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MFN-015-99

June 11, 1999

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

Attention: Jared Wermiel, Branch Chief, Nuclear Reactor Regulation

Subject: **TRACG Transient Application Methodology**

Reference: GE/NRC Meeting on May 25, 1999

Dear Mr. Wermiel:

On May 25, 1999, we presented to you and your staff our plan to submit TRACG Transient Application Methodology for review and approval. Enclosed with this letter are:

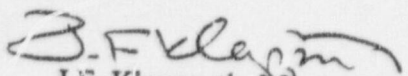
1. The GE proprietary version of the presentation and the affidavit in Attachment 1
2. The non-proprietary version of the presentation in Attachment 2.

GE will submit the framework document under a separate transmittal letter by June 18, 1999.

The attachments contain GE-NE proprietary information which is provided under the NRC/GE-NE proprietary information agreement. GE-NE customarily maintains this information in confidence and withholds it from public disclosure.

The attached affidavit identifies that the designated information has been handled and classified as proprietary to GE-NE. Along with the affidavit this information is suitable for review by the NRC. GE-NE hereby requests that the designated information be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790.

Sincerely,


J.F. Klapproth, Manager
Engineering & Technology

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Attachment 1

TRACG Transient Application Methodology for BWRs
Proprietary Version of the GE Presentation

General Electric Company

AFFIDAVIT

I, **David J. Robare**, being duly sworn, depose and state as follows:

- (1) I am Technical Account Manager, General Electric Company ("GE") and have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in a GE presentation to the NRC held on May 25, 1999 entitled, *TRACG Application Methodology For BWR Transients*, dated May 1999. The proprietary information is delineated by bars marked in the margin adjacent to the specific material or by bars around information on a portion of a page.
- (3) In making this application for withholding of proprietary information of which it is the owner, GE relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), 2.790(a)(4), and 2.790(d)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (4) Some examples of categories of information which fit into the definition of proprietary information are:
 - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by General Electric's competitors without license from General Electric constitutes a competitive economic advantage over other companies;
 - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

- c. Information which reveals cost or price information, production capacities, budget levels, or commercial strategies of General Electric, its customers, or its suppliers;
- d. Information which reveals aspects of past, present, or future General Electric customer-funded development plans and programs, of potential commercial value to General Electric;
- e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in both paragraphs (4)a. and (4)b., above.

- (5) The information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GE, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GE, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within GE is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his delegate), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GE are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- (8) The information identified in paragraph (2), above, is classified as proprietary because it contains detailed results of analytical models, methods and processes, including computer codes, which GE has developed, discussed with the NRC, and intends to apply to perform evaluations of transients for the BWR.

The development and approval of the TRACG computer code was achieved at a significant cost, on the order of several million dollars, to GE.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GE asset.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GE's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GE's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GE.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GE's competitive advantage will be lost if its competitors are able to use the results of the GE experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

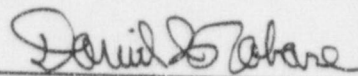
The value of this information to GE would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GE of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

STATE OF CALIFORNIA)
)
COUNTY OF SANTA CLARA) ss:

David J. Robare, being duly sworn, deposes and says:

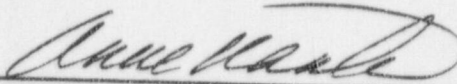
That he has read the foregoing affidavit and the matters stated therein are true and correct to the best of his knowledge, information, and belief.

Executed at San Jose, California, this 1ST day of JUNE 1999.

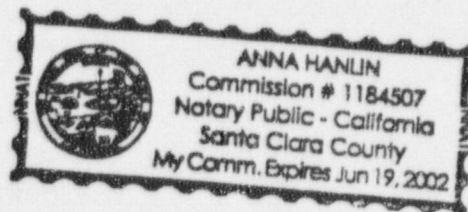


David J. Robare
General Electric Company

Subscribed and sworn before me this 1ST day of JUNE 1999.



Notary Public, State of California



Attachment 2

TRACG Transient Application Methodology for BWRs
Non-Proprietary Version of the Presentation

Introduction and Agenda

**TRACG Methodology
For Application to BWR
Transient Events**

**Presentation to USNRC
James F. Klapproth**

May 25, 1999



Agenda

- **Introduction**

- Meeting Objectives
- Overview of Proposed Processes
- Schedule Highlights

9:00-9:30

- **TRACG Application to BWR Transients**

- Review Elements
- LTR Outline
- Application Methodology

9:30-11:30

- **Discussion and Action Items**

11:30-Noon

Meeting Objectives

- Provide an Overview of the Proposed TRACG Application to BWR Licensing Analyses
- Present GE Recommendations on Review Methodology
- Describe Proposed Leverage of Prior USNRC TRACG Review
- Review Proposed Schedule

Start of a Process that Results in a
NRC SER by July 2000

TRACG Application Review Scope

●What Is in Scope

- Application only to BWR-2 through BWR-6
- Application to Anticipated Operational Occurrences (AOO)

●What Is Not in Scope?

