UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
METROPOLITAN EDISON COMPANY	)	Docket No. 50-289
	)	(Restart)
(Three Mile Island Nuclear	)	
Station, Unit No. 1)	)	

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 ANALYSES

Introduction

By Board Notification BN-82-93, dated September 14, 1982, the Staff transmitted information concerning the Semiscale test regarding feed and bleed capability to the Appeal Board for TMI-1 Restart. The information consisted of: 1) a NRC Memorandum for D. Eisenhut from R Mattson, "Board Notification Concerning Recent Semiscale Test Results," dated August 30, 1982 (hereinafter, Mattson memo); 2) a NRC Memorandum for T. Speis from D. Bassett, "Feed and Bleed Experiments in Semiscale," dated August 23, 1982 (hereinafter, Basset memo); and 3) a letter report to R. Tiller, DOE, from P. North, EG&G, "Primary Coolant System Feed and Bleed - PM-137-B2," dated August 6, 1982 (hereinafter, EG&G letter).

At the NRC's request EG&G "conducted experiments designed to investigate the feasibility of primary coolant system (PCS) feed and bleed as a means of rejecting decay heat in the absence of steam generator heat removal." (EG&G

letter, at 1) During these experiments, several attempts were made to establish steady state feed and bleed. However, measurements showed a continuous loss of primary coolant inventory. This led to uncovery of the core simulator, causing premature termination of the test to prevent overheating of the Semiscale core simulator. (EG&G letter, at 7, 8; Mattson memo, at 1) The results of these experiments and further analyses performed by EG&G "suggested that a reasonable uncertainty may exist in the ability to effect stable [primary coolant system] feed and bleed." (EG&G letter, at 1)

In order to assist the Appeal Board in interpreting the Semiscale test results, the EG&G analyses thereof, and the Staff's covering memoranda which seek to downplay their import, UCS will summarize below the main conclusions of EG&G and explain their relevance and significance to this proceeding. At the outset, however, we wish to explain several other aspects of the Board Notification.

Timeliness of the Staff's Board Notification

The Staff has unconscionably delayed reporting the Semiscale test results and EG&G's analyses thereof to the Boards, but most particularly to the Appeal Board for TMI-1 Restart. The Staff gives no indication of when the subject Semiscale tests were performed (nor whether NRC observed the tests), but the tests obviously were performed sometime before the August 6, 1982, letter report to DOE (with copies to the NRC) from EG&G. The receipt of the EG&G letter and its summary conclusion was immediately reported by the Staff to the NRC Commissioners. (Weekly Information Report for the Commissioners for the week ending August 13, 1982, dated August 19, 1982, Enclosure E, at 1, 2) A full month passed until Board Notification BN-82-93, dated September 14, 1982, was prepared. Almost two more weeks passed before UCS received its copy from the TMI service list on September 27, 1982. (The postage meter tape on the envelope

was dated September 24, 1982.) Thus, more than seven weeks passed between the time of EG&G's formal description of the Semiscale test results and receipt by UCS of the Board Notification. (We recognize that the Appeal Board may have received the notification about a week earlier.)

During this precise period, the Appeal Board heard oral argument on the TMI-1 restart appeal. The Staff surely must have been well aware of the Semiscale test results and that the viability of feed and bleed was a central issue in this proceeding. The Staff's delay is unconscionable for several reasons.

First, it should be noted that none of the Staff's covering memoranda contains any significant information or analyses beyond that in the EG&G letter itself. Thus, if additional analyses were performed in the intervening period after receipt of the EG&G letter, they were not reported and do not constitute a reason for delaying the Board Notification.

