanical Engineers (ASME) steam tables for thermodynamic properties and uses a number of empirical heat transfer and fluid flow correlations. Heat transfer between connected fluid nodes and between connected metal and fluid nodes is classified and calculated with the aid of various heat transfer correlations for forced and natural convection, nucleate, transition, and film boiling, and conduction. At each time step, the flow in each connector is compared and limited to a critical or maximum flow for that connector. For subcooled flow, the Zaloudek correlation is used; for two-phase saturated flow, the Moody correlation defines the critical flow. Effects of velocity differences in two-phase flows are accounted for using a drift flux model formulation.

A detailed comparison of the SLB analyses of the Waterford 3 OSGs and RSGs reveals that the main difference in the analyses lies in the computing technology that was available at the time the calculations were performed. For the OSGs, in the early to mid-1970s, the analyses were performed either manually or by using relatively simple computer programs. For the RSGs, in the 2009-2010 timeframe, the analyses were performed using the more-detailed ANSYS®[1] and TRANFLOW computer codes, which require a large amount of computer memory and Central Processing Unit resources not available during the OSG design period.

A comparison of SLB transient pressure differentials internal to the OSG/RSGs using manual calculations and TRANFLOW are provided in Table 1 (Attachment 1) (Reference 1). As presented in Table 1, flow loads with the OSG design methodology (16 times steady state ΔPs) are higher for all internal components except for the secondary separators (steam dryers). The dryers are located nearest the break location (steam outlet nozzle) and therefore experience initial and more rapid depressurization. Note that as reported in the analytical report for the OSGs (CENC-1246, Reference 17) the structural and vibration evaluation of the steam dryer support beams and wall brackets had significant margins compared to the ASME Code, Section III allowable (Reference 1). Also note that the steam dryers do not constitute a primary fluid (reactor coolant) pressure boundary.

Conservative results are obtained using 16 times steady state normal operating pressure differential compared to results using TRANFLOW that are similar to NRC approved code(s) for calculating SG internal pressure loads during a postulated SLB (CEFLASH-4A). This is discussed below.

As discussed below, the TRANFLOW results for input to calculating SLB loads across the SG secondary side components have been shown to be technically equivalent to the results from

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[1] *ANSYS is a registered trademark of ANSYS, Inc., in the United States and/or other countries. Other names may be trademarks of their respective owners.*

the NRC-approved Computer Codes CEFLASH-4A and CEFLASH-4B. Therefore, regardless of the fact that the manually calculated pressure differentials are conservative for all components except the steam dryers, the use of TRANFLOW does not result in a significant reduction in margin of safety. These loads are determined to be unnecessarily conservative for use in the ASME Code Section III analyses, etc.

Reference 1 describes TRANFLOW as a computer code that solves the mass, energy, and momentum conservation equations for transient thermal-hydraulic phenomena using a fully implicit backward differencing technique. The TRANFLOW computer code was used for the following purposes for the Waterford 3 RSG analyses:

1. Determining the detailed distribution of fluid temperatures and heat transfer coefficients for SG secondary side stress analyses.

2. For the SLB accident, determining the pressure drops across SG secondary side internal components.

As noted in Section 4. below, review of the Waterford 3 UFSAR confirmed that there is no discussion of methodologies used to determine the parameters identified in Item 1 above.

Regarding Item 2, as noted in Section 2.2, it has been determined that the Waterford 3 UFSAR subsection 3.9.1.2.2.1.28, "CEFLASH-4A," incorrectly states that the program is used to calculate SG internal loadings following a postulated main SLB, and is used in the SLB accident structural analysis. In the OSG analysis, as described above, manual calculations were used to determine the SLB internal loads for the ASME Code Section III analysis. For the RSGs at Waterford 3, the computer code TRANFLOW was used to calculate SG internal loads during a postulated SLB.

3.1 Benchmarks

Although TRANFLOW has not been previously approved by the NRC for determining loads on SG internals during a SLB, it has been shown to produce results comparable to NRC approved codes that were used for that purpose.

