

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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USNRC

ATOMIC SAFETY AND LICENSING APPEALS BOARD NOV 8 10:36

Administrative Judges:

Gary J. Edles, Chairman  
Dr. John H. Buck  
Dr. Reginald L. Gotchy

OFFICE OF SECRETARY  
DOCKETING & SERVICE  
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In the Matter of )  
METROPOLITAN EDISON COMPANY, )  
ET AL. )  
(Three Mile Island Nuclear )  
Station, Unit No. 1) )

Docket No. 50-289  
(Design Issues)

MEMORANDUM AND ORDER

November 5, 1982

Introduction

This order sets out our preliminary views and concerns regarding the posture of the record on one of the technical issues before us, i.e., the issue of so-called "feed and bleed" capability. As explained in more detail below, the Licensing Board relied on feed and bleed as a backup for the emergency feedwater system at TMI-1. Our initial review of the record, although not yet complete, suggests that the Board's reliance may have been misplaced. Information submitted in recent Board Notifications tends to support this conclusion. While we have not yet completed our review of the record, it may turn out that a reopening would be necessary to resolve our concerns. We believe, however, that a more satisfactory alternative may be available. The

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purpose of this order is to invite comments from the parties regarding this alternative.

### Background

In its August 9, 1979 Order and Notice of Hearing, the Commission directed that the licensee take a number of short and long term actions designed to improve the reliability of the emergency feedwater system at TMI-1. The Licensing Board was instructed to determine, among other things, the necessity and sufficiency of those actions. <sup>1/</sup> After exploring the matter at the restart hearing, the Licensing Board concluded that the emergency feedwater system at TMI-1 was not sufficiently reliable, by itself, to provide adequate protection of the public health and safety. Based on the testimony of several staff and licensee witnesses, <sup>2/</sup> however, the Board found that, in the event of a failure of the emergency feedwater system, the core could be adequately

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<sup>1/</sup> Metropolitan Edison Co. (Three Mile Island, Unit 1), CLI-79-8, 10 NRC 141, 144-46 (1979).

<sup>2/</sup> See, e.g., Jones, fol. Tr. 4589, at 1-4; Tr. 5586-89 (Jensen); Capodanno, et al., fol. Tr. 5642, at 1-3 and 11; Tr. 6200-201, 16734-36, 16846-47, 16893-94 (Wermiel); Tr. 7704-709, 7806 (Keaten).

cooled using feed and bleed <sup>3/</sup> while repairs to the emergency feedwater system were being made. Accordingly, the Board found that the short and long term actions were sufficient to provide reasonable assurance that the public would be adequately protected. <sup>4/</sup> The Union of Concerned Scientists (UCS), who had vigorously contested the viability of feed and bleed at the hearing, challenged those findings in the course of appealing the Licensing Board's disposition of UCS Contentions 1,2,3 and 5 and Board Question 6. <sup>5/</sup>

On September 14, 1982, the staff transmitted to us and the parties (by Board Notification BN-82-93) information concerning a test of feed and bleed capability in a small research facility (Semiscale), during which the electrically

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<sup>3/</sup> With this method, the high pressure injection (HPI) pumps inject -- i.e., "feed" -- cooling water into the reactor vessel to absorb decay heat. This water is then expelled -- i.e., "bled" -- from the system through the break itself, the power-operated relief valve (PORV), or the safety relief valves. (In accident analyses, the PORV is generally assumed to be unavailable because it is not safety grade.) The pressure will rise because of the HPI flow and boiling in the core. HPI flow must be sufficient to replace the mass lost out of the reactor coolant system.

<sup>4/</sup> LBP-81-59, 14 NRC 1211, 1370-71, 1374-75 (1981).

<sup>5/</sup> As explained later (note 22, infra), it is not our intention to address all of these matters now.

heated reactor core simulator was unexpectedly uncovered.<sup>6/</sup> On October 7, 1982, UCS filed a "response" to that notification and moved that we direct the staff to produce "all documents in the Staff's possession relating to feed and bleed . . . ." <sup>7/</sup> At our direction, the staff filed a response to the UCS motion. <sup>8/</sup> The licensee also responded, and UCS filed a reply.

#### Discussion

We are in the process of reviewing the evidentiary record, as well as the papers now before us. It is our present view that the viability of feed and bleed has been called into question by the tests recently performed at the Semiscale facility. <sup>9/</sup> The contractor's report attached to

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<sup>6/</sup> The staff indicated that the information was being provided "for background only and should not be used as a basis for any conclusion regarding feed and bleed."

<sup>7/</sup> UCS Response to Board Notification BN-82-93 and Motion that the Appeal Board Direct NRC Staff to Provide All Pertinent Documentation and Analyses (October 7, 1982) at 4.

