Staff 6/1/81

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

NRC STAFF PROPOSED FINDINGS OF FACT
AND CONCLUSIONS OF LAW REGARDING BOARD QUESTIONS 8 AND 9

1. In addition to admitting various contentions proposed by the Intervenors, the Board posed several Board Questions which were to be addressed by both the Staff and the licensee in testimony. The findings set forth below concern Board Questions 8 and 9.

PROPOSED FINDINGS

BOARD QUESTION 8

2. In addition to Board Question 8, several contentions were admitted by the Licensing Board in this proceeding dealing with the physical separation of Units 1 and 2 at Three Mile Island. These were ECNP Contention 19; Sholly Contentions 10 and 16; TMIA Contention 7; Aamodt Contention 8; and CEA Contentions 5, 6 and 7. These contentions were all either withdrawn by the sponsoring party or dismissed by the

Board for lack of prosecution. The Board did, however, believe that the issue should be heard and thus posed Board Question 8:

> Even though no contentions survive on the issues raised by short-term Item 4 of the Commission's August 9, 1979 Order, the board wants testimony presented on the issue raised by this item. Short-term Item 4 requires:
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> The licensee shall demonstrate that decontamination and/or restoration operations at TMI-2 will not affect safe operations at TMI-1. The licensee shall provide separation and/or isolation of TMI 1/2 radioactive liquid transfer lines, fuel handling areas, ventilation systems, and sampling lines. Effluent monitoring instruments shall have the capability of discriminating between effluents resulting from Unit 1 or Unit 2 operations. "Memorandum on Board Questions," dated September 12, 1980 at 8.)

3. The Staff and the licensee filed testimony on the separation of TMI-1 and TMI-2. The licensee's testimony by Edwin C. Fuhrer and Richard J. McGoey follows Tr. 10020. The Staff's testimony by Phillip G. Stoddart follows Tr. 10158[1/]. None of the Intervenors presented any evidence or cross-examined the witnesses on this issue. Representatives of the Commonwealth of Pennsylvania did participate in cross-examination.

4. The licensee testified that the TMI-1 liquid radwaste processing systems, the waste gas systems, and the solid waste systems are adequate to safely contain, store, and process anticipated waste streams during both normal and postulated accident conditions. In

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1/ Ronald R. Bellamy, Chief of the Technical Support Section for the NRC TMI Program Office, was also made available to the Board to answer more detailed questions. (Tr. 10160.) His Professional Qualifications Statement follows Tr. 10159.

addition, TMI-1 will not rely on liquid or gaseous waste storage at TMI-2, and the cleanup activities at TMI-2 will not have to rely on TMI-1 waste handling facili-ties. The licensee also stated that common facilities and interconnections between Units 1 and 2 that have the potential for permitting the movement of contaminated fluids from one unit to the other have been isolated and that the Unit 1 and 2 monitoring systems are capable of discriminating between effluents resulting from each unit. Finally, the licensee testified that future cleanup activities will be carefully planned, reviewed, and implemented so as to not adversely affect the safe operation of Unit 1.

5. During cross-examination by the Commonwealth of Pennsylvania, the licensee's witnesses gave additional testimony. This testimony concerned the quantity of tankage available at both units, the physical barrier which is being constructed between the Unit 1 auxiliary building and the fuel handling building, the electronic valve controls which prevent concurrent releases of effluents from both units, the mobile solidifica-tion system to be used at Unit 1, and the EPICOR I and II systems used in decontamination of TMI-2. The Board asked questions relating to the storage module for the long-term resin s. 'age facility, reactor building purges, and the various systems used to decontaminate Unit 2.

6. The Staff testified that decontaminated water from TMI-2 will not interfere with water storage space needed in the event of an accident at TMI-1 and that an accident in the decontamination and disposal of TMI-2 radioactive water would not impact upon the safe operation of TMI-1. Further, the Staff stated that radiation monitoring provisions

will be adequate to discriminate between effluents from Units 1 and 2. Upon cross-examination by the Commonwealth of Pennsylvania, the Staff also discussed 10 C.F.R. Part 50, Appendix I calculations; tritium concentrations at TMI; and Staff analysis of the auxiliary steam and condensate, demineralized water, and industrial waste systems.