- LOCA/ECCS Analysis
- Containment Response
- Application to ABWR or SBWR

Benefits to Industry by use of TRACG

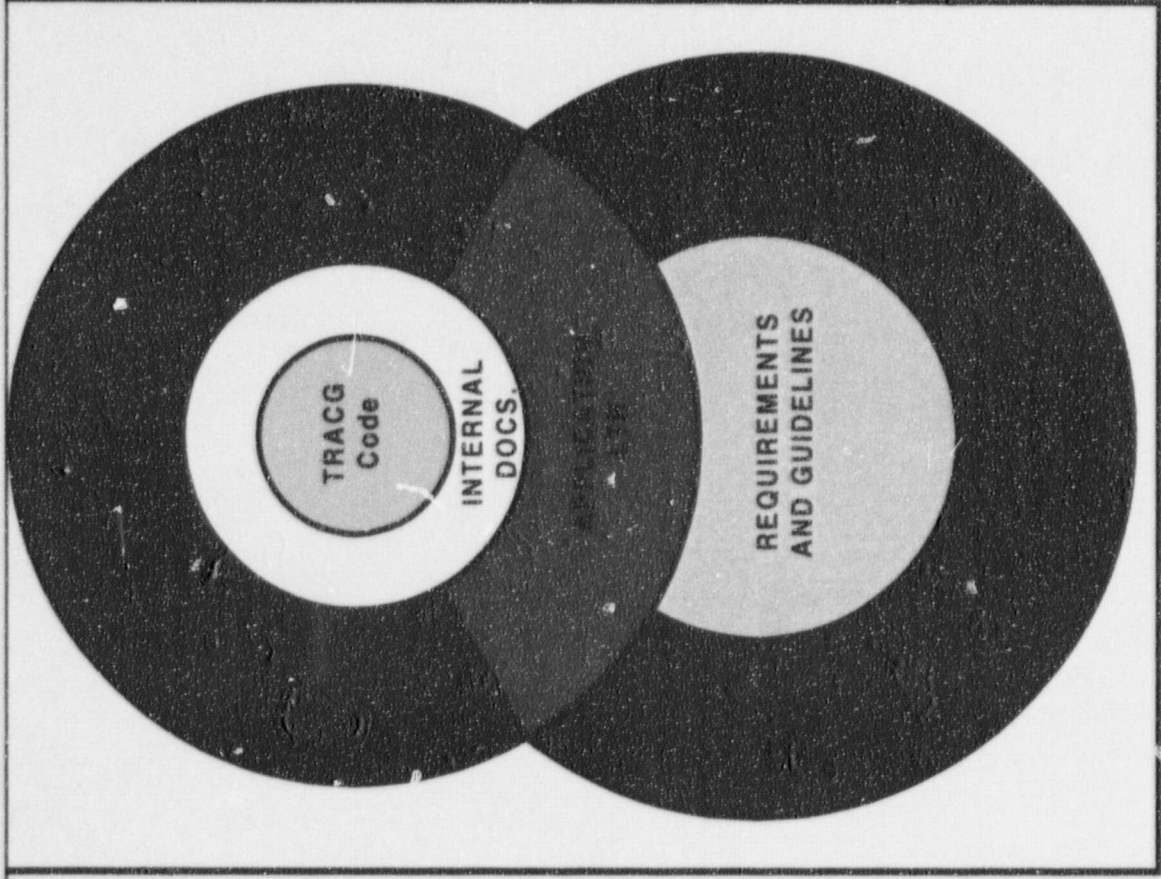
- Integrated Analysis Using a Single Computer Code
 - Eliminate potential for errors in data transcription between codes
 - Improved understanding of process by all organizations
 - Plant Staff/Analysts/Regulators
- More Realistic Prediction of Plant Transient Response
 - Better operational response to AOOs
 - Improved plant safety
 - Improved Operating Limits/Plant Capacity Factors
- Better Quantification of Margin and Uncertainty
 - Application to risk-based decision making