<sup>8/</sup> See our Order of October 15, 1982 (unpublished).

<sup>9/</sup> See Board Notifications BN-82-93 (Sept. 14, 1982) and BN-82-107 (Oct. 22, 1982).

Board Notification 82-107 described two such tests. The first test, S-SR-1, was performed using "high head" high pressure injection (HPI) pumps similar to those at TMI-1. This test was terminated as a result of "operational problems with uncontrolled coolant leakage." <sup>10/</sup> Semiscale test S-SR-2, which used "low head" HPI pumps, resulted in, excessive heating of the core simulator.

The licensee considers the S-SR-2 test, inapplicable to TMI-1 because it was conducted with lower charging pressure pumps than those available at TMI-1. <sup>11/</sup> Similarly, the staff does not view the Semiscale tests as an indication of any inability of a Babcock and Wilcox designed reactor to feed and bleed and argues that the S-SR-2 test was representative of only a typical Westinghouse plant. <sup>12/</sup> In contrast, UCS maintains that both tests raise questions

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<sup>10/</sup> See EG&G report at 20, 22 (attached to BN-82-107).

<sup>11/</sup> See Licensee's Reply to Union of Concerned Scientists' Response to Board Notification BN-82-93 Concerning Semiscale Tests of Feed and Bleed and Motion that Appeal Board Direct NRC Staff to Provide all Pertinent Documentation and Analysis (filed Oct. 25, 1982) at 3.

<sup>12/</sup> See NRC Staff Response to Appeal Board Order of October 15, 1982 (filed Oct. 25, 1982) at 7.

about the ability to perform feed and bleed successfully at TMI-1. 13/

While these tests may not be directly applicable to TMI-1 because of the differences in flow capacity of the HPI pumps and relief valves, we agree with UCS that these tests raise serious concerns about the viability of the feed and bleed option. Even apart from those concerns, however, we are inclined toward the view that there is insufficient evidence of record to support the Licensing Board's conclusion that feed and bleed is a viable means of removing decay heat from the reactor core at TMI-1. 14/

Without feed and bleed as a backup, natural circulation in the primary system cooled by emergency feedwater is the only method of removing decay heat from the reactor core in the event of a main feedwater transient. There are two possible types of natural circulation, depending on the state of the reactor coolant. If the reactor coolant system is relatively free of steam bubbles, liquid natural

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13/ See Union of Concerned Scientists' Reply to Appeal Board Order of October 15, 1981 (filed Oct. 29, 1982) at 3-4.

14/ For example, the record contains no evidence of a convincing demonstration of the feed and bleed option. Such a demonstration would satisfy our concern that there must be a reliable means of decay heat removal.

circulation can be achieved. If there is substantial steam voiding at the high points of the reactor coolant system, however, cooling would depend on the establishment of a type of natural circulation referred to as the boiler-condenser mode. It is our tentative view that the ability of the boiler-condenser mode of natural circulation to remove enough decay heat to prevent core damage also has not been adequately demonstrated on the record. <sup>15/</sup> Therefore, at the present time, we do not consider the boiler-condenser mode a viable method of removing decay heat.

We must also consider the reliability of liquid natural circulation. Analyses indicate that liquid natural circulation would be interrupted by steam voiding for any break in the primary system larger than 0.005 ft<sup>2</sup>. Tr. 4683-84 (Jones). Steam bubbles would collect at the high points of the primary system. This steam can be removed by use of the reactor coolant pumps or by ejection from high

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<sup>15/</sup> The licensee's witness Jones testified that this mode had been predicted by computer modeling but no tests had been performed to demonstrate its viability. Tr. 4687-88, 4691; Jones and Broughton (Board Question on UCS 8), fol. Tr. 5038, at 16-17. We also note that the Advisory Committee on Reactor Safeguards and the staff have subsequently expressed concern for the modeling of the dynamic thermal hydraulic behavior of B&W plants during small break loss of coolant accidents. See, e.g., letter from P. Shewmon to W.J. Dircks, dated October 13, 1982 and letter from D.G. Eisenhut to J.J. Mattimoe, dated March 25, 1982.

point vents. Tr. 4617, 4623-24 (Jones). <sup>16/</sup> The reactor coolant pumps are not safety-grade and, as a result, cannot be relied upon to perform this function. Therefore, it seems that the vents in the hot leg high points are needed to remove steam and to help reestablish natural circulation. <sup>17/</sup>

The other aspect of this method of decay heat removal is the need for a reliable emergency feedwater system. As mentioned above, the Licensing Board found that the emergency feedwater system was not sufficiently reliable and required feed and bleed as a backup. The emergency feedwater system will not be fully safety grade at restart. <sup>18/</sup>

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<sup>16/</sup> In response to one of our questions in preparation for oral argument, the licensee indicated that the high point vents for the hot leg piping and reactor vessel head will not be installed until the first refueling outage after restart. The justification for this schedule was that the vents were intended solely as a means of removing noncondensable gases that might be produced in accidents beyond the design basis. See Licensee's Response to the Atomic Safety and Licensing Appeal Board's Order of July 14, 1982 (filed August 12, 1982) at 14-15.

