

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

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

SUPPLEMENT TO NRC STAFF POSITION ON NEED TO CONSIDER CLASS 9 EVENTS

Pursuant to an Appeal Board decision which noted that the Commission had requested the Staff to "bring to [its] attention, any individual cases in which [the Staff] believes the environmental consequences of Class 9 accidents should be considered,"<sup>1/</sup> this Licensing Board issued an order directing the Staff to inform the Board and the Commission

whether or not (and the reasons therefor) any specific accident sequence, which has a reasonable nexus to the TMI-2 accident and which heretofore may have been regarded as a Class 9 accident, should be considered in the analyses of the acceptability of returning TMI Unit 1 to operation.

First Special Prehearing Conference Order at 17 (December 18, 1979).

1/ Public Service Company (Black Fox Station, Units 1 and 2), ALAB-573, 10 NRC \_\_\_, \_\_\_ (December 7, 1979) (slip. op. at 31). The Appeal Board also asked the Staff to advise the Commission whether the consequences of Class 9 accidents should be considered in the Black Fox proceeding.

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In compliance with the Board's order, the Staff submitted on January 31, 1980 a response entitled "NRC Staff Position on Need to Consider Class 9 Events." In this document the Staff explained that after its review of the TMI-2 accident and close analogs to that accident it expected "...to be able to determine whether to impose additional requirements on TMI-1 so that, together with those requirements already imposed, such scenarios would not represent credible accident sequences at TMI-1 should that facility be permitted to restart." Id. at 3. The Staff thus concluded "...that no other specific accident sequences which heretofore may have been regarded as Class 9 accidents need be considered in the analysis of the acceptability of returning TMI-1 to operation." Id.<sup>2/</sup>

During the second Special Prehearing Conference held on February 13, 1980, the Board expressed its desire for additional information on accident scenarios and on "fixes" required by the Staff. In response to the Board's inquiry, the Staff offered to supplement its earlier Staff position on the need to consider Class 9 events by providing a summary of activities ongoing in the NRC that will have the effect (1) of reducing the likelihood of Class 9 events; and (2) of mitigating events such as those that occurred at TMI-2.<sup>3/</sup>

2/ The Staff also discussed its position on the environmental consequences of TMI-2 type accident scenarios.

3/ The technical information in this paper was provided by the technical staff pursuant to a request from the legal staff.

## I. ORIGIN AND GENERAL DISCUSSION OF THE NRC ACTION PLANS

Subsequent to publication of its August 9, 1979 Order and Notice of Hearing, CLI-79-8, 10 NRC 141 (1979) (Order), in which the Commission established this Atomic Safety and Licensing Board to conduct the TMI-1 suspension hearing, the Commission initiated its long-term response to the recommendations of the President's (Kemeny) Commission.<sup>4/</sup> In November 1979 the Commission compiled its preliminary views in a document entitled "NRC Views and Analysis of the Recommendations of the President's Commission on the Accident at Three Mile Island," NUREG-0632. Contained within NUREG-0632 is a letter to Dr. Frank Press<sup>5/</sup> from Commission Chairman Joseph M. Hendrie. In that letter Chairman Hendrie explained the actions that had been or would be taken by the Commission as a result of NRC's internal reviews of the TMI-2 accident including the intention of the Commission to form action plans for its TMI related activities. Letter dated November 9, 1979 to Dr. Frank Press from Joseph M. Hendrie.

To identify and consolidate all TMI-2 related activities, the Staff has prepared NUREG-0660, "NRC Action Plans Developed as a Result of the TMI-2

<sup>4/</sup> NRC's response to the recommendations of the President's Commission was requested by Dr. Frank Press, Director of the Office of Science and Technology Policy, Executive Office of the President. Dr. Press is the Chairman of the interagency panel assigned by the President to review the Kemeny Commission report. See Memorandum for all NRC employees from Lee V. Gossick, Executive Director for Operations, re: NRC Views and Analysis of the Recommendations of the President's Commission on the Accident at Three Mile Island, dated November 20, 1979.

