

EXECUTIVE SUMMARY

An Event Response Team was chartered to determine the causes for inaccuracies contained in the Millstone Unit 1 Updated Final Safety Analysis Report (UFSAR). The team reviewed documents and interviewed personnel to gather information pertaining to five areas: 1) Licensing Commitments, 2) UFSAR updates, 3) the Design Basis Document Project, 4) Administrative Controls, and 5) events and corrective actions associated with licensing commitments and design basis. The team used root cause analysis methods described in Nuclear Group Procedure 3.15 to determine fundamental causes and contributing factors.

The considerable scope and historical nature of this event preclude an analysis to an absolutely strict standard and definition of root cause. This analysis does identify the fundamental factors that led to an inaccurate UFSAR and exacerbated the extent of the inaccuracies. This report also identifies generic impications and other adverse conditions that were discovered during the investigation. This report does not address the safety significance of Unit 1 UFSAR inaccuracies.

The Northeast Utilities 50.54(f) Project Completion Plan activities will, when completed, ascertain the extent and safety significance of the inaccuracies in the Unit 1 UFSAR and associated design basis documents.

In recent years (1994-1995), NU corrected some specific UFSAR inaccuracies as they were identified. To some degree these individual efforts mitigated the extent of the Unit 1 UFSAR inaccuracies. These efforts notwithstanding, the era preceding these years created and sustained the ACR 7007 event pattern through January 1996.

The fundamental causes for the Millstone Unit 1 UFSAR inaccuracies are as follows:

- The original 1986/1987 UFSAR contained errors and omissions.
- The administrative control programs (e.g., Design Control, Corrective Action, Commitment Tracking) did not fully address regulatory requirements. Assuming the original UFSAR was accurate, verbatim compliance with the previous and current administrative programs would not have maintained an accurate UFSAR. Corrective actions for events and internal assessments did not fully address the adequacy of administrative programs for meeting regulatory requirements.
- NU did not fully implement the administrative programs. NU did not see the UFSAR as a document that was required to be accurate.
- Internal correspondence and events involving the design basis (e.g., NOV's, LERs) from 1985 through 1996 show a pattern of information communicated to NU management. This information consistently

identified weaknesses and risks associated with the UFSAR and design bases. NU management made commitments, on the docket, to correct these deficiencies. The actions were ineffective, partially implemented, or not done.

- NU oversight did not identify this event pattern to management, its significance, or the effectiveness of corrective actions to prevent recurrence.

Due to the nature of the errors identified in this report, the potential exists for the presence of similar configuration management conditions at Connecticut Yankee and the other Millstone units. The team cannot ascertain the full extent of the implications without a sample similar to the set of 50.54(f) initiatives currently in progress for Unit 1. The team recognizes that Engineering initiated these efforts concurrent with the completion of this report.

Other adverse conditions are as follows:

- There is an organizational tendency to focus narrowly on the technical aspects of issues and their technical resolution. This lack of a questioning attitude inhibits the identification of root causes, generic implications, and the corrective actions to prevent a class of recurrent issues.
- While there is a strong emphasis on safety as a stated objective, the organization does not consistently recognize or emphasize the collective set of administrative (e.g., the proposed Determine Course of Action (DCA) concept) and technical processes (e.g., Setpoint Control) that demonstrate and assure that objective is met.
- There is a general lack of understanding and appreciation for the relationship between 10 CFR 50, design bases, licensing bases, industry codes, and NU's administrative programs.
- Line managers use a limited set of tracking and trending tools. Task completion and scheduling compliance are the primary management focus. There is an absence of performance or success criteria for processes (e.g., license commitments) and programs (e.g., corrective actions preventing recurring events).

