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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE PRESIDING BOARD

In the Matter of	
INQUIRY INTO THREE MILE ISLAND UNIT 2 LEAK RATE DATA FALSIFICATION	Docket No. LRP

PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW OF THE NUMEROUS EMPLOYEES VOLUME TWO

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February 2, 1987

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IX. The Parties' Involvement in Leak Rate Testing.

Introduction

390. The Board had the opportunity to evaluate the credibility of virtually every TMI-2 CRO and SRO who was involved in TMI-2 leak rate testing, because every such person except Messrs. Blessing and Germer testified at the hearings we conducted. However, the passage of time since the events in question has blurred the memories of those people about the leak rate tests and test practices in question. Therefore, it was difficult to conclude, in most cases, who was responsible for, or aware of, plant conditions or evolutions that might have affected any given leak rate test. See ¶¶ 179-80, 272-79, supra.

391. In evaluating responsibility for leak rate test practices, we have determined not to assign responsibility for each test to every person on the shift or shifts who conceivably may have been involved in some aspect of the particular test in question, no matter how small a part he may have played in the test, or in the operator actions that occurred during the test. Thus, we reject NRR's approach, which in a number of instances seems to have been to assign blame to each person on a shift for that shift's tests. See generally Exhibits 5-A and 5-B; e.g., Tr. 1484-94, 1552, 2331-41, 2363-66. Rather, we agree with Mr. Stier's approach, which he described to us as follows:

> "Where we found misconduct on a shift we did not directly impute that conduct to

> everybody on the shift unless we had some basis to do that, that is, some evidence that there were general discussions about practices or something to indicate there was communication. So, yesterday, when I compared my conclusions with those of NRR with respect to test manipulation, I may have overgeneralized somewhat about misconduct on particular shifts. I meant that on the shift we found somebody who had engaged in test manipulation. That should not be taken to mean that we found that everybody on that shift did."

Tr. 1620-21.

392. We are troubled by the NRR approach, which is not immediately apparent from Exhibits 5-A and 5-B and was never clearly explained to us. See Tr. 1484-94. While NRR claimed that they did not invariably conclude that one operator was responsible for leak rate test falsification just because they had concluded that another operator on the same shift was responsible for that type of conduct (e.g., Tr. 1485, 1552, 2331-66), NRR in many cases did assign responsibility to all operators and the shift foreman on a shift for the procedurally-deficient tests or test practices on that shift. See Exhibit 5-B, Attachment 5, Tables 5-10. There are several problems with NRR's approach. For many operators, their leak rate test practices were merely shown to be deficient, rather than displaying a consistent pattern of falsification or culpable neglect. E.g., compare id., Table 5 (finding that 71 percent of Mr. McGovern's leak rate tests were "questionable") with Tr. 1486-87 (NRR did not find that "A" and "F" shifts, of

which (at various times) Mr. McGovern was a member, falsified leak rate tests). Also, leak rate tests are included in NRR's "box scores" (i.e., the Tables in Exhibit 5-B) even though the only "questionable" feature of the Test is the rounding-off practice suggested by the NRC inspector, Mr. Haverkamp. E.g., NRR Test Nos. 12A-D, 13. Furthermore, "questionable" Tests are assigned to operators who apparently did not perform them (e.g., NRR Test Nos. 84, 124, 150, 152) or who did perform them but may have been unaware of the alleged operator action during the Test that makes it "questionable" (e.g., NRR Test Nos. 120, 124, 128, 140.

393. We believe that Mr. Stier's approach of assigning responsibility for a given test to an operator or supervisor only if there is direct evidence of his involvement in that test is the only appropriate analysis. Accordingly, the individual findings that follow do not use NRR's "guilt by association" approach, but rather assign individual responsibility for a test only if there is clear evidence that the individual in question was so involved.

394. The Commission's use of the word "manipulate" (instead of "falsify," compare caption of this proceeding) appears to have been deliberate. 22 N.R.C. at 880-81. We interpret the word not to connote intent, but rather to call for a finding of the facts. Therefore, we use the term

"manipulate" in a non-pejorative context, and use "falsify" or "falsification" to connote a finding of intent to deceive.