<sup>5/</sup> See note 4, infra.

"Accident" (Action Plans).<sup>6/</sup> Relevant portions of Draft 2 of the Action Plans are attached as Attachments 1-4. This document, which is under review by the Commission, identifies TMI-2 related activities ongoing in the NRC, including task objectives, task description, current schedule, and applicability to plants under construction and operating reactors.<sup>7/</sup> It groups activities in four major categories: Operational Safety; Siting and Design; Emergency Preparedness and Radiation Effects; and NRC Organization, Management, Practices, and Procedures. The great majority of fully defined requirements that could apply to TMI-1 are included in the Order of August 9, 1979. For example, analyses required in Section I.C (operating procedures) of the Action Plans are the same as those required by the Order. However, there are some items in the Action Plans that are not included in the Order. The Staff intends that in general these items are applicable to plants in construction and to operating plants. These items are being considered by the Staff for implementation at TMI-1, but a decision on their implementation, either before or after restart, has not yet been made. Items required for operating reactors will also be proposed by the Staff for TMI-1 by restart or by the schedule as it eventually appears in the Action Plans finally approved by the Commission.

6/ In addition, on March 11, 1980, the Staff provided the Commission with its views on the future treatment of Class 9 accidents under the National Environmental Policy Act.

7/ Draft 2 does not include items in the Rogovin Report. These items will be added in Draft 3, which will be available soon. Draft 3 will also include items in IE Bulletins.

## II. DISCUSSION OF ACCIDENT SCENARIOS AND PREVENTIVE AND MITIGATIVE MEASURES

Since the TMI-2 accident, special attention has been drawn to severe core accidents, including core melting (so called "Class 9" accidents). The Staff has therefore proposed to the Commission that additional efforts be made to mitigate the consequences of such events. Task II.B describes activities ongoing within the NRC in the area of degraded or melted cores. It should be noted that Items II.B.1 (reactor coolant system vents), II.B.2 (plant shielding to provide access to vital areas and protect safety equipment for post-accident operation), and II.B.3 (post-accident sampling) are included in the Order (Item 8: Category A recommendations as specified in Table B-1 of NUREG-0578). Items II.B.6 (features to cope with core melt accidents in reactors at sites with high population densities) and II.B.7 (containment inerting) are not in the Order. Other items eventually decided to be applicable to the generic class of reactor or containments represented by TMI-1 will be applied to that plant on a schedule consistent with other operating reactors.

During the deliberations of the NRC groups and of the other organizations that have reported the results of their reviews,<sup>8/</sup> the TMI-2 scenario and related specific and generalized scenarios were considered, including numerous

<sup>8/</sup> After the accident at TMI-2, offices within and organizations outside the NRC reviewed the safety of nuclear power plants in order to reduce the probability of a TMI-2 accident or other similar accident in the future. Within the NRC, these efforts were focused in the Bulletins and Orders (B&O) Task Force, the Lessons Learned Task Force, the Special Inquiry Group (Rogovin), and the Advisory Committee on Reactor Safeguards (ACRS). Outside the NRC, the President's Commission on the Accident at Three Mile Island (Kemeny Commission), various industry groups, and several Congressional committees have worked and are still working toward that end.

variations on initiating events and subsequent failures. Specific design and procedural changes were recommended to make these initiating events and subsequent failures less likely and to improve measures to deal effectively with and to mitigate the consequences of these scenarios even if they were to occur. In addition, recommendations were made in the areas of management and technical competence, operator and other staff training, quality assurance, staffing, health physics, maintenance, and emergency preparedness. These recommendations were necessary to improve plant safety in general and to address TMI-2 related scenarios. As a result, further efforts were required of the licensees and reactor vendors to improve the analysis of transients and accidents as well as the procedures for handling such events.

