



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 28, 1999

MEMORANDUM TO: Stuart A. Richards, Director
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Stephen Dembek, Chief, Section 2. *Stephen Dembek*
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: MEETING WITH GE NUCLEAR ENERGY ON TRACG THERMAL
HYDRAULIC METHODOLOGY

On July 15, 1999, the Nuclear Regulatory Commission (NRC) staff met with GE Nuclear Energy (GE) to discuss GE's plans for applying the TRACG code methodology for use in boiling water reactor (BWR) anticipated operational occurrence (AOO) transients. The list of meeting attendees is attached (Attachment 1).

On June 18, 1999, GE sent the NRC report NEDC-32900P, "TRACG Licensing Application Framework for AOO Transient Analyses." This document provided a framework for the approach to be used for obtaining the NRC's approval of the TRACG methodology. GE requested this meeting to obtain the NRC staff's feedback on the approach before the next series of topical reports are submitted. GE stated they plan to submit their proposed methodology in an October 1999 topical report and they will be requesting NRC concurrence that the TRACG methodology is acceptable for use in evaluating BWR AOO transients by July 2000. GE stated that they would be the sponsor of this topical report (it will not be submitted by a utility).

During the course of the meeting, the NRC staff provided the following feedback to GE:

1. The staff commented that the references made to methodology reviews for the simplified BWR (SBWR) did not apply to BWR 2 through 6 designs. The SBWR reviews specifically did not consider BWR features and phenomena which were specific to the BWR 2-6 product line and were not included in the SBWR. As a result, the staff believes that the GE characterization of the status of these "reviews" is optimistic.
2. The framework provided in NEDC-32900P is a good planning tool for the NRC. However, the difficulty will be in the implementation of the plan.
3. Barring unforeseen changes in NRC staff priorities, the NRC will be ready to review the topical report as soon as it is submitted. If GE submits the topical report in October 1999, the staff plans to complete their acceptance review by January 2000. To ensure completing the review by July 2000, GE should ensure prompt responses to any requests for additional information (RAI).

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Electric

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- 2 -

4. The NRC staff proposed another meeting on this subject in January 2000 prior to issuing a formal RAI.
5. The NRC will need the actual code to allow the staff to test the code.

The slides used by GE are attached (Attachments 2 and 3). Three of the slides in Attachment 3 are considered proprietary information and are not included.

Attachments: 1. Attendance List
2. Intro and Agenda Slides
3. Application Methodology Slides

cc w/att 1: See next page

GE Nuclear Engineering

cc w/att 1:

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NRC/GE NUCLEAR ENGINEERING MEETING ON TRACG
LIST OF ATTENDEES
July 15, 1999

| <u>NAME</u> | <u>ORGANIZATION</u> |
|-------------------|--|
| Jared Wermiel | Office of Nuclear Reactor Regulation/Division of Systems Safety and Analysis /Reactor Systems Branch (NRR/DSSA/SRXB) |
| Stephen Dembek | NRR/Division of Licensing Project Management |
| Tony Ulises | NRR/DSSA/SRXB |
| George Thomas | NRR/DSSA/SRXB |
| Ralph Caruso | NRR/DSSA/SRXB |
| Ralph Landry | NRR/DSSA/SRXB |
| Muhammad Razzaque | NRR/DSSA/SRXB |
| Jim Klapproth | GE |
| Charles Heck | GE |
| Jens Andersen | GE |

Introduction and Agenda

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

**Presentation to USNRC
James F. Klapproth**



Agenda

- **Introduction** **9:00-9:15**
 - Meeting Objectives
 - Overview of Scope
 - Milestones Status and Schedule

- **TRACG Application to BWR Transients** **9:15-9:45**
 - Proposed Application Methodology
 - Review of GE Submittals

- **Discussion and Action Items** **9:45-Noon**

Meeting Objectives

- Summarize Proposed Application Methodology
- Review Schedule for LTR Submittals and NRC Review
- Obtain NRC Feedback and Concurrence that the Proposed Application Methodology and the Proposed Documentation are Acceptable

**NRC Concurrence in a Process that
Results in NRC SER by July 2000**

TRACG Transient Application Status

• Previous Submittals to the NRC

- Presentation of “Plan for Application of TRACG to BWR AOO Transients” to the NRC May 25, 1999
- Submittal of TRACG Licensing Application Framework for AOO Transient Analyses, NEDC-32900P, June 1999 Transmitted to the NRC on June 18, 1999

Description of Proposed Application Methodology

Outline of Licensing Topical Reports

Roadmap for Review Process

TRACG Application Review Scope

•What Is in Scope?