Second, the Staff purportedly follows a policy of promptly notifying Boards of information that "could reasonably be regarded as putting a new or different light upon an issue before Boards or as raising a new issue." (NRC Office Letter No. 19) However, the Staff's performance regarding Board Notification of the feed and bleed test results indicates that this policy was abandoned. Attached for the Appeal Board's information is a compilation of the information concerning the Semiscale feed and bleed tests provided by the Staff to the Commissioners in the Weekly Information Reports from August 6, 1982 to September 30, 1982. Using the information, the Appeal Board can note the availability of significant information relevant to the issues in this proceeding which the Staff has chosen not to bring to the attention of the Appeal Board and the parties, except perhaps the Licensee. In particular, it should be noted that the final report on the Semiscale feed and bleed tests has been received by the

Staff, but the Staff continues its practice of delaying notification of the Board and parties. To date, UCS has no information concerning when (or even if) the Staff will provide that report to the Appeal Board and parties in the TMI-1 Restart proceeding.

Third, the Staff should have been aware of the Appeal Board's interest in any empirical information on the ability of feed and bleed to cool the core. The Appeal Board asked the Staff the following question:

> Have any tests been conducted at the LOFT facility that provide information on the ability of feed and bleed to adequately cool the core? If so please state conclusions. (Appeal Board Order, July 14, 1982, at 14)

UCS cannot imagine by what "logic" the Staff failed to even mention the Semiscale test results regarding feed and bleed either in its August 9, 1982, response to this question or during oral argument on September 1, 1982.

For the above reasons, UCS concludes that the Staff's delay in issuing Board Notification BN-82-93 is unconscionable. UCS further concludes that continuing recalcitrance by the Staff should not be permitted. Therefore, UCS respectfully moves that the Appeal Board order the Staff to immediately serve all documents in the Staff's possession relating to feed and bleed on the Appeal Board and parties in this proceeding. The documents which UCS is aware of and believes should be among those served include the following:

1) The final report on the Semiscale feed and bleed tests mentioned in the September 30, 1982, Weekly Information Report for the Commissioners for the week ending September 24, 1982.

2) The request of NRR to RES to perform the Semiscale feed and bleed experiment. (Bassett memo, at 1)

3) A NRC Memorandum for Karl Kniel from Brian Sheron thru Themis Speis, "Status of Feed and Bleed for Emergency Decay Heat Removal," dated March 31, 1982. Among the "general conclusions" stated in this memorandum (which was

released under the FOIA and came to UCS' attention only two or three weeks ago) is the conclusion that "[f]eed and bleed, if performed, should be at a relatively low (P << relief valve setpoints) pressure." This is contrary to the Licensee's and Staff's position in this proceeding that the safety valves can be relied upon during feed and bleed cooling and, therefore, the PORV need not be safety grade.

False Staff Assertion

In his covering memorandum to Darrell Eisenhut, dated August 30, 1982, Roger Mattson makes the assertion on page 1 that "neither the staff nor the licensees or applicants have ever relied upon feed and bleed to meet the Commission's regulations...." This assertion is false.

In the TMI-1 restart proceeding, the NRC Staff proposed the following finding:

> Until EFW system upgrading at TMI-1 is completed the Staff is relying on the feed and bleed mode of core cooling to protect against events for which the EFW system is not fully safety grade. (NRC Staff Proposed Findings of Fact and Conclusions of Law Regarding Plant Design and Modification Issues, June 1, 1981, Paragraph 435, emphasis added.)

The Staff also proposed the following finding:

> Based on our consideration of the evidence on the record of this proceeding we find that although the EFW system at TMI-1 will not be fully safety-grade at the planned time of restart, it will have been upgraded to significantly improve its reliability, that operator action within about 20 minutes to actuate the safety-grade HPI pumps and initiate feed and bleed cooling can protect against failures of both the main and emergency feedwater systems, that feed and bleed cooling can be continued until feedwater is restored and thus that there is reasonable assurance that the public health and safety will be adequately protected against feedwater transients if TMI-1 is allowed to restart prior to full upgrading of the EFW system to safety-grade. (Id., Paragraph 441, emphasis added)

The Licensee also testified that a postulated loss of emergency feedwater event must be protected against by the use of safety grade equipment so that plant safety limits are not exceeded, i.e., the limits of 10 CFR 50.46. That

safety grade equipment was asserted to be the use of HPI and LPI in the feed and bleed mode. (Capodanno, et. al., ff. Tr. 5642, at 1-2.)