Licensing Review Approach

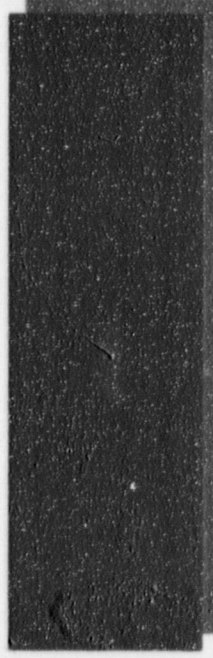
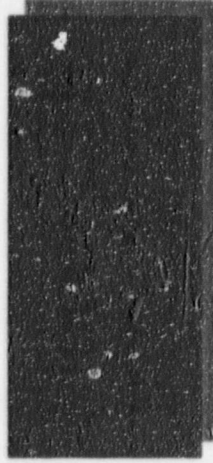
- Build on Previous NRC Reviews of TRACG
 - Documents submitted and reviewed under SBWR Docket
 - Model Description LTR: NEDE-32176P
 - Qualification LTR: NEDE-32177P
 - NRC RAI's received by GE
- Revise previously submitted documents to:
 - Include RAI responses
 - Delete extraneous information not in review scope

Leverage Prior NRC Review to Our Mutual Advantage

TRACG Application Framework for AOO Transients



Approach



Rev. 1

Reviewed by NRC

Rev. 2

To be issued 9/99
Incorporates RAIs
Deletes SBWR
Models

Rev. 1

Reviewed by NRC

Rev. 2

To be issued 9/99
Incorporates RAIs
Deletes SBWR
Qualification Studies

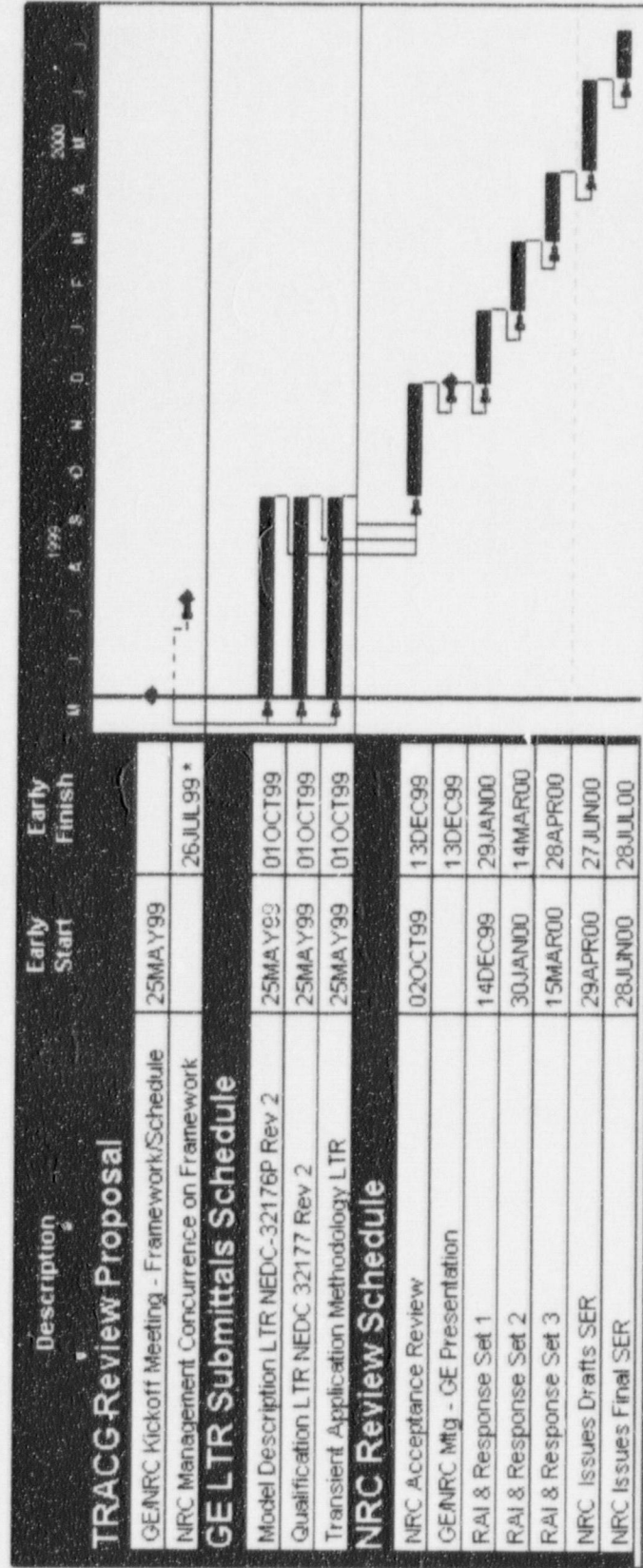
Rev. 0

Will document
transient application
methodology

Approach similar to
ODYN Safety
Evaluation

Primary Review is RAI Resolution and
Application Methodology

Proposed Schedule



Key Milestones

<u>Date</u>	<u>Milestone</u>
5/99	GE/NRC Kickoff Meeting
6/99	Submit Licensing Application Framework Document
7/99	NRC Concurrence with Review Plan
10/99	LTR Submittals
7/2000	SER for TRACG Transient Application