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

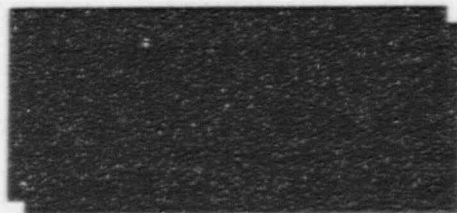
•What Is Not in Scope?

- LOCA/ECCS Analysis
- Containment Response
- ATWS
- Rod Drop Accident
- Application to ABWR or SBWR



**Require Separate
Application Methodology
and Separate Submittals**

Approach

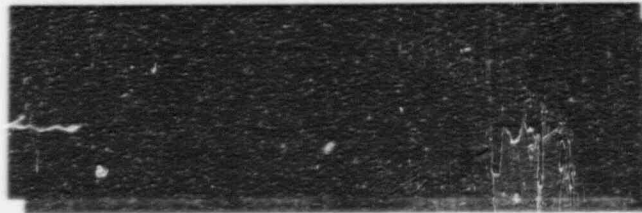


Rev. 1

Reviewed by NRC

Rev. 2

To be issued 10/99
Incorporates RAIs
Deletes SBWR
Models



Rev. 1

Reviewed by NRC

Rev. 2

To be issued 10/99
Incorporates RAIs
Deletes SBWR
Qualification Studies



Rev. 0

Will document
transient application
methodology
To be issued 10/99
Approach similar to
ODYN Safety
Evaluation

Primary NRC Review is existing RAI Resolution
and Application Methodology

Expected Outcomes

- **Output from the NRC - One SER for TRACG Application to BWR AOOs**
- **At this Meeting - NRC Concurrence that the Proposed Application Methodology for Application of TRACG to BWR AOO Transient is Acceptable**
 - Maximum use of previous NRC RAls
 - Focus NRC review on new materials