Moreover, the ASLB went even further. The Board ruled that even after it is safety grade, the TMI-1 emergency feedwater system will not be sufficiently reliable that it can itself serve as a guarantee of adequate decay heat removal for anticipated operational occurrences and/or accidents. (PID, Paragraphs 624, 1050) Therefore, the Board specifically relied on feed and bleed as a necessary back-up to EFW, in order to conclude that the health and safety of the public will be adequately protected. (Id., Paragraph 1056) Therefore, tests and analyses indicating that feed and bleed cannot be relied upon go directly to the heart of the TMI-1 restart PID.

Mattson's assertion is flatly wrong. In its zeal to downplay the significance of unfavorable test results, the Staff has apparently forgotten its own sworn testimony and proposed findings and the testimony of the Licensee.

Semiscale Applicability to TMI-1

The Staff also seeks to avoid the force of the Semiscale tests by raising a question as to their applicability to large PWR's. (Mattson memo, at 2) This is a familiar refrain raised each time test failures occur. There must be a point at which these qualifications are discounted. In 1979, the Staff reported to Boards the results of other "unanticipated results" during Semiscale tests. (Board Notification - Update of Semiscale Experiment S-07-06 (BN-78-1), June 27, 1979) At that time, the Staff promised as follows:

> The typicality of future Semiscale tests will be assessed in light of the available information, and modifications to the test matrix will be made accordingly. (Memorandum, R. L. Tedesco to D. B. Vassallo, "Update to Board Notification on Semiscale S-06-7", May 30, 1979, page 4)

One must assume that the question of "typicality" was addressed in the three years that have passed between these tests and that NRC would not have ordered

these Semiscale tests on feed and bleed to go ahead unless it were prepared to believe the results. Can there be any serious question that the possibility of significant "atypicality" would never have been raised by the Staff if the tests had been successful?

Assessment of Relevance and Significance

The Appeal Board must consider in the face of the Semiscale feed and bleed test results and the additional analyses performed by EG&G exactly where it can look in the record to find a basis for concluding nevertheless that feed and bleed cooling is viable for TMI-1. The Staff urges the Appeal Board not to base any conclusions on the information provided by Board Notification BN-82-93. UCS disagrees. A number of the conclusions expressed in the EG&G letter relate directly to UCS' exceptions and provide additional support for sustaining those exceptions. We discuss now the relevance and significance of some of those conclusions to the TMI-1 restart proceeding.

One of the principal conclusions to be drawn from the EG&G letter is that stable feed and bleed cooling is theoretically possible only within a certain band of primary system pressure. Feed and bleed cooling at pressures below the lower bound of this pressure band is not possible because the flow through the PORV (or safety valves) decreases with decreasing pressure and energy removal from the primary coolant system would be insufficient. Feed and bleed cooling at pressures above the upper bound of the pressure band is not possible because flow out the PORV (or safety valves) increases with increasing pressure and flow from the HPI pump(s) decreases with increasing pressure. Thus, at pressure above the operating band there would be a continuous net loss of primary coolant system inventory. (EG&G letter, at 2-3)

The relevance and significance of that conclusion to the TMI-1 restart proceeding is that the record contains no evidence that any analysis has been

done to demonstrate that, if a theoretically feasible pressure band exists for TMI-1, the feed and bleed pressure band encompasses 2500 psig, which is the set point of the pressurizer safety valves at TMI-1. The Licensing Board ruled that TMI-1 relies on the safety valves only and not the PORV and that the TMI-1 PORV is not required for feed and bleed cooling. (PID, paragraph 791) Thus, the EG&G letter together with the Licensing Board's decision establishes that it must be demonstrated that stable feed and bleed cooling is feasible in the pressure band bounded at the high end by the opening set point of the pressurizer safety valves and at the low end by the pressure at which the safety valves reclose. The record contains no such evidence.