A. Charles D. Adams.

395. Mr. Adams served in the United States Navy for 8-1/2 years; upon his discharge, he went to work for Carolina Power & Light Company in Southport, North Carolina. At Carolina Power he was a CRO and obtained his SRO license. He began employment with Met Ed in October 1975 as a shift foreman at TMI-2. Adams Prep. St., p. 1, ff. Tr. 3776. He was the only TMI-2 operator to have had prior experience at a nuclear facility other than TMI and the only foreman not to have been a CRO. Stier Report, Vol. VI(A), Tab A, 3/19/85 Adams Interview, p. 50; see Tr. 3656 (A. Miller).

396. During 1978-79, he was assigned to "C" shift under the supervision of Mr. Mehler. The CROs under his supervision were Mr. Congdon and Mr. Cooper. At some point during 1978, Mr. Phillippe was assigned to "C" shift as a CRO trainee. Adams Prep. St., p. 1.

397. Mr. Adams believed that TMI-2 was required to obtain a valid leak rate depicting unidentified leakage under 1 gpm every 72 hours during plant operation. Stier Report, Vol. VI(A), Tab A, 3/8/85 Adams Interview, p. 7. If his shift obtained a leak rate test result that indicated that leakage was in excess of 1 gpm unidentified leakage, they would attempt to verify if the computer calculation was correct by looking at

other plant parameters and also by performing another leak rate test. Id., p. 8.

398. Mr. Adams believed in 1978-79 that, in theory, the leak rate test was accurate, but in practice it was not, because of oscillations in the secondary part of the plant which made it difficult to operate the primary side in a stable condition. Id., pp. 14-15.

399. Mr. Adams did not direct his shift to apply the "Exceptions and Deficiencies" Procedure to unsatisfactory leak rate tests because he never considered that Procedure with respect to leak rates. Stier Report, Vol. VI(A), Tab A, 3/8/85 Adams Interview, p. 123. He also was unaware that Administrative Procedure 1012 governing logging start and stop times of surveillance tests was applicable to leak rate tests Id. pp., 123-24.

400. Mr. Adams recalls that, on his shift, if a leak rate test depicting unidentified leakage over 1 gpm was obtained, they attempted to verify the validity of the leak rate test by looking at other plant parameters, and looking for leaks that could be quantified. Stier Report, Vol. VI(A), Tab A, 3/13/85 Adams Interview, pp. 2-3. Because multiple leak rate tests could be run within two or three hours of each other with inconsistent results although the plant remained in essentially the same state, Mr. Adams believed that the more accurate test results were those that reflected less than 1 gpm

unidentified leakage and only those test results were retained and filed. Tr. 3822-23.

401. Mr. Adams testified that the practice on his shift to monitor other plant parameters was ongoing during the eight hours his shift was on duty, and thus he felt he knew what was happening with the plant and would use this knowledge in evaluating the results of leak rate tests. Stier Report, Vol. VI(A), Tab A, 3/13/85 Adams Interview, p. 13. Thus if he were given a test reflecting negative unidentified leakage, and his review of other plant parameters showed him that the plant was not leaking in excess of one gallon per minute unidentified, he would approve and file the test, believing that the negative result was due to plan oscillations. Id., pp. 15-16.

402. Mr. Adams was shown a copy of the MUT level strip chart for NRR Test No. 120 with the words "Pressurized MUT" written on it. See Exhibit 18. He was unable to identify the person who wrote those words. Tr. 3805. He stated that it was possible that he had participated in an experiment involving that Test and written those words on the MUT level strip chart, but he could not recall doing so. Tr. 3808. Mr. Adams further testified that the first time he recalled being shown the MUT level strip chart for NRR Test No. 120 was in 1985, six years after the event, and that he could not

recall anything about that Test after that length of time. Tr. 3806.

