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OFFICE OF THE CHAIRMAN UNITED STATES NUCLEAR REGULATORY COMMISSION WASHINGTON, D.C. 20555

July 30, 1981



The Honorable Morris K. Udall, Chairman Subcommittee on Energy and the Environment Committee on Interior and Insular Affairs United States House of Representatives Washington, D.C. 20515

Dear Mr. Chairman:

This responds to your letter of May 7, 1981 in which you asked questions of NRC pertaining to the conduct of the TMI-2 "hot functional" testing during September 1977. During that testing, a bubble apparently formed in the high points of the hot leg piping; however, no fuel was yet installed. As you are aware, analysis of the accident at TMI-2 that occurred on March 28, 1979 indicates that a bubble condition again existed within the primary system but this time evolved early in the accident with the formation of large quantities of steam due to the core heat.

Careful study of the March 28, 1979 accident by a number of investigative bodies has led to many of the post-TMI requirements for retrofitting operational plants, one of which is to provide the capability to vent the primary system remotely. Both internal and external studies have shown that precursors to this accident had not been properly evaluated by the nuclear industry as well as the NRC. To assure that such operating information is fully evaluated in the future, we formed a new office in the agency known as Analysis and Evaluation of Operational Data.

As you have observed, NRC did not analyze the event that occurred in September 1977 because it was not reported. There was an NRC inspector onsite during the time frame in which the bubble existed in the hot leg piping. However, the NRC inspector was performing an inspection which required him to witness the testing of main steam pressure relief valves located in the auxiliary building. The inspector was not aware of the bubble in the hot leg piping.

The NRC has now reviewed this event. Available logs, strip charts, and other information were examined at the site. Because the plant was in hot functional testing, the instrumentation in operation during the September 1977 event was limited. While this instrumentation satisfied existing requirements, it was insufficient to permit detailed analysis of this event. Additional discussions were held with the engineers who made the referenced log entries which described the event and with B&W

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personnel who were onsite during hot functional testing. The review of data and discussions revealed that sufficient data and facts are not available to permit a detailed reconstruction of the conditions which resulted in bubble formation in the hot leg piping during hot functional testing.

The Office of Inspection and Enforcement provided the bulk of the substantive preparation of the responses to your questions. When appropriate, the Office of Analysis and Evaluation of Operational Data provided review and comments.

If we can be of further assistance, please let me know.

Sincerely,

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NunzioVJ. Patladino Chairman

Enclosure: Responses to Questions

cc: Rep. Manuel Lujan

ENCLOSURE

Question #1: Was the September 1977 event reported to the NRC by the licensee?

Response: It was not reported.

Question #2: If it was not reported, was there a requirement to report it to the NRC at the time it occurred?

Response: 0 CFR 50.55(e) paragraphs ii and iv, requires the reporting of deficiencies during the construction phase. It is not possible to determine from interviews and existing records whether the event at issue did or did not meet those requirements.

Nevertheless, we do believe the licensee should have examined the event in greater detail to determine its safety significance. We would also add that it is clearly in the best interests of the licensee and the industry for the NRC to learn of events of similar safety significance, regardless of the strict legal reporting requirements.

The obvious intent of the regulations is that significant incidents be reported. The formation of a steam bubble (or "bubble condition") in the high points of the hot leg piping constitutes such an incident. The ability to cope with incidents involving gases or vapor in the system is now being provided through installation of high point vents. Had the September 1977 event been reported, as it should have been, it might have triggered an earlier reexamination of the B&W design.

Whenever there is doubt over whether an unusual event should be reported, the question should be resolved in favor of reporting. And reporting requirements aside, licensees should remember that the safety assurance of all plants depends importantly on accurate and complete reporting of safety significant events.

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Question #3: When did the staff become aware of the September 1977 event?

Response: The staff became aware of the September 1977 event several months after the accident on March 28, 1979 at TMI-2.

Question #4: What action was taken by the staff once they, found out about it?

Response: No specific action was taken on the September 1977 event; however, comprehensive action was already underway to prevent conditions that had occurred during the TMI-2 accident from occurring at other plants.

Question #5: Subsequent to NRC learning of the event, what modifications in operation procedures, instrumentation, and plant components have been required as a result of the staff's analysis of it?

Response: As noted in the above response, no action has been taken as a result of this specific event.