With the exception of the items discussed in the Kemeny and Rogovin reports, which were published after the Order, the recommendations of these groups were considered for inclusion in the Staff recommendations to the Commission for incorporation into its Order regarding the TMI-1 license suspension. The recommendations of the Director of NRR were identified as the eight short-term and four long-term requirements in the Commission's Order.

The scenarios considered may be summarized as those clear and close analogs of the TMI-2 accident that involve combinations of initiating events including feedwater transients and small break LOCA's, and subsequent failures including loss of auxiliary feedwater, loss of all feedwater, loss of ECCS, and small break LOCA's. Some of these combinations could result in inadequate core

cooling and possible subsequent serious core damage or core melting with substantial hydrogen generation and significant release of radiation.

The following are examples of scenarios examined:

1. Loss of feedwater plus loss of auxiliary feedwater plus a stuck-open PORV plus a loss of HPI (this scenario corresponds to the TMI-2 event without operator action to restore safety systems or to close the PORV).
2. Small break plus loss of all ECCS (HPI and LPI).
3. Loss of feedwater plus loss of all auxiliary feedwater.
4. Small break plus loss of all feedwater.

These scenarios were chosen to be representative of those that result from combinations of the initiating events and failures discussed above. The first two scenarios, which involve multiple failures, would be expected to lead to substantial core damage or core melt. The third and fourth scenarios, also involving multiple failures, are not likely to result in core damage since the high pressure injection system can be used to assure core cooling.

As required by Item 8 of the Order, specifically 2.1.9 in NUREG-0578, further analyses by the licensee are continuing for small break LOCAs, inadequate

core cooling, and transients and accidents. Additional scenarios may be identified in the future through the reliability engineering and risk assessment program recommended in Task II.C.1 (reliability engineering and risk assessment) of the TMI-2 Action Plans currently under review by the Commission.

Those measures required by the Order that prevent or reduce the probability of initiating events, that prevent or reduce the probability of subsequent failures and that permit dealing effectively with and mitigate the consequences of a degraded core or core melt, are identified in the following list. Also listed are items that are not mentioned in the Order. These items are continuing to be evaluated by the Commission and the Staff in the context of the TMI-2 Action Plans.

Measures Which Prevent or Reduce the Probability  
of Initiating Events

Action	Order Item	Other Reference
1. ICS failure modes and effects analysis	1 (long-term)	
2. Retraining of operators	1	
3. Requirement for licensee review of operating experience	8	Action Plans I.C, I.E
4. Operational quality assurance program	6	
5. Verify management and technical capability	6	Action Plan I.B.1
6. Verify capability of safety review and operational advice	6	
7. Review training of operations staff	6	Action Plan I.A.2
8. Review facility procedures	6	Action Plan I.C
9. Review plant maintenance	6	
10. Requirement for shift turnover procedure	8	Action Plan I.C
11. Requirement relating to shift manning		Action Plan I.A.1
12. Requirement for upgrading operator training and qualifications		Action Plan I.A.2
13. Revisions to scope and criteria for operator licensing examinations		Action Plan I.A.3
14. Systematic assessment of licensee safety		Action Plan I.B.2
15. Requirement for an onsite safety engineering group		Action Plan I.B.3
16. Requirement for a control room design study		Action Plan I.D
17. Required changes to PORV setpoint	2	
18. Anticipatory reactor trips	2	

Measures Which Prevent or Reduce the Probability  
of Subsequent Failures

Action	Order Item	Other Reference
1. EFW timeliness and reliability	1	
2. Independence of EFW from ICS	1	
3. Reactor trip on loss of main feedwater (reduce challenges to PORV)	1	
4. Program of analysis, procedures and training related to small breaks, transients, and accidents	1	Action Plan I.C
5. Required review of the TMI-2 accident	2	
6. Required review of plant transients	2	
7. Required valve position review	2	
8. Required containment isolation review	2	
9. Required safety-related valve positioning procedures	2	
10. Required EFW train operability review	2	
11. Required safety-related system operability review	2	
12. Required personnel awareness of action taken during TMI-2 accident	2	
13. Required natural circulation procedures and training	2	
14. Required safeguards termination criteria	2	
15. Required manual termination criteria for HPI	2	
16. Required changes to PORV setpoint	2	
17. Required manual reactor trip procedures	2	
18. Required anticipatory reactor trips (to reduce challenges to PORV)	2	
19. Required prompt reporting procedures	2	
20. Required reactor coolant pump trip	2	
21. Required small break LOCA analyses	2	