403. Mr. Adams stated that he was not aware, in 1978-79, that a hydrogen addition to the MUT could have an effect on MUT level. He testified that he does not recall any discussion about the hydrogen effect among the CROs or his supervisors. Stier Report, Vol. VI(A), Tab A, 3/19/85 Adams Interview, p. 36. When advised of Mr. Congdon's statement that he believed it likely that others on his shift, including his shift foreman, were aware that he was adding hydrogen on occasion to the MUT to affect leak rate tests, Mr. Adams testified that this was possible, but that he had no recollection of being aware. Id., pp. 43-44. However, he testified that, if he were aware, in 1978-79, that a CRO was adding hydrogen to the MUT in an effort to affect leak rate test results, he would not have approved the practice. Id., p. 45.

404. Although there were some leak rate tests that he approved for which an unstable level transmitter was used, Mr. Adams testified that it was the practice of his shift to select the more accurate MUT level transmitter for the computer during the performance of leak rate tests. Stier Report, Vol. VI(A), Tab A, 3/13/85 Adams Interview, pp. 125-126, 133. Mr. Stier's investigators agreed, stating that "this pattern of

selecting the [proper] transmitter for the computer appears to be fairly consistent on your shift." Id., pp. 125-26.

405. Mr. Adams was on duty on October 18, 1978 when the events occurred which triggered LER 78-62/1T. His only recollection of that particular day is that there was a lot of activity in the control room, and it was unusual because the shift supervisor and the Supervisor of Operations were involved in leak rate testing. Adams Prep. St., p. 5. When apprised of the United States Attorney's statement indicating that an NRC inspector interrupted a conversation among the supervisor of operations, two shift supervisors and a shift foreman, he testified that he had no recollection of such a conversation. Stier Report, Vol. VI(A), Tab A, 3/13/85 Adams Interview, p. 73.

406. There is no evidence that Mr. Adams was involved in leak rate test manipulation through any method other than hydrogen additions. Stier Report, Vol. II(A), Tab A, Adams Assessment, p. 16; see Tr. 1552, 1585 (Messrs. Congdon and Cooper did not manipulate leak rate test results through water additions).

407. Although Mr. Adams acknowledged the possibility of having participated in an experiment in which hydrogen was added to the MUT, the evidence is unclear as to whether he did in fact take part in that experiment. Tr. 2732-34, 2758 (Congdon). Even if Mr. Adams was involved in that experiment,

we find that NRR Test No. 120 was performed out of curiosity (¶¶ 260 supra), and as such does not constitute leak rate test falsification. Aside from that experiment, there is no evidence that Mr. Adams was involved in, or aware of, leak rate manipulation or falsification. There is insufficient evidence of Mr. Adams' involvement in any leak rate testing improprieties, and therefore we exonerate him of any involvement in or knowledge of such acts.

408. We are also unable to conclude that Mr. Adams was guilty of culpable neglegect with respect to leak rate testing at TMI-2. There is insufficient evidence to conclude that he was aware of leak rate test manipulation on his shift. We also note that he was never a CRO at TMI-2; therefore, he would have been unlikely personally to have performed a leak rate tests at TMI-2. As a shift foreman, he would have relied on his licensed CROs to perform leak rate tests in compliance with applicable Technical Specifications and procedures. Although Mr. Congdon has admitted that he occasionally added hydrogen in an effort to obtain a satisfactory leak rate test result, there is insufficient evidence to conclude that he ever discussed this practice with Mr. Adams, or that Mr. Adams was otherwise aware of it. Accordingly, and in the absence of evidence to the contrary, we exonerate Mr. Adams of any culpable neglect with respect to leak rate test falsification or manipulation at TMI-2.

B. Raymond R. Booher.

409. Mr. Booher became employed by Met Ed at TMI in 1971. After working first as an AO, he became a CRO at TMI-2 in 1977. During 1978-79, he was assigned to "E" shift. His shift supervisor was Mr. Smith, his shift foreman was Mr. Hoyt, and his fellow CROs were Messrs. Hartman and Blessing (a trainee). He left the employ of Met Ed in 1981. Booher Prep. St., pp. 1-2, ff. Tr. 4175.

410. Mr. Hartman has accused Mr. Booher of falsifying leak rate tests at TMI-2. See ¶¶ 31, 33, supra. Specifically, Mr. Hartman has alleged that Mr. Booher "jogged" water (i.e., added it slowly, Tr. 4242) during leak rate tests without entering those additions into the computer calculation of the leak rate. Also, Mr. Hartman has alleged that Mr. Booher added hydrogen to the MUT during leak rate tests to falsify the results.

