

United States
Nuclear Regulatory Commission



Report of Investigation

GENERAL ELECTRIC COMPANY NUCLEAR ENERGY:

Allegedly: (1) deliberately withheld or delayed from disclosure information of potential safety significance from the NRC because of commercial considerations, modified procedures for licensing calculations in order to obtain more favorable values of stability decay ratios, and failed to report procedural errors in licensing calculations which could impact the results for certain licensed boiling water reactors; and (2) deliberately presented false or misleading information to the NRC in response to questions raised during licensing reviews and during the LaSalle Unit 2 Enforcement Conference.

Office of Investigations

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SYNOPSIS

On September 15, 1989, the U. S. Nuclear Regulatory Commission (NRC) Executive Director for Operations (EDO) requested that the NRC Office of Investigations (OI) initiate an investigation into allegations that the General Electric Company Nuclear Energy (GE) allegedly: (1) deliberately withheld or delayed from disclosure information of potential safety significance from the NRC because of commercial considerations, modified procedures for licensing calculations in order to obtain more favorable values of stability decay ratios, and failed to report procedural errors in licensing calculations which could impact the results for certain licensed boiling water reactors (BWRs); and (2) deliberately presented false or misleading information to the NRC in response to questions raised during licensing reviews and during the Commonwealth Edison Company (CECo) LaSalle County Station Unit 2 (LaSalle Unit 2) Enforcement Conference.

On March 9, 1988, LaSalle Unit 2 experienced a dual reactor water recirculation pump trip which resulted in unexpected neutron flux oscillations (unstable core indicating a decay ratio of greater than or equal to 1.0) which was terminated with a reactor scram. The oscillations occurred while the Unit was at a high rod line (high power level) and low flow (natural circulation) condition. The LaSalle Unit 2 reactor is a GE BWR fifth generation that was licensed by the NRC for commercial operation in October 1984.

The reactor underwent cycle 2 core reload in 1986 with a predicted stability decay ratio of 0.6 calculation performed by GE in the CECo licensing submittal for LaSalle Unit 2. NRC inspections documented the March 9, 1988, neutron flux oscillation event, and the reports were sent to CECo along with Notice of Violation EA 88-271. There was also an NRC Enforcement Conference held on November 18, 1988, in which presentations were made by the NRC, CECo, and GE.

It was determined that the oscillations in this event did not adversely effect any safety system or the safe operation of the plant.

After an extensive review of GE, CECo, and NRC records, it was determined that the issues concerning decay ratio calculations and the ability to predict core stability through calculational models was an extremely dynamic and complex matter with many differing professional opinions concerning the appropriate methodology, reliability of the resultant calculations, and the safety significance of core oscillations in respect to reactor designs and fuel types. For these reasons the investigation was approached in a manner that

first established the chronology of BWR core stability issues, the changes that occurred, and finally the identity and nature of involvement of the responsible GE personnel. There were hundreds of records identified during the investigation that required technical analysis in order to determine the true nature of knowledge and understanding of GE officials regarding stability calculations. Once the level of knowledge and understanding was established, the focus then shifted to determining how that knowledge was imparted to the NRC and NRC licensees both leading up to and including the LaSalle Unit 2 event of March 9, 1988, as well as the and subsequent Enforcement Conference on November 18, 1988. Due to the evolving nature of BWR core stability issues and the relationship to allegations that focused on events and alleged GE officials knowledge in the 1979 time period, it was necessary to examine records and issues beginning as early as 1969 and tracking the evolution of knowledge through the significant milestones in the process of understanding thermal hydraulic stability. Finally, it was also necessary to accurately differentiate between individual hypothesis or theory versus an understanding of facts based on actual test data.

This investigation developed extensive evidence of a continuing dialogue of meetings, telephone conversations, letters, briefings, and reports where GE and NRC officials communicated with each other concerning thermal hydraulic stability, and the methods of demonstrating compliance with 10 CFR Part 50 stability requirements. Essentially there were two time phases to the communications. The first was prior to a stability test conducted at the Vermont Yankee Nuclear Power Plant (Vermont Yankee) in 1981. This phase began with the initial methods of demonstrating that the BWRs were stable and would not enter unstable operating regions. This method of compliance used a mathematical model known as FABLE. It was the practice for GE to conduct the calculations using the FABLE model to demonstrate that the decay ratio value was less than 1.0 and, therefore, the reactor was predicted to be stable. During the period leading up to the Vermont Yankee test, the stability margins were becoming more narrow (a higher calculated decay ratio), and it was believed that a test such as Vermont Yankee should be conducted in order to benchmark and validate the FABLE calculations. The Vermont Yankee test resulted in dramatic unexpected results. It was discovered that the FABLE calculation had significantly under predicted the decay ratio and where the predicted decay ratio had been 0.7, the actual test conditions revealed a decay ratio of 1.0 or greater. This event caused GE to recommend a changed approach to compliance with the 10 CFR Part 50 General Design Criteria (GDC) 12. GE submitted a Service Information Letter (SIL) to the BWR owners and the NRC. GE recommended in the SIL, certain procedures to detect reactor oscillations and suppress them as the method of compliance with GDC-12. This recommended change by GE led to the second time phase or post Vermont Yankee test communications concerning stability. The post Vermont Yankee era included extensive reviews of test data and communications which culminated in the 1985 NRC acceptance of a new stability licensing basis for GE BWRs NEDE-24011, Revision 6, Amendment 8. The NRC also issued Generic Letter 86-02 which directed BWR licensees with a computed decay ratio of 0.8 or greater to institute technical specifications for the function of detection and suppression of reactor oscillations.

Evidence suggests that the NRC and GE believed the stability issue was essentially a settled matter after Generic Letter 86-02 until the oscillations occurred at the LaSalle Unit 2 on March 9, 1988.

Due to the extensive amount of communication between GE and the NRC concerning reactor stability, it could not be concluded that GE withheld or delayed from disclosure to the NRC information of potential safety significance for commercial consideration. The issue of reactor stability was thoroughly studied by the NRC, and there was no evidence discovered where the NRC described reactor oscillations as a significant safety hazard. There was also no evidence collected that showed that the procedures used by GE in calculating the decay ratio for demonstrating stability were changed. The evidence reviewed suggested that GE had consistently applied the procedures for calculating decay ratios.

The information presented by GE during the LaSalle Unit 2 Enforcement Conference of November 18, 1988, appeared to have been thoroughly coordinated with CECO prior to the presentation. The issue that GE should not have been surprised by the events of March 9, 1988, because of what one engineer believed to have been true in 1979 could not be substantiated. The theories and hypothesis concerning stability in 1979 were tested in 1981 with the Vermont Yankee test. That test demonstrated that the reactor stability could not be accurately predicted with the FABLE model, as GE had previously done. The results of these findings were a changed licensing basis and a shift to a detect and suppress method of compliance with stability regulations. The FABLE calculation was qualified with a 0.2 deviation factor which was the result of an independent review by Oak Ridge National Laboratory (ORNL) under contract to the NRC.

It was determined by this investigation that there was insufficient evidence to conclude that any of the alleged wrongful actions subscribed to GE occurred deliberately.

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