

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of
METROPOLITAN EDISON COMPANY
(Three Mile Island Nuclear
Station, Unit No. 1)

Docket No. 50-289
(Restart)

UNION OF CONCERNED SCIENTISTS' REPLY
TO APPEAL BOARD ORDER OF OCTOBER 15, 1982

Introduction

On October 7, 1982, UCS filed "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" (hereinafter "UCS Response to BN-82-93"). By Order dated October 15, 1982, the Appeal Board directed the Staff to respond to the UCS motion, granted leave for the other parties to respond, and directed that all responses be in the hands of the Appeal Board and UCS no later than the close of business, Monday, October 25, 1982. The Appeal Board granted UCS leave to reply to any responses received.

UCS received copies of responses to the Appeal Board's Order only from the Staff and the Licensee. We consider the Staff to have violated the Appeal Board's Order because we did not receive Board Notification BN-82-107, which is relied on and cited repeatedly in the "NRC Staff Response to Appeal Board Order of October 15, 1982," until Wednesday, October 27, 1982.

We turn now to our reply to the Licensee and Staff responses.

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Reply to Licensee Response^{1/}

The Licensee makes two major arguments in support of its position. First, GPU claims that the Semiscale tests are not relevant to the TMI-1 design. Licensee Response at 1-2, 3-5. Second, it claims that its analyses prove the efficacy of feed and bleed. Id. at 5-6. We will address these points seriatim.

According to GPU, the important factor which demonstrates the inapplicability of the Semiscale results is that the Semiscale test simulated a plant with low-head HPI pumps and that TMI-1 has high-head pumps. First, this misses the fundamental issue raised by the Semiscale tests: The tests showed the extreme sensitivity of feed and bleed viability to a number of different, plant-specific variables including the mass flow rate, the energy removal rate, pressurizer and surge line geometries, and surge line orientation. Both UCS and EG&G concluded that the tests demonstrate that plant-specific analyses of feed and bleed supported by adequate experimental data are needed to conclude that this cooling method will work. Letter from P. North to R.E. Tiller, August 6, 1982 (hereinafter EG&G, August 6 letter) at 7; UCS Response to BN-82-93 at 8-10. The significance of the Semiscale test (S-SR-2) was not that it used low-head HPI pumps and the PORV to attempt feed and bleed, but that it "suggested that a reasonable uncertainty may exist in the ability to effect stable [primary coolant system] feed and bleed." EG&G, August 6 letter, at 1.

In any event, the Licensee was apparently as unaware as UCS that another Semiscale test (S-SR-1) was performed using a high-head HPI pump, and "the

^{1/} "Licensee's Reply to Union of Concerned Scientists' Response to Board Notification BN-82-93 Concerning Semiscale Tests of Feed and Bleed and Notion that Appeal Board Direct NRC Staff to Provide All Pertinent Documentation and Analyses," dated October 25, 1982 (hereinafter "Licensee Response").

system was allowed to establish conditions at the safety relief pressure^{2/} in response to a loss of feedwater and loss of offsite power." Analysis of Primary Feed and Bleed Cooling in PWR Systems, EGG-SEMI-6022, September 1982, (hereinafter EGG-SEMI-6022) at 22, emphasis and footnote added. During the initial part of the test, primary coolant system inventory remained relatively constant. However, the bleeding mass flow rate increased due to changing fluid conditions in the pressurizer. When the liquid level lowered to a point just above the core, an attempt was made to halt the net loss of coolant by adjusting the PORV set point downward, thereby reducing system pressure, in an attempt to increase HPI flow. The mass balance was still unfavorable (i.e. more water being lost than added), so pressure was again reduced in another attempt to recover primary system mass inventory by increasing HPI flow. At this point, although HPI flow "was large enough to begin to recover mass inventory, core unrecovery was too extensive to prevent excessive rod temperatures." Therefore, the test was terminated. Id. at 31, emphasis added; See also pp. 20-31 generally.