Another principal conclusion to be drawn from the EG&G letter is that "the largest uncertainty affecting the feed and bleed operating [pressure] band arises from the influence of two-phase PORV flow." (EG&G letter, at 5) This conclusion is equally applicable if the safety valves rather than the PORV are being used to perform the "bleeding" fuunction. The Semiscale tests demonstrate the sensitivity of the energy removal rate from the primary coolant system to a decrease in steam quality in the flow through the PORV or safety valves. With decreasing quality of the "bleed" flow, the mass flow rate increases substantially. This rapidly lowers the upper end of the pressure band within which stable feed and bleed cooling may be theoretically possible. In the example cited by EG&G, a decrease in bleed flow quality from 100% to 75% precludes establishing stable feed and bleed -- i.e., the theoretically possible operating pressure band "does not exist at qualities below approximately 75%." (Id., at 4)

The relevance and significance of this conclusion to the TMI-1 restart proceeding is that the record contains no evidence regarding this phenomenum at TMI-1. In fact, the only information available to the Appeal Board shows that

the TMI-1 safety valves failed when subjected to two-phase flow in the EPRI tests. (H. D. Hukill to R. C. Haynes, May 7, 1982, transmitted to the Appeal Board by Thomas Baxter, May 13, 1982) UCS has already discussed the import of those failures. (Union of Concerned Scientists' Reply to Staff and Licensee Responses to Appeal Board Order of July 14, 1982, August 25, 1982, at 7-10) However, the EG&G letter indicates there are several other uncertainties affecting the "bleeding" mass flow rate and energy removal rate besides the capability of the PORV or safety valves to handle two-phase flow. EG&G identifies those uncertainties as involving transient versus steady-state behavior in the primary coolant system, pressurizer/surge line geometry and surge line orientation. (EG&G letter, at 5,6) The record in this proceeding contains no evidence that the effects of these uncertainties on feed and bleed cooling at TMI-1 have been evaluated.

The two conclusions to be drawn from the EG&G letter which are discussed above concern the uncertainties involved in determining whether feed and bleed is even theoretically possible at TMI-1. Other aspects of the EG&G letter relate directly to questions concerning whether adequate operator training and emergency procedures can be and have been provided at TMI-1 and whether the operator actions required for feed and bleed cooling are simple or complex.

The ASLB ruled that "extensive training and well-conceived procedures are required when the feed-and-bleed cooling mode is relied upon to dissipate the heat from the core, but the complete record as it stands today supports the conclusion that these procedures and training can be provided." (PID, Paragraph 625, emphasis added) The ASLB also ruled that a high degree of reliability of the feed and bleed cooling mode "is expected" and that "initiation of feed and bleed is a very simple operation and can be continued indefinitely." (Id., Paragraphs 1051, 1052) The information supplied in the EG&G letter directly undermines these rulings.

The principal information provided by EG&G related to the question of whether adequate operator training and procedures can be and have been provided is as follows:

> [EG&G's analysis] does not address transient behavior that may have an important bearing on the ultimate viability of primary feed and bleed. In particular, it should be evident that there exists some uncertainty regarding the ability to safely bring the primary coolant system to within the 'feasible' operating pressure band without sustaining unacceptable coolant loss in the process. Factors which bear on this transient process include the primary coolant system state at the initiation of an attempt to feed and bleed, and the nature of the coolant discharged through the PORV(s) in depressurizing the system to within the operating band. These questions can only be addressed through experimentation and the use of computer code analyses. (EG&G letter, at 5, emphasis added)

EG&G reached the following conclusion:

> Irrespective of the existence of a theoretically feasible operating pressure band, there remains the question as to whether the reactor system can be safely maneuvered into this pressure range. In this regard it is clear that a dependence must be placed on computer code analyses (with suitable verification) and adequate supporting experimental data. Such analyses and/or experiments should examine the plausible scenarios which lead the operator to commence feed and bleed, since the initial condition of the primary coolant system (particularly inventory) will have a significant effect on the outcome. (Id., at 7, emphasis added)

In summary, the information by the EG&G letter demonstrates how utterly simplistic was the Licensee and Staff testimony on which the ASLB based its rulings regarding the feasibility and reliability of feed and bleed cooling at TMI-1 and whether adequate operator training and emergency procedures can be and have been provided for the TMI-1 operators. Furthermore, the EG&G letter indicates that further computer studies and experiments will have to be performed to resolve the major, significant uncertainties that presently exist regarding the feasibility of feed and bleed cooling and that plant specific analyses, such as the development of "the operating map that results for each set of individual PWR plant parameters", are also required. (Id.)