7. Clean-up and decontamination activities at TMI-2 cannot interfere with the operation of TMI-1. Tr. 10128 (McGoey, Fuhrer). There is no credible accident that could occur during the decontamination of the water from the TMI-2 accident which could interfere with storage space that might be needed for TMI-1. Stoddart (Separation), ff. Tr. 10158, at 4. There is no pathway through which water from an accident at Unit 2 could flow to Unit 1. Id. This separation has been assured by the licensee's compliance with Item 4 of the Commission's August 9, 1979 Order. Id. at 4-5. As implemented by the licensee, separation has been accomplished by locking closed certain valves, removing motive force from valve operators, and adding blind flanges in such a manner as to preclude all transfer of liquids from one unit to the other. Id. at 8. These actions (detailed in Chapter C4 of the TMI-1 Restart SER, NUREG-0680 (Staff Ex. 1) prevent the transfer, even by accident, of contaminated water from TMI-2 to TMI-1 and thus prevent any interference with storage space assigned to Unit 1. Id.

8. There is a total of 278,400 gallons of radioactive liquid storage space available in the reactor coolant bleed tank, miscellaneous waste storage tank, neutralizer feed tank, neutralized waste storage tank, and spent resin storage tank at TMI-1 in the event of an accident at that Unit. Stoddard (Separation), ff. Tr. 10158, at 9. In addition,

there is a 450,000 gallon capacity available in the TMI-1 reactor building basement. Id; Fuhrer and McGoey, ff. Tr. 10020, at 6. The increase in the volume of water in the TMI-2 auxiliary building as a result of the TMI-2 accident was approximately 100,000 gallons. Stoddard (Separation), ff. Tr. 10158, at 7, 14.

9. During the TMI-2 accident, radioactive water was transferred from TMI-2 to the radwaste facility at TMI-1 which was designed to be shared by both units. Routine operating procedures called for the transfer of the contents of certain TMI-2 storage tanks to the shared radwaste facility in the TMI-1 auxiliary building. Stoddart (Separation), ff. Tr. 10158, at 9-10. Had tankage at Unit 1 not been available during the accident, the Unit 2 accident water could have been retained completely within Unit 2. Fuhrer and McGoey, ff. Tr. 10020, at 6. The licensee has implemented the separation criteria, however, and such a transfer betwen the Units cannot now occur. Stoddard (Separation), ff. Tr. 10158, at 10.

10. Unit 2 cleanup activities will not rely on Unit 1 facilities. There is assurance that the Unit 1 waste handling capability will be available for Unit 1 needs throughout the Unit 2 cleanup process. Indeed, the Unit 2 decontamination presents less severe risks to Unit 1 than if Unit 2 were an operating facility. Fuhrer and McGoey, ff. Tr. 10020, at 45-46.

11. Specifically, the Unit 2 decontamination effort does not rely on any Unit 1 equipment or systems for the processing of wastes. The waste water from the TMI-2 accident is being processed by liquid waste systems installed since the March, 1979 accident. These systems are

EPICOR I, EPICOR II, a submerged demineralizer (to be installed), and an evaporator/solidification facility (to be installed). Fuhrer and McGoey, ff. Tr. 10020, at 11-13.

12. Gaseous waste from the TMI-2 decontamination will be released from the reactor building purge, auxiliary and fuel handling building ventilation discharge, and the EPICOR II system. Fuhrer and McGoey, ff. Tr. 10020, at 17. The preaccident radwaste gas system is used for the accumulation, storage, and controlled disposal of gases evolved from primary coolant or radioactive liquid wastes in Unit 2. Id; Tr. 10142-3 (McGoey). The system consists of a vent collection header, two gas compressors, two waste gas decay tanks, a HEPA filter, and a charcoal filter. Fuhrer and McGoey, ff. Tr. 10020, at 17. The auxiliary and fuel handling building ventilation system continuously filters, monitors, and disposes of radioactive gases released to the atmosphere of these buildings; the reactor building purge system performs a similar function. Id. at 19.