Thus, Licensee's sole basis for claiming that the Semiscale tests are not relevant to TMI-1 is patently wrong. The high-head pump test did no better than the low-head test. In addition, Semiscale test S-SR-1 demonstrated that the TMI-1 PORV may be essential for feed and bleed cooling. We remind the Board again that we do not assert that either the pump characteristics or the PORV are precisely the same as the TMI-1. We reiterate: the point is that substantial uncertainties exist with respect to the viability of feed and

^{2/} Although the PORV was used as the bleeding path, its setpoint was adjusted so that it opened at the safety valve setpoint. Thus, there is no significance to the fact that the PORV rather than the safety valve was used. This test simulated the plant conditions which would exist at TMI-1 using the safety valves and high-head HPI pumps for feed and bleed.

bleed and that plant-specific analyses, backed up by testing, must be done to resolve those uncertainties. As EG&G noted: "Further analysis appears warranted to predict the probable response in . . . Babcock and Wilcox plant designs." Id. at vii.

A related point is the Staff's claim that the Semiscale test "was only representative of a typical Westinghouse 4-loop plant." NRC Staff Response to Appeal Board Order of October 15, 1982 (hereinafter "Staff Response"), at 7. The implication, that the tests do not yield meaningful information for PWR's generally, is nonsense. The subject tests were no more or less representative of a Westinghouse plant than a Babcock & Wilcox (or for that matter a Combustion Engineering) plant. EG&G conducted the tests using the pressure vs. flow characteristics of pumps and valves that are used in Westinghouse plants because of "the availability of information and existing computer decks at [Idaho Nuclear Engineering Laboratory]." Id. As the Board has undoubtedly observed, EG&G reports its results generally in terms of their relevance to "large PWR's." The Staff's circumlocutions should not be permitted to confuse issue. EG&G itself states the relevance of the semiscale test results to Babcock & Wilcox plants like TMI-1:

While analysis of other plant designs (i.e., Combustion Engineering and Babcock and Wilcox) was outside the scope of the present analysis, it is clear that such analysis should be undertaken. A simplified approach, consisting of constructing the "operating map" as illustrated in this report, for each design would be a significant step in this direction.

Finally, it should be pointed out that no attempt was made in the present study to examine implications of the results presented herein relative to existing emergency operator guidelines. This is an area that needs to be explored to determine if these guidelines appear adequate and are reflective of an understanding of the limits and dynamics of primary feed and bleed. Id. at 111-112.

Licensee asserts further that, because of differences between the TMI-1 design and the test conditions (of Semiscale test S-SR-2), "[u]ncertainties in

obtaining a feasible operating hand for feed-and-bleed cooling, the subject of discussion in BN-82-93, are therefore eliminated with the use of high-head HPI pumps." Licensee Response at 5. The first fallacy in this argument is that Licensee would ignore its own training and emergency procedures for TMI-1, which direct the operators to use the PORV for feed and bleed cooling.^{3/} Pollard, ff. Tr. 9027, at 5-16, 5-17; See also Licensee's Proposed Findings, paragraph 174, June 1, 1981. Instead, it would have the Board look to a theoretical analysis of plant behavior which, while it purports to show that the "bleeding" function could be accomplished through the safety valves, is totally inconsistent with the actual plant procedures, which direct use of the PORV.

Moreover, the Licensee fails to demonstrate that the theoretically feasible pressure band for steady state feed and bleed, if it exists at all, encompasses 2500 psig. See UCS Response to BN-82-93 at 8. In fact, in Semiscale test S-SR-1, discussed above, the upper bound of the theoretically feasible pressure band (assuming 100% quality bleed flow) was 15.4 MPa (2234 psig). EGG-SEMI-6022 at 22. Thus, until a plant-specific evaluation is done for TMI-1, with suitable test verification, it is not known whether 2500 psig is within the theoretically possible pressure band for all bleed flow qualities from 0-100% at TMI-1.

The Licensee claims that its computer analyses are a "confirmation" of feed and bleed. In the face of both of the new semiscale tests and all of the recent disclosures undermining the predictive capability of the B&W model (See

^{3/} At note 2 on page 4 of its Response, Licensee implies that use of the PORV could only improve the situation by increasing HPI flow and decreasing bleed flow. However, this ignores the fact that early opening of the PORV could result in more inventory loss than cycling of the safety valve at 2500 psig.