- Question #6: Could a steam bubble develop in the hot legs of operating B&W reactors following a transient causing sudden cooling of the reactor cooling system?
- Response: Yes, if coupled with a reactor coolant system depressurization. However, actions required of B&W plants by Bulletins and Orders and the TMI Action Plan should reduce the likelihood of steam bubble formation in the hot leg piping. Subsequent to the TMI-2 accident, operators were trained to take actions to minimize the potential for formation of a steam bubble. Following a cooldown and depressurization in PWRs, high pressure injection pumps start automatically on low pressure. Operators are instructed to start these if they do not start automatically and to allow them to run until 50°F subcooling is established. This overpressure is maintained and impedes bubble formation until the system is cooled sufficiently to condense any bubble that may form.

Question #7: If so, what actions would be taken to restore circulation?

<u>Response</u>: Circulation can be restored by either continuous or intermittent operation of the main coolant pumps. Lacking the ability to establish forced circulation or natural circulation, cooling can be established through operation of the high pressure pumps in conjunction with primary system relief and safety valve operations.

Question #8: On what dates were remotely controlled vents installed on high points on the hot legs of B&W reactors?

Response:

Remote controls for vents in high points in the hot legs of B&W reactors have not yet been installed. The Commission approved requirements for such vents in its Action Plan of May 1980 and directed staff to initiate rulemaking. The staff has developed a proposed rulemaking for operating license applicants and separately, has developed another for those holding operating licenses. The Commission approved the proposed rulemaking for operating license applicants and a notice was published in the Federal Register (46 FR 2649) on May 13, 1981. It contains, as an effective date for implementation, July 1, 1982. The Commission is deliberating on the proposed rulemaking for operating reactors which proposes the same effective date.

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COMMITTEE ON INTERIOR AND INSULAR AFFAIRS U.S. HOUSE OF REPRESENTATIVES WASHINGTON, D.C. 20515

May 7, 1981

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The Honorable Joseph Hendrie Chairman, Nuclear Regulatory Commission Washington, D.C. 20555

Dear Mr. Chairman:

The record of the TMI inquiries indicates that during hot functional testing at TMI-2, a steam bubble developed in the high point of the pipe through which water flowed from the reactor pressure vessel to one of the steam generators. (This seems to be the event described on page 65 of the Report of the Senate Special Investigation into the TMI accident.) During the event in question, considerable difficulty was encountered in condensing the steam bubble, and it appears that persons present at TMI-2 on March 28, 1979 recalled this event as they sought to take actions to restore circulation between the reactor pressure vessel and the steam generators.

The recollection of the September 1977 event probably influenced judgements as to what would be required to restore circulation during the March 28 accident. For example, Mr. Brian Mehler told NRC investigators that following closure of the PORV block valve there had been a plan to enter the reactor building for the purpose of manually opening a valve at the top of the hot-leg. This plan was abandoned, however, once radiation levels prevented access to the valve in question. Later in the day, in a conversation between Mr. Leland Rogers, a B&W engineer assigned to TMI, and B&W staff in Lynchburg, Virginia, Mr. Rogers, in disagreeing with advice that the primary coolant system be filled, indicated that he believed this could not be done. In apparent reference to the 1977 event, Mr. Rogers said in that instance, " . . . it took us something like four days to get out of that thing to try and cool it down to where we could get that bubble condition out of there. We've got a similar condition here."

While the September 1977 event would have seemed to have been a matter deserving of analysis in the NRC inquiries into the accident, no such analysis appears to have been undertaken.

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I would appreciate the Commission's answering the following questions:

-- Was the September 1977 event reported to the NRC by the licensee?

-- If it was not reported, was there a requirement to report it to the NRC at the time it occurred?

-- When did NRC staff become aware of the September 1977 event? What action was taken by the staff once they found out about it?

-- Subsequent to the NRC learning of the event, what modifications in operating procedures, instrumentation, and plant components have been required as a result of the staff's analysis of it?

-- Could a steam bubble develop in the hot-legs of operating B&W reactors following a transient causing sudden cooling of the reactor coolant system? If so, what actions would be taken to restore circulation?

-- On what dates were remotely controlled vents installed on high points in the hot-legs of B&W reactors?

Thank you for your assistance.

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Sincerely,

MORRIS K. UDALL Chairman