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Docket No. 50-213
B12289

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
ISAP Topic 2.02
DWST Oxygen Reduction

In May, 1985,(1) Connecticut Yankee Atomic Power Company (CYAPCO) notified the NRC of its intention to evaluate, within the context of the Integrated Safety Assessment Program (ISAP), a proposed plant modification to reduce the oxygen in the Haddam Neck Plant's Demineralized Water Storage Tank (DWST). Subsequently, in a letter dated July 31, 1985,(2) the NRC requested CYAPCO provide the Staff with a review of this, as well as other, planned CYAPCO plant improvement projects. CYAPCO responded to this request and provided the NRC with a review of this project, noting that the project was partially installed and that testing of the system was underway.(3) The purpose of this letter is to update the Staff as to the current status of the project.

Project Background

As originally conceived, the project included the design and installation of a nitrogen blanketing system for the DWST. The purpose of the project was to reduce the oxygen content on the secondary side, consistent with our objective of improved plant water chemistry. The DWST, presently an atmospheric tank, is a major source of oxygen in the feedwater system.

The system was designed to maintain a constant pressure nitrogen blanket on the water in the DWST during makeup to or letdown from the condenser hot wells, as

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(1) J. F. Opeka letter to C. I. Grimes, "Integrated Safety Assessment Program," dated May 17, 1985.

(2) H. L. Thompson letter to J. F. Opeka, "Integrated Safety Assessment Program," dated July 31, 1985.

(3) J. F. Opeka letter to C. I. Grimes, "Integrated Safety Assessment Program," dated September 19, 1986.

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well as during other various draw-down or pump-in modes. Breather valves were included in the system and were designed to operate during various pump-in modes or, if tank draw-down exceeds nitrogen makeup capacity, thereby maintaining tank integrity. Also, the DWST overflow line was extended to a loop seal. This provided an additional relief path and a configuration conducive to returning the tank to atmospheric conditions, if ever required. Previous to this design change, the tank was vented to atmosphere via a gooseneck vent and had overflow capabilities.

The system was partially installed and testing began during the 1986 refueling outage. Partial testing was completed during the outage with the remainder of the testing and activation of the system scheduled for the 1988 refueling outage. It is noted that the system had not been put into service.

Recent Findings

Concurrent with the installation of the system, the modification was being reviewed within the framework of the ISAP for the Haddam Neck Plant. As part of this review, the principles of Probabilistic Risk Assessment (PRA) were applied to estimate the overall impact of the proposed design change on the core melt frequency at Haddam Neck.

Although the design for the DWST oxygen reduction system reflected sound engineering and current design practices, the PRA evaluation revealed that implementation of the project as designed could result in a slight increase in total core melt frequency. This slight increase in core melt frequency is mainly due to the replacement of the gooseneck vent overflow line (a passive feature) with a loop seal and redundant breather valves (an active feature) whose operability over long time periods could not be directly confirmed. An additional concern was the high duty cycle. Current estimates indicate a need requiring breather valve operation at least daily. If both redundant valves are failed, due to either common cause failure or multiple undetected random failures, a loss of main feedwater with subsequent loss of auxiliary feedwater could occur due to the tank failure.

Upon initial inspection, this project did not appear to have the potential to adversely affect total core melt frequency. In fact, it appeared that the only conceivable changes were beneficial. Consequently, detailed PRA system analysis techniques were not utilized to evaluate this project prior to the current ISAP evaluation.

As such, the 10CFR50.59 evaluation of the DWST Oxygen Reduction plant design change request did not capture the insights which could only be derived by reviewing the project from a probabilistic standpoint. The project was reviewed, per the criteria of 10CFR50.59, and was not found to constitute an unreviewed safety question. This conclusion was based largely on the fact that there were two redundant breather valves in the system in addition to an overflow loop seal, thus providing protection from a single failure of a breather valve. Consequently, NRC approval prior to implementation was not required.

However, in assessing the project from a probabilistic standpoint, additional and more subtle factors are considered including common cause failures of equipment. Common cause failures of the breather valves on the system could, in the worst case scenario, lead to increased unavailability of the main and auxiliary feedwater systems and a resultant increase in the core melt frequency of the plant.

Current Activities

As a result of the identification of this situation, the following activities are being undertaken:

1) Measures have been taken to maintain the system in a deactivated condition and evaluations are being performed to determine the necessary steps to permanently decommission the modification;

2) Alternate methods to control the oxygen content of main feedwater are being evaluated;

3) The reportability of this event, per 10CFR50.72 and 50.73, is being investigated, and will be determined no later than November 10, 1986; and

4) Further documentation and details of the probabilistic analysis, and discussion of future related activities will be forwarded to the Staff in the Haddam Neck ISAP Final Report, scheduled to be submitted during November, 1986.

Conclusions

While we did not anticipate this development, we believe that this activity, as well as an analogous situation which occurred on Millstone Unit No. 1 during the review of a project to provide degraded grid protection for Class 1E Power Systems[4] are illustrative of the benefits that the ISAP process and maintaining plant-specific Living PRA models will foster as they are fully implemented. The intricacies associated with proper implementation of design changes necessitate the conduct of thorough and comprehensive reviews. There are instances, such as the case in point here, where conventional engineering practices can lead to small but nonetheless undesirable adverse consequences. The ultimate goal of improved overall plant safety is being served in the long term via the ISAP process and our Living PRA models. We will keep you advised of any significant developments on this issue.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

J. F. Opeka

J. F. Opeka
Senior Vice President

E. J. Mroczka

By: E. J. Mroczka
Vice President

cc: Dr. T. E. Murley, Region I

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(4) J. F. Opeka letter to J. A. Zwolinski, "Degraded Grid Protection for Class 1E Power Systems," Docket No. 50-245, dated November 14, 1985.