TABLE OF CONTENTS

Cover Page

Executive Summary 1

Table of Contents 3

1.0 Introduction 4

2.0 References 6

3.0 Persons Involved 6

4.0 Compilation of Facts 7

5.0 Conclusions 7

6.0 Corrective Actions 9

7.0 Comments 11

Attachments

A. Barrier Analysis Summary 13

B. Analysis of Events Involving the Design Basis 17

C. Administrative Programs Review 26

D. UFSAR Update Review 44

E. Design Basis Documentation Program Review 55

F. Oversight Review 64

G. Employee Interviews 65

H. References 82

I. Definitions 95

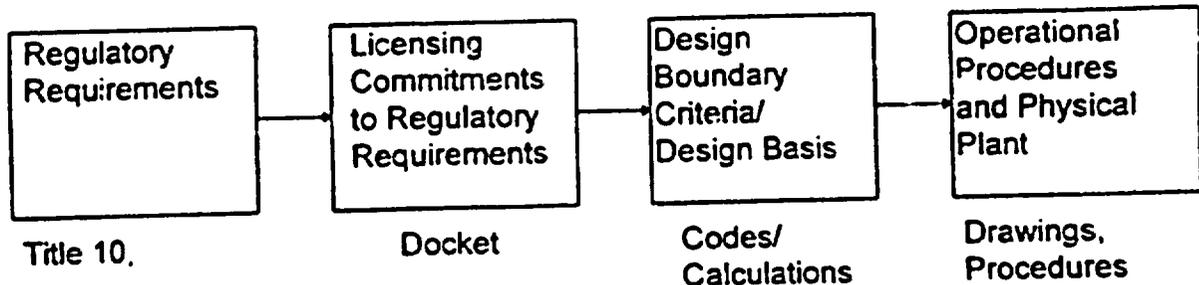
1.0 INTRODUCTION

1.1 Event Description

The UFSAR, system descriptions and design basis documents contain inaccuracies.

1.2 Scope

This event analysis determined the causes for inaccuracies contained in the UFSAR and associated documents. There are several general considerations affecting this work scope. The first consideration is understanding the location and role of the UFSAR in the logic process connecting regulatory requirements to the implementation of these requirements in operational procedures and the physical plant. The following model graphically depicts this logic. The documents shown below the model are examples of applicable documents for each step of the process. The UFSAR captures licensing commitments, design criteria establishing the bounding parameters for a system's operation, the description of physical plant, and the description of operational and maintenance procedures. The UFSAR also describes the commitment to implement administrative controls for the processes associated with each logic block.



A second consideration is the evolution of changes in each of the four logic blocks over the twenty five year operating history of Millstone Unit 1. The event scope includes a chronological review of the applicable process changes for the logic blocks.

The third consideration addresses the adequacy of the process controls and their implementation. Specifically, what administrative controls governed the work activities implementing regulatory requirements for each logic block and how effective was their implementation? The adequacy of these process controls may have generic implications and lead to multi-unit analyses. These general considerations frame the

detailed event scope. The detailed event scope includes five areas:

- Licensing
- UFSAR Updates
- Design Basis
- Administrative Controls
- A review of prior internal and external assessments

The Licensing commitments detailed scope included a chronology of processes used to make, manage and track commitments, the process for ensuring that the design incorporated these commitments, and the methods for documenting this information.

The UFSAR Update scope included a chronology of the UFSAR, the 10 CFR 50.71(e) rule making applicability, the 1986-1987 reconstituted UFSAR, process and content, the process for incorporating subsequent updates, and the UFSAR update process interfaces with other processes.

The Design Basis detailed scope analyzed the Design Basis Document Project, how it reflects and incorporates licensing commitments, interfaces and existing processes (e.g. Design Error Detection and Correction), other design basis documentation (e.g. calculations, drawings, specifications), and design basis maintenance.

The Administrative Controls evaluation reviewed programs and procedures applicable to Licensing commitments, UFSAR Updates, changes to the UFSAR, and operational procedures resulting from design changes, and 10 CFR 50.59 evaluations. This review included the chronological development and evolution of these Administrative Controls. This work scope reviewed the adequacy of prior process controls and the effectiveness of their implementation.

The final detailed area addressed the collective body of prior and current corrective actions associated with Licensing Commitments and Design Basis. This part of the evaluation established the chronology of internal and external assessments identifying design issue events (since 1985), their analysis, associated corrective actions, and the effectiveness of the Corrective Actions to preclude recurrent design events. These events were the primary input to the root cause analysis.

Document reviews and personnel interviews were the primary data collection methods. The analysis involved the root cause methods (e.g., Barrier Analysis, Event and Causal Factor Analysis Charting, Change Analysis), actual performance for each area, comparison of the above between each areas, and the effectiveness of prior corrective actions.