3.1.1 TRANFLO/RELAP5

As described in Reference 8, TRANFLOW is the workstation version of TRANFLO, a computer code originally developed for Westinghouse in the early 1970s to determine thermal-hydraulic conditions in the SGs during various transients to assist in the design and structural analyses of SGs. Westinghouse used TRANFLO to predict the pressure drops across the SG tube support plates in a utility's license amendment request to increase the lower limit of the voltage repair criteria for the SG tubes. During review, the NRC requested that the analyses be performed using the RELAP5 computer code since TRANFLO had been approved for use in calculating mass and energy release to the containment following a SLB, but not for detailed modeling of internal thermal-hydraulic conditions in a SG due to blowdown transients. The analyses were rerun using RELAP5. RELAP5 has been approved for use in calculating the mass and energy release analysis (Standard Review Plan 6.2.1.3, Reference 9).

Subsequently, Westinghouse performed comparisons of TRANFLO results to those of RELAP5 which, as indicated in the preceding paragraph, the NRC considered acceptable for calculating blowdown loads. Reference 1 concludes that, based on detailed comparison of RELAP5 and TRANFLO/TRANFLOW, the two computer codes should be considered technically equivalent.

3.1.2 CEFLASH-4A and CEFLASH-4B

Reference 1 includes a comparison of TRANFLOW results to those of CEFLASH-4B, and concludes that similar results were obtained by the two codes for a secondary side depressurization of a SG. The comparison shows good agreement between the two codes during a rapid secondary side depressurization of a preheat type SG. TRANFLOW comparisons to CEFLASH-4B results confirm that TRANFLOW is applicable for different types of SG designs (e.g., pre-heat and feedring type SGs).

The following paragraphs explain why it can be concluded that TRANFLOW results will also be similar to results from CEFLASH-4A.

CEFLASH-4A is an NRC-approved code for analyzing the reactor coolant system (RCS) blowdown transient to provide thermal hydraulic data for use in Appendix K large break loss of coolant accident (LOCA) analyses. Analyzing RCS blowdown and decompression over the entire duration of an Appendix K large break LOCA analysis is not necessary to develop thermal hydraulic data for use in blowdown loads analyses. Only the hydrodynamics of the brief, initial phase of the transient are relevant (Reference 1).

For analyzing blowdown loads, CEFLASH-4A was modified to produce a code version designated as CEFLASH-4B. The modifications included removing CEFLASH-4A features that do not influence the course of the early decompression phase and adding nodes and volumes that expand the amount of spatial detail.

Combustion Engineering document CENPD-252-P-A (Reference 4) is the NRC approved topical report for CEFLASH-4B. The report documents the results of a comparison of predicted CEFLASH-4A and CEFLASH-4B blowdown hydrodynamics during the brief, initial interval pertinent to developing data for blowdown loads analyses. CENPD-252-P-A states that the excellent agreement between the two codes' predictions confirms the similarity of CEFLASH-4A and CEFLASH-4B for blowdown loads analyses. As a result, it can be reasonably concluded that TRANFLOW produces results comparable to those of CEFLASH-4A.

3.1.3 NOTRUMP

SG models using the NOTRUMP computer code were first used in simulations of the loss of normal feedwater (LONF) and feedwater line break (FWLB) transients in the late 1970s. The Westinghouse methodology for analyzing FWLB accidents (NOTRUMP) has been accepted by the NRC on many plant-specific applications. In the early 1980s, NOTRUMP capabilities were expanded to include small break LOCAs by integrating additional models for break flow, drift flux, core and reactor coolant pumps. Topical report WCAP-10079-P-A was submitted to the NRC and in May of 1985, the NRC approved NOTRUMP for calculating small break LOCA events (Reference 1).

The TRANFLOW calculated pressure and SG level responses compare favorably with the NOTRUMP calculations for the LONF event, defined as a complete loss of main feedwater flow while the reactor is operating at the maximum power level. This comparison demonstrates that TRANFLOW is fully capable of replicating the physics of level behavior during the LONF transient (Appendix A of Reference 1).