Union of Concerned Scientists' Reply to Staff and Licensee Responses to Appeal Board Order of July 14, 1982, August 25, 1982 at 26-29), it is difficult to understand how this assertion can be put forward. It can certainly not be credited. In addition, the B&W model used in the analyses cited by Licensees and Staff is generic; it is not even plant-specific to TMI-1. Tr. 5127, Jones. There has been no experimental verification of whether the model accurately reflects TMI-1. It is ironic if not surprising that, while claiming that the results of S-SR-2 are totally inapplicable to TMI-1 because of differences in pump configuration, Licensee relies on non-plant-specific computer analyses for its claim that feed and bleed is viable for TMI-1. This may be an appropriate place to recall that the Licensee has the burden of proof on all issues, and appropriately so. The reed to which it clings on this issue is far too slim to support that burden.

Finally, the Licensee has an understandable interest considering recent developments in downplaying at this stage the importance of feed and bleed to this proceeding and to the safety of TMI-1. It was the Licensee that put forward feed and bleed many times as a reliable cooling mode which compensated for other potential equipment failures. For example, the fact that pressurizer heaters are not safety grade was dismissed on grounds that feed and bleed cooling could be used if natural circulation were not possible. Licensee Proposed Findings, June 1, 1982, paragraph 135. With respect to the need for feed and bleed, Licensee claims that "seemingly contrary" testimony of its witness cited by UCS was later corrected. Licensee Response, n. 1 at p. 2. This correction assumed that a safety grade EFW system exists at TMI-1 and that it is sufficiently reliable. Tr. 5646-7, Lanese. As to the former, UCS disputes the characterization of the EFW system as safety grade because, at restart, EFW flow is still controlled by the non-safety grade ICS. UCS

Brief on Exceptions, p. 104-105. Second, there is no dispute that the TMI-1 EFW system at restart is not safety grade for design basis accidents such as steam line break and high energy line break. Staff Response, n. 11 at p. 7. As to the latter, the ASLB found that the TMI-1 EFW system is not sufficiently reliable either before or after it is upgraded to safety grade and UCS agrees.

In sum, the Licensee's argument, which is echoed by the Staff (Staff Response at 7 and n. 11), amounts to urging the Appeal Board to close its eyes to the clear fact that feed and bleed cooling is essential to protect public health and safety at restart for some design basis accidents.

Reply to Staff Response

We now proceed to consider the Staff's arguments. The Staff "construes" UCS's response as a motion to reopen the record and then urges the Board to reject it because it does not meet the legal standards for such a motion. The flaw in this argument is that UCS has not made a motion to reopen the record. We have drawn the Board's attention to the meaning and relevance of the technical information presented in a Board Notification which was, in our view, grossly mischaracterized by the Staff. The Staff (and Licensee for that matter) are obliged by Commission precedent to bring to the attention of Boards all new developments which bear on the issues in individual licensing proceedings. This obligation is not simply an exercise in paper shuffling; it is required because both the Licensing and Appeal Boards, as delegees of the Commission's responsibility to assure the safety of the plants it licenses, must refuse to allow a plant to operate if there are significant questions about its safety. Therefore, the facts surrounding the Semiscale results are now before the Appeal Board; UCS does not have to make a motion to reopen the record to accomplish that. Our response was made to alert the Board to

important aspects of the tests directly relevant to TMI-1 which the Staff either failed to mention or mischaracterized. Our request for production of the rest of the relevant documents was made at least partially so that we can determine whether to make a motion to reopen the record.

The Staff has now produced the specific documents requested on page 3 of the UCS Response to BN-82-93. As to our general request for other relevant documents, the Staff simply claims that it has provided everything that "the Staff considers arguably relevant and material..." Staff Response at 4. The Appeal Board will understand that UCS does not find comfort in that assertion. The Staff is a party to this case with an interest in minimizing the import of these findings. It cannot be entrusted with what is the Board's job: determining the relevance and materiality of these documents. At the very least, the Staff should be required to present all documents not on the record relating to the viability of feed and bleed. This would include:

1. Documents dealing with the adequacy of the B&W codes for predicting plant behavior during feed and bleed;
2. All documents dealing with the Semiscale tests or other experiments of feed and bleed viability,
3. Any memoranda from the Office of Analysis and Evaluation of Operational Data (AEOD) relating to feed and bleed viability or transients at operating plants involving feed and bleed;
4. Any documents indicating Staff requirements to modify the TMI-1 plant design or operating procedures related to feed and bleed;
5. Documents related to the capability of TMI-1 HPI pumps and safety valves (or relief valves) to operate under feed and bleed conditions;
6. Any material presented to the ACRS on a) the pertinent Semiscale tests and b) feed and bleed generally.