411. Mr. Booher denied Mr. Hartman's allegation that he made unaccounted-for water additions to the MUT during leak rate tests. He stated:

> "We were required to log water additions made during the performance of a leak rate test. The operator performing the test was supposed to check the log for water additions. Although the NRC has accused me of deliberately adding water during the leak rate test to affect the results, I never did this, and I believe that I have been unfairly accused. For three of the tests where I was allegedly involved in manipulation specifically, January 13, 1979, February 2, 1979, and February 23, 1979, I logged the water entry as I was supposed to. The operators who

> performed those tests did not enter the water additions on the computer printout. I did not "jog" water, as the NRC claims, for tests dated March 10, 12, 13, and 15, 1979 (two of which I signed). I really cannot understand how the NRC experts distinguished supposed jogged additions on strip charts showing similar effects for the entire day, but I do know that I did not engage in the practices they attributed to me by their analysis of these documents."

Booher Prep St., pp. 4-5; Tr. 4186, 4221. Mr. Booher testified that he did not even know how to "jog" water into the MUT. Tr. 4202-04.

412. MPR's analysis confirms Mr. Booher's testimony that one cannot know whether water was added to the MUT during a leak rate test based only on the MUT level strip charts, because of the numerous oscillations on those charts. Stier Report, Vol. IV(A), Section VI, pp. VI.13-15; see also ¶ 311, supra. MPR's analysis undercuts NRR's technical analysis, which was based largely on the MUT level strip chart. Exhibit 5-A, Enclosure 1, pp. 6-7 (references to "MUT strip chart" as basis for conclusion that water was added during leak rate test). MUT level changes could have been due to changes in plant conditions, not water additions. Tr. 4211. As Mr. Booher explained, the leak rate Tests he referred to in his testimony and the water additions to the MUT during those Tests were performed by different operators, and therefore the water additions during those Tests could have been made inadvertently. Tr. 4179-80, 4196, 4200. The same is true of

hydrogen additions to the MUT during leak rate tests. Id.; see also ¶ 272-79, 306-10, supra.

413. The only other basis cited by NRR for its conclusion that Mr. Booher falsified leak rate tests by adding water to the MUT is Mr. Hartman's testimony. Exhibit 5-A, Enclosure 3, pp. 12-13. However, as described in ¶¶ 20-34, supra, Mr. Hartman has vacillated as to whether Mr. Booher added water to manipulate leak rate tests. In these hearings, Mr. Hartman conceded that he did not know whether Mr. Booher accounted for the additions of water made during the leak rate tests that Mr. Booher performed. Tr. 2282. Mr. Blessing also did not confirm Mr. Hartman's allegation against Mr. Booher. Exhibit 5-A, Enclosure 13, p. 3. Mr. Booher testified that Messrs. Hartman and Blessing could have performed plant evolutions during leak rate tests without him being aware of it. Tr. 4188. Therefore, we cannot rely on Mr. Hartman's allegation to conclude that Mr. Booher added water to the MUT to falsify leak rate tests.

414. With respect to Mr. Hartman's past claim that Mr. Booher added hydrogen to the MUT to manipulate leak rate tests, Mr. Booher also denied that allegation. He testified:

> "I recall that I added hydrogen to the makeup tank on my own initiative to maintain a specified pressure band. I do not think that I would have considered adding hydrogen during a leak rate test to have been prohibited by the leak rate test procedures. I no longer recall whether I thought hydrogen had an actual effect on leak rate tests. I do recall some discussion

> on this subject, although I can no longer pinpoint the time. I am certain that I never deliberately added hydrogen to affect the makeup tank level."

Booher Prep. St., p. 4. Mr. Booher went on to explain that, in one or two of the leak rate tests that he signed, another operator on the panel may have added hydrogen to the MUT during the test. Id.; Tr. 4188. However, he testified that he did not recall whether at that time he was "aware that a hydrogen addition could affect a test result", and that he "did not collaborate in manipulating this test, or any other, by adding hydrogen." Booher Prep. St., p. 4.