Measures Which Prevent or Reduce the Probability  
of Subsequent Failures (Continued)

Action	Order Item	Other Reference
22. Required guidelines for operator action covering RCP trip	2	
22. Required emergency procedures and training for reactor coolant pump trip	2	
23. Required emergency procedures and training for inadequate core cooling	2	
24. Required automatic RCP trip design	2	
25. Required review of licensee management and technical capability	6	Action Plan I.B.1
26. Review capability safety review and operational advice	6	
27. Review training of operations staff	6	Action Plan I.A.2
28. Review operational quality assurance program	6	
29. Review facility procedures	6	Action Plan I.C
30. Requirement for a subcooling meter in PWRs	8	
31. Instrumentation for inadequate core cooling (short-term)	8	
32. Requirement for unambiguous indication of inadequate core cooling	8	Action Plan II.F
33. Requirement for a shift technical advisor	8	Action Plan I.A
34. Requirement for clear definition of shift supervisor responsibilities	8	Action Plan I.C
35. Requirement for control room access procedures	8	Action Plan I.C
36. Requirement for shift turnover procedures	8	Action Plan I.C
37. Requirement for an onsite technical support center	8	
38. Requirement for an onsite operational support center	8	

Measures Which Prevent or Reduce the Probability  
of Subsequent Failures (Continued)

Action	Order Item	Other Reference
39. Requirement for review (by licensees) of operating experience	8	Action Plans I.C, I.E
40. Testing of relief and safety valves	8	Action Plan II.D
41. Direct indication of relief and safety valve position	8	Action Plan II.D
42. Requirement relating to shift manning		Action Plan I.A.1
43. Requirement for upgrading operator training and qualifications	6	Action Plan I.A.2
44. Revisions to scope and criteria for licensing examinations		Action Plan I.A.3
45. Requirements related to simulator use and development		Action Plan I.A.4
46. Requirements relating to criteria for licensee organization and management capability	6	Action Plan I.B.1
47. Systematic assessment of licensee safety		Action Plan I.B.2
48. Requirement for an onsite safety engineering group		Action Plan I.B.3
49. Requirement for NSSS vendor review of emergency procedures		Action Plan I.C
50. Long-term program for continuing improvement to plant emergency procedures		Action Plan I.C
51. Reliability engineering and risk assessment program (IREP)		Action Plan II.C.1
52. Program to decrease the frequency of challenges to ECCS		Action Plan II.E.1
53. Research program on ECCS effectiveness (LOFT, etc.)		Action Plan II.E.2
54. Systems interaction program (OSI-A-17)		Action Plan II.C.1
55. Program to evaluate and improve auxiliary feedwater system reliability		Action Plan II.E.1

Measures Which Prevent or Reduce the Probability  
of Subsequent Failures (Continued)

Action	Order Item	Other Reference
56. Requirement for indication and automatic initiation of auxiliary feedwater	8	Action Plans II.E.1, II.E.2
57. Requirement for emergency power for pressurizer equipment	8	Action Plan II.G
58. Requirement for plant drills for emergency procedures		Action Plan I.A.2
59. Requirement for review of shift supervisor duties	8	Action Plan I.A.1
60. Correct defective welds in safety-related systems		DDR activities

Measures to Deal Effectively With and Mitigate the  
Consequences of a Degraded Core or Core Melt

