ENCLOSURE 1

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Implementation of LANCR02/PANAC11 in Downstream Methods
Licensing Topical Report
NEDO-33935 Supplement 1, Revision 0, October 2022

Non-Proprietary Information

Global Nuclear Fuel

3901 Castle Hayne Road
Wilmington, NC 28401

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IMPLEMENTATION OF LANCR02/PANAC11 IN DOWNSTREAM METHODS

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Revision Summary

Rev. #	Section Modified	Revision Summary
0	N/A	Initial Release

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Abstract

The use of the LANCR02/PANAC11 (L02/P11) methodology for core design and monitoring purposes requires the implementation and use of consistent models in supporting downstream codes and methodologies such as those used for stability, anticipated operational occurrence (AOO) and anticipated transient without scram (ATWS) transient analyses, and emergency core cooling / loss-of-coolant accident evaluations (ECCS/LOCA). The purpose of this Licensing Topical Report (LTR) is to establish an approved process that will subsequently be followed for this implementation.

To fulfill its purpose, this LTR:

1. Identifies the scope of changes to downstream methods driven by the L02/P11 methodology,

2. Identifies the downstream methods in which implementation or consistency is necessary,

3. Describes the implementation strategy for these changes,

4. Describes the process for evaluating and documenting the significance of the changes resulting from the implementation of the method changes, and

5. Documents the necessary changes to GESTAR II.

1 Introduction

1.1 Overview

Global Nuclear Fuel (GNF) has combined LANCR02 (L02) lattice physics with the PANAC11 (P11) core simulator for the evaluation of Boiling Water Reactors (BWRs) [1, 2, 3]. This combined lattice physics/core simulator package (L02/P11) will be used for the same general application purpose as the existing licensed nuclear methodology package TGBLA06 / PANAC11 (T6/P11) [4, 5].

L02/P11 introduces two changes that must be implemented in downstream analyses codes:

- The first is the change from the T6 to the L02 lattice physics model and how the L02 evaluated cross sections are handled in the downstream methods.
- The second change pertains to the local loss methodology used in the calculation of pressure drop (e.g., across fuel spacers within a bundle assembly). The L02/P11 methodology uses a Reynolds number single-phase and modified homogeneous two-phase dependent formulation (hereafter called Method C), allowing for representation of bundle pressure losses over a wider range of flow and quality conditions.

This document contains a general plan for incorporation of L02 and Method C into codes and methodologies as described in GESTAR-II-US [6].

The use of the L02/P11 methodology for core design and monitoring purposes requires the implementation and use of consistent models in supporting downstream codes and methodologies. Table 1 lists the downstream methodologies and associated computer codes utilizing L02/P11 based cross sections or Method C.

Table 1: Methodologies to Implement L02/P11 and/or Method C

Methodology	Code	References
Control Rod Drop Accident	TRACG04	[7, 8, 9]
Fluence	DORTG01	[10]
LOCA/ECCS	SAFER04 TASC-03 TRACG04	[11, 12] [13] [14, 8, 9]
Safety Limit MCPR	GESAM02	[15, 16]
Stability	ODYSY05 TRACG04	[17, 18, 19, 20, 21, 22] [20, 21, 22, 23, 8, 9]
Transients	ODYNM10, ODYNV09 TASC-03 TRACG04	[24, 25, 26, 27] [13] [28, 29, 30, 31, 8, 9]

This LTR describes the process necessary for implementing the changes for use within the methodologies listed in Table 1.

1.2 Implementation Approach

Table 1 lists the downstream methodologies and associated computer codes that would utilize L02/P11 and/or Method C. The way in which these downstream methods use the L02/P11 method and/or Method C, and any changes necessary to the codes or methodologies themselves, is described in detail in Section 2. The approach for implementation testing and validation of requirements of these downstream methods is described in detail in Section 3.

An introduction to the overall implementation approach is provided below to give context to these more detailed sections in the report.

1.2.1 Scope of Changes

1.2.1.1 L02/P11 Implementation

L02 and P11 form the basis of the steady state nuclear methods. Compatibility between the two codes is attained through processing of the L02 neutronic parameter output before it is utilized by P11. No changes to the P11 code were required to make use of L02 derived parameters.

The L02 data is processed by P11 and made available to the downstream codes in the same way as is done using T6. This process makes the use of L02 transparent to the downstream codes, and therefore no changes to the various downstream codes is expected to be required.