**TRACG Application Methodology
For BWR Transients**

**Presentation to NRC
J. G. M. Andersen
C. L. Heck**

May 1999



Scope: Application of TRACG for BWR Transients

- **Plants:** BWR/2/3/4/5/6
- **Events:** Anticipated Operational Occurrences (Transients);
 - Increase / Decrease in Reactor Pressure
 - Increase / Decrease in Core Flow
 - Increase / Decrease in Reactor Coolant Inventory
 - Decrease in Core Coolant Temperature
 - Same Events as Currently Approved for ODYN
- **Documentation**
 - TRACG Licensing Application Framework for AOO Transient Analyses
 - TRACG Model Description LTR, NEDE-32176, Revision2
 - TRACG Qualification LTR , NEDE-32177, Revision2
 - TRACG Application LTR for AOO Transient Analyses
- **Review Scope**
 - One SER for Application of TRACG to BWR AOO Transients
 - Applicability of TRACG for AOO Transients
 - Qualification
 - Application Methodology for AOO Transients

Plants

- **BWR/2**

- Non jet Pump Plants with External Recirculation Loops**

- Oyster Creek, Nine Mile Point 1

-

- **BWR/3/4**

- Jet Pump Plants with Motor/Generator Recirculation Flow Control**

- Dresden 2/3, Quad Cities 1/2, Pilgrim, Millstone, Monticello

- Hatch 1/2, Browns Ferry 1/2/3, Susquehanna 1/2, Brunswick 1/2, Cooper, Duane Arnold, Fitzpatrick,

- Limerick 1/2, Vermont Yankee, Peach Bottom 2/3, Hope Creek 1, Enrico Fermi 2

- **BWR/5/6**

- Jet Pump Plants with Valve Recirculation Flow Control or Adjustable Speed Drives (ASD)**

- LaSalle 1/2, WNP-2, Nine Mile Point 2

- Ferry, River Bend, Grand Gulf, Clinton 1

Events

Same Events as Currently Approved for ODYN/TASC

- | | |
|---|--|
| <ul style="list-style-type: none"> • Increase in Reactor Pressure <ul style="list-style-type: none"> - Turbine trip w/o bypass - Generator load rejection w/o bypass - Feedwater controller failure - Pressure regulator failure closed - Loss of condenser vacuum - Main steam line isolation w/o position scram - Loss of AC power transformer - Loss of auxiliary power - all grid connections | <ul style="list-style-type: none"> • Decrease in Core Flow <ul style="list-style-type: none"> - Trip of one recirculation pump - Trip of two recirculation pumps - Recirculation pump seizure - Recirculation flow controller failure decreasing - Recirculation pump shaft break - Fast closure of one recirculation valve - Fast closure of two recirculation valves - Flow blockage |
| <ul style="list-style-type: none"> • Decrease in Reactor Pressure <ul style="list-style-type: none"> - Pressure regulator failure open - Inadvertent opening of relief valve - Inadvertent ADS operation - Inadvertent opening of bypass valve | <ul style="list-style-type: none"> • Increase in Core Flow <ul style="list-style-type: none"> - Recirculation flow controller failure increasing - Startup of idle recirculation loop - Fast opening of one recirculation valve - Fast opening of two recirculation valves |
| <ul style="list-style-type: none"> • Increase in Reactor Coolant Inventory <ul style="list-style-type: none"> - Feedwater controller failure (increased flow) - Inadvertent Auxiliary Pump Start | <ul style="list-style-type: none"> • Decrease in Core Coolant Temperature <ul style="list-style-type: none"> - Loss of feedwater heating *) - Feedwater controller failure (increased flow) - Inadvertent HPCS injection - Inadvertent HPCI injection |
| <ul style="list-style-type: none"> • Decrease in Reactor Coolant Inventory <ul style="list-style-type: none"> - Loss of feedwater flow - Feedwater pump trip and restart - Feedwater controller failure (decreased flow) | |