In addition to comparison to code predictions, TRANFLO verification included the comparison of TRANFLO results to test data and field data as summarized in Appendix A of Reference 1.

Qualification of code capability is also obtained by means of numerous predictions of experimental blowdown. TRANFLO has been used to predict the secondary side pressures and mass flow rates during vessel blowdown transients. Included are experiments B53B done at Battelle Northwest, Experiments 7, 12, and 14 done at Frankfurt/Main, and several series of blowdown tests conducted by CISE as part of the CIRENE-3 program. TRANFLO results were generally in good agreement with, or conservative with respect to, test data.

3.1.4 CATHARE 2

In a paper presented at the 16th International Conference on Nuclear Engineering (ICONE16) in Orlando, Florida, USA, Vergnault, et. al., of the French Institute for Radiological Protection and Nuclear Safety (IRSN) discussed the dynamic stability characteristics of SGs installed at the Cruas nuclear power facility subjected to various levels of tube support plate (TSP) blockage. In the IRSN study, a stand-alone model of the SG was evaluated for dynamic stability using the CATHARE 2 computer code. The work presented in this study shows that CATHARE 2 and TRANFLOW yield similar results, verifying that TRANFLOW correctly transmits dynamic phenomena and is qualified to simulate dynamic stability transients.

3.2 Quality Assurance

To further demonstrate TRANFLO's suitability for determining thermal-hydraulic conditions in the SGs during various transients, the code has been developed and maintained under the Westinghouse Quality Assurance (QA) Program which is in compliance with the design control measures, including verification, stated in 10 CFR Part 50, Appendix B. The NRC has reviewed and approved the Westinghouse QA Program. Under the Westinghouse QA Program, TRANFLO is treated in the same manner as other computer programs used by Westinghouse in design and safety analyses, including programs that have been submitted to and approved by the NRC for use in safety analyses.

Based on the above, TRANFLOW uses a variety of well-known mathematical methods and empirical correlations in order to provide accurate solutions to thermal-hydraulic design problems using standard SG parameters and assumptions. TRANFLOW has been extensively validated and qualified by a variety of sources and methods. It has been shown that the results produced using TRANFLOW are acceptable when making engineering justifications for the design of the SG components. Moreover, TRANFLOW has gone through the same qualification process under the same NRC-approved Quality Assurance Program as have codes that have been approved by the NRC; therefore, it is acceptable for use to determine SG internal loads during a postulated SLB.

4. REGULATORY EVALUATION

4.1 Applicable Regulatory Requirements/Criteria

General Design Criterion 14 requires that the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture. RCS components are designed in accordance with ASME Code, Section III, Division 1.

10 CFR Part 50, Appendix B, Criterion III. Design Control, requires the following: The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. The verifying or checking process shall be performed by individuals or groups other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualifications testing of a prototype unit under the most adverse design conditions. Design control measures shall be applied to items such as the following: reactor physics, stress, thermal, hydraulic, and accident analyses; compatibility of materials; accessibility for inservice inspection, maintenance, and repair; and delineation of acceptance criteria for inspections and tests.

The data from TRANFLOW is used to evaluate loss of coolant accidents (LOCA). NRC guidelines for mass and energy release analysis for postulated LOCAs are provided by Standard Review Plan (SRP) 6.2.1.3 (Reference 9). Multiple methods and computer models are listed for calculating mass and energy releases for design basis calculations including RELAP5 and CEFLASH-4A. The SRP establishes that other methods are acceptable if they are found to be conservative for these calculations.

As stated in subsection 5.4.2.1 of the Waterford 3 UFSAR (Reference 5), the SGs are designed so that the ASME Code, Section III allowable stress limits are not exceeded for a specified number of cycles for a set of defined reactor coolant system transients. This method of evaluation of the original and RSGs has been reviewed and documented to establish its past and present design basis. It has been confirmed that the only change to the method of evaluation (i.e., ASME Code Section III analysis) as a result of the installation of the replacement SGs is the use of TRANFLOW to calculate fluid temperatures and heat transfer coefficients in order to determine temperature profiles in the SG shell during all applicable transient conditions and to determine SLB internal pressure loads. Only a general statement is made in the UFSAR that “the steam generator assemblies are designed to withstand the blowdown forces resulting from the steam nozzle.”