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As to the latter, we are aware that the Staff briefed the ACRS on these Semiscale tests during the week ending October 1, 1982; this is reported in the Weekly Information Report to the Commissioners. Surely, the material presented to the ACRS is "arguably relevant and material." It is also worth noting that while the Staff was prepared to brief the ACRS on this subject on or before October 1, 1982, the Staff did not send out Board Notification BN-82-107 (transmitting the EG&G report dated September 14, 1982) until October 22, 1982.

UCS also finds it exceedingly difficult to believe that the request from NRR to EG&G to perform these tests was made orally and was related to "System Depressurization with Auxiliary Pressurizer Spray" as asserted in Affidavit of Brian W. Sheron and Walton L. Jensen, Jr., Concerning Semiscale Test (S-SR-2) Results, at 2. Semiscale is operated by EG&G, a private contractor, under contract to DOE. It strains credulity to believe that tests and reports of this magnitude would be undertaken by a contractor without written authorization. In addition, the Depressurization with Auxiliary Pressurizer Spray relates to recent Combustion Engineering plants, which have no PORV's. Furthermore, depressurization with pressurizer spray does not relate to feed and bleed since the former involves no inventory loss from the primary system. In sum, there are many reasons to doubt the statements made in the Sheron and Jensen Affidavit in this regard.

The Staff states that it did not inform the Appeal Board of the Semiscale results in response to the Board's questions of July 14, 1982, because the Board asked only whether LOFT tests had been done. Staff Response at note 5 on page 2. Of course, this response evades the point made by UCS. The Board and the parties have a right to expect the Staff to exhibit a more forthcoming attitude than is indicated by this exchange. The Appeal Board should not be required to frame its questions as if it were cross-examining an accused felon.

The Staff's only response to the substance of UCS's interpretation of the Semiscale tests is to assert that the tests are just used to verify computer codes and that subsequent calculations using a code called RELAP-5 show that the TMI-1 core would remain covered. The Staff offers not one iota of the underlying data or calculations necessary so that this Board could determine whether:

1. RELAP-5 is an acceptable code for TMI-1 (note that the Licensee's analysis was done by the B&W code);
2. The RELAP-5 code properly models the specifics of the TMI-1 design (the Staff does not mention whether this code is generic or plant-specific);
3. There are experimental data to back up the RELAP-5 results.

The Board is simply asked to accept on faith that actual tests done at Semiscale for both high-head and low-head HPI pump configurations are to be disregarded in favor of calculations using a computer code, the accuracy of which is also to be taken on faith. This is like being told to keep your umbrella down on a rainy day because the weatherman predicted sun.

Nothing the Staff presents overcomes the basic conclusion to be drawn from the Semiscale tests: that plant-specific computer code analyses with suitable verification and adequate supporting experimental data are required to verify the viability of feed and bleed. EGG-SEMI-6022, at 15. Furthermore, the Staff has said nothing about the TMI-1 training and emergency procedures which rely on use of the PORV for feed and bleed cooling and the Staff never addresses in any manner those EG&G recommendations concerning the adequacy of operator training and emergency operating guidelines. See, for example, Id. at 112. See also UCS Response to BN-82-93, at 10, 12.

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Finally, UCS had originally noted the Staff's statement that "feed and bleed, if performed, should be at a relatively low (P<< relief valve setpoints) pressure." UCS Response to BN-82-93, at 4-5. This provide strong support for our argument that the PORV should be safety grade, since use of safety valves as the bleeding path threatens overpressuring the reactor vessel. The Staff does not deny this fact. Sheron and Jensen Affidavit at 2. They could hardly do so, since the documents now released are full of references to the obvious risk of using the safety valves in this manner. See Memorandum from Sheron to Kniel, Enclosure, "Status Summary of Feed and Bleed Capability in PWRs," at 5, 7, and Enclosure, "Present Staff Position Regarding 'Feed and Bleed' for Decay Heat Removal," at unnumbered third page (both are attached to the Staff Response). The statement on page 7 of the "Status Summary.." is unequivocal:

[h]igh pressure feed and bleed is not recommended due to vessel structural considerations. Feed and bleed should be performed at lower pressures. [emphasis added]

If, as the Staff claims, none of this is inconsistent with its position at the hearings (Staff Response at 2), that is presumably because the Staff never mentioned that feed and bleed at high pressure (which is, of course, the condition when the safety valves are used rather than the PORV) may threaten the integrity of the pressure vessel. Its failure to mention this hardly insignificant consideration, while it may be consistent, is no reason for ignoring the fact.