2.0 REFERENCES

The rigor and depth of this root cause analysis led to extensive document reviews. Attachment H lists the references used in this root cause analysis.

3.0 PERSONS INVOLVED

3.1 Team members:

Names deleted by NRC

3.2 Individuals contacted and/or interviewed:

Design Engineering

Tech. Support Engineering

Names deleted by NRC

Licensing

Others

Names deleted by NRC

4.0 COMPILATION OF FACTS

Attachments A (Detailed Barrier Analysis), B (Analysis of Events Involving the Design Bases), C (Administrative Programs), D (UFSAR Update), E (Design Basis Document Project), F (Oversight), G (Employee Interviews), and I (Definitions and Criteria) comprise the complete compilation of facts.

5.0 CONCLUSIONS

The following conclusions focus specifically on the fundamental causes for the Millstone Unit 1 UFSAR inaccuracies. Section 7.0 lists the generic implications and other adverse conditions that were discovered during the investigation. The analyses contained in Attachments A - G provide the support for these conclusions. Attachment A is an

analysis summary. The attachment sections supporting each conclusion are indicated in brackets [].

- 5.1 The Unit 1 UFSAR submitted in December 1986 and March 1987 contained errors and omissions [See Attachments B, G].
- 5.2 Some of these errors were known by Northeast Utilities and communicated to the NRC on the docket on multiple occasions. [Attachment B]
- 5.3 Repeated commitments to provide complete and accurate information (e.g., accurate UFSAR) to the NRC and corrective actions to address factual errors were ineffective, not done, or partially implemented. [Attachments A - G]
- 5.4 Northeast Utilities voluntarily initiated the Design Basis Documentation Program (DBDP) to compile and summarize the available design basis information for selected safety related systems. Through the DBDP, NU identified that it did not have calculations to support some parts of the design bases. Northeast Utilities decided to reconstruct these calculations only when required as part of a plant modification. [Attachments B, E]
- 5.5 Generally, Northeast Utilities did not perceive or view the UFSAR as a licensing basis document. They generally viewed the UFSAR as a historical reference document that did not have to be accurate. [Attachment G]
- 5.6 Regulatory requirements evolved over time. Although NU committed to implement the applicable requirements, administrative programs did not fully incorporate these requirements. Assuming verbatim compliance, the administrative controls would not assure that the design bases were maintained or that the UFSAR was accurate. These programs perpetuated factual errors and/or contributed to new UFSAR inaccuracies. Some specific programmatic weaknesses were corrected over time. Some weaknesses still exist. [Attachments C, D]
- 5.7 The long term pattern of decisions and actions has generic implications for Connecticut Yankee and Millstone Units 2 and 3. A sample of internal and external assessments and design events (e.g., LERs) for Units 2 and 3 and Connecticut Yankee supports the potential for generic implications. The team cannot ascertain the full extent of the implications without a sample similar to the set of 50.54(f) initiatives currently in progress for Unit 1. These generic implications do not apply to Seabrook, because both the management team and the

administrative programs affecting Seabrook were different.
[Attachments B - G]

- 5.8 There was a general lack of accountability and teamwork for UFSAR accuracy. [Attachment G]
- 5.9 The 50.54(f) Project Completion Plan internal self-assessment addressing the underlying causes for Northeast Utilities received the 50.54(f) letter should address the root causes for the pattern cited in conclusion 5.7 and comment 7.1. [NU 50.54(f) Project Completion Plan]

6.0 CORRECTIVE ACTION

Full implementation of the current 50.54(f) Project Completion Plan activities will correct the anomalies, inaccuracies and omissions in the Unit 1 UFSAR. The plan also addresses administrative control adequacy and a self-assessment of the reasons NU received the 50.54(f) letter. Therefore, the team recommends only two actions specific to UFSAR accuracy. Table 6.1 identifies the conclusions, comments, and associated corrective actions.