As noted above, in the OSG analysis, manual calculations were used to determine the SLB internal loads for the ASME Code Section III analysis. The change in computational method used to calculate the SLB internal pressure loads used as input in the ASME Code Section III analysis is not considered to be an adverse change. As discussed in Section 3.2 above, a detailed review of the use of TRANFLOW when compared to the use of an NRC approved code, CEFLASH-4A for calculating SLB loads results in the same or equivalent SG internal loads following a postulated SLB. By comparison, the manual calculation method used for the original SGs resulted in overly conservative SLB internal pressure loads. The SG internal loads during the SLB method is not codified in Section III, and because no specific licensed code is described for this purpose in the Waterford 3 UFSAR, there is no restriction on which computational method can be used.

To demonstrate suitability for its intended purpose, TRANFLOW was developed and maintained under the Westinghouse Quality Assurance (QA) Program, which is in compliance with the design control measures, including verification, stated under 10 CFR Part 50, Appendix B. Verification of TRANFLOW has included comparison to test data, field data, manual calculations, and independent computer code prediction.

The Technical Evaluation in Section 3. above concludes that the use of the computer code, TRANFLOW, instead of manual calculations to calculate pressure drops across secondary side components in the Waterford 3 SGs is acceptable. The proposed deletion of subsection 3.9.1.2.2.1.28, CEFLASH-4A, of the Waterford 3 UFSAR will not adversely affect the ability to demonstrate that the design requirements of the reactor coolant pressure boundary are met during a postulated SLB event. As demonstrated in Reference 1, the use of the computer code, TRANFLOW, results in the calculation of internal loads during a postulated SLB event that are comparable to NRC approved codes, CEFLASH-4A, CEFLASH-4B and RELAP5.

4.2 <u>Precedent</u>

TRANFLOW is the workstation version of TRANFLO, a computer code originally developed for Westinghouse in the early 1970s to determine thermal-hydraulic conditions in the SGs during various transients to assist in the design and structural analyses of SGs. TRANFLO has been approved for use (Reference 7) for calculating mass and energy release data following a MSLB. TRANFLO has been used for mass and energy release analysis following a MSLB by other licensees (References 10 through 16). However, no precedent could be identified for the use of TRANFLO for determining the pressure drops across the steam generator secondary side internal components.

4.3 <u>No Significant Hazards Consideration Determination Analysis</u>

Entergy Operations, Inc. (Entergy) is proposing that the computer code, TRANFLOW, be the method documented in the Updated Final Safety Analysis Report (UFSAR) used to calculate secondary side internal loads in the Waterford 3 replacement steam generators during a postulated steam line break (SLB).

The proposed change does not change any plant system, structure or component, or change any plant operating parameters.

Entergy has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of Amendment," as discussed below:

1. Does the proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The proposed change from the use of manual calculations to the use of the computer code, TRANFLOW, to calculate steam generator (SG) secondary side internal loads during a postulated SLB has no effect on previously evaluated accident probabilities or consequences.

As stated in subsection 5.4.2 of the Waterford 3 UFSAR, the SGs, including the tubes, are designed for the reactor coolant system transients listed in subsection 3.9.1.1 so that allowable stress limits are not exceeded for a specific number of cycles. In addition, the SG assemblies are designed to withstand the blowdown forces resulting from the severance of the steam nozzle. The SG component is not adversely affected by the use of TRANFLOW to calculate SLB internal pressure loads instead of manual calculations as the manual calculation method of evaluation is not described in the UFSAR. The proposed use of TRANFLOW does not adversely affect the ability to demonstrate that the design requirements of the reactor coolant pressure boundary are met during a postulated SLB event and all plant conditions. TRANFLOW uses a variety of well-known mathematical methods and empirical correlations in order to provide accurate solutions to thermal-hydraulic design problems using standard SG parameters and assumptions. TRANFLOW has been extensively validated and qualified by a variety of sources and methods. The use of the computer code, TRANFLOW, results in the calculation of internal loads during a postulated SLB event that are comparable to NRC approved codes, CEFLASH-4A, 4B and RELAP5. It has been shown that the results produced using TRANFLOW are acceptable when making engineering justifications for the design of the SG components.