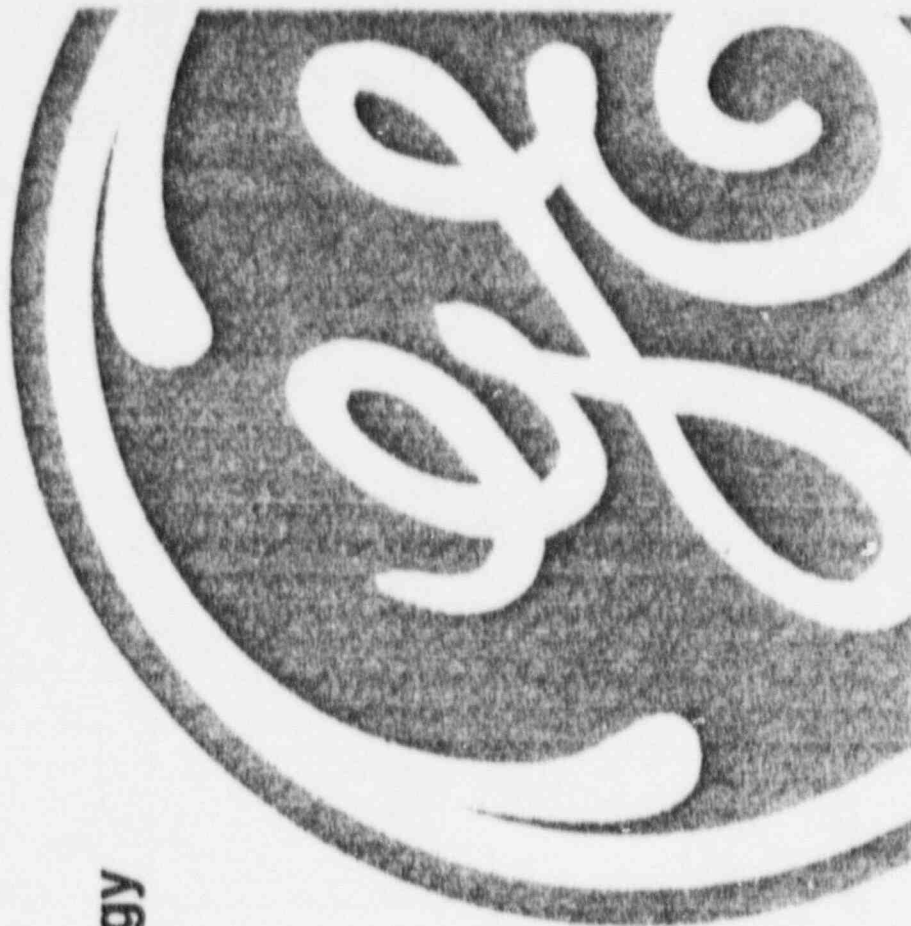
Key Milestones

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

TRACG Application Methodology for BWR Transients

J. G. M. Andersen

July 1999



TRACG Application for BWR Transients - Objective

• Previous Submittals to NRC

- Plan for Application of TRACG to BWR AOO Transients Presented to NRC May 25, 1999
- TRACG Licensing Application Framework for AOO Transient Analyses, NEDC-32900P, June 1999 Transmitted to NRC on June 18, 1999

 Description of proposed application methodology

 Outline of Licensing Topical Reports

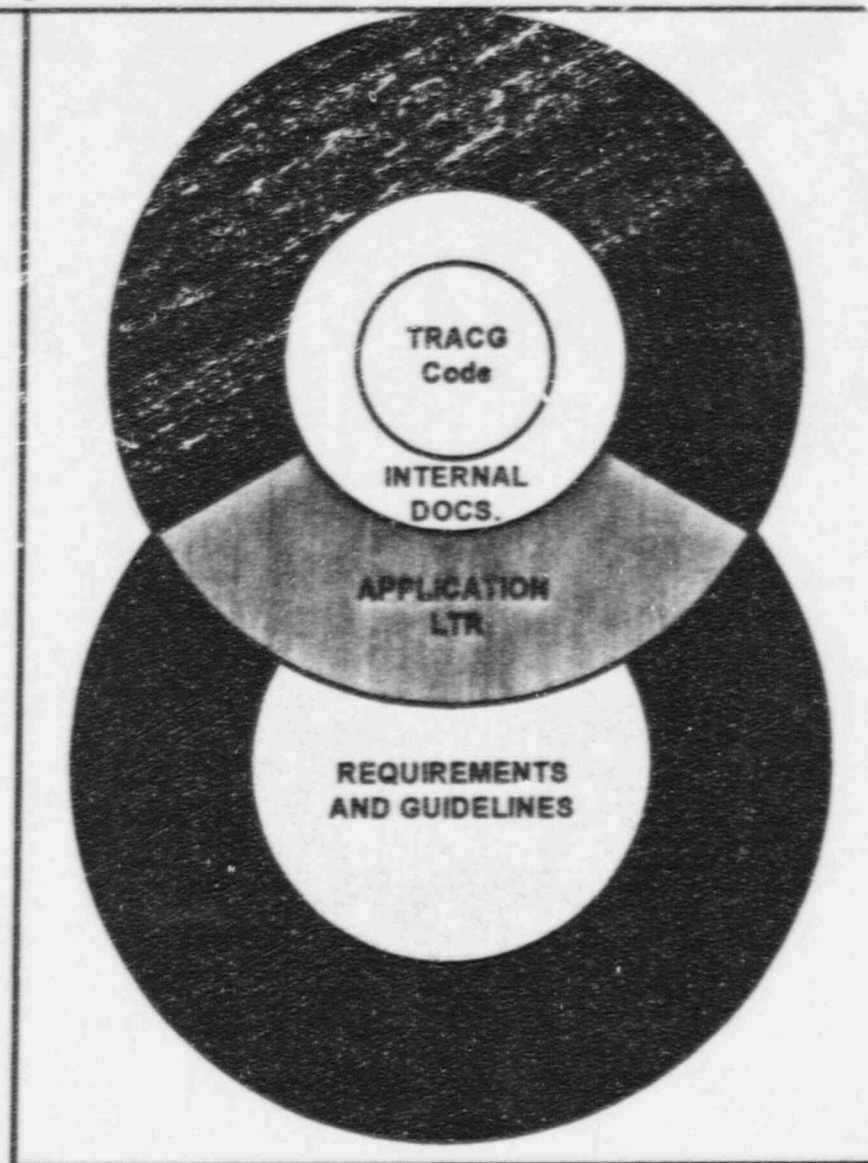
• Objective for this Meeting

- Summarize Proposed Application Methodology and Clarify any NRC Concerns/Questions
- Obtain NRC Feedback and Concurrence that the Proposed Application Methodology and the Proposed Documentation is Acceptable
- Review Schedule for LTR Submittals and NRC Review

