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March 31, 1986

Docket No. 50-213
B12020

Office of Nuclear Reactor Regulation
Attn: Mr. Christopher I. Grimes, Director
Integrated Safety Assessment Project Directorate
Division of PWR Licensing - B
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Haddam Neck Plant
Probabilistic Safety Study - Summary Report and Results

Northeast Utilities Service Company (NUSCO), on behalf of Connecticut Yankee Atomic Power Company (CYAPCO), has recently completed a plant-specific Probabilistic Safety Study (PSS) including a Best Estimate LOCA Analysis for the Haddam Neck Plant. The studies have been and will be utilized for many purposes. Among the near-term applications for the PSS is for assistance in making backfitting decisions in the context of the Integrated Safety Assessment Program (ISAP) currently being implemented at the Haddam Neck Plant.

Background

During the past several years, NUSCO has been implementing a Living PRA Program for the nuclear plants within the Northeast Utilities (NU) system. The major element of this program is the development, maintenance and use of PRA models, of each of the system's nuclear power plants, for assistance in evaluating potential plant backfits and operating procedures modifications. The Living PRA Program affords us the flexibility to quickly and accurately analyze the impact on plant safety of changes to the plant's design configuration and significant changes to operating procedures.

NUSCO has completed the development of a computerized PRA model of the Haddam Neck Plant. This model will be periodically updated to incorporate plant design changes, significant operational changes and relevant updated equipment performance data.

The Haddam Neck PSS utilized current state-of-the-art computational and modeling techniques. Included in the study were a comprehensive analysis of best estimate plant specific LOCA and transient response, Haddam Neck specific operating, reliability and maintenance data, the latest plant design

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changes and draft symptom-oriented Emergency Operating Procedures. The scope of the PSS also included support system failure initiated events, interfacing system LOCA events and fire initiated events.⁽¹⁾

As noted in SECY-85-160,⁽²⁾ the integrated assessment of the Haddam Neck Plant is scheduled to be completed during 1986. The schedule was based, in part, on our schedule for completion of and documentation of a summary report of the Haddam Neck PSS during March 1986. In keeping with the schedule for completion of the integrated assessment, our submittal of the Haddam Neck PSS Summary Report and Best Estimate LOCA Analysis will enable the Staff to begin the probabilistic safety analysis review phase of the integrated assessment of Haddam Neck.

Results

It is Northeast Utilities Corporate Policy to provide dependable and economic power to its customers, without endangering the health and safety of the public. As one element of achieving this policy, NU has set forth quantitative safety goals for the design and operation of our nuclear power plants. If it is determined that any one of our nuclear power plants does not meet the acceptance criteria as established by our safety goals, our policy is to take the corrective action necessary to meet the criteria, on a schedule commensurate with the level of deficiency found.

The Haddam Neck PSS calculated a mean core melt frequency of 5.5×10^{-4} per reactor-year for the Haddam Neck Plant which exceeds one of our safety goals. As a result, we have committed resources to work to decrease the overall core melt frequency at the Haddam Neck Plant. We have begun evaluating some of the engineering insights obtained from the PSS, in order to determine the alternatives available to reduce the calculated core melt frequency. A summary of the engineering insights obtained from the PSS and items we are evaluating to reduce the calculated core melt risk at the Haddam Neck Plant are contained in Enclosure 2.

As outlined in Enclosures 1 and 2, the PSS and Best Estimate LOCA Analysis yielded many insights into the operation of the plant including:

- o Containment heat removal is available for most core melt sequences. As the availability of containment heat removal is considered to be an effective means of maintaining containment integrity and removing fission products to prevent large scale radioactive releases if core melt occurs, the public risk impact of a majority of the dominant core melt sequences is reduced by having containment heat removal available.

(1) The fire initiated events section of the PSS has not been completed at the present time. NUSCO will document and docket the updated results to the Staff following completion of the analysis.

(2) SECY-85-160, "Integrated Safety Assessment Program - Implementation Plan," dated May 6, 1985.

- o An AC independent means of providing containment spray during a station blackout is provided by the diesel-driven fire pump. This feature is important in minimizing the offsite public consequences resulting from a core melt accident due to station blackout.
- o Approximately 40% of the calculated core melt frequency at Haddam Neck is attributable to small and medium break LOCA scenarios. The PSS utilized LOCA frequencies which were derived from generic PWR data as presented in WASH-1400. As the Haddam Neck Plant utilizes austenitic stainless steel which has superior ductility toughness and resistance to brittle fracture compared to ferritic carbon steel used in many PWR plants, the actual Haddam Neck Plant LOCA frequency is expected to be lower.
- o The Haddam Neck plant-specific control room simulator has been completed and is currently being used for operator training. This affords us the opportunity to improve the training of operators to respond to plant transient situations.