Based on the above, the proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No

   The proposed use of TRANFLOW to calculate SG secondary side internal loads during a postulated SLB event does not introduce any new equipment, create new failure modes for existing equipment, or create any new limiting single failures. Operation of the SGs with secondary side components that have been analyzed for the effects of SLB internal loads using TRANFLOW have been shown to maintain SG primary or secondary side pressure boundary integrity during all plant conditions.

   Therefore, based on the above, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

   Response: No

   To demonstrate suitability for its intended purpose, TRANFLOW was developed and maintained under the Westinghouse Quality Assurance (QA) Program, which is in compliance with the design control measures, including verification, stated under 10 CFR Part 50, Appendix B. Verification of TRANFLOW has included comparison to test data, field data, manual calculations, and independent computer code prediction. Westinghouse has performed a comparison of TRANFLOW results with those of the NRC approved codes CEFLASH-4A. CEFLASH-4B and RELAP5 for analyzing SG SLB internal loads which shows that the results are technically equivalent. The NEI 97-06, Rev. 3 (Reference 6) Steam Generator Structural Integrity Performance Criteria have been shown to be met during a postulated SLB with the use of the computer code, TRANFLOW, in the design of the replacement SGs (Reference 1). Meeting the NEI 97-06, Rev. 3 Structural Integrity Performance Criteria ensures that the SG tubes are capable of performing their safety related functions. SG tubes are relied on to maintain primary system pressure and temperature during all plant conditions. Additional loading conditions associated with the design basis accidents have been evaluated and it has been determined that the use of TRANFLOW would not contribute to SG tube burst or collapse. ASME Code Section III analysis stress limits continue to be met for the secondary side subcomponents (e.g., tube support plates, steam dryer support beams and wall brackets, etc.) during all plant conditions with the use of TRANFLOW and adverse interactions with SG tubing will not occur. Therefore, the proposed change does not involve a significant reduction in any margin of safety.

Based on the above, Entergy concludes that the proposed change presents no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

4.4 Conclusions

Based on the above, the use of the computer code, TRANFLOW, to calculate secondary side internal loads in the Waterford 3 RSGs during a postulated SLB is acceptable.

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission’s regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5. ENVIRONMENTAL CONSIDERATION

The proposed amendment has been evaluated for environmental considerations. The review has resulted in the determination that the proposed amendment would change requirements with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or would change an inspection or surveillance requirement. However, the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22, paragraph (b), no environmental impact statement or environmental assessment needs to be prepared in connection with the proposed amendment.

6. REFERENCES

1. Westinghouse Electric Company LTR-SGMP-17-107 P-Attachment, Revision 0, “Acceptability of the TRANFLOW Computer Code for Steam Line Break Internal Pressure Loads for the Waterford 3 Replacement Steam Generators,” February 2018.

2. NRC letter to Entergy Operations, Inc., Waterford Steam Electric Station, Unit 3, Nuclear Regulatory Commission Problem Identification and Resolution Inspection Report 05000382/2016008," January 26, 2017.

3. Waterford 3 Condition Report CR-WF3-2016-7782.

4. CENPD-252-P-A, "Blowdown Analysis Method, Method for the Analysis of Blowdown Induced Forces in a Reactor Vessel," July, 1979 (Combustion Engineering Proprietary Information).

