



OFFICE OF THE  
SECRETARY

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555

July 3, 1985

MEMORANDUM FOR: William J. Dircks, Executive Director  
for Operations  
FROM: *for* Samuel J. Chilk, *JCH* Secretary  
SUBJECT: SECY-85-176 - APRIL 12 UCS LETTER  
ON TMI-1

The Commission has reviewed the April 12 letter from the Union of Concerned Scientists (UCS) regarding Three Mile Island, Unit 1, and the May 3, 1985 memorandum from the Executive Legal Director responding to that letter. The Commission does not believe the UCS letter warrants further Commission review, and is referring it to you for an appropriate response by letter to UCS.

cc: Chairman Palladino  
Commissioner Asselstine  
Commissioner Bernthal  
Commissioner Zech  
M. Cutchin  
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# UNION OF CONCERNED SCIENTISTS

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Nunzio J. Palladino, Chairman  
Thomas M. Roberts, Commissioner  
James K. Asselstine, Commissioner  
Frederick M. Bernthal, Commissioner  
Lando W. Zech, Commissioner  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Gentlemen:

We are writing to bring to your attention recent statements by the NRC staff which directly contradict its sworn testimony in the TMI-1 restart proceeding and which raise questions about the basis for concluding that TMI-1 can be safely operated.

As you are undoubtedly aware, the effectiveness of the so-called boiler-condenser mode of natural circulation for decay heat removal was a central safety issue in the TMI-1 restart case raised and pursued by the Union of Concerned Scientists. Indeed, concerns about the reliability of the TMI-1 decay heat removal mechanisms led the Appeal Board to hold four days of reopened hearings in March 1983.

UCS has learned that sworn testimony by the staff during the reopened hearing has recently been directly contradicted by the staff's statements in support of NRC's proposed research budget. During the reopened TMI-1 hearings, the staff testified that, although additional testing was planned, "[t]he purpose of the testing is not to confirm the effectiveness of boiler condenser decay heat removal." However, last month the NRC staff stated that an area where research is needed regarding TMI-1 restart is a "test to assess the effectiveness of the boiler-condenser process to remove decay heat . . . ."

## Background

There are a limited number of theoretically possible ways to remove decay heat from the TMI-1 reactor coolant system (RCS) following a small break loss-of-coolant accident — the type of accident which occurred at TMI-2. The processes discussed in the restart proceeding were decay heat removal through the break itself, by a "feed and bleed" process, by liquid natural circulation in the RCS, and by the two-phase (liquid water and steam) boiler-condenser mode of natural circulation in the RCS. (Forced circulation of the RCS is not mentioned because GDC-17 prohibits reliance on offsite electrical power, which is the only source of power for the reactor coolant pumps.)

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For breaks smaller than a certain size, heat removal through the break itself is insufficient. The "feed and bleed" process cannot be relied upon because the evidence in the reopened hearings led the Appeal Board to decline "to state conclusively that feed and bleed will successfully provide core cooling at TMI-1." [Ref. 1] Liquid natural circulation will be blocked following some small break loss-of coolant accidents by steam formation in the reactor coolant system. Thus, for some break sizes, the boiler-condenser mode of cooling is the only possible way to provide adequate decay heat removal for TMI-1.

#### Discussion

At the time of the reopened hearings, the NRC staff was directed by the Appeal Board to respond to a series of questions about boiler-condenser cooling, inter alia. The staff testified under oath:

The staff has concluded that the heat transfer mechanisms involved in the boiler-condenser process are adequate to remove decay heat from the reactor system and will prevent core uncovering if at least one train of ECCS is operable.

[Ref. 2]

Although the Appeal Board recognized that the NRC's computer calculations did not predict the occurrence of the boiler-condenser mode for TMI-1, it relied upon B&W computer calculations, in combination with the staff's endorsement of the heat-transfer equations used by B&W, as its basis for concluding that "the boiler-condenser method will satisfactorily remove decay heat at TMI-1." [Ref. 3]

The staff acknowledged during the reopened hearings that "there are no experimental data from a test facility geometrically similar to the B&W reactor design confirming the boiler condenser mode of natural circulation." [Ref. 4] In the absence of any test data, the staff claimed that computer analyses "demonstrate the efficacy of boiler condenser natural circulation," and explicitly denied that testing was necessary to confirm the effectiveness of the boiler-condenser process:

The purpose of the testing is not to confirm the effectiveness of boiler condenser decay heat removal. Rather, its purpose is to satisfy the confirmatory research needs for the B&W design, and to provide additional confirmation of operating guidelines.

[Ref. 5, emphasis added.]