1.2.1.2 Method C Implementation

Method C loss coefficients have been developed for several fuel designs, including GNF2 and GNF3. These coefficients were developed based on comparisons to experimental data.

Most downstream computer codes already support the use of Method C loss coefficients, though some may require modification. Generally, downstream codes support their use through input options; however, other codes obtain the coefficients for the method by pass-through from upstream codes.

1.2.2 Implementation Strategy

The use of L02 nuclear data and Method C losses documented in this plan is consistent with the steady state nuclear methods [3] and is applicable to the downstream methods. The L02 nuclear data will be used together with Method C where applicable for all downstream analyses where the steady state nuclear methods [3] are applied. Analyses for which there are no downstream interfaces and are either generic or plant/cycle independent and were originally performed with T6 (e.g., moderator temperature coefficient) remain valid and GNF does not intend to reproduce with L02 physics.

The downstream methodologies and any existing conservatisms within them will not change beyond what is necessary to implement the use of LANCR02 or Method C, unless otherwise described herein.

Should any code changes be identified as necessary for compatibility with LANCR02 data or Method C loss coefficients, the changes will be implemented and tested in accordance with GNF's program for software quality assurance [32].

GNF will implement the L02 and Method C methodologies into the downstream codes and processes, inclusive of the applicable analyses outlined in GESTAR-II-US, as updated as a part of this Supplement. To establish the effect of using L02 and Method C in the downstream methods, analyses representative of the operating BWR fleet at conditions typical to those currently analyzed will be performed and compared against results obtained using the currently approved methods. The results will be evaluated and documented.

1.2.3 Implementation Requirements and Documentation Approach

The expected impact of the L02 nuclear data and Method C losses on outcomes critical to the downstream methodologies is expected to be small. Further, while the neutronic response and pressure drop characteristics associated with these changes may be slightly different than the current approved methodologies, they do not approach the level to which they would affect the overall predictive capabilities of the codes used in the evaluation. Therefore, extensive requalification of the downstream methods due to use of L02 or the improved local loss formulation is deemed unnecessary. For some methodologies, selective requalification may be appropriate and such requalification will be performed. This is discussed in further detail in the following section where applicable.

2 Methodology Changes

2.1 Steady State Nuclear Methods

L02/P11 [3] has been submitted to the NRC for review and approval, and no further changes to the methodology are required for use with the downstream methods.

2.2 Cycle Specific Safety Limit MCPR

Changes to the cycle specific Safety Limit Minimum Critical Power (SLMCPR) methodologies [15, 16] are not required. The GESAM02 code which is used to calculate the $MCPR_{99.9\%}$ is directly compatible with the L02 and Method C. Uncertainties used by the methodology are provided as inputs to the GESAM02 code. Appropriate uncertainties for use with L02/P11 are defined in Reference 3.

2.3 1D Nuclear Transient Methods

One-dimensional methods are used for certain transient applications via the ODYN methodology [24, 25, 26, 27] and frequency domain stability solutions using the ODYSY [17, 18, 19, 20] method. Both methodologies utilize a software code to convert neutron kinetics, thermal-hydraulics, and reactor state information from P11 into forms suitable for use by the ODYN and ODYSY codes. The P11 output provided to the conversion code is independent of whether T6 or L02 is used, therefore no changes to the conversion code are required to process L02 neutronic data.

2.3.1 Transient AOOs and ATWS (ODYN)

LANCR02 nuclear data is provided to P11, output to the conversion code, and processed in a form usable by ODYN. No changes to the method are required to use L02 data.

Thermal-hydraulic data is provided by P11 to the conversion code and provided in a form usable by ODYN. Method C losses are not directly applied in the ODYN codes. However, Method C losses are applied in codes used in the ODYN transient methodology such as TASC [13]. No changes to the method are required to use Method C losses.

2.3.2 Transient AOOs and ATWS (TASC)

The TASC method [13] does not contain a nuclear model and therefore is not impacted by the change from T6 to L02.

The Method C formulation is already approved for use within this method.

2.3.3 ODYSY Stability Methods

L02 nuclear data is provided to P11, output to the conversion code, and processed in a form usable by ODYSY. No changes to the method are required to use LANCR02 data.

Thermal-hydraulic data is provided by P11 to the conversion code and provided in a form compatible with ODYSY. Method C losses are supplied via input options. No changes to the methods are required to use Method C losses.

