GE Nuclear Energy

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Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Richard W. Borchardt, Director
Standardization Project Directorate

Subject: GE Nuclear Energy Reply to Notice of Nonconformance (NRC Inspection Report No. 7990043/9301)

References: Letter. R. W. Borchardt (NRC) to P. W. Marriott (GE), Same Subject, dated April 18, 1884

GE has reviewed the staffs comments on our response to NRC inspection Report 99900403/93-01, and specifically the staff reservations concerning our response to Item 93-01-06. We believe that three specific items are identified in the staff response. Each of these is addressed below.

Status of SSAR Chapter 6 and 15 Analyses

GE understands the staff position that the analytical results for the SBWR as presented in Chapters 6 and 15 of the SSAR will be considered unvalidated and preliminary in nature. We were somewhat surprised by the addition of this item in your April 18, 1994 letter, since your November 18, 1993 letter, Item 1.2 identifies this as, "an unresolved item and will be discussed with GE in future meetings." Such discussions have not occurred.

GE is more confident than the NRC staff, however, concerning the potential for changes to the TRACG code and the associated potential for changes in the licensing basis analyses. While changes are always possible, either due to new test data or other considerations, we have a very high confidence that substantive changes will not be forthcoming. TRACG has evolved over several years, and has been validated against a very wide range of test data. The NRC has accepted this code for bench marking of the SAFER code, and for BWR stability analysis. Barring unforeseen events, we do not expect the SBWR results to change.

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The TRACG code currently has been given GE Level 2 (production) status, and all GE internal verifications of the program have been completed. Our plan has always been to continue to monitor the continuing additional test data comparisons that are to be performed and the SBWR test program (which concludes in 1995), and to assess any TRACG coding changes, internal correlations changes, or application modeling changes that are identified during that time. Should changes be identified that will affect the results presented in Chapter 6 or 15, they will be reperformed, verified, and submitted as SSAR amendments. Should no such changes be identified, it is our intention to notify the NRC when the calculations are considered verified and final.

Clarification of Documentation and Verification of Code Changes

GE apologizes that our response of December 17, 1993 concerning Engineering Computer Programs was not clear about the implications of our control procedure which differentiates between changes and new versions of computer codes. Our intent was to identify that the TRACG code under discussion had received the more rigorous verification and documentation that we impose on new versions, rather than being just a change and replacement for an existing version. In no way should there be an implication that there was any less emphasis on complete documentation and verification for the new models and coding that were introduced. As discussed below, the final documentation and verification Design Review thoroughly addressed all of the issues identified in your letter of November 18, 1993. The Design Record File is the control document for the development and verification, as required by GE procedures.

There is apparently still some confusion about the code Qualification Document (CQD) that was submitted as part of the SBWR design certification process. As noted in your April 18, 1994 letter, it was anticipated that the extensive staff review of TRACG might result in additional documentation, so the CQD was submitted prior to the completion of the TRACG testing and verification to allow the staff to begin their review. The models and results presented there were not (and are not) expected to change during the final model qualification, and the early documentation approach was considered prudent to allow for timely review. However, the CQD was not intended to provide the complete record of all models and verification for TRACG. GE expects to provide the staff with the final code verification and validation, and demonstration that the code has been subject to appropriate quality assurance procedures as part of the qualification review.

The specific model change concerns identified in your November 18, 1993 letter were addressed during the TRACG code verification process as follows:

The TRACG models and their qualification basis have been carefully reviewed and independently verified by a design review team, as required by GE procedures. The TRACG design review material/presentation included all the features of the code and the testing performed to verify the performance of the code. The testing plan and tests performed were sufficient to verify all the new features as well as the overall performance of the new version of TRACG. The design review material is maintained in the TRACG Design Record File.

The TRACG models which are documented in the TRACG Model Description [NEDE-32176P] were presented to the design review team along with the verification basis as summarized in Table 1. Table 1 also indicates which models are new or modified in this version of TRACG.

Table 1. TRACG Models

TRACG Model Feature	Status	Verification Basis
Basic Hydraulic Model		
Conservative equations	Modified	Test data and alternate calculation
Constitutive Correlations		
Flow regime map	Modified	Test date and alternate calculation
Wall friction and singular losses	Modified	Test data and alternate calculation
Interfacial shear	Modified	Test data and alternate calculation
Counter current flow	Unchanged	Test data and alternate calculation
Critical flow	Modified	Test data and alternate calculation
Two-phase level model *	Modified	Test data and alternate calculation
Turbulent mixing	New	Test data
Interfacial heat transfer	Modified	Test data and alternate calculation
Wall heat transfer*	Modified	Test data and alternate calculation
Thermal radiation heat transfer	Modified	Test data
Heat Conduction Model		
Heat conduction equation	Unchanged	Test data and alternate calculation
Transient gap conduction	New	Test data and alternate calculation
Kinetics Model		
3-dimensional equations	New	Test data and alternate calculation
Nuclear parameters	New	Test data and alternate calculation
Decay heat model	New	Test data and alternate calculation