13. During the cleanup operations at TMI-2, solid waste will be processed and shipped from TMI-2. Fuhrer and McGoey, ff. Tr. 10020, at 19. All of the handling of Unit 2 solid waste is done within the Unit 2 boundaries. Id. at 20. The licensee has a draft contingency plan should sufficient offsite storage space become unavailable. Tr. 10027 (Fuhrer). An interim waste storage facility is being planned which would be available for waste storage in mid-1981. Tr. 10027 (McGoey). The interim waste staging facility has approximately six months storage capacity for waste generation. Tr. 10028 (Fuhrer). The waste facility will be designed such that waste could be stored in a safe configuration

for five to ten years. Tr. 10031 (McGoey). The licensee does not intend to mix the wastes from Unit 1 and 2 in the onsite storage facility. Tr. 10032 (McGoey).

14. The liquid radwaste sytems, waste gas systems, and solid waste systems either in existence or planned at Unit 2 are adequate to serve all the needs of Unit 2 during its decontamination. Both Unit 1 and 2 have all the waste processing capability required so that neither Unit need rely on the other for waste treatment. Fuhrer and McGoey, ff. Tr. 10020, at 21.

15. The potential impact of Unit 2 on Unit 1 is not like that normally present when two nuclear units share a common site because Unit 2 is shutdown and will remain so for an extended period of time. Power operation associated radionuclides (the principal contributors to accident associated doses) at TMI-2 have essentially decayed away. Cleanup activities at TMI-2 will involve the use of EPICOR II and SDS to decontaminate waste water and the decontamination of the auxiliary and fuel handling buildings, the reactor building, and the reactor coolant system. Accidents related to the operation of EPICOR II have been analyzed and it was found that the consequences of such accidents were significantly less than those postulated on similar bases for operating units. Accident analyses of the SDS operation have also been performed; the possible consequences of these accidents show the offsite doses to be approximately 2×10^{-4} mrem. The accident analyses for Unit 2, however, show potential offsite doses of up to tens of millirems. Further, the radiological impact outside the immediate area in which decontamination of buildings and equipment is taking place will be minimal because of

controlled ventilation, special precautions to be taken which will minimize local airborne contamination, and automatic closure of the exhaust system should the effluent release monitors detect an excessive rate of release. Thus, the risks to the safe operation of TMI-1 from the decontamination activities at TMI-2 are less than the risks from a normally operating reactor. Fuhrer and McGoey, ff. Tr. 10020, at 41-43.

16. The licensee, pursuant to the Commission's August 9, 1979 Order, has isolated all interconnections between the Unit 1 and Unit 2 liquid radioactive waste processing systems. Stoddart (Separation), ff. Tr. 10158, at 18; Fuhrer and McGoey, ff. Tr. 10020, at 22. The transfer of radioactive liquids between units is prevented by means of locked valves, the installation of spool pieces, and blind flanges. Stoddart (Separation), ff. Tr. 10158, at 19. The Staff has reviewed the methods for separation of the radioactive liquid transfer lines and has found them to be acceptable (see Chapter 4 of NUREG-0680 (Staff Ex. 1). Id; Fuhrer and McGoey, ff. Tr. 10020, at 23. No party presented any evidence that would show this separation to be insufficient.

17. The licensee has also provided for the separation of the fuel handling areas and ventilation systems. Stoddart (Separation), ff. Tr. 10158, at 19; Fuhrer and McGoey, ff. Tr. 10020, at 23-25. The ventilation systems for Unit 1 and Unit 2 are independent systems; the ventilation systems have no interconnections or common interface points. Therefore, the reactor building purge systems, the auxiliary building ventilation systems, and the waste gas processing systems are completely independent. Stoddart (Separation), ff. Tr. 10158, at 19.