Summary and Conclusion

The above discussion demonstrates that the ASLB's acceptance of the viability of feed and bleed cooling was wholly unwarranted. The uncertainties revealed by the Semiscale tests dramatically undermine the ASLB's conclusions. As the Appeal Board is well aware, UCS has taken a number of exceptions to the Licensing Board's decision where it relies on feed and bleed cooling to resolve safety concerns raised by UCS. [UCS Exceptions 9-11, 16, 18-19, 107; UCS Exceptions (Reopened Proceeding) 10-11] Even before these latest revelations, the record did not support the ASLB's heavy reliance on feed and bleed to protect public health and safety. [Union of Concerned Scientists Brief on Exceptions to the Partial Initial Decision of December 14, 1981, at 9-12, 15, 18-19, 21-24, 106-108; Union of Concerned Scientists' Brief on Exceptions to Partial Initial Decision (Reopened Proceeding), at 23-29] The ASLB had, in essence, accorded feed and bleed cooling the presumption of innocence. That is, in the absence of evidence that will not work, the Board presumed that it will. The Staff apparently seeks to have the Appeal Board continue this presumption of innocence. The Staff urges the Appeal Board not to base any conclusions on the information provided by this Board Notification (BN-82-93) and states its conclusion that "the Semiscale results have not produced new and unique results that indicate a PWR would have a definite problem regarding feed and bleed." (Bassett memo, at 1, emphasis added) The qualifications contained in this remarkable sentence raise a number of questions. Is the Staff attempting to downplay the Semiscale results because they do not present "new and unique" evidence (implying that pre-existing evidence pointed to the same problems) or because the results do not indicate a "definite" problem? If it is the former, whether the evidence is "new" or "unique" is of no import whatever. In fact, there is all the more reason to be concerned if these test results corroborate

other evidence. Indeed one must then question why the existence of this problem was never revealed by the Staff during the restart hearing if there was evidence which revealed it.

As to the latter interpretation of the sentence - the assertion that a "definite" problem is not shown - it can only be characterized as wishful thinking. There is no basis provided for concluding that the Semiscale results are not valid. In addition, it should be noted that the Staff's statement is a partial paraphrasem of a statement in the EG&G letter, but it distorts the meaning by omitting the next sentence. EG&G's conclusion was as follows:

> In and of themselves, the results from the Semiscale experiments do not point to the existence of a definite problem regarding primary feed and bleed. But they do tend to support a concern about the relative tenuousness of the process. (EG&G letter, at 9)

In UCS's view, EG&G has substantially understated the problem. However, it has been more forthright th[illegible] Staff.

The Semiscale tests and EG&G's analyses provide direct evidence that feed and bleed will not work or, at the very least, that its viability is highly questionable. There may or may not be a pressure range at TMI-1 within which feed and bleed will work. That pressure range, if it exists, is unlikely to encompass the pressure at which the TMI-1 pressurizer safety valves operate. Further, if a pressure range for steady state feed and bleed theoretically exists, there is a serious question whether, as a practical matter, TMI-1 can be safely maneuvered into that condition. Additional questions now arise concerning the adequacy of the operator training and emergency procedures at TMI-1 because the condition of the primary system at the time the operator initiates feed and bleed can have a significant effect on the outcome. In addition, there is a critical, plant-specific relationship (undetermined for TMI-1) between the quality of the fluid discharged through the "bleeding" valve

and the rate at which mass and energy are removed from the primary coolant system. The Semiscale tests showed that feed and bleed can (and did) result in a net loss of primary coolant inventory during feed and bleed leading to uncovery of the core.