* Analyzed with PANACEA

Review Scope

Review Element	Comment	Review Status
Licensing Application Framework	Regulatory requirements and Guidelines	
TRACG Model Description NEDE-32176P	Findings from Reference 1 will be addressed in NEDE-32176P, Rev. 2 Additional Qualification will be included in NEDE-32177P, Rev. 2	Rev. 1 Reviewed by NRC [1]
TRACG Qualification NEDE-32177P	Findings from Reference 2 will be addressed in NEDE-32177P, Rev. 2	Rev 1. Reviewed by NRC [2]
Application Methodology	GE Proprietary Material Removed	

1. Letter, T. R. Quay (NRC) to J. E. Quinn (GE), Staff Review of General Electric's (GE's) Licensing Topical Report (LTR), NEDE-32176P, *TRACG Model Description, Revision 1*, Related to Reactor Systems Area, July 5, 1996.

2. Letter, T. R. Quay (NRC) to J. E. Quinn (GE), Status of Staff Review of TRACG Qualification (NEDE-32177, Rev. 1) and Application (NEDE-32178, Rev. 0) Licensing Topical Reports (LTRs), June 27, 1996.

Overview / Outline of LTRs

- **TRACG Model Description LTR**

- NEDE-32176P, Rev. 2, September 1999
- Addresses comments from NRC review of Rev. 1

- **TRACG Qualification LTR**

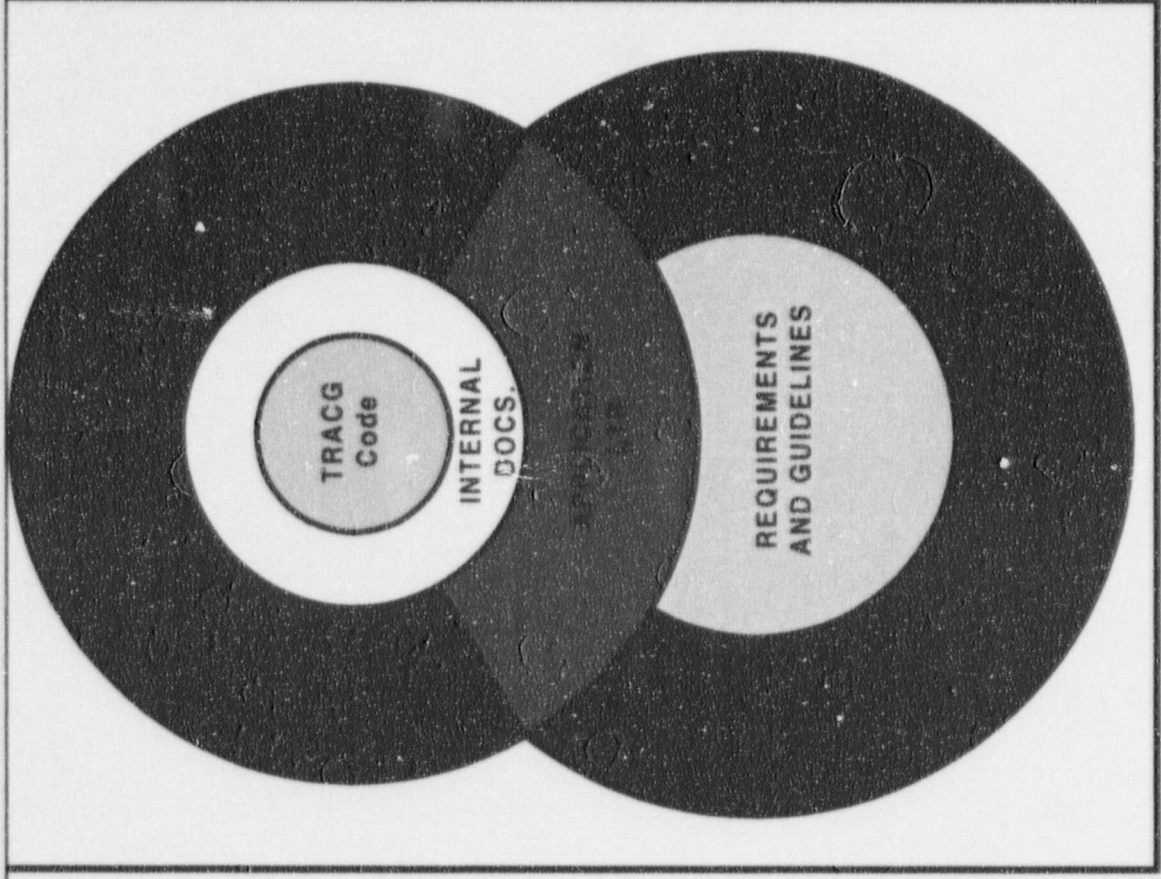
- NEDE-32177P, Rev. 2, September 1999
- Addresses comments from NRC review of Rev. 1