<sup>17/</sup> We do not believe that installation of reactor vessel head vents is necessary for this purpose.

<sup>18/</sup> The current schedule calls for completion of the modifications needed to make the emergency feedwater system fully safety grade by the end of the next refueling outage. See Affidavit of Richard H. Jacobs at 4-5, attached to NRC Staff's Response to Appeal Board's Order of July 14, 1982 (filed August 9, 1982). See also Licensee's Response to the Atomic Safety and Licensing Appeal Board's Order of July 14, 1982 (filed August 12, 1982) at 9-13.



The emergency feedwater system is dependent on the nonsafety-grade Integrated Control System (ICS) to operate the emergency feedwater flow control valves. <sup>19/</sup> Our view at present is that this deficiency could be overcome on an interim basis by the assignment of an individual whose sole function would be to operate the flow control valves ; manually in the event that the valve control system failed following the onset of an accident. <sup>20/</sup> Our present view, although subject to change in light of our further review, is that the assignment of this individual, together with the installation of the high point vents in the hot legs, would ensure core cooling by natural circulation during the

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<sup>19/</sup> The presence of a safety-grade manual control capability is unclear from the record. See Tr. 5580-81 (Jensen); Tr. 5710-11 (Lanese); Tr. 7106-107 (Broughton); Tr. 7705 (Keaten); and Staff Ex. 1 at C1-11. See also Licensee's response to our order of July 14, 1982, at 10. Such a capability would effectively satisfy our concerns with dependence on the non-safety grade ICS. The matter of the lack of environmental qualification of certain components in the emergency feedwater system will be addressed in a later decision.

<sup>20/</sup> We understand that the licensee will station an individual at the emergency feedwater flow control valves during surveillance tests to realign the flow, if required. See Wermiel and Curry, fol. Tr. 16718, at 3-4. This approach was used at other B&W plants to satisfy similar concerns of the staff. See letter from H.R. Denton to W. Cavanaugh, III, dated May 31, 1979; letter from H.R. Denton to W.O. Parker, Jr., dated May 18, 1979; and letter from H.R. Denton to J.J. Mattimoe, dated June 27, 1979 (all reprinted in NUREG-0645, Report of the Bulletins and Orders Task Force, Vol. II, Appendix D).

interim before the emergency feedwater system is modified to full safety-grade status at the next refueling outage. <sup>21/</sup>

It is our tentative view that, in the absence of the changes suggested in this opinion, we would need more evidence, possibly in the form of additional test results, before we would be able to conclude on this record that there is reasonable assurance that the plant can be operated without endangering the public. <sup>22/</sup> The measures we believe necessary on an interim basis, however, were not fully considered at the hearing. <sup>23/</sup> For this reason, we are issuing our tentative views in advance of a final decision so as to permit the parties an opportunity to comment. <sup>24/</sup> We are particularly interested in the parties' views concerning the sufficiency of our proposed requirements or, in the absence of the proposed changes, the need for

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<sup>21/</sup> Once the emergency feedwater system is fully safety-grade, this individual would no longer be required. The high point vents would continue to ensure the availability of natural circulation.

<sup>22/</sup> UCS has raised a number of issues on appeal concerning emergency feedwater reliability and the viability of feed and bleed as a backup. It is not our intention to dispose of these matters now; we shall discuss them in detail in our decision addressing the design issues.

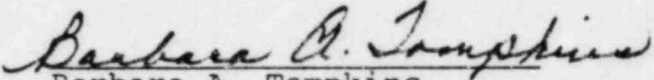
<sup>23/</sup> The Licensing Board stated that its decision did not depend on the installation of the high point vents prior to restart. LBP-81-59, supra, 14 NRC at 1230.

<sup>24/</sup> See Niagara Mohawk Power Corp. (Nine Mile Point Nuclear Station, Unit 2), ALAB-264, 1 NRC 347, 354-55 (1975).

reopening the record on feed and bleed. Comments must be in our hands by close of business Monday, November 15, 1982.

It is so ORDERED.

FOR THE APPEAL BOARD

  
Barbara A. Tompkins  
Secretary to the  
Appeal Board