2.4 3D Nuclear Transient Methods

The three-dimensional nuclear transient methods are all based upon the TRACG04 code (TRACG) [8, 9]. TRACG receives nuclear data from P11, which receives it from the lattice physics codes T6 or L02. The process in which TRACG receives its nuclear data from PANAC11 is the same whether the nuclear data originates in T6 or L02.

Nuclear uncertainties for Doppler, SCRAM reactivity, and void coefficient will be determined using L02 based data following the (approved) process defined in Reference [31].

The void coefficient response from T6 exhibits a bias compared to benchmark data, which is corrected for in TRACG. The neutronic data obtained from L02 is in better agreement with benchmark data than T6, and so in recomputing the response surface that arises from using L02 the correction in the bias will be smaller. The bias and uncertainty of L02 void reactivity response will be evaluated following the approved process to establish the need of the bias correction in the downstream 3D Nuclear Transient methods. The uncertainty associated with the model will be generated and used for statistical analyses to account for heterogeneity in the fuel and core loading.

The TRACG code supports Method C losses. The use of this method is enabled via input options.

2.4.1 TRACG Model and Qualification LTRs

The 3D nuclear transient methods reference the TRACG Model Description and Qualification LTRs [8, 9] for the technical basis and capabilities of TRACG. GNF will update the TRACG model document to describe the interface to L02/P11 method as well as the Method C losses. The qualification LTR will be updated to include Method C qualification for GNF2 and GNF3 fuel.

2.4.2 Control Rod Drop Accidents

The GNF methodology for Control Rod Drop Accidents [7] is analyzed using TRACG. The application methodology is essentially a process that is applied using T6/P11 and TRACG. The same process will be applied using L02 such that neutronic parameters will be generated by L02, processed by P11, and then passed to TRACG. No changes to the method are required to use L02 data. Uncertainties used in the process will be confirmed to be no larger than are used in the current T6/P11 application.

Method C losses are supplied via input options. No changes to the methods are required to use Method C losses.

2.4.3 Stability

The three-dimensional stability solution methodologies [20, 21, 22, 23] are all based upon TRACG. Neutronic parameters are generated by L02, processed by P11, and then passed to TRACG. No changes to the methods are required to use L02 data. L02 based nuclear uncertainties will be used in statistical analyses as appropriate.

Method C losses are supplied via input options. No changes to the methods are required to use Method C losses.

2.4.4 Transient AOOs and ATWS Overpressure

Three-dimensional transient AOO and ATWS overpressure analyses [31] are based upon TRACG. Neutronic parameters are generated by L02, processed by P11, and then passed to TRACG. No changes to the method are required to use L02 data. LANCR02 based nuclear uncertainties will be used in statistical analyses as appropriate.

Method C losses are supplied via input options. No changes to the methods are required to use Method C losses.

2.5 LOCA/ECCS Methods

2.5.1 TRACG

The TRACG-LOCA methodology [14] employs a point kinetics model, the adequacy of which was established via comparison to a detailed 3D neutronics model based upon T6/P11. In addition, T6 and P11 are considered concurrent methods, meaning that codes, relations, or subroutines implemented within TRACG for which the approval basis is documented elsewhere. Concurrent methods are considered part of the ECCS evaluation model, but their approval basis is documented in separate LTRs.

Method C losses are supplied via input options. No changes to the methods are required to use Method C losses.

2.5.2 SAFER

The SAFER methodology [11, 12] does not utilize the three-dimensional neutronics model.

The SAFER methodology models the pressure drop across the core and does not make use of channel based local losses. Method C is therefore not applicable within SAFER calculations. Method C losses impact the SAFER boundary conditions through indirect input options from upstream calculations. No changes to the methods are required to use Method C losses.

2.5.3 TASC

The TASC methodology was discussed in Section 2.3.2.

2.6 Reactor Pressure Vessel Flux

The Reactor Pressure Vessel (RPV) flux methodology [10] utilizes data from T6 to calculate the uncertainties in the methodology due to the effects of burnup (exposure) and the fission spectrum. The atom density of each fuel element as well as its neutron yield and fission energy as a function of fuel exposure, are obtained from T6. Sensitivity studies performed using T6 indicate that the effects of burnup and fission spectrum on the neutron source is less than half a percent, as long as the core average exposure and enrichment are used for the normalization of neutron sources. No changes to the method are required to use L02 data.

Reactor pressure vessel fast neutron flux is calculated using the DORTG01 code. No changes to the method are required to use L02 nuclear data.