The Appeal Board, noting that "[f]uture experimental work is planned to investigate the boiler-condenser mode of cooling at an integrated systems test facility (GERDA)," ruled that:

We believe that the heat removal calculations include sufficient conservatism to make a full-scale test of the

boiler-condenser process at TMI-1 unnecessary before restart. However, we recommend that this cooling process be studied further as part of continuing research in order to increase the current knowledge of thermal-hydraulic behavior during small break loss of coolant accidents.

[Ref. 6]

In other words, while endorsing research to gain further knowledge of plant behavior, the Appeal Board accepted the staff's position that there is no serious question that the boiler-condenser mode will be effective in removing decay heat. This ruling was necessary for restart since, as we explain above, the record precludes reliance on all other heat removal modes for certain small breaks.

Last month, in response to inquiries from Congressman Udall's staff concerning the NRC's research budget, the NRC staff delineated "areas where continued research is needed." Among those applicable to TMI-1 are the following:

Issues and Concerns Regarding Adequate Decay Heat Removal Capability in TMI-1 Restart (Applicable to all B&W Designed Plants):

- o Test to assess the effectiveness of the boiler-condenser process to remove heat from the reactor coolant and maintain natural circulation.
- o Use of high-point vents to assure natural circulation and long-term adequate core cooling.

[Ref. 7, emphasis added.]

Thus, there is a direct contradiction between the staff's sworn testimony that "the purpose of the testing is not to confirm the effectiveness of boiler condenser heat decay heat removal," and the staff's current claim that an area where research is needed regarding TMI-1 restart is a "[t]est to assess the effectiveness of the boiler-condenser process" to remove decay heat.

In addition to arguing against reliance on inconsistent computer predictions (in the absence of any experimental data) to judge the effectiveness of the boiler-condenser cooling, UCS also argued "that the boiler-condenser process cannot be considered sufficiently reliable without an assurance that the assumptions regarding operator action made in the computer analyses are appropriate." [Ref. 8] Our concern was (and remains) that if the operator were confronted by unpredicted plant behavior during the boiler-condenser cooling mode, this might result in incorrect operator actions causing serious consequences. However, the Appeal Board's "limited reopening of the record excluded the adequacy of TMI-1 emergency procedures." [Ref. 9]

We bring this matter to your attention now because we recently obtained a December 30, 1981, memorandum indicating that the NRC staff had concerns similar to UCS's regarding the potential for incorrect operator actions. The purpose of the staff memorandum was, in part, to identify experimental data

needed to confirm the predicted behavior of B&W plants during small break loss-of-coolant accidents. The staff stated:

Recent B&W analyses have shown the system pressure to behave in a cyclic manner that could be confusing to the operator during certain small break conditions.

\* \* \*

We do not know if the unique oscillatory phenomenon is real or an artificiality of the analyses. Recent analyses of small breaks in B&W plants by [Los Alamos National Laboratory] do not show the repressurization phenomenon calculated by B&W. We believe the predicted phenomenon could produce false symptoms of other events . . . and lead to incorrect operator actions which could result in more severe consequences than now predicted for the SBLOCA [small break loss-of-coolant accident].

\* \* \*

At present, we have no confirmatory integral systems data with which to verify the acceptability of the predicted behavior of transients and accidents including small break LOCAs in B&W designed reactors. Also, the long-term hydraulic stability of the plant following a SBLOCA has never been analytically or experimentally confirmed.

[Ref. 10, emphasis added.]

Apparently, there was little change in the factual information available to staff between December 1981 and the March 1983 reopened hearings regarding plant behavior during boiler-condenser cooling. During the reopened hearings, the staff described an intermittent "chugging" behavior and attempted to explain actual plant behavior. However, the Appeal Board noted that the staff's explanation "was not illustrated in the graphs [of the computer predictions] and appears to us to be contrary to some basic laws of physics." [Ref. 11]

As we noted above, the staff testified in the reopened hearings that one purpose of further testing of the boiler-condenser process was "to provide additional confirmation of operating guidelines." This is clearly not the same as the staff statement in December 1981 that "the predicted phenomenon could produce false symptoms of other events . . . and lead to incorrect operator actions which could result in more severe consequences than now predicted for the SBLOCA." During the reopened hearings, the staff never suggested that the lack of understanding of plant behavior during boiler-condenser cooling could lead to consequences beyond the licensing basis. On the contrary, when UCS attempted to demonstrate precisely this point, the staff succeeded in cutting off any questioning on the grounds that this went beyond the scope of the hearing. As UCS stated in response to the objection:

It is our position that a computer analysis or any of the many computer analyses we have been offered -- and I



think there are five or six between the various witnesses in this case -- of system behavior is only good so far as it corresponds to what one would actually see happening in the plant over the period of time that the analysis attempts to make predictions.