415. In the hearings before this Board, Mr. Hartman denied being aware of any operator who added hydrogen to affect a leak rate test result. Tr. 2240, 2285-86.

416. Mr. Stier and Faegre & Benson agreed that their technical analyses could not confirm Mr. Hartman's allegations except on the basis of speculation. Stier Report, Vol. I, p. 63; Faegre & Benson Report, Vol. One, p. 46. Accordingly, and based on the essential parts of the testimony of Messrs. Booher, Blessing, and Hartman that we have summarized, we cannot find that there is clear and convincing evidence that Mr. Booher falsified leak rate tests by adding water or hydrogen to the MUT.

417. Mr. Hartman's motive for accusing Mr. Booher seems to have been based on a personal dislike for Mr. Booher. Mr. Hartman testified that Mr. Booher was not a good operator

(Exhibit 5-A, Enclosure 3, p. 11; see Booher Prep. St., p. 5); however, Mr. Hoyt testified that Mr. Booher was his "right-hand man" when Mr. Hoyt was not in the TMI-2 Control Room, and that Mr. Booher was the CRO that "really carried the shift" (Tr. 4287), suggesting jealousy toward Mr. Booher by Mr. Hartman. Mr. Blessing, the third CRO on "E" shift in 1979, testified that neither he nor Mr. Hartman were friendly with Mr. Booher. Exhibit 5-A, Enclosure 13 (1/4/85 Memorandum, p. 3); Tr. 4184. Mr. Blessing further testified that, because he did not like Mr. Booher, he performed most evolutions under Mr. Hartman's direction (Exhibit 5-A, Enclosure 13, (1/4/85 Memorandum, p. 3)), leading the Board to conclude that the person responsible for the improper behavior on "E" shift was Mr. Hartman (who admitted it), rather than Mr. Booher (who denied it). Mr. Booher thought that he and Messrs. Hartman and Blessing were not close, socially or professionally (Tr. 4184), leading the Board to find that Mr. Booher may not have communicated well with his fellow CROs, in light of their admitted dislike for him.

418. Mr. Booher did recall that, for a time, he submitted leak rate tests with negative unidentified leakage to his foreman, but that, after a time, he was told that negative results were no longer acceptable. He could not recall who gave him that directive, or why. Booher Prep. St., pp. 2-3.

419. Mr. Booher attributed problems in getting good leak rate tests to variations in instrument accuracy and then to increasing leakage from a pressurizer valve or valves. He did recall that he thought that those problems might prevent him from obtaining a satisfactory leak rate test result, but he recalled no concern for his job security if he could not obtain a satisfactory result. Id., p. 3.

420. Mr. Booher logged only the completion times of surveillance tests performed on his shift. He explained that he never logged the start time of any surveillance test, and did not recall anyone ever telling him to do so. Id.; see also Tr. 1470 (Capra). He admitted that, in retrospect, logkeeping practices in 1978-79 at TMI-2 were "somewhat sloppy". Tr. 4231.

421. Mr. Booher's only recollection of LER 78-62/1T was from subsequent investigations. Mr. Booher did not believe that TMI-2 had to enter the Action Statement of Technical Specification 3.4.6.2 unless a satisfactory leak rate test could not be obtained during each 72-hour period of plant operation. He recalled that his interpretation of the leak rate Technical Specifications did not change during 1978-79, so that he could only conclude that the LER had no effect on him. Id., pp. 3-4; Tr. 4227.

422. Mr. Booher's recollection was that he had received no training on the safety implications of the leak

rate test. Tr. 4228-29. He explained that, today, "training is much better than it was then." Tr. 4230.