** The modification to the two-phase level and the heat transfer models include the model upgrades for the SBWR identified in the GIST program GEFR-00850].*

Table 1. TRACG Models (Continued)

TRACG Model Feature	Status	Verification Basis
Component Needs		
Pipe	Unchanged	
Pump	Modified	Test data and alternate calculation
Valve	Modified	Test data and alternate calculation
Tee	Unchanged	
Fuel channel	Modified	Test data and alternate calculation
Jet pump	Modified	Test data and alternate calculation
Steam separator	Modified	Test data and alternate calculation
Vessel	Modified	Test data and alternate calculation
Steam dryer	Unchanged	Alternate calculation
Upper plenum	Unchanged	Test data and alternate calculation
Heat exchanger	Modified	Test data
Numerical Method		
Hydraulic equations	Modified	Test data and alternate calculation
Heat conduction	Modified	Test data and alternate calculation
Control System		
Control blocks	Modified	Test data and alternate calculation

The testing of TRACG included comparisons to an extensive set of test data, ranging from separate effects tests and component performance tests allowing unit level testing of the TRACG models to integral systems tests and plant data allowing integral testing of the TRACG models. The comparison basis is documented in the TRACG Qualification report [NEDE-32177P]. TRACG, furthermore, was extensively tested by comparisons to alternate calculations and by expert review. The testing of TRACG is summarized in Table 2, and is documented in the TRACG DRF. Table 2-1 in the TRACG Qualification report [NEDE-32177P] provides a cross reference between the TRACG models and the data which were used to test these models.

Table 2. TRACG Tests

TRACG Test Cases	Comparison Basis
FRIGG OF-64 (48, 68 Bars)	Test Data
Christensen (55, 69 Bars)	Test Data
Wilson	Test Data
Bartolomei	Test Data
EBWR	Test Data
PSTF Level Swell (Top break)	Test Data
PSTF Level Swell (Bottom break)	Test Data
THTF (Tests 3.06.6B, 3.08.6C)	Test Data
CSHT (Steady-state, transient)	Test Data
CSHT CCFL Test	Test Data
Marviken (Test 15, 24)	Test Data
PSTF Critical Flow (Single phase)	Test Data
PSTF Critical Flow (Two-phase)	Test Data
Edwards Blowdown	Test Data
ATLAS Pressure Drop	Test Data
ATLAS Critical Power	Test Data
FRIGG Natural Circulation	Test Data
FRIGG Stability	Test Data
VK-50	Test Data
SPERT III	Test Data
INEL 1/6 Scale Jet Pump Tests	Test Data
BWR/4 Jet Pump Test	Test Data
BWR/5 Jet Pump Test	Test Data
GE Two-Stage Separator Test	Test Data
GE Three-Stage Separator Test	Test Data
SSTF Upper Plenum Test	Test Data
GIRAFFE (Steady-state)	Test Data
TLTA Boiloff Test (6441/6-1)	Test Data
TLTA DBA (6425)	Test Data
TLTA DBA (6426)	Test Data
TLTA DBA (6423)	Test Data
FIST DBA (DBA1B)	Test Data
FIST Small Break (6SB2C)	Test Data
GIST (Tests A07, B01, B07, CO1A, D03A)	Test Data
SSTF System Test (SRT-3 Run 26)	Test Data
GIRAFFE System Response Test	Test Data
Aritomi	Test Data
Peach Bottom Turbine Trip Tests (1,2,3)	Test Data
Hatch Two-Pump Trip Test	Test Data
Hatch MSIV Closure Test	Test Data
LaSalle Instability Event	Data
Leibstadt Stability Tests (Test 4, 4A, 5, 5A)	Test Data

Table 2. TRACG Tests (Continued)