5. Waterford Steam Electric Station, Unit 3, Updated Final Safety Analysis Report (UFSAR), Revision 310.

6. NEI 97-06, "Steam Generator Program Guidelines" Revision 3, June 2011.

7. WCAP-8859-A, "TRANFLO Steam Generator Code Description", [ADAMS Accession Number ML011970414].

8. Westinghouse Electric Company LTR-NCE-04-28, Rev. 1, "Position Paper on the Use of the TRANFLO/TRANFLOW Computer Program in Steam Generator Design Analyses.

9. Standard Review Plan 6.2.1.3 (NUREG-0800), "MASS AND ENERGY RELEASE ANALYSIS FOR POSTULATED LOSS-OF-COOLANT ACCIDENTS (LOCAs)."

10. Safety Evaluation Report for Beaver Valley Power Station, Related to Technical Specification Amendment 271, February 6, 2006, [ADAMS Accession Number ML060100325].

11. Safety Evaluation Report R.E. Ginna Nuclear Power Plant, Related to Amendment No. 95 to Renewed Facility Operating License No. DPR-18, March 16, 2006, [ADAMS Accession Number ML060600424].

12. Millstone Power Station Unit 3, License Amendment Request, "Stretch Power Uprate", July 17, 2007, [ADAMS Accession Number ML072000386].

13. Point Beach Units 1 and 2, License Amendment, "Change of Containment Maximum Pressure TS Limit from 3 PSIG to 2 PSIG", November 26, 2002, [ADAMS Accession Number ML023080127].

14. Safety Evaluation Report Prairie Island Units 1 and 2, Related to Technical Specification Amendment 181, July 1, 2009, [ADAMS Accession Number ML091460809].

15. Safety Evaluation Report Salem Nuclear Generating Station, Units 1 and 2, Related to License Amendment 287 and 270, February 27, 2008, [ADAMS Accession Number ML080220414].

16. Turkey Point Units 3 and 4, License Amendment, "Request for Extended Power Uprate, Attachment 1; Descriptions and Technical Justifications for the Renewed Operating License", December 14, 2010, [ADAMS Accession Number ML103560174].

17. Report Number CENC-1246, “Analytical Report for Louisiana Waterford Unit No. 3 Steam Generator,” Combustion Engineering, Inc. Nuclear Power Systems Component Engineering C-E Contract No. 74270, September 1975 (Combustion Engineering Proprietary Information).

Attachment 1: Table 1. Comparison of SLB Pressure Differentials Across the SG Secondary Side Internal Components Calculated by Manual Calculations for the OSGs and TRANFLOW for the RSGs

Enclosure Attachment 1 to

W3F1-2018-0014

Table 1

Comparison of SLB Pressure Differentials Across the SG Secondary Side Internal Components Calculated by Manual Calculations for the OSGs and TRANFLOW for the RSGs

(1 Page)

Table 1

Comparison of SLB Pressure Differentials Across the SG Secondary Side Internal Components Calculated by Manual Calculations for the OSGs and TRANFLOW for the RSGs

Component	Steady State ΔP(1)	OSG Design Basis 16 * Steady State ΔP (Manual Calculations)	Max. ΔP - SLB (TRANFLOW)
	(psi)	(psi)	(psi)
TSP - A (Cold Leg Side)	0.082	1.31	-0.65
TSP - A (Hot Leg Side)			-0.30
TSP - B	0.123	1.97	-0.06
TSP - C	0.198	3.17	0.04
TSP - D	0.282	4.51	0.11
TSP - E	0.359	5.74	0.21
TSP - F	0.436	6.98	0.33
TSP - G	0.515	8.24	0.51
TSP - H	0.619	9.90	0.75
U-Bend - Cross Flow	0.689	11.02	-
Wrapper Barrel	-	-	7.53
Wrapper Transition Cone	-	-	8.49
Lower Deck Plate	1.371	21.94	17.73
Mid Deck Plate	-	-	3.47
Secondary Separators (Dryers)	0.136	2.18	7.51
Primary Separators (Swirl Vane Blades)	1.155	18.48	6.47

Notes:

1. BE Fouling, 0% Plugging, 100% Power