

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

Docket No. 50-289
(Restart)

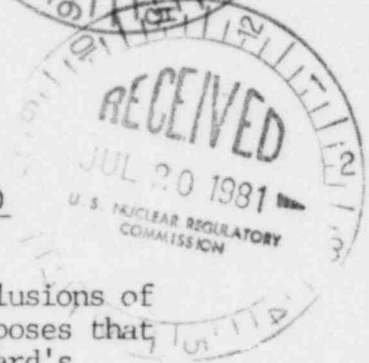
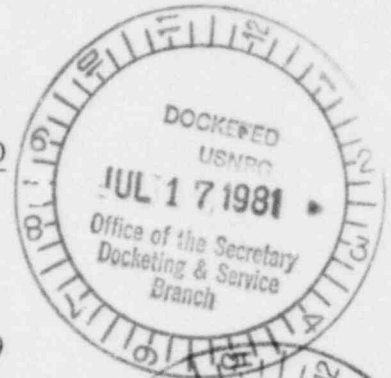
COMMONWEALTH OF PENNSYLVANIA'S PROPOSED FINDINGS
OF FACT AND CONCLUSIONS OF LAW ON UCS 12 (FLOOD LEVEL)

Note: Since the following proposed findings of fact and conclusions of law relate to only one aspect of UCS 12, the Commonwealth proposes that these findings be inserted at the appropriate point in the Board's decision on UCS 12.

Flood Level and Instrument Relocation

1. The Board is particularly concerned with the ability of safety-related equipment at TMI-1 to function under conditions of reactor building flooding similar to those that occurred during the TMI-2 accident. The water level in the reactor building that resulted from the TMI-2 accident has been approximately eight to nine feet above the containment floor. Keaten, et al., ff. Tr. 7558, at 6.

2. Licensee's witness testified that "the only environmental stress to which certain safety-related equipment at TMI-2 was exposed that was beyond conditions for which it was qualified was submergence due to flooding." It was then claimed that adequate protective measures will be completed prior to restart to prevent the recurrence of this problem. Braulke, ff. Tr. 6802, at 1-2. See also Cronenberger, ff. Tr. 16, 252, at 2; Keaten, et al., ff. Tr. 7558, at 4-5. The Staff's witness agreed with this testimony. Rosztoczy, ff. Tr. 21, 867, at 1.



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3. According to the Licensee, all of the instruments on Table 1 of Keaten, et al., ff. Tr. 7558, with the exception of the NI-2 source range nuclear instrument indication are located below the TMI-2 flood level. Therefore, Licensee presumes that these instruments failed due to submergence. Similarly, Licensee believes that all but six instruments from Table 2 of this testimony (items 1, 2, 3, 5, 6, and 7) failed due to submergence. Tr. 6884 (Braulke). These six instruments are above the TMI-2 flood level. Id.

4. Licensee testified that the instrumentation that presumably failed due to submergence during the TMI-2 accident was not designed for use under water, and that the seals would eventually fail under submerged conditions. Tr. 6885 (Braulke).

5. The protective measure utilized by the Licensee to prevent a recurrence of instrument failure due to reactor building flooding is the relocation of safety-related instrumentation to above the maximum calculated flood level from design basis accidents. For this purpose, Licensee originally calculated a flood level of 5.94 feet above the containment floor. Tr. 6886 (Braulke). Later, this level was recalculated to 5.66 feet. Cronenberger, ff. Tr. 16, 252, at 2-3.*

6. In explaining why the recalculated flood level was 5.66 feet rather than 5.94 feet, Mr. Cronenberger explained that certain conservatisms in the original analysis were unwarranted. For example, it was projected that the entire volume of the borated water storage tank would not be injected into the containment, since a certain volume of water in the tank is below the level of suction in the tank. Tr. 16,

* It is not clear why the flood level was recalculated. The Board notes, however, that some important safety equipment was relocated to a level below the original 5.94 feet but above the recalculated 5.66 feet. See ¶7 infra.

254 (Cronenberger). This does not explain, however, why the calculated flood level is lower than that experienced during the TMI-2 accident.

7. The steam generator and pressurizer level instrumentation have been relocated to an elevation of over 5.75 feet above the reactor building floor. This is the only equipment that is actually being relocated by Licensee. Cronenberger, ff. Tr. 16, 252, at 3. Licensee asserts that all other instrumentation from Tables 1 and 2 which had a safety function were already located above the Unit 1 calculated flood level. Tr. 16, 256 (Cronenberger).

8. Thus, even the instrumentation that was relocated was not raised to a level above the actual TMI-2 flood level or the original flood level calculation of 5.94 feet. The lowest portion of the housing of the relocated pressurizer and steam generator level instrumentation is at 5.8 feet. Tr. 16, 259 (Cronenberger).