6.1 Corrective Actions for UFSAR Accuracy

- 6.1.1 Conduct a verification effort, similar to the Millstone Unit 1 effort, for Millstone Units 2 and 3 and Connecticut Yankee. The initial efforts should use a sampling method to ascertain the content, quality and availability of design bases information and the current licensing basis. The team recognizes that Engineering initiated this corrective action during the preparation of this report. (Refer to Conclusion 5.7)
- 6.1.2 Develop and implement a Corrective Action Monitoring Plan. (Required per NGPs 3.15 and 2.40)

6.2 Corrective Actions for Comments

- 6.2.1 Nuclear Group Directors should develop and conduct a program to educate employees (including contractors) on the requirements and linkage between Title 10, current licensing bases, industry codes, NU's administrative programs and design activities. This action should not be delegated. (Refer to Comment 7.3)
- 6.2.2 Unit 1 Engineering should take the lead for developing measurement tools for functional area performance (e.g., PDCK close-out). (Refer to Comment 7.6)

Table 6.1

Conclusion/Comment	Corrective Action
5.1 UFSAR submitted to NRC in 1986/87 with errors.	Addressed by 50.54(f) Project Completion Plan.
5.2 NU knew about these errors.	Historical fact; no action required.
5.3 Commitments to correct the errors were ineffective.	Addressed by 50.54(f) Project Completion Plan.
5.4 Calculations did not exist to support some of the design bases, and were not reconstructed.	Addressed by 50.54(f) Project Completion Plan.
5.5 NU did not view UFSAR as a licensing basis document.	Corrective action 6.2.1: develop and implement education program.
5.6 NU's administrative programs did not fully incorporate regulatory requirements.	Addressed by 50.54(f) Project Completion Plan.
5.7 Decade-long pattern of decisions and actions has generic implications.	Corrective action 6.1.1: conduct a verification effort at MP2, MP3, CY.
5.8 Lack of accountability and teamwork for UFSAR accuracy.	Corrective action 6.1.2: develop and implement a Corrective Action Monitoring Plan.
5.9 Root cause for 5.7 will be identified by 50.54(f) self-assessment.	Addressed by 50.54(f) Project Completion Plan.
7.1 Issues and their causes were identified to management; management should have been accountable for the corrective actions.	Addressed by 50.54(f) Project Completion Plan.
7.2 NU Oversight did not identify administrative programs weaknesses or pattern of design control events.	Addressed by recent reorganization and corrective actions 6.1.2.
7.3 Employees do not understand relationship between 10 CFR, design bases, industry standards, administrative programs.	Corrective action 6.2.1: develop and implement education program.
7.4 Organization does not appreciate processes needed to achieve stated safety objectives.	Corrective action 6.2.1: develop and implement education program.

Table 6.1 Continued

Conclusion/Comment	Corrective Action
7.5 Organization focuses narrowly on problems and their resolutions.	Corrective action 6.2.1: develop and implement education program.
7.6 Line managers use a limited set of tracking and trending tools.	Corrective action 6.2.2: develop measurement tools for functional area performance.

7.0 COMMENTS

- 7.1 The causal factors of the Unit One UFSAR accuracy issue parallel root cause themes identified in other internal and external assessments and event analyses. (Attachment C to the January 1996 Nuclear Safety Concerns Program Self-Assessment provides a partial listing of prior assessments and related themes.) These assessments, across multiple functional areas, indicate that the assessment process worked as intended to identify issues and their causes to management since 1985 (the period of interest). Specifically, internal management correspondence and event analyses (e.g., LERs, SSFIs) periodically and consistently provided management with information on the status of Unit One's design basis and UFSAR accuracy, from 1986 to present day. Management should have been accountable for both the adequacy of the administrative programs (e.g., Design Control) to ensure employee success (e.g., producing an accurate UFSAR), and for taking effective corrective actions to prevent recurrent events. [Attachments B - E]
- 7.2 Until 1995, NU oversight did not identify the pattern of administrative program weaknesses and events concerning the design bases to management or verify the effectiveness of corrective actions for known issues. [Attachment F]
- 7.3 Most of the engineers and managers contacted during this analysis (individuals who should be well versed in design control requirements) have not read Title 10 of the Code of Federal Regulations, Regulatory Guides, or ANSI Standards pertinent to design control. There is a general lack of understanding and appreciation of the relationship and implications between 10 CFR 50, design bases (50.2), licensing bases, industry codes, and NU's administrative programs controlling configuration and design. [Attachment G]
- 7.4 The team's interviews and document reviews indicate an organizational emphasis on safety as an objective. However, the