The methodology does not make use of local loss coefficients.

3 Implementation and Testing

3.1 Software Quality Assurance Plan

GNF follows a quality assurance (QA) plan [32] for software codes that is compliant with Appendix B of Title 10 Part 50 of the Code of Federal Regulations (10 CFR 50). In accordance with this procedure, any code changes found necessary to implement L02/P11 described within this document will be classified as a maintenance activity since the original constructions based upon T6 and current local loss formulations and application will still be available. A software test plan and software test report will be constructed to test all changes made to the ECPs. Sufficient testing will be performed to provide confidence that other models or functionality of the code have not been changed.

3.2 Generic Requirements

For codes that require modification, existing capabilities to perform analyses using T6 data and the existing local loss formulation will be retained for backward compatibility and sensitivity studies. For each affected code, unit testing will be performed to confirm that the correct models have been implemented. Simulations using the currently licensed models will be run for regression and sensitivity studies. The sensitivity studies are intended to be representative, such that comprehensive requalification of the ECP is deemed unnecessary.

Following or in parallel to this testing of any needed ECP maintenance, implementation testing within each functional area will be conducted. The purpose of this testing is to establish the following:

- Identify process changes necessary to exercise the models
- Perform comparisons of the application process using L02/P11 and Method C versus T6/P11 and the current local loss formulation
- Determine and document the significance of the method changes considering the process for including uncertainties in the application methodology (see additional considerations in Section 3.3)

These elements of impact will be subsequently examined by independent verification or design review to recommend the final application process.

3.3 Specific Requirements by Methodology

3.3.1 Steady State Nuclear Methods

The steady state nuclear methods and their uncertainties for L02/P11 are documented in Reference [3].

3.3.2 Cycle Specific Safety Limit MCPR

A representative set of $MCPR_{99.9\%}$ analyses will be performed using the current methodology and compared against the same set of analyses performed using the L02 neutronic parameters and Method C. The comparison results will be documented.

3.3.3 1D Nuclear Transient Methods

3.3.3.1 Transient AOOs and ATWS (ODYN)

The Peach Bottom Turbine Trip qualification will be analyzed using LANCR02 nuclear data and compared against results in Reference [27]. The comparison will be documented.

Representative ODYN Transient AOO and ATWS analyses will be performed using L02 data and Method C losses and compared against results obtained using the current methods. Limiting reload licensing transients for a single plant with ODYNM10 and another plant with ODYNV09 will be performed. The comparison results will be documented.

3.3.3.2 Transient AOOs and ATWS (TASC)

The MCPR transients and ATWS simulation performed as part of the ODYN testing will exercise the TASC method. Like the ODYN analyses, TASC results obtained using L02 and Method C will be compared to the current methodologies and the results documented.

3.3.3.3 ODYSY Stability Methods

Analyses representative of the BWR fleet will be performed using LANCR02 and Method C and compared against results obtained using the current methods. In particular, the limiting cases in representative reload licensing stability analyses for one Enhanced Option I-A, one Option I-D, one Option II, one Option III, and one DSS-CD plant (or application) will be performed, and the comparison results documented.

3.3.4 3D Nuclear Transient Methods

3.3.4.1 Control Rod Drop Accidents

A typical CRDA event will be analyzed using the current methodology and the revised methodology then the results compared and documented. The impact of L02 and Method C on rod worth, step worth, and enthalpy following the current CRDA methodology will be assessed and documented.

3.3.4.2 Stability

A typical two-recirculation pump trip (2RPT) event will be analyzed using L02 and Method C and compared against results obtained using the current set of methodologies for DSS-CD and GS3. The comparison results will be documented. Additional comparison analyses will be performed using the DIVOM methodology and the results compared and documented.

3.3.4.3 Transient AOOs and ATWS Overpressure

The testing of the TRACG Transients AOO and ATWS Overpressure analyses follows the testing laid out in Reference [31].

The Peach Bottom turbine trip analysis will be analyzed using the L02 data and compared against the results documented in Reference [31]. The comparison results will be documented.

Demonstration analyses representative of the current fleet and similar in nature to those laid out in Reference [31] will also be performed using L02 and Method C and compared against results obtained using the current methodology. The comparison results will be documented.

3.3.5 LOCA/ECCS Methods

3.3.5.1 TRACG

A comparison of a small break initial power response for point kinetics and L02 based 3D neutronics will be performed to demonstrate the continued adequacy of using the point kinetics model. In addition, a TRACG-LOCA [14] analyses representative of the BWR fleet will be performed using Method C and compared against results obtained using the current methodology. The results will be documented.