9. The Board believes that the level of certainty inherent in Licensee's flood level calculation is questionable. The Staff's witness was questioned on this uncertainty as follows:

Q Do you think that three significant figures is a reasonable way to specify flood level? Do you think you can determine flood level that accurately?

A (WITNESS LaGRANGE) Well, I assume there are probably a lot of conservatism in the calculation of that flood level, but I would find it hard to believe that you can get it right down to three digits.

Tr. 22, 002 (LaGrange)

10. The uncertainty inherent in flood level calculations is also demonstrated by Licensee's testimony on the failure of non-safety-related instruments. According to Licensee's witness, "a couple of them had terminations that are very close to the flood level so we are not sure

whether that actual termination point on the terminal block is actually covered with water or not." Tr. 6919 (Braulke).

11. In light of this uncertainty and the significant difference between Licensee's calculated flood level and the level actually experienced at TMI-2, the Board believes that a careful Staff review of Licensee's approach to this problem is warranted.

12. The NRC Staff did not, however, conduct a significant review of Licensee's calculations. The Staff witness testified that he did not review the adequacy of Licensee's calculation of the flood level in containment following a small break loss of coolant accident. Tr. 22, 000-01 (LaGrange). Instead, the Staff simply assumed that the flood level calculated by Licensee was correct. Id. at 22, 001.* Moreover, the Staff did not consider the margin between the stated flood level and instrument location. Id.

13. The Staff's other witness agreed later, however, that an extremely conservative approach to flood level calculations is appropriate. The witness testified that "the uncertainties of the calculation should be added to the nominal value, the calculated nominal value, and then the flood level established. But the established flood level should be something that the actual water level will never exceed." Tr. 22, 102-03 (Rosztoczy).

14. Apparently, the only information received by the Staff regarding the basis for Licensee's flood level calculation is stated in Licensee's October 31, 1980 response to IE Bulletin 79-01B. The letter states, in pertinent part:

Flood level in the Reactor Building was
recalculated for TMI-1 following the TMI-2

* This was true both for the original (5.94 feet) and recalculated (5.66 feet) flood levels. Tr. 22, 091 (LaGrange). See also UCS Ex. 40, at 4.

accident. The flood level was based on the available tankage involved in accident mitigation and the fluid losses out of the break. The flood level was conservatively calculated to be 5.94 feet (Elevation 286.94 ft.).

UCS Ex. 34, at 2. This information is not sufficiently detailed to determine what systems are assumed by Licensee to contribute to accident flood levels.

15. Normal leakage from other contaminated and uncontaminated water systems, in fact, contributed to flooding at TMI-2. This leakage is calculated to be about 6,000 gallons per month, resulting in a monthly increase in water level of about one-tenth of a foot. Stoddard, ff. Tr. 10, 159, at 12.

16. In addition, it is apparent that the TMI-1 reactor building may accumulate more water than at TMI-2, since there is "less likelihood that substantial quantities of liquid radwaste will be inadvertently transferred from the reactor building to tankage in the auxiliary building." Fuhrer & McGoey, ff. Tr. 10, 020, at 6.

17. The Staff's witness was not even sufficiently familiar with the systems at TMI-1 to discuss which systems would contribute to reactor building flooding. The witness would, however, consider "any ... source of water which could [by] reasonable means be entering the containment or the appropriate building," including normal system leakage but excluding secondary breaks in addition to the initial accident. Tr. 22, 095-97. The witness did not know whether all of these sources were included in Licensee's flood level calculation, although he testified that such NRC review would be desirable. Id.

18. The Board is at a loss to explain the lack of Staff review of this issue. The Staff's testimony claimed that "the staff performed

their own analyses and calculations to assess the adequacy of the licensee's specified environmental conditions." Rosztoczy, ff. Tr. 21, 867, at 3. Yet the Staff performed no analysis or calculation of the only environmental condition that, according to both the Staff's and the Licensee's testimony, resulted in instrument failures at TMI-2. On cross-examination, the Staff's witness provided no reasonable explanation for this approach. Tr. 22, 093-94 (Rosztoczy).

19. Apparently, the Staff did not recalculate the flood level for TMI-1 as part of a conscious decision merely to accept the flood level calculations of all licensees. This decision was based primarily on time considerations. In this respect, TMI-1 was treated the same as all other reactors, despite the fact that the flood level of the TMI-2 accident exceeded the calculated TMI-1 flood level. Tr. 22, 098-99 (Rosztoczy).