- **TRACG Application LTR for AOO Transient Analyses**

- September 1999
- contents
- Examples of what to expect

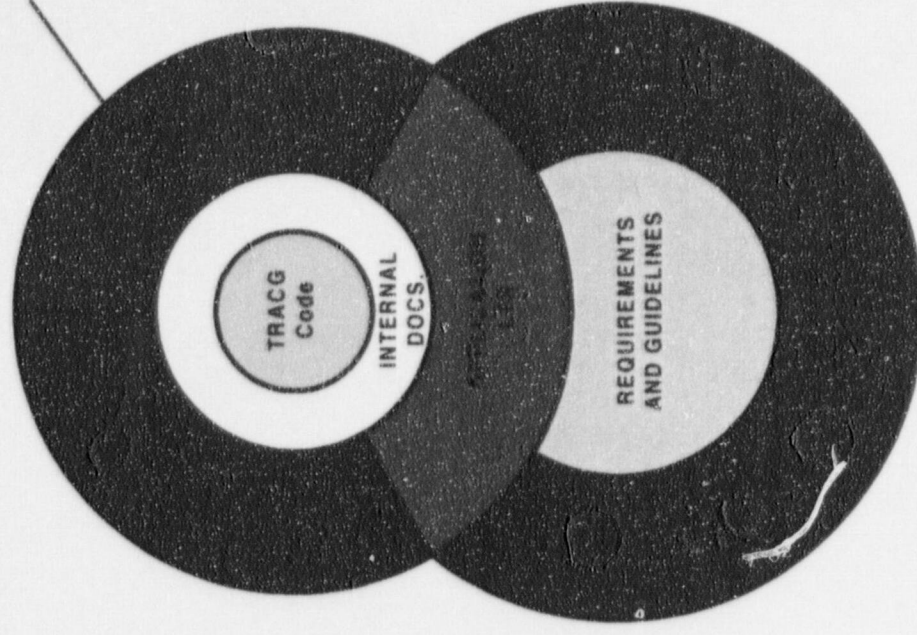
All Review Comments Addressed Transient Application Methodology Developed
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TRACG Application Framework for AOO Transients



TRACG Model Capability

- **Structure**
 - Capability to model plant geometry
- **Basic Equations**
 - Capability to address global processes
- **Models and Correlations**
 - Capability to model and scale individual processes
- **Numerical Methods**
 - Capability to perform efficient and reliable calculations



Outline of Model Description LTR (NEDE-32176P)

1. Introduction
2. Modular Structure
3. Thermal-Hydraulic Model
4. Heat Conduction Model
5. Flow Regime Map
6. Models and Correlations
 - Range of applicability
 - Model uncertainty
 - Implementation
7. Component Models
8. Numerical Methods
9. Three-Dimensional
Neutron Kinetics Model
10. Control System

GE Proprietary Material
Removed

High Level Outline Unchanged from Prior Reviews Review Comments Addressed
--

TRACG Qualification

- **Qualification Strategy**

- Separate Effects Tests
- Component Performance Data
- Integral System Effects Tests
- Full Scale Plant Data