3.3.5.2 SAFER

The SAFER [11, 12] analyses representative of the BWR fleet will be performed applying Method C for the upstream calculations and compared against results obtained using the current methodology. The results will be documented.

3.3.5.3 TASC

Testing of the TASC methodology was discussed in Section 3.3.3.2. As already noted, the use of Method C was already approved for use.

3.3.6 Reactor Pressure Vessel Flux

Sensitivity studies using L02 data will be performed to compare the effects of burnup and fission spectrum on uncertainty calculations against the current methodology. The results will be documented.

3.4 Summary Review

The results of the downstream testing will be aggregated into a single summary report describing the impact of using L02 and Method C as compared to the current methodologies. If the impact on critical parameters exceeds the various uncertainties associated with the process, further documentation will be provided, such as the impact of using L02 or Method C losses independently, such that the nature of the changes is sufficiently understood and documented.

4 GESTAR II Changes

This section describes the GESTAR II [6] changes proposed to incorporate this Supplement following its implementation and final approval. Plants that implement GESTAR II via Technical Specifications (TS), will not need to include a specific reference to this Supplement in TS to implement this nuclear or local loss methodology.

The following GESTAR II markups include two GESTAR sections and the corresponding references sections. The GESTAR II Nuclear Design Section 3.3 changes pertain to the change in nuclear method to include LANCR02 lattice physics. The GESTAR II Thermal-Hydraulic Design Section 4.2.4 changes reflect the changes to local loss methodology in this Supplement.

The additions are shown in a **bold blue font**.

4.1 Nuclear Design Section Changes

3.3 Analytical Methods

The nuclear evaluations of all General Electric BWR cores are performed using the analytical tools and methods described in this section. There are two sets of procedures available for fuel design and licensing analysis: GENESIS and GEMINI. The nuclear physics methods described in References 3–4, 3–7, 3–10 and 3–11 are utilized as part of the GENESIS group. The advanced physics methods described in References 3–5 and 3–16 **or 3–12** are utilized as part of the GEMINI group. The particular procedure that can be utilized is optional. In either case, the nuclear evaluation procedure is best addressed as two parts: lattice analysis and core analysis.

3.6 References

3-12 ***LANCR02/PANAC11 Application Methodology*, NEDC-33935P, Revision 0, December 2021.**

4.2 Thermal-Hydraulic Design Section Changes

4.2.4.2 Local Pressure Drop

The local pressure drop is defined as the irreversible pressure loss associated with an area change, such as the orifice, lower tieplate, and spacers of a fuel assembly. The general local pressure drop model is similar to the friction pressure drop and is

$$\Delta P_L = \frac{w^2}{2g_c \rho} \frac{K}{A^2} \phi_{TPL}^2$$

where

ΔP_L = local pressure drop

K = local pressure drop loss coefficient

A = reference area for local loss coefficient

ϕ_{TPL} = two–phase local multiplier

and w, g_c, and ρ are defined above. The formulation for the **local pressure drop loss coefficient and the** two–phase multiplier is **as** reported in Reference 4–**13.**

4.13 References

4-13 ***LANCR02/PANAC11 Application Methodology*, NEDC-33935P, Revision 0, December 2021.**

5 List of Acronyms

Acronym	Explanation
AOO	Anticipated Operational Occurrence
ATWS	Anticipated Transient Without SCRAM
BWR	Boiling Water Reactor
CRDA	Control Rod Drop Accident
ECCS	Emergency Core Cooling System
ECP	Engineering Computer Project
GESAM	Computer code used for calculating the SLMCPR
GESTAR	GE Standard Application for Reactor Fuel
GNF	Global Nuclear Fuel
L02	LANCR02 computer code
LANCR02	Lattice Neutronic Characteristics Evaluation & Research Code
LOCA	Loss of Coolant Accident
LTR	Licensing Topical Report
MCPR	Minimum Critical Power Ratio
P11	PANAC11 computer code
PANAC11	GE 3D core simulator code
QA	Quality Assurance
RPV	Reactor Pressure Vessel
SLMCPR	Safety Limit Minimum Critical Power Ratio
T6	TGBLA06 computer code
TRACG	Transient Reactor Analysis Code - GE
TS	Technical Specification

6 References

1. NEDC-33376P Revision 4, "LANCR02 Lattice Physics Model Description", December 2021.

2. NEDC-33376P Revision 4, "LANCR02 Lattice Physics Model Qualification Report", December 2021.

3. NEDC-33935P Revision 0, "LANCR02/PANAC11 Application Methodology", December 2021.

4. MFN-035-99, S. Richards (NRC) to G. Watford (GE), Amendment 26 to GE Licensing Topical Report NEDE-24011-P-A, "GESTAR II – Implementing Improved GE Steady State Methods (TAC No. MA6481)", November 10, 1999.