20. The Staff's witness did agree, however, that the flood level of the TMI-2 accident "raises some questions" regarding the TMI-1 flood level. The witness responded to this question in two ways. First, the witness claimed that the TMI-2 flood level was high due to the pumping of TMI-1 storage water into the TMI-2 reactor building. The source of this information was conversations between the witness and Met Ed employees. The witness did not know the reason for this transfer or the pathway that was used. Tr. 22, 099; 22, 101-02 (Rosztoczy). There is no assurance that this type of transfer, therefore, would not be repeated. Moreover, the Board questions the reliability of this evidence due to the hearsay nature of the testimony, and in light of the witness' inability to answer any related questions.

21. The Board can only presume that TMI-1 water was transferred

through the TMI-2 borated water storage tank to serve a reactor coolant function, as suggested by the Commonwealth's cross-examination, and not directly into the reactor building. See Tr. 22, 102 (Dornsife). If this were the case, additional borated water could be used in this manner during an accident at TMI-1 as well, as long as a source of borated water was available. Alternatively, Licensee could continue to cool the reactor by entering the recirculation mode, as discussed infra.

22. The witness' second response was his "understanding" that the TMI-1 operating procedures would not permit a repeat of the TMI-2 flood level. Tr. 22, 099 (Rosztoczy). Yet the witness had sought no information from other NRC branches to determine whether such operational limitations are appropriate or possible. The Staff intends to conduct this analysis sometime in the future. Tr. 22, 100 (Rosztoczy).

23. Essentially, the Staff's position is that it is safe to restart TMI-1 provided that the flood level is maintained below the specified value. The Staff's witness testified that, in order to ensure that the flood level does not exceed the specified value, it would be appropriate to impose a license condition or "something of that sort" on the TMI-1 emergency procedures. Tr. 20, 002-03 (Rosztoczy). This witness also testified, however, that the operational limitations necessary to achieve this result were beyond his responsibility and knowledge. Tr. 22, 004 (Rosztoczy).

24. Although the Staff's approach might appear appropriate on its face, it is not supported by the record. Licensee relies on the reactor building in order to store liquid wastes in the event of an accident at TMI-1. Licensee claims that "[t]he Unit 1 reactor building can safely contain the maximum volume of water available from post-accident Unit 1

sources during an accident." The same testimony states that instrument relocation will "decrease the likelihood that such instrumentation will be flooded in the event it is necessary to contain large volumes of liquids in the Unit 1 reactor building." The building can contain approximately 456,000 gallons before instruments will be adversely affected. Fuhrer & McGoey, ff. Tr. 10, 020, at 5-6. The Board notes the uncertainty in which this language is couched.

25. Licensee's witness on plant separation also testified orally that the TMI-1 reactor building has a capacity of approximately 456,000 gallons before important plant instrumentation may be affected. Apparently, Licensee's calculated flood level is based on this 456,000 gallon figure. Tr. 10, 038-39 (Fuhrer). The borated water storage tank alone has approximately 400,000 gallons, most of which may contribute to the reactor building flood level. Therefore, this witness believed that an accident at TMI-1 could very much push the 456,000 gallon limit, when considering contributions from other portions of the primary system. Id. at 10, 043-44.

26. The level of water in the containment from a loss of coolant accident with heat removal through the steam generators or through feed and bleed would result in the same maximum water level in the containment building. This would result from emptying the entire borated water storage tank and the majority of the primary system inventory. Tr. 4736 (Jones).

27. On cross-examination, Dr. Jordan asked Licensee's witness, Mr. Braulke, why the calculated flood level (then 5.9 $\frac{1}{2}$ feet) was lower than the 8-9 feet experienced at TMI-2. Mr. Braulke responded that:

There may be some differences with the containment structure. I think as far as the TMI-2 accident was concerned, a level similar

to what we have calculated for TMI-1 was reached after, I think, about three days or four days. And at that time there was the--at least it is my understanding--the conscious and deliberate decision not to go into the recirculation mode but to continue the mode they were in, which would have continued to add water to the building, and I think that increased a little over a half an inch a day up through the first month.

Tr. 6916 (Braulke).

28. Therefore, in order to prevent recurrence of the TMI-1 flood level, Licensee would have to enter the recirculation mode. This requires operation of "a few motor-operated valves." Tr. 6917 (Braulke). In addition, it might be necessary to use the decay heat system coolers to cool the water prior to recirculation. Id.

29. In fact, the recirculation mode has not been used in this manner. The decision during the TMI-2 accident was not to enter the recirculation mode. Tr. 6918 (Braulke).

30. Licensee's witness was not able to give an authoritative answer as to why Licensee elected not to enter the recirculation mode. The witness knew that one reason was that Licensee wanted to hold the containment water in reserve. On cross-examination, it was suggested that additional reasons involved the high level of radiation in the containment building water that would have to be carried outside of containment, and the high leakage rate of the decay heat removal system that might have to be used. The witness merely answered that "there might have been some concern over [those] points." Tr. 6924 (Braulke). The Board is not able to find, based on this record, that Licensee clearly will be able to enter the recirculation mode safely under all circumstances.