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

TRACG Application Framework for ACO Transients



Application Methodology

GE Proprietary Material
Removed

GE Proprietary Material removed

Approach

| | |
|--------------------------------------|---|
| Scenario Specification | BWR AOO Transients |
| Plant Selection | BWR/2-6 |
| Phenomena Identification and Ranking | NEDE-32900P Table 3-2 |
| Frozen Code Version | TRACG02A – GE Program Library |
| Code Documentation | NEDE-32176P Rev. 2 |
| Code Applicability | NEDE-32900P Table 3-3 |
| Assessment Matrix | NEDE-32900P Table 3-4 |
| Plant Nodalization | NEDE-32177P Rev. 2 |
| Code and Experimental Accuracy | NEDE-32176P Rev. 2, NEDE-32176P Rev. 2, Application Methodology LTR |
| Effect of Scale | None – Assessed on Full Scale Plant Data |
| Plant Input and State | Application Methodology LTR |
| Sensitivity Calculations | Application Methodology LTR All Important Model and Plant Parameters |
| Combined Bias and Uncertainty | Application Methodology LTR ANOVA or Order Statistics |
| Total Uncertainty | Application Methodology LTR |

Phenomena Identification and Ranking (PIRT)

- **Identification of All Involved Phenomena**

- All BWR AOO Transient Event Categories
- Grouped by Plant Region

- **Ranking of Phenomena**

- High: Significant Impact on Transient
- Medium: Small Impact on Transient
- Low: Insignificant Impact on Transient
- N/A: Not Present for Transient

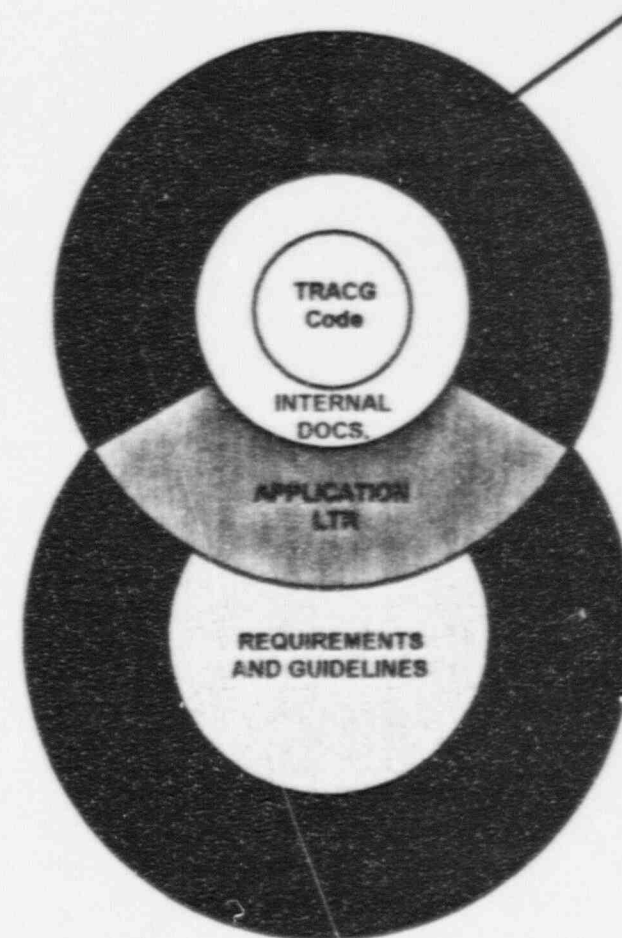
- **All High and Medium Ranked Phenomena Included in Application Methodology**

TRACG Model Capability

NEDE-32900P Table 3-3

| | |
|------------------|---|
| | Model Elements NEDE-32176 Rev.2 Section Number |
| Phenomena | Cross Reference |

- **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



TRACG Qualification

NEDC-32900P Table 3-4

| | |
|------------------|--|
| | Qualification Basis NEDE-32177 Rev.2 Section Number |
| Phenomena | Cross Reference |