In light of the above, and our continuing efforts to identify, evaluate and when necessary implement procedural or hardware modifications to upgrade the operation of the plant, CYAPCO has concluded that continued operation of the Haddam Neck Plant does not pose any undue risk to the public.

Summary Report

NUSCO has completed summary reports of the Haddam Neck PSS and Best Estimate LOCA Analysis which we are providing to the Staff as an attachment to this letter.⁽³⁾ The PSS summary report is a comprehensive summary of the core melt frequencies for various sequences calculated in the study and the calculational methodologies and analysis techniques utilized in the development of the PRA model. The PSS summary report contains the items outlined below:

- o Determination of Initiating Events
 - System investigations
 - Initiator frequency calculations
- o Accident Sequence Analysis
 - Classification of event sequence outcomes
 - Plant systems event tree models
 - Plant support system event tree models
- o Plant Systems Reliability Analysis
 - Plant component reliability data collection and analysis
 - Plant systems reliability modeling

(3) The summary reports consist of the Haddam Neck Probabilistic Safety Study (Volumes 1-4) and the Best Estimate LOCA Analysis (one volume) for the Haddam Neck Plant.

- o Human Reliability Analysis
 - Introduction and methodology
 - Screening analysis
 - Detailed representation of operator action
 - Summary of results
- o Accident Sequence Quantification
 - Matrix quantification
 - Core melt accident sequence quantification results
 - Containment heat removal reliability consideration

In support of the PSS, a Best Estimate LOCA Analysis was performed concurrent with the development of the PSS models. The Best Estimate LOCA Analysis summary report describes the results of comprehensive plant specific accident analyses used to determine best estimate system success criteria, best estimate plant response to failed equipment and components, and time frames for operator recovery of failed systems. These calculations were performed using the NULAP 5 Code with best estimate input values. The Best Estimate LOCA Analysis contains analyses of the scenarios described below:

- o Station Blackout
- o Incore Instrument Tube Rupture
- o Steam Generator Tube Rupture
- o Large Break LOCA
- o Medium Break LOCA
- o Small Break LOCA
- o Total Loss of Main and Auxiliary Feedwater with Feed and Bleed Cooling
- o Anticipated Transient Without Scram
- o Total Loss of DC Power

In accordance with your request we are providing 26 copies of the PSS and Best Estimate LOCA Analysis to the ISAP Project Directorate for distribution within the NRC (including NRR, Region 1, ACRS, etc.).

In addition to the summary reports, we are providing the Staff with additional information on the scope and results of the PSS as outlined below.

- o Enclosure 1

A summary of the results of the PSS is provided herein.

- o Enclosure 2

Discussions of the major engineering insights NUSCO has obtained from the PSS including the following two plant design changes already implemented at the plant are provided herein.

- o Plant Design change to eliminate the common dependence of emergency diesel generator cooling on Motor Control Center-5 (MCC-5). This dependence, found while doing the analysis, could be significant during a loss of offsite power event as the diesel generators are dependent on MCC-5 to maintain diesel generator cooling. However, the diesel generators are not dependent upon

MCC-5 to start up following a loss of offsite power event. If one or both diesel generators start-up, accept their emergency loads and properly reenergize MCC-5 as designed, the original configuration would result in long-term diesel generator cooling availability.

- o Plant design change to mitigate the effects of the loss of MCC-5 (as an initiator) by tripping the charging pumps.

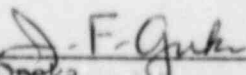
These design changes were credited in our quantification of the PSS as a result of our preliminary evaluations of the PSS models which highlighted these design conditions as being potential significant contributors to the total core melt frequency at the plant.

Upcoming Activities

In order to facilitate Staff review and understanding of the Haddam Neck PSS and to ensure that maximum utilization of the PSS is achieved, in ISAP and other applications, we are willing to meet with your Staff to review the PSS. Our efforts to date have focused on completing and documenting this study, and on a limited number of high priority issues which were identified during the conduct of the PSS. In the near term, we plan to complete and document our analysis of fire initiated events and to evaluate the report in more detail to identify additional issues which warrant further study. Consistent with the overall ISAP framework, these issues will be identified, new ISAP topics will be proposed and they will be evaluated in a manner consistent with the process in place for all other ISAP topics.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY



J. F. Opeka
Senior Vice President

cc: T. E. Murley, Region I (with Enclosures 1 and 2 only)