TRACG Test Cases	Comparison Basis
Forsmark Stability Tests (Test 5, 7, 8, 12, 15)	Test Data
Cofrentes Stability Event	Data
PSTF Containment Tests	Test Data
BWR/4 Steady-state Power Distribution	Alternate Calculation
BWR/6 Steady-state Power Distribution	Alternate Calculation
Bundle Pressure Drop (GE10, GE11)	Alternate Calculation
Bundle Leakage Flow (GE10, GE 11)	Alternate Calculation
Bundle WR Flow (GE10, GE11)	Alternate Calculation
Steamline Pressure Drop (BWR/4,5)	Alternate Calculation
BWR/4 Loss of Feedwater Heater	Alternate Calculation
BWR/4 Load Rejection w/o BP	Alternate Calculation
BWR/5 Load Rejection w/o BP	Alternate Calculation
BWR/4 Turbine Trip w/o BP	Alternate Calculation
BWR/5 Turbine Trip w/o BP	Alternate Calculation
BWR/4 Feedwater Controller Failure	Alternate Calculation
BWR/5 Feedwater Controller Failure	Alternate Calculation
BWR/4 MSIV Closure	Alternate Calculation
BWR/5 MSIV Closure	Alternate Calculation
BWR/4 1 Pump Trip	Alternate Calculation
BWR/4 2 Pump Trip	Alternate Calculation
BWR/4 Pump Seizure	Alternate Calculation
BWR/4 Flow Controller Failure	Alternate Calculation
BWR/4 Single Loop Operation	Alternate Calculation
BWR/4 Idle Loop Start-up	Alternate Calculation
Control Rod Drop Accident	Alternate Calculation
ABWR MSIV Closure ATWS	Alternate Calculation
ABWR All Pump Trip	Alternate Calculation
ABWR Load Rejection	Alternate Calculation
ABWR Main Steamline Break	Alternate Calculation
ABWR HPCF Break	Alternate Calculation
BWR/4 MSIV Closure ATWS	Alternate Calculation
BWR/4 DBA	Alternate Calculation
BWR/4 Small Break	Alternate Calculation
SBWR Containment Pressure	Alternate Calculation
SBWR Feedwater Controller Failure	Expert Review
SBWR Pressure Regulator Failure	Expert Review
SBWR Inadvertent SRV open	Expert Review
SBWR Loss of Feedwater Heating	Expert Review
SBWR Fast TCV Closure	Expert Review
SBWR Slow TCV Closure	Expert Review
SBWR Pressure Regulator Failure	Expert Review

Table 2. TRACG Tests (Continued)

TRACG Test Cases	Comparison Basis
SBWR Load Rejection w/BP	Expert Review
SBWR Load Rejection w/o BP	Expert Review
SBWR Turbine Trip w/BP	Expert Review
SBWR Turbine Trip w/o BP	Expert Review
SBWR MSIV Closure	Expert Review
SBWR Loss of Condenser Vacuum	Expert Review
SBWR Loss of AC Power	Expert Review
SBWR Loss of Feedwater Flow	Expert Review
SBWR Inadvertent IC Start-up	Expert Review
SBWR MSIV Closure ATWS	Expert Review
SBWR Loss of AC Power ATWS	Expert Review
SBWR Loss of Feedwater Heating ATWS	Expert Review
SBWR Loss of Feedwater Flow ATWS	Expert Review
SBWR Turbine Trip w/BP ATWS	Expert Review
SBWR Loss of Cond. Vacuum ATWS	Expert Review
SBWR FWCF ATWS	Expert Review
SBWR Bottom Drain Line Break	Expert Review
SBWR GDCS Break	Expert Review
SBWR IC Return Break	Expert Review
SBWR RWCU Suction Break	Expert Review
SBWR Feedwater Line Break	Expert Review
SBWR Steamline Break	Expert Review
SBWR DVP Stub Tube Break	Expert Review
SBWR Start-up	Expert Review

The testing performed was carefully reviewed by the independent design review team and considered to be sufficient and adequate to verify all the new features as well as the overall performance of TRACG.

Independent Verification of Code Qualification Input Decks

Independent verification of inputs and application range is required by NQA-1 and GE internal procedures for all design analysis using qualified (Level 2) Engineering Computer Programs. However, for the code qualification process, the outputs of the code are directly verified through Independent Design Review. Those Design Reviews consider the model changes as well as the full range of comparisons with data and alternate calculations. When the Design Review Team considers it appropriate that input decks be verified for critical comparisons, they can require it.

General Electric takes strong exception to the stated staff position that all input decks for verification of computer codes should be independently verified. Such verification is not required by GE's procedures covering Engineering Computer Program qualification. General Electric believes that imposing the requirement that all code qualification input decks be separately verified would impose a significant resource investment with no, or even potentially negative impact on quality. Under the current system, the Independent Design Review Teams are chartered with the task of overall final verification of codes. They clearly understand that they have full responsibility for the adequacy of the verification. Imposing a separate verification requirement would dilute that responsibility and ownership. The resultant system quality might therefore be reduced. General Electric believes that the current system has proven itself with high quality codes and verifications over an extended period, and strongly recommends that the staff not require a change to this successful approach.

Notwithstanding the above, in order to best satisfy the NRC staff concerns, GE did commit, in writing, in our submittal of December 17, 1993, to complete an independent verification of the inputs to the GIST facility TRACG input decks. That independent verification has been completed, and the results filed in the TRACG Design Record File. GE has no recorded commitment to verify all TRACG verification input decks.

Sincerely,

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