18. The only common point where the atmosphere is in direct comunication between Units 1 and 2 is on the shared fuel handling floor of the TMI-1 and TMI-2 fuel handling building. A portion of the fuel handling building is referred to as the fuel handling area and is used by both units. The free airspace between the 347 foot - 6 inches elevation (fuel handling area) and the 404 foot - 6 inch elevation (roof) allows direct communication of air in the fuel handing building. Stoddart (Separation), ff. Tr. 10158, at 19-20. To effect separation, the licensee is installing an engineered safety feature ventilation exhaust system to ventilate the TMI-1 portion of the fuel handling building; a TMI-2 exhaust system is already in existence. Id. at 20-21; Tr. 10056 (Fuhrer). In addition, ventilation barriers are being constructed to prevent cross-flow between the fuel handling floor area and the portions of the fuel handling building dedicated to TMI-1 or TMI-2. Stoddart (Separation), ff. Tr. 10158, at 21.

19. Activities at TMI-2 will not affect TMI-1 operations through the common fuel handling building. During TMI-2 fuel movements, the licensee will suspend work in the TMI-1 area of the fuel handling building. Further, the engineered safety feature filtration system for TMI-1 will be in operation whenever TMI-1 fuel movements are in progress. Stoddart (Separation), ff. Tr. 10158, at 22-23. None of the parties offered any evidence which could demonstrate the insufficiency of the licensee's separation or isolation of the ventilation systems and fuel handling building.

20. The licensee's effluent monitoring systems are able to discriminate between releases from TMI-1 and TMI-2 because the effluents

themselves are maintained separately up to the point of discharge in the case of liquid effluents and discharge from separate points in the case of gaseous effluents. Stoddart (Separation), ff. Tr. 10158, at 17; Fuhrer and McGoey, ff. Tr. 10020, at 25; Tr. 10129 (Fuhrer, McGoey). All identified plant radioactive effluent release pathways are either continuously monitored or sampled for radioactivity content during releases. Stoddart (Separation), ff. Tr. 10158, at 16; Fuhrer and McGoey, ff. Tr. 10020, at 25-26. Plant systems which are known to contain or could contain radioactive materials and which are potential contributors to plant effluents are also monitored or sampled prior to release of their contents. Potential radioactive liquid releases are monitored at several individual process streams prior to being mixed with effluents from the other Unit and released to the Susquehanna River at a common point. Stoddart (Separation), ff. Tr. 10158 at 16-17; Fuhrer and McGoey, ff. Tr. 10020, at 25-26. Gaseous effluents are released from individual vents or stacks servicing only the Unit of origin. Stoddart (Separation), ff. Tr. 10158, at 18; Fuhrer and McGoey, ff. Tr. 10020, at 26. No evidence was presented which challenged the adequacy of the effluent monitoring system and its ability to distinguish between releases from TMI-1 and those from TMI-2.

21. Based on the facts presented on the record, the Licensing Board finds that the licensee has complied with short-term Item 4 concerning the separation of TMI-1 and TMI-2. Specifically, the licensee has shown that decontamination of Unit 2 will not affect the safe operation of Unit 2. In addition, the licensee has provided for the separation and/or isolation of the radioactive liquid transfer lines, fuel handling areas,

ventilation systems, and sampling lines. Finally, the licensee's effluent monitoring equipment is able to distinguish between effluents from Unit 1 and those from Unit 2.

BOARD QUESTION 9

22. The Licensing Board posed the following question regarding groundwater monitoring at TMI: a. What measures are taken to monitor groundwater quality at the site? b. What measures are taken to ensure against contamination of the groundwater under routine operations, accident conditions, and clean-up operations?

c. Is there any evidence at the present time of changes in the groundwater quality, including but not limited to radioactivity and boron, attributable to operations at TMI-1 and/or 2?

d. If changes in groundwater quality have occurred, distinguish, if possible, the sources of any contamination, i.e., routine operations at Unit 1, routine operations at Unit 2, unplanned or accident conditions at Unit 1, unplanned or accident conditions at Unit 2. or clean-up operations.

e. What mitigative measures are available, should groundwater contamination occur?

(Tr. 2397-98).

23. The Staff and the licensee filed testimony on this issue. The licensee's testimony was presented by William E. Riethle and Edwin C. Fuhrer (follows Tr. 16417). The Staff's testimony was presented by Terry L. Johnson (Board Question 9 (a, c, d, e) (follows Tr. 16267) and by Phillip G. Stoddart (Board Question 9(b)) (follows Tr. 16269). No other

testimony was filed. The Commonwealth of Pennsylvania cross-examined both the Staff and the licensee witnesses.