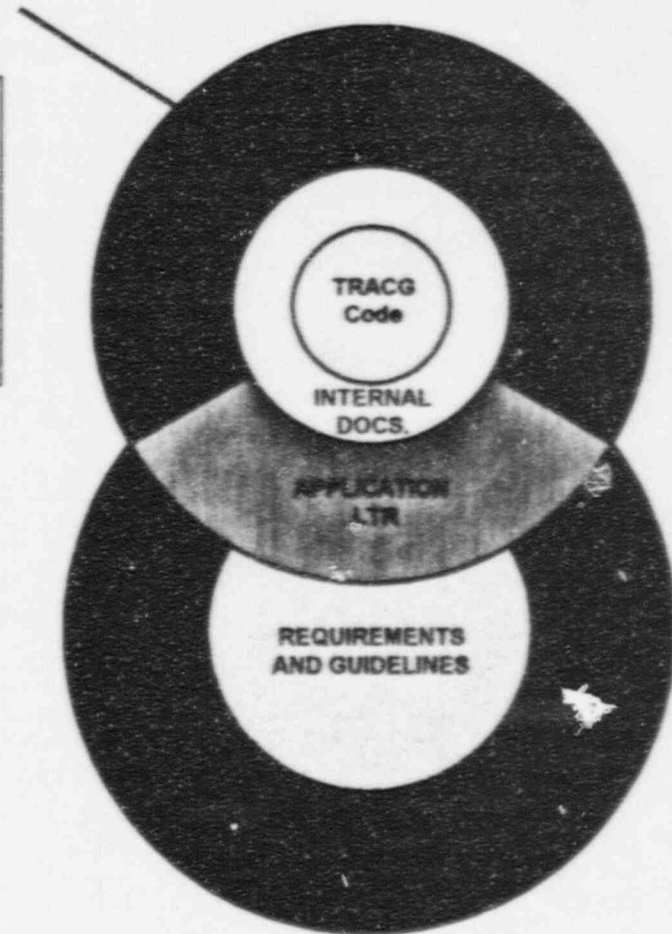
- **Qualification**

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

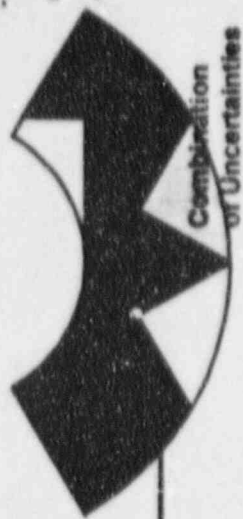
- **Determination of Adequacy of TRACG Models**

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

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



Combination Bias and Uncertainty



GE Proprietary Material
Removed

Licensing Criteria for AOO Transients - OLMCPR

GE Proprietary Material
Removed

Submittals to NRC

• Model Description LTR NEDE-32176P Rev. 2

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

• Qualification LTR NEDE-32177P Rev. 2

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

Review only sections
relevant for application
to AOO transients

Submittals to NRC

• Application Methodology LTR

1. Approach

2. Introduction

3. Requirements and Capabilities

- NEDC-32900P Table 3-2 - Phenomena Identification and Ranking Tables
- NEDC-32900P Table 3-3 - Cross Reference to Model Description LTR

4. Assessment and Ranging of Parameters

- NEDC-32900P Table 3-4 - Cross Reference to Qualification LTR
- Model and Experimental Accuracy

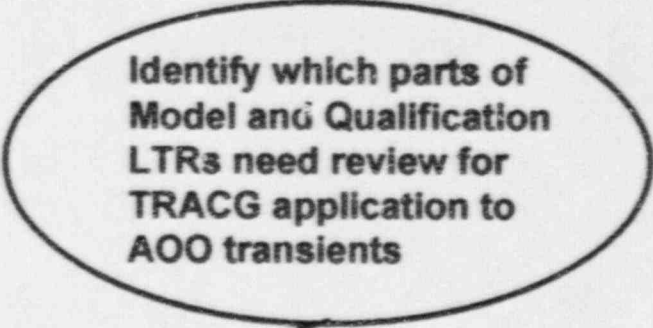
5. Sensitivity and Uncertainty Analysis

6. Combination of Uncertainties

7. Results

8. Conclusions

9. References



Identify which parts of Model and Qualification LTRs need review for TRACG application to AOO transients

Requested Output from NRC

- **One SER for Transient Application**

For Example:

TRACG is Applicable for BWR AOO Transients and can be Used for Design and Licensing Calculations when Following the Process Described in the Application Methodology LTR

Requested Actions at this Meeting

- **NRC Concurrence that the Proposed Application Methodology for Application of TRACG to BWR AOO Transients is Acceptable.**
 - Approach
 - Phenomena Identification and Ranking Tables
 - Statistical Methodology
 - Licensing Criteria
 - Proposed Documentation

- **GE will Continue to Produce and Submit Remaining LTRs**

July 28, 1999

4. The NRC staff proposed another meeting on this subject in January 2000 prior to issuing a formal RAI.
5. The NRC will need the actual code to allow the staff to test the code.

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