On the basis of this new evidence, as well as the previous record, UCS Exceptions 9-11, 16, 18-19, 107 and UCS Exceptions (Reopened Proceeding) 10-11 should be sustained. Operation of TMI-1 would pose an undue risk to public health and safety and therefore cannot be justified.

Respectfully submittted,

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Dated: October 7, 1982

ENCLOSURE

Information Regarding the Semiscale Test Facility Contained in the Staff's Weekly Information Reports to the Commissioners

Report Date	For Week Ending	Information
8/19/82	8/13/82	The modifications to the Semiscale facility (conversion to MOD-2B) are in progress and should be completed in early November 1982. Results of the Semiscale feed and bleed experiment (S-SR-2) are being analysed. A letter from EG&G (North to Tiller dtd. 08/06/82, Primary Coolant System Feed and Bleed, PM-137-82) has been received which discusses a steady-state feed and bleed analysis for both Semiscale and a typical PWR. The conclusion reached is that the Semiscale experiment does not point out the existence of a definite problem regarding primary feed and bleed, but they [sic] do tend to support a concern about the relative tenuousness of the process. Transient analysis of the feed and bleed process have [sic] an important bearing on the feed and bleed process and these [sic] are currently in progress for both the Semiscale experiment and a typical PWR.
8/26/82	8/20/82	Major modifications to the Semiscale facility to upgrade the intact loop primary coolant pump and pressurizer are continuing on schedule. When the modifications are completed, the upgraded facility (designated MOD-2B) will have primary coolant pumps with operating parameters similar to those for a large PWR and a pressurizer with submerged heaters and elevation and surgeline comparable to a large PWR. An information package on all system changes is being made available, on a request basis, to analysts modeling the Semiscale facility. Evaluation of the primary feed and bleed tests is continuing. A report on the tests and analyses is expected in early September 1982.
9/9/82	9/3/82	Analysis of the Semiscale feed/bleed tests has now been completed and documented. The report is under review by the staff and will be reported when the review is completed. Upgrades to the MOD-2A system, which will be designated MOD-2B, are continuing on schedule. The system will be more representative of a four loop U-tube PWR when upgrades are finished.

Report Date	For Week Ending	Information
9/16/82	9/10/82	The Semiscale report covering the primary feed and bleed test is being reviewed in draft form by RES and NRR. The report addresses the results of the feed and bleed test by comparing the results with a RELAP5 test calculation, a RELAP5 calculation for a RESAR-3 plant, and the results of LOFT loss of feedwater tests which included feed and bleed cool down. Presentations are being prepared for the ACRS on the test results.
9/30/82	9/24/82	The task action group established to review B&W design research facilities held its first meeting last week. Discussions centered on the phenomena and tests which RES believes are necessary to resolve questions concerning 2 X 4 loop designs to respond to accident conditions and accident signatures operators can expect to see. Representation included AEOD, ACRS, RES, NRR, utilities, EPRI, and B&W. A large amount of information is contained in the Semiscale 2 X 4 loop study performed by EG&G. Additional views are being prepared for discussion by the group with the goal of arriving at the most cost-effective means of resolving safety issues and data needs. The final report on the Semiscale feed and bleed tests has been received. The report is being distributed for study and determination as to whether or not additional testing is needed.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of METROPOLITAN EDISON COMPANY (Three Mile Island Nuclear Station, Unit No. 1)	)	Docket No. 50-289 (Restart)

CERTIFICATE OF SERVICE

I hereby certify that copies of "UNION OF CONCERNED SCIENTISTS' RESPONSE TO BOARD NOTIFICATION BN-82-93 CONCERNING TESTS OF FEED AND BLEED AND MOTION THAT APPEAL BOARD DIRECT NRC STAFF TO PROVIDE ALL PERTINENT DOCUMENTATION AND ANALYSES" have been served on the following persons by deposit in the United States mail, first class postage prepaid, this 7th day of October 1982.

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* Hand delivered to 1717 H St., NW, Washington, D.C. on October 8, 1982.

** Hand delivered to indicated address.