BOARD QUESTION 9(a)

24. At the request of the NRC Staff, the licensee installed a series of eight monitoring wells and seven observation wells at the TMI site. Tr. 16420-21 (Reithle). The wells were sited so as to detect leakage of contaminated water from the Unit 2 containment and auxiliary buildings. Johnson, ff. Tr. 16267, at 3. The monitoring wells have been sampled at approximately one-week intervals since their installation in January 1980; the monitoring wells have also been sampled at approximately one-week intervals since April, 1980. Id. Sampling on all wells continues at the present time. The samples have been tested extensively for radioactivity and chemical combination. Johnson, ff. Tr. 16267, at 4.

BOARD QUESTION 9(b)

25. The basic measures taken to ensure against contamination of the groundwater from routine, accident, or cleanup operations are contained in the design and construction of the plant. The plant was designed to accommodate gross failure or leakage of the radioactive liquid systems without significant impact on the groundwater. Another method is to rely on administrative and operational measures to minimize the potential for groundwater contamination. Prudent practice requires that both approaches be used, i.e., design the plant to prevent leakage to the groundwater as the primary line of defense, and apply administrative or operational controls over the contents of tanks containing radioactive

liquids as the secondary line of defense. Stoddart (Groundwater), ff. Tr. 16269, at 2.

26. Under either normal or accident conditions, groundwater contamination through liquid pathways can potentially occur in TMI-1 from four sources: permanent structure leakage, tankage leakage, the piping tunnel from the BWST, and localized spills. The permanent structures which could contain significant radioactivity are the Containment, Auxiliary, Fuel Handling, and Control Buildings. Each of these structures is located on island bedrock, several feet below the average groundwater table. Each building is designed to minimize in-leakage and there are lower elevation sumps to collect and transfer the liquid collected to radwaste systems for processing. Riethle and Fuhrer, ff. Tr. 16417, at 3.

27. The TMI-1 BWST is the only significant source of radioactivity in tankage at TMI-1 which is outside the permanent structures. It is a stainless steel tank that is constructed on a concrete slab and the BWST level is monitored and alarmed. Riethle and Fuhrer, ff. Tr. 16417, at 3.

28. The only piping external to the permanent structures which contain significant radioactivity is that running in a tunnel from the BWST to the Unit 1 Auxiliary Building. This tunnel contains a sump to collect and transfer to processing any liquid collected from water filtration or from piping leakage. Riethle and Fuhrer, ff. Tr. 16417, at 4.

29. Localized spills are handled on a case-by-case basis. Following a spill, the area would be radiologically surveyed. Affected soil would be removed such that the remaining soil would not exceed an

average of 10% of the water maximum permissible concentration (MPC) for unrestricted areas and that no soil sample would exceed 25% of the water MPC for unrestricted areas. Riethle and Fuhrer, ff. Tr. 16417 at 4.

30. TMI-1 has three design features which are somewhat unique in that they are designed to remove groundwater that may seep into the plant. These consist of three sumps at below-grade elevations and are: (1) the Borated Water Storage Tank Tunnel Sump, located beneath the BWST; (2) the Heat Exchanger Vault Sump; and (3) the Tendon Access Gallery Sump. If any radioactive leakage should get into these sumps, as in the case of a leak from the BWST, the radioactivity would be detected by the monitor and the discharge would be automatically diverted to a liquid radwaste management system for treatment. Stoddart (Groundwater), ff. Tr. 16269, at 4.

31. An additional factor in the limitation of the potential for discharge or leakage of radioactively contaminated plant fluids to the groundwater is that the licensee has committed to reducing leakage from systems containing radioactive fluids to as-low-as-practicable levels prior to restart of TMI-1. NUREG-0680, Staff Ex. 1, describes the licensee's program for leakage reduction. Staff Ex. 1, at C8-31. The Staff has reviewed the licensee's commitment and found it to be acceptable. Stoddart (Groundwater), ff. Tr. 16269, at 5.