organization does not emphasize or recognize the collective set of administrative (e.g., the proposed Determine Course of Action (DCA) concept) and technical processes (e.g., Setpoint Control) that demonstrate and assure that the objective is met. For example, the team identified many activities that could result in the need to change the UFSAR. Each of these activities has independent administrative controls, rendering them fully effective only if another activity which could change the UFSAR is not in progress. The overall UFSAR change mechanism processes are not integrated and create the potential for omissions and conflicts. The organization needs to acquire a balanced perspective and appreciation for safety as both process and objective. [Attachment G]

- 7.5 The "event" data for this root cause reveals an organizational tendency to focus narrowly on the technical aspects of issues and their technical resolution. The lack of questioning attitude inhibits identification of generic implications, root cause analysis, and the corrective actions to prevent a class of recurrent issues. [Attachment B]
- 7.6 This root cause analysis found that line managers use a limited set of tracking and trending tools. Line managers do not use routine performance measurement tools with defined success criteria. There are few objective measures indicating the relative or actual status of overall or specific performance. For example, submittal of UFSAR changes is required within 30 days of a PDCR being declared operable. Neither this information nor other UFSAR change processes (e.g., Design Calculations) are tracked or trended. Therefore, it is not possible to measure performance to the success criteria of a UFSAR that accurately describes the facility and its procedures.

8.0 ATTACHMENTS

- Attachment A - Barrier Analysis Summary
- Attachment B - Analysis of Events Involving the Design Basis
- Attachment C - Administrative Programs Review
- Attachment D - UFSAR Update Review
- Attachment E - Design Basis Documentation Program Review
- Attachment F - Oversight Review
- Attachment G - Employee Interviews
- Attachment H - References
- Attachment I - Definitions and Criteria



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D C 20555-0001

March 7, 1996

Attachment 2
IN 96-17
March 18, 1996
Page 1 of 3

Mr. Robert E. Busch
President - Energy Resources Group
Northeast Utilities Service Company
P.O. Box 128
Waterford, CT 06385

Dear Mr. Busch:

On December 13, 1995, the NRC issued to Northeast Utilities (NU) a letter requesting NU pursuant to Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f) to "describe actions taken to ensure that future operation of Millstone Unit 1 will be conducted in accordance with the terms and conditions of the Millstone Unit 1 operating license, the Commission's regulations, including 10 CFR 50.59, and the Millstone Unit 1 Updated Final Safety Analysis Report (UFSAR)." Since that time NRC has continued to conduct inspections and investigations at the Millstone Station to determine the state of compliance of NU nuclear facilities with NRC requirements. As part of these efforts, NRC has obtained a copy of an internal NU document, "ACR 7007 - Event Response Team Report" (7007 Report), dated February 22, 1996.

The Executive Summary of the 7007 Report states that an Event Response Team was chartered to determine the causes for the inaccuracies in the Millstone Unit 1 UFSAR. The fundamental causes for these inaccuracies were found by this Team to include:

- The original 1986/1987 UFSAR contained errors and omissions;
- Administrative control programs such as Design Control, Corrective Action, and Commitment Tracking did not fully address regulatory requirements;
- NU did not fully implement the administrative programs. NU did not see the UFSAR as a document that was required to be accurate;
- Internal correspondence and events involving the design basis from 1985 through 1996 show a pattern of information communicated to NU management. This information consistently identified weaknesses and risks associated with the UFSAR and design bases. NU management made commitments, on the docket, to correct these deficiencies. The commitments to correct these deficiencies were ineffective, partially implemented, or not done;
- NU oversight did not identify this event pattern to management, its significance, or the effectiveness of corrective actions to prevent recurrence.