In the case of Small-Break LOCA in particular, what is happening in the plant has a substantial amount to do with what the operator perceives and how he acts upon what he perceives. We don't intend at this point to go into any of the details of the procedures, but we think it is a highly relevant point. If the operator cannot be expected to distinguish, for example, between a Small-Break LOCA or some other accident, and if on the basis of that he does not take the appropriate actions, and [the] plant does not conform to what the assumptions are in the computer analyses, then the computer analyses are simply not useful.

I think it is important to remember how the TMI-2 accident happened, where an operator turned off emergency core cooling because he was afraid that his plant was going solid, because his indications led him to believe that that was happening and that that was worse, and we think that we are addressing and will be addressing throughout the examination of these witnesses whether an analogous situation doesn't exist now for TMI-1.

[Ref. 12]

UCS continues to believe that further testing is needed, prior to restart, to assure that plant behavior is sufficiently well understood to reduce the potential for incorrect operator actions or, as the staff phrased it, "to provide additional confirmation of operating guidelines." Please note that we do not wish to raise anew here the question of whether this issue was within or outside the scope of the reopened hearing. Fortunately, the Commission's responsibility is not demarcated by such distinctions. The Commission has the responsibility to assure the overall safety of TMI-1, regardless of whether a question falls within the limited scope of any particular hearing.

### Conclusion

There are at least two major safety questions related to TMI-1 which are the subject of future research and testing. The first is whether the boiler-condenser mode of cooling is adequate to remove decay heat. The second is whether plant behavior is sufficiently understood so that the operator will take the appropriate actions and will not take actions that would add to the seriousness of the accident.

We therefore request the Commission to establish the answers to the following questions:

1. What factual information does the NRC expect to obtain from future research and testing that it does not now have regarding the adequacy of decay heat removal for TMI-1?

2. What factual information does the NRC expect to obtain from future research and testing that it does not now have regarding the effectiveness of the boiler-condenser mode of decay heat removal for TMI-1?

3. What factual information does the NRC expect to obtain from future research and testing that it does not now have regarding the TMI-1 plant behavior during boiler-condenser cooling?

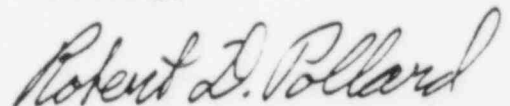
4. What is the current basis for believing that boiler-condenser cooling would be effective for TMI-1?

5. What is the current basis for believing that TMI-1 plant behavior during boiler-condenser cooling would not lead to incorrect operator actions?

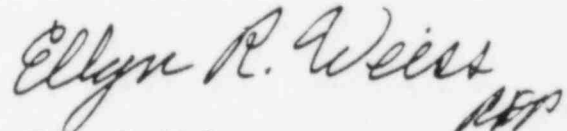
6. If the factual information currently available to NRC establishes the adequacy of decay heat removal and the effectiveness of boiler-condenser cooling for TMI-1, why should the planned research and testing be paid for by NRC?

In addition, we request that the Commission refer this matter to OIA to determine whether false or misleading statements were made by the staff.

Sincerely,



Robert D. Pollard  
Nuclear Safety Engineer



Ellyn R. Weiss  
General Counsel

References: See next page.

cc: TMI-1 Service List

References

1. ALAB-729, 17 NRC 814, 852 (1983).
2. NRC Staff Testimony of Brian W. Sheron and Walton L. Jensen, Jr. in Response to Appeal Board Questions 2, 4, 5, 6, 7, 9, 10 and 11, served February 16, 1983, p. 6, ff. Appeal Tr. 83, March 7, 1983.
3. ALAB-729, 17 NRC 814, 842 - 844 (1983).
4. NRC Staff Testimony of Brian W. Sheron and Walton L. Jensen, Jr. in Response to Appeal Board Questions 2, 4, 5, 6, 7, 9, 10 and 11, served February 16, 1983, p. 8, ff. Appeal Tr. 83, March 7, 1983.
5. Id., p. 9.
6. ALAB-729, 17 NRC 814, 848 (1983).
7. Memorandum from Enrico F. Conti, Office of Nuclear Regulatory Research, to Thomas Rehm, Office of the Executive Director for Operations, March 13, 1985, enclosure, "Areas Where Continued Research is Needed," p. 2.
8. ALAB-729, 17 NRC 814, 846-847.
9. Id., n. 127.
10. Memorandum from Harold R. Denton, Office of Nuclear Reactor Regulation, to Robert B. Minogue, Office of Nuclear Regulatory Research, "Request for the Conceptual Design of a Facility for the Study of B&W and CE Integral System Characteristics," December 30, 1981, pp. 2, 3.
11. ALAB-729, 17 NRC 814, 845, n. 118.
12. Appeal Tr. 570-571, March 17, 1983. See also pp. 585-588.