BOARD QUESTION 9(c)

32. Initial analyses of water samples from some monitoring wells showed concentrations of tritium above inferred background levels in the vicinity of major plant structures. Riethle and Fuhrer, ff. Tr. 16417,

at 6. Based on readings taken in nearby wells and in the Susquehanna River by EPA, it appears that the normal background level of tritium in the area is about 100 - 500 pCi/l; tritium levels in this range have been observed in MW-1, north of the plant structures. Tritium readings taken in other monitoring and observation wells have been variable. Johnson, ff. Tr. 16267, at 4. However, the tritium levels are all less than the MPC of 3,000,000 pCi/l as specified in 10 C.F.R. Part 20, Appendix B. Id. 5.

33. Concentrations of other radionuclides were also found to be below the MPC for unrestricted areas. The laboratories testing the samples reported that the radionuclide levels detected were essentially the normally occurring environmental levels. Johnson, ff. Tr. 16267, at 5; Riethle and Fuhrer, ff. Tr. 16417, at 6. In addition, there is no evidence of nonradioactive chemical concentrations exceeding allowable limits for discharge into the Susquehanna River. Id.

BOARD QUESTION 9(d)

34. The highest tritium levels occurred at wells which were located near the Unit 2 Borated Water Storage Tank (BWST). The fittings and valving appurtenant to the BWST have been known to be leaking onto the immediately surrounding ground surface. This leakage occurred several months to more than a year ago. At the request of the Staff, additional observation wells were drilled to confirm that the BWST was the source of contamination. Soil samples were taken near the BWST during the drilling of the observation wells. The concentrations of various radionuclides

were measured at various depths in the soil column, from ground level to a depth of over 25 feet. Johnson, ff. Tr. 16267, at 5-6.

35. The tests on the soil samples recovered from the well drilling operations show higher concentrations of tritium at locations above the water table and close to the BWST. Infiltration of precipitation has carried the contamination downward to the water table, through which it has been transported to other locations. Based on tne well data, soil samples, and the fact that the BWST has leaked, the Staff concludes that the analysis of the test data supports the hypothesis of the BWST leakage through the fittings as the source of contamination. Johnson, ff. Tr. 16267, at 6; Tr. 16274 (Johnson).

36. The licensee also believes that the Unit 2 BWST is a major source of radionuclides in the ground on the east side of Unit 2. Tr. 16431-16441 (Riethle). Tritium has consistently been found in the groundwater monitoring wells and well soil samples near the BWST in concentrations generally higher than in other other areas near the plant. This supports the conclusion that the history of leakage from the BWST has contributed to tritium in the groundwater of the adjacent area. In addition, the groundwater monitoring data show a correlation of tritium concentration with distance from the BWST -- i.e., the closer to the BWST the higher the tritium concentrations. The presence of cesiums and cobalts in the groundwater and the soil also is consistent with the conclusion that leakage from the BWST is the major source of radionuclides in the adjacent area. Riethle and Fuhrer, ff. Tr. 16417, at 9-10.

BOARD QUESTION 9(e)

37. There are several mitigative measures available to limit groundwater contamination. One measure is recharge, which involves pumping clean water into the underground aquifer system to dilute the concentration of contaminants. Other methods include drilling interceptor wells into the flow path of the contaminated water, or the placement of a grout curtain which will contain the contaminated water. The contaminated water can then be pumped to the surface for collection and treatment. Another procedure is to pump from the contaminated well until the contaminated water is removed, collected and treated. Johnson, ff. Tr. 16267, at 6-7; Riethle and Fuhrer, ff. Tr. 16417, at 13. At present, the contamination levels found in the wells do not indicate a need to initiate any of the above mitigative measures. Tr. 16282 (Johnson); Tr. 16430 (Riethle).

38. Based on the facts presented above, the Board finds that the Staff and the licensee have made adequate provision for the monitoring of groundwater at the TMI site.

CONCLUSIONS OF LAW

39. Based upon the facts presented on the record, the Board concludes that the licensee is in compliance with short-term Item 4 of the Commission's August 9, 1979 Order. Further, the Board finds that

adequate provision is being made for the monitoring of groundwater at TMI Units 1 and 2.

Respectfully submitted,

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Dated at Bethesda, Maryland
this 1st day of June, 1981