-

- **Determination of Adequacy of TRACG Models**

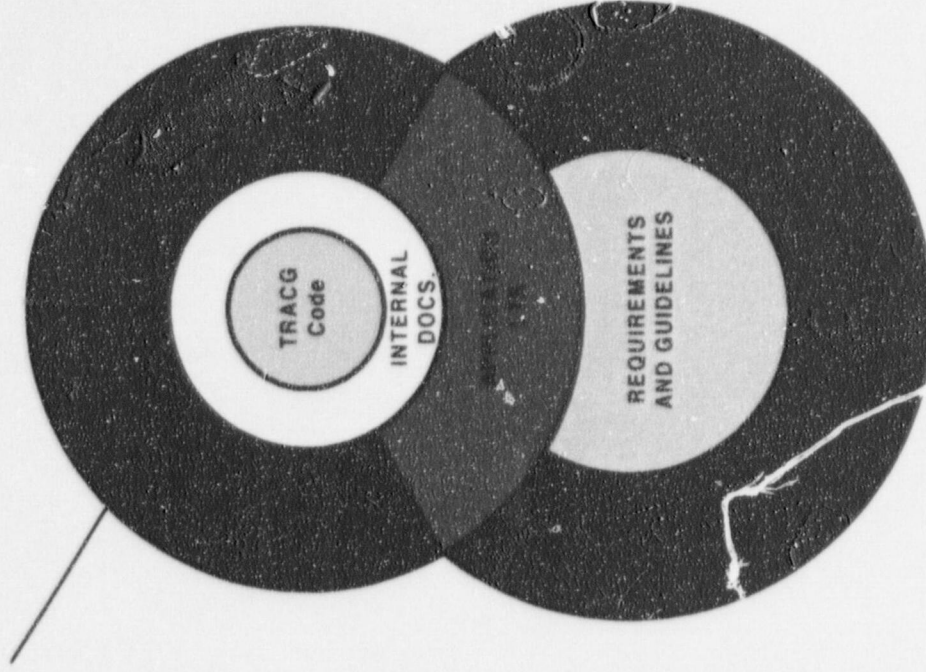
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- **Determination of Model and Experimental Uncertainty ***

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- A section defining model biases and uncertainties for all highly ranked PIRT parameters will be contained in Application Methodology LTR



Outline of Qualification LTR (NEDE-32177P)

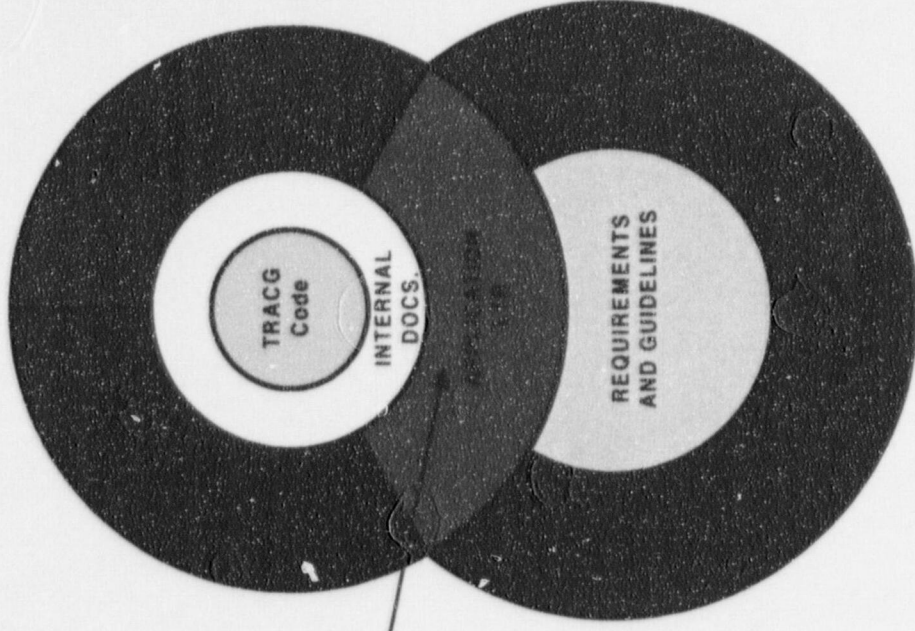
- 1. Introduction**
- 2. Qualification Strategy**
- 3. Separate Effects Tests**
- 4. Component Performance Tests**
- 5. Integral System Effects Tests**
- 6. BWR Plant Nodalization**
- 7. Plant Data**
- 8. Conclusions**

GE Proprietary Material
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High Level Outline Unchanged from Prior Reviews Review Comments Addressed
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TRACG Application Methodology - Major Elements

- **Plant and Event Definition**
- **Identification of Important Phenomena**
 - All Identified Event Categories
 - Ranking by Impact on Critical Safety Parameters
- **Determination of Code Applicability**
 - Structure, Basic Equations, Models and Correlations, Numerics
- **Qualification and Determination of Code Uncertainty**
 - Separate Effects Tests, Component Tests, Integral Effects Tests, Full Scale Plant Data
- **Determination of Effect of Reactor Input Parameters and State**
- **Determination of Total Uncertainty**
 - One Sided Upper Statistical Limit for Critical Safety Parameters



Structured Approach Similar to ODYN Safety Evaluation
Consistent with CSAU Methodology