Action	Order Item	Other Reference
1. Upgrade of emergency plans to satisfy Regulatory Guide 1.101	3	Action Plan III.A.1
2. Establishment of an emergency operations center	3	Action Plan III.A.1
3. Upgrade of offsite monitoring	3	Action Plan III.A.1
4. Assessment of state and local emergency plans	3	Action Plan III.A.1
5. Requirement to conduct a test exercise of the emergency plan	3	
6. Review of managerial capability and resources	6	Action Plan I.B.1
7. Review capability of safety review and operational advice	6	
8. Review training of operations staff	6	
9. Review facility procedures	6	
10. Review plant maintenance	6	
11. Program on radiation source control		Action Plan III.D
12. Siting policy rulemaking		Action Plan II.A
13. Requirement for post-accident sampling capability	8	Action Plan II.B
14. Requirement for shielding to allow post-accident access to vital areas	8	Action Plan II.B
15. Requirement for training to mitigate core damage		Action Plan II.B
16. Program to upgrade state and local government preparedness		Action Plan III.B
17. Program for improved radiological effluent monitoring		Action Plan III.D.1
18. Program to study radioiodine pathways		Action Plan III.D.2
19. Program to study liquid pathways		Action Plan III.D.3
20. Program to study offsite dose monitoring and calculations		Action Plan III.D.4

Measures to Deal Effectively With and Mitigate the  
Consequences of a Degraded Core or Core Melt (Continued)

Action	Order Item	Other Reference
21. Program to upgrade licensee emergency preparedness	3	Action Plan III.A.1
22. Program to upgrade licensee emergency support facilities	4	Action Plan III.A.2
23. Program to maintain supplies of thyroid blocking agent		Action Plan III.A.3
24. Long-term program to improve licensee emergency preparedness (amend 10 CFR Part 50 and Appendix E)	4	Action Plan III.A2.1
25. Program to improve NRC emergency preparedness		Action Plan III.A3
26. Requirement for dedicated hydrogen recombiner penetrations	8	Action Plan II.E
27. Requirement for improved containment isolation dependability	8	Action Plan II.E.4
28. Plan for criteria for gross containment integrity check		Action Plan II.E.4
29. Requirements and restrictions on containment purging		Action Plan II.E.4
30. Research on phenomena associated with core degradation and fuel melting		Action Plan II.B.5
31. Requirement to comply with CSB Technical Position 6.4		DOE activities
32. Environmental qualification program for containment isolation valves		NRR Program
33. Addition of hydrogen recombiners		voluntary addition
34. Required emergency procedures and training for inadequate core cooling	2	
35. Improvement in post-accident monitoring		II.F.B.3
36. Improve filter Tech Specs		DOE activities
37. Automatic switchover to ECCS receive mode		DOE activities
38. Improve uneven drawdown of RB spray system		DOE activities

Task II.B.8 (rulemaking proceeding) has been revised for Draft 3 of the Action Plans and is attached separately as Attachment 5 for informational purposes. The overall rulemaking, which will consider both an interim rule and a long-range revision of NRC requirements, is estimated to be completed one to two years after publication of the interim rule.

The Action Plans and the Staff recommendations for rulemaking will be placed directly before the Commission for its consideration.

Respectfully submitted,

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Counsel for NRC Staff

*James R. Tourtellotte*

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Dated at Bethesda, Maryland  
this 21st day of March, 1980

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE COMMISSION

In the Matter of

METROPOLITAN EDISON COMPANY,  
ET AL.

(Three Mile Island, Unit 1)

Docket No. 50-289

CERTIFICATE OF SERVICE

I hereby certify that copies of "SUPPLEMENT TO NRC STAFF POSITION ON NEED TO CONSIDER CLASS 9 EVENTS" and ATTACHMENTS 1-5 in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or, as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 21st day of March, 1980:

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ATTACHMENT 1

DRAFT 2  
NUREG-0660  
1/23/80



NRC ACTION PLANS DEVELOPED AS A RESULT  
OF THE TMI-2 ACCIDENT

DUPLICATE DOCUMENT

Entire document previously  
entered into system under:

ANO 8002260318

No. of pages: 290