31. The margin of error for equipment relocation above the potential flood level also affects the desirability of using the feed

and bleed mode of heat removal from the primary system, since feed and bleed results in the flooding of the containment building. Tr. 4729-31 (Jones/Keaten). In fact, the B&W computer analyses used to test the adequacy of feed and bleed heat removal do not account for the potential for equipment flooding. Tr. 4730 (Jones).

32. The Board is extremely displeased that the Staff produced no knowledgeable witnesses on flood level calculations, if such a review was conducted at all by the Staff. This record deficiency occurred despite the Commonwealth's specific request for a witness on this topic. Tr. 22, 104; 22, 157-58 (Cutchin, R. Adler). See Letter from Robert W. Adler, Attorney for the Commonwealth, to Administrative Judges Smith, Jordan, and Little (June 23, 1981). The NRC Regulations provide that:

In a proceeding in which the NRC is a party, the NRC Staff will make available one or more witnesses designated by the Executive Director for Operations, for oral examination at the hearing or on deposition regarding any matter, not privileged, which is relevant to the issues in the proceeding.

10 C.F.R. §2.720(h)(2) (emphasis added). This requirement includes the "obligation to lay all relevant materials before the Board to enable it adequately to dispose of the issues before it." Consolidated Edison Co. of N.Y., Inc. (Indian Point Station, Units 1, 2, & 3), CLI-77-2, 5 NRC 13, 15 (1977).

33. The approach of the Division of Inspection and Enforcement appears no better. The Staff conducted an onsite inspection of only a "very limited number of components." UCS Ex. 40, at 5. Therefore, the Staff does not know what other instruments are potentially subject to failure due to submergence. Consistent with the Staff's approach

moreover, the inspection would have focused only on equipment potentially below Licensee's calculated flood level. There is even less basis for knowing the susceptibility to submergence of equipment located above Licensee's calculated flood level but below the TMI-2 flood level.

34 The Board has already expressed some reservations regarding Licensee's approach to flood level calculations and instrument relocation. Tr. 6918 (Jordan). After further evaluation of the record, the Board concludes that the following requirements are necessary to provide reasonable assurance that TMI-1 can be operated without endangering the health and safety of the public:

(1) The following short-term actions must be completed and certified to the Commission prior to restart:

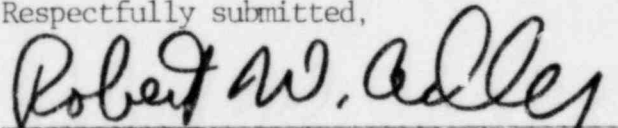
(a) The Staff is directed to conduct a complete review of Licensee's flood level calculations. This review shall ensure that Licensee's calculations are based on the appropriate assumptions. In particular, the Staff shall ensure that all systems, including normal system leakage, that may contribute to reactor building flooding, were included in Licensee's analysis. The Staff shall ensure that Licensee's analysis was performed with an appropriate degree of conservatism, as set forth in ¶13, supra. If Licensee's calculations were not based on the appropriate conservatisms, the actions set forth in (2), below, shall be required;

(b) The Staff shall conduct a complete review of the operational limitations that must be imposed on Licensee to ensure that the reactor building flood level does not exceed Licensee's calculated maximum flood level. This analysis

shall ensure, for the design basis accidents expected to result in reactor building flooding, that it is possible and appropriate from an operational standpoint to maintain the flood level within the calculated maximum flood level. In particular, the Staff shall review the ability of Licensee to enter the recirculation mode under all postulated accident circumstances where the recirculation mode would be necessary to maintain flood levels within Licensee's calculation. The Staff shall review all emergency procedures for these accidents to ensure that these operational limitations are properly incorporated into the procedures. If the necessary operational limitations are not possible or appropriate for some postulated events, the Licensee shall be required to demonstrate prior to restart why the operation of TMI-1 under these circumstances will not endanger the health and safety of the public.

(2) If it is determined pursuant to (1)(a), above, that Licensee's calculation of maximum expected flood level did not employ the appropriate degree of conservatism, a new flood level shall be determined using the correct assumptions. Licensee shall then be required to relocate all equipment important to the safe operation of the plant above the newly calculated flood level. This relocation shall be required by June 30, 1982.*

Respectfully submitted,



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* June 30, 1982, is the compliance deadline for environmental qualification of safety equipment set forth in Petition for Emergency and Remedial Action, CLI-80-21, 11 N.R.C. 707 (1980).