Application Methodology

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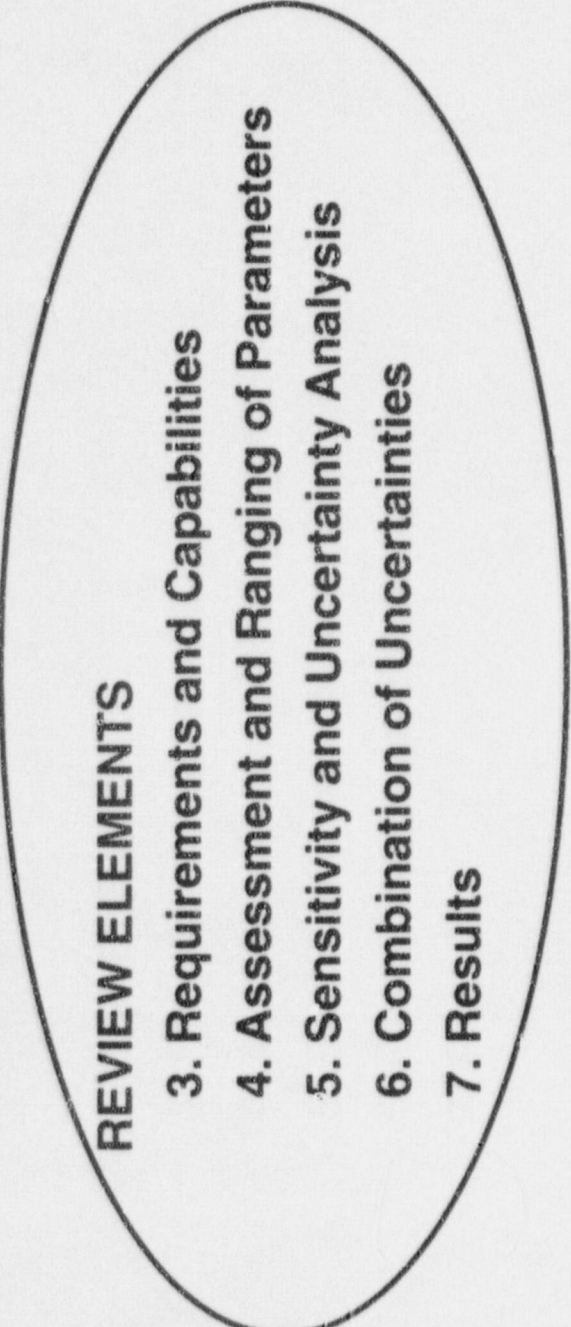
GE Proprietary Material Removed

Contents of Application LTR (NEDE-#####)

Described in Section 3.1.3 of the Application Framework.

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1. Approach
2. Introduction



REVIEW ELEMENTS

3. Requirements and Capabilities
4. Assessment and Ranging of Parameters
5. Sensitivity and Uncertainty Analysis
6. Combination of Uncertainties
7. Results

8. Conclusions
9. References

Requirements and Capabilities

- Scenario Specification
- Nuclear Power Plant Selection
- Phenomena Identification, Ranking

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Important Phenomena for BWR AOO Transients

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Previously Approved/Reviewed TRACG Applications

GE Proprietary Material
Removed

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Assessment and Ranging of Parameters

- **Model Capability**
- **Model Application Qualification Matrix**
- **Model Uncertainties and Biases**
- **Application Uncertainties and Biases**

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TRACG Model Capability Matrix

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TRACG Qualification Matrix

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Sensitivity and Uncertainty Analysis

- Initial Conditions (Table 3-5)
- Plant Parameters (Table 3-6)
- Scale and Noding Effects
- Uncertainty Inputs

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Plant Parameter and Initial Condition Uncertainties.

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Demonstration of Model Uncertainty and Bias

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Demonstration of PIRT Rankings

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Combination of Uncertainties

- **Examples of Recommended Approach**
- **Planned Confirmation Calculations**

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Combination of Uncertainties

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Combination of Uncertainties (continued)

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Application Methodology Calculations

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Demonstration of Separate Effect Compared to Data

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Demonstration of Combined Uncertainty in $\Delta\text{CPR}/\text{ICPR}$

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Demonstration (continued)

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TRACG Application to BWR AOO Transients

Summary

- **Scope:** BWR/2-6 AOO Transients
- **Meets All Regulatory Requirements**
- **Demonstration of Model Capability and Applicability**
- **Extensive Prior Reviews and Acceptance of TRACG**
- **Rigorous and Sound Statistical Methodology**
 - Model Uncertainty
 - Initial Conditions and Plant Parameter Uncertainties
 - One Sided Upper Statistical Limit for Critical Safety Parameters
- **Application Methodology Demonstrated for All Event Types**

Obtain SER for TRACG Application to BWR AOOs
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