The 7007 Report further states that, due to the nature of the causes that the Team has identified, the potential exists for the presence of similar configuration management conditions at Millstone Unit 2. It notes that

~~4667126164~~

Attachment 2

R. Busch

-2-

without a sample similar to the initiatives currently in progress for Millstone Unit 1 as a result of the 10 CFR 50.54(f) letter of December 13, 1995, the full implications for Millstone Unit 2 cannot be ascertained. The 7007 Report recognizes that those efforts may be underway. This Report also addresses Millstone Unit 3 and Haddam Neck which we are addressing by separate letter.

Current licensee reviews and NRC inspections of Millstone Unit 2 have identified a number of operability and design concerns. Millstone Unit 2 shutdown on February 20, 1996, when a potential design deficiency was identified that could block or reduce safety injection flow during the recirculation phase of an accident. During this shutdown, other design discrepancies were identified in which NU had not maintained the current design or licensing basis for Millstone Unit 2. For example, NU's inspection of the containment sump screen mesh revealed that debris larger than the design value could pass through with potential adverse consequences to the emergency core cooling systems. NU identified that the flood protection enclosure could not be installed on one of the service water pumps that has been relied on for ultimate heat sink operability. Further, the NRC identified that the post-accident containment hydrogen monitor design was flawed in that insufficient sample flow would be available at low containment pressures when the monitor must be operable.

Consequently, there is a question as to whether Millstone Unit 2 conforms to the UFSAR, license conditions, and Commission regulations. Therefore, the NRC requires additional information to be submitted pursuant to Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f) in writing, under oath or affirmation, to determine whether or not the license for Millstone Unit 2 should be suspended, modified, or revoked. The information is to be submitted no later than 7 days prior to Millstone Unit 2 restart (prior to criticality) from its current outage and is to describe actions taken to ensure that future operation of Millstone Unit 2 will be conducted in accordance with the terms and conditions of the Millstone Unit 2 operating license, the Commission's regulations, including 10 CFR 50.59, and the Millstone Unit 2 UFSAR.

The submittal should describe actions taken to assure that deficiencies identified at Millstone Unit 2 based on your ongoing review have been evaluated for operability, existence of unreviewed safety questions, and reportability. In particular, seriously degraded conditions must be reported pursuant to 10 CFR 50.72(b)(2)(i) and 50.73(a)(2)(ii).

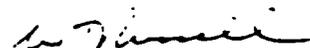
In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter and your responses will be placed in the NRC Public Document Room (PDR) the Gelman Building, 2120 L Street, NW., Washington, DC, and in the local public document room located at the Learning Resources Center, Three Rivers Community-Technical College, 574 New London Turnpike, Norwich, CT 06360. The NRC also intends to place in the PDR a copy of the 7007 Report on March 15, 1996, unless you provide a sufficient basis to withhold this Report by March 12, 1996. Any request for withholding must be accompanied by a bracketed copy of the Report that identifies the information that you seek

R. Busch

-3-

to have protected and a redacted copy that deletes such information. You must provide for each portion of the document you seek to be withheld the bases for your claim of withholding.

Sincerely,



William T. Russell, Director
Office of Nuclear Reactor Regulation

Docket No. 50-336

cc: See next page

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
96-16	BWR Operation with Indicated Flow Less Than Natural Circulation	03/14/96	All holders of OLs or CPs for boiling-water reactors
96-15	Unexpected Plant Performance During Performance of New Surveillance Tests	03/08/96	All holders of OLs or CPs for nuclear power reactors
96-14	Degradation of Radwaste Facility Equipment at Millstone Nuclear Power Station, Unit 1	03/01/96	All holders of OLs or CPs for nuclear power reactors
96-13	Potential Containment Leak Paths Through Hydrogen Analyzers	02/26/96	All holders of OLs or CPs for nuclear power reactors
96-12	Control Rod Insertion Problems	02/15/96	All holders of OLs or CPs for nuclear power reactors
96-11	Ingress of Demineralizer Resins Increases Potential Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations	02/14/96	All holders of OLs or CPs for pressurized water nuclear power reactors
96-10	Potential Blockage by Debris of Safety System Piping Which is Not Used During Normal Operation or Tested During Surveillances	02/13/96	All holders of OLs or CPs for nuclear power reactors
96-09	Damage in Foreign Steam Generator Internals	02/12/96	All holders of OLs or CPs for pressurized water reactors

OL = Operating License
 CP = Construction Permit