5. NEDC-33173P-A Revision 5, "Applicability of GE Methods to Expanded Operating Domains", August 2019.

6. NEDE-24011-P-A-31, "General Electric Standard Application for Reactor Fuel", November 2020; and the U.S. Supplement, NEDE-24011-P-A-31-US, November 2020.

7. NEDE-33885P-A Revision 1, "GNF CRDA Application Methodology", March 2020.

8. NEDE-32176P Revision 4, "TRACG Model Description", January 2008.

9. NEDE-32177P Revision 3, "TRACG Qualification", August 2007.

10. NEDC-32983P-A Revision 2, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations", January 2006.

11. NEDE-23785-1-PA, Vol. I, Vol. II and Vol. III, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident," Volume 1, "GESTR-LOCA – A Model for the Prediction of Fuel Rod Thermal Performance," Revision 1, October 1984; Volume 2, "SAFER – Long Term Inventory Model for BWR Loss-of-Coolant Analysis," Revision 1, October 1984; Volume 3, "SAFER/GESTR Application Methodology," Revision 1, October 1984; Volume 3, Supplement 1, "Additional Information for Upper Bound PCT Calculation," Revision 1, March 2002.

12. NEDE-30996P-A, Vol. I and Vol. II, "SAFER Model for Evaluation of Loss-of-Coolant Accidents for Jet Pump and Non-Jet Pump Plants,"; Volume 1, "SAFER – Long Term Inventory Model for BWR Loss-of-Coolant Analysis," Revision 0, October 1987; Volume 2, "SAFER Application Methodology," Revision 0, October 1987.

13. NEDC-32084P-A Revision 2, "TASC-03A A Computer Program for Transient Analysis of A Single Channel", July 2002.

14. NEDE-33005P-A Revision 2, "TRACG Application for Emergency Core Cooling Systems / Loss-of-Coolant-Accident Analyses for BWR/2-6", May 2018.

15. NEDC-32601P-A Revision 0, "Methodology and Uncertainties for Safety Limit MCPR Evaluations", August 1999.

16. NEDC-32694P-A Revision 0, "Power Distribution Uncertainties for Safety Limit MCPR Evaluations", August 1999.

17. NEDO-32339-A Revision 1 (Including Supplements), "Reactor Stability Long-Term Solution: Enhanced Option I-A", December 1996.

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19. NEDE-33213P-A, "ODYSY Application for Stability Licensing Calculations Including Option I-D and II Long Term Solutions", April 2009.

20. NEDC-33075P-A Revision 8, "GE Hitachi Boiling Water Reactor Detect and Suppress Solution – Confirmation Density", November 2013.

21. NEDO-32465-A Revision 1, "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications, August 1996 and NEDE-32465 Supplement 1P-A, Migration to TRACG04/PANAC11 from TRACG02/PANAC10 for Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications", October 2014.

22. NEDE-33766P-A Revision 1, "GEH Simplified Stability Solution (GS3)", March 2015.

23. NEDE-33147P-A Revision 4, "DSS-CD TRACG Application", August 2013.

24. NEDO-24154-A, "Qualification of the One-Dimensional Core Transient Model (ODYN) for BWRs", Vol. 1, August 1986.

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28. NEDE–32906P-A Revision 3, "TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses", September 2006.

29. NEDE–32906P Supplement 2-A, "TRACG Application for Anticipated Operational Occurrences Transient Analyses", March 2006.

30. NEDE-32906P Supplement 1-A, "TRACG Application for Anticipated Transient Without Scram Overpressure Transient Analyses", November 2003.

31. NEDE-32906P Supplement 3-A Revision 1, "Migration to TRACG04 / PANAC11 from TRACG02 / PANAC10 for TRACG AOO and ATWS Overpressure Transients", April 2010.

32. NEDO-11209-A Revision 16, "GE Hitachi Nuclear Energy Quality Assurance Program Description", December 2020.