Furthermore, while the Staff claims that RELAP-5 calculations show that pressure vessel integrity would not be threatened for TMI-1 (Sheron and Jensen Affidavit at 4), those calculations were terminated at 5000 seconds. In comparison, the Semiscale tests ran for over 17,000 seconds. Even putting aside the question of the accuracy of the RELAP-5 code and of the assumptons

made with regard to plant conditions, there is certainly no reason to believe that feed and bleed cooling will be needed no longer than 83 minutes at TMI-1, particularly for those design basis accidents for which it is undisputed that EFW is not safety grade.

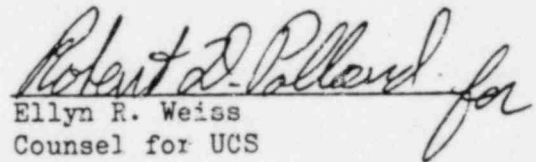
UCS has had relatively little time compared to the Staff to review BN-82-107, which is a lengthy and complex document. We are simply unable at this time to analyze it in the necessary depth. However, we have found serious cause to question the Staff's claims that the RELAP-5 calculations provide assurance of the viability of feed and bleed for TMI-1. For one thing, the RELAP-5 calculations done by EG&G assumed operation of both HPI pumps, both charging pumps and both PORVs. EGG-SEMI-6022, at 91. Thus, there was no attempt to comply with the single failure criterion for accident analysis. Such analysis would not be acceptable under the NRC rules. Since no details are provided concerning the parameters used by the Staff for its TMI-1 RELAP-5 calculations, it is not possible to judge the value of the results.

In addition, we have noted and wish to bring to the Appeal Board's attention one of EG&G's conclusions that relates to another issue in this proceeding - whether water level instrumentation should be provided for the TMI-1 reactor pressure vessel. One of the "conclusions that can be directly drawn from these [Semiscale] experiments [is] is as follows: * * * 3. Temperature response[s] in the hot leg, upper plenum, and upper head do not appear to be good indicators for determining liquid level in the vessel. As evidenced by the test data, the hot leg, upper plenum, and upper head temperatures did not respond to local liquid levels." Id. at 56, emphasis added.

Summary

Rather than dispell the question raised by BN-82-93, BN-82-107 confirms that the viability of feed and bleed for TMI-1 is in great doubt and can only be evaulated by a plant-specific analysis and experimental testing of the critical plant-specific variables. Furthermore, the adequacy of the operator training and emergency procedures at TMI-1 related to feed and bleed cooling need to be evaluated. On the basis of the facts known today, it cannot be concluded with reasonable assurance that feed and bleed cooling will cool the core. Therefore, TMI-1 should not be permitted to restart.

Respectfully submitted,


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Dated: October 29, 1982

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BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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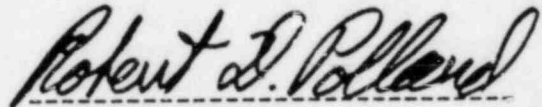
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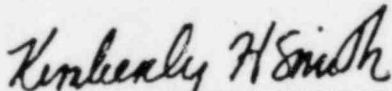
AFFIDAVIT OF ROBERT D. POLLARD

Having been sworn, I hereby depose that the facts contained in the foregoing "Union of Concerned Scientists' Reply to Appeal Board Order of October 1, 1982, are true and accurate to the best of my knowledge and belief.



Robert D. Pollard

Sworn and subscribed before me
this 29th day of October 1982:



Notary Public

My Commission expires
October 31, 1986

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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(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' REPLY TO APPEAL BOARD ORDER OF OCTOBER 15, 1982" have been served on the following persons by deposit in the United States mail, first class postage prepaid, this 29th day of October 1982.

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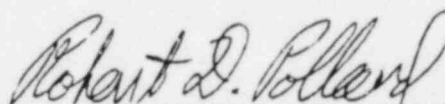
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