423. Because of the uncertainty whether Mr. Booher was aware of the apparent practices of Mr. Hartman with respect to leak rate tests (Tr. 4217), Mr. Booher's sworn denial that he was involved in leak rate test manipulation, and the testimony of Messrs. Blessing and Hartman that personality problems on "E" shift may have contributed to poor shift communications, we cannot find that Mr. Booher was involved in leak rate test falsification or manipulation. The two leak rate Tests (NRR Test Nos. 94 and 128) performed by Mr. Hartman that did not include entries for water additions to the MUT are no cause for criticism of Mr. Booher, because Mr. Booher logged those additions. See ¶¶ 239-41, supra. It does not seem plausible that, if Mr. Booher intended to hide the fact of a water addition to the MUT during a leak rate test, that he would have logged those additions. Mr. Booher was a credible witness who readily conceded to procedural shortcomings with respect to his involvement in leak rate testing at TMI-2. Accordingly, we exonerate Mr. Booher of involvement in or awareness of leak rate test falsification or manipulation. We also find insufficient evidence that Mr. Booher was guilty of culpable neglect concerning Mr. Hartman's leak rate test practices because of the poor communications on "E" shift that

apparently were the result of Mr. Hartman's personality problems.

C. John A. Brummer.

424. During 1978-79, Mr. Brummer was employed by Met Ed as a lead instrumentation engineer, assigned primarily to TMI-2. Brummer Prep. St., p. 1, ff. Tr. 5236. Mr. Brummer was a primary member of the TMI-2 PORC from 1974 until July 1978, and thereafter was an alternate member of the PORC. Stier Report Vol. VI(B), Tab B, 10/17/83 Brummer Interview, p. 8. However, Mr. Brummer was not aware of LER 78-62/1T prior to the TMI-2 accident. Id., pp. 37-38.

425. Although Mr. Brummer may have reviewed TMI-2 Technical Specifications and Met Ed Administrative Procedures in connection with his service on the PORC, he has no recollection of any specific involvement with Technical Specifications or Administrative Procedures involving leak rate testing. He never performed a leak rate test at TMI-2. Brummer Prep. St., p. 2; see Exhibit 5-B, Attachment 5, Table 11. Nor was Mr. Brummer aware, during 1978-79, of any of the problems encountered by many TMI-2 operators in achieving satisfactory leak rate test results. Stier Report Vol. VI(B), Tab B, 10/17/83 Brummer Interview, pp. 12-13, 20. In fact, Mr. Brummer cannot recall observing the performance of any leak rate test during 1978-79. Id., p. 21. During 1978-79,

Mr. Brummer was not aware of any TMI-2 operator falsifying any leak rate test through any method. Id., pp. 29-34, 45-46.

426. The Board deemed it unnecessary to call Mr. Brummer as a witness, because the evidence in the record made plain that he had no involvement in leak rate testing at TMI-2. See Tr. 4169. Instead, we ordered that Mr. Brummer's prefiled testimony be bound into the record as the testimony he would have given had he been called as a witness. Tr. 5236.

427. In light of the foregoing, the Board exonerates Mr. Brummer of any involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2. There is also no evidence that he was guilty of culpable neglect as to any TMI-2 leak rate test practices.

D. Joseph J. Chwastyk.

428. Mr. Chwastyk began employment with Met Ed in 1968. In 1969 he became a CRO at TMI-1. In approximately 1973, he became a shift foreman at TMI-1, and shortly thereafter a Unit 1 shift supervisor. In 1977, he became a dual-licensed shift supervisor for both TMI-1 and TMI-2. Chwastyk Prep. St., p. 1, ff. Tr. 3407. Mr. Chwastyk currently is employed as a nuclear consultant, Tr. 3406, and he no longer holds a license to operate a nuclear plant. Exhibit 5-B, Attachment 5, Table 1. During 1978-79, Mr. Chwastyk supervised "B" shift in both Units. Chwastyk Prep. St., p. 2. The shift

foreman assigned to "B" shift at TMI-2 was Mr. Conaway and the CROs were Messrs. Illjes, Kidwell and Mell (a trainee). Id.

429. As a shift supervisor, it was Mr. Chwastyk's duty to ensure that his shift complied with the Technical Specifications. As relevant to this proceeding, this duty was satisfied by maintaining unidentified leakage below 1 gpm. Id. As one means of demonstrating compliance with 1 gpm LCO for unidentified leakage, Mr. Chwastyk recalled that his shift generally performed a leak rate test each day they were on shift. Id., p. 3. If his shift obtained a leak rate test result over 1 gpm, they would run another leak rate test; if the next one was under 1 gpm, they would discard the first one. Id., p. 3. At the time, Mr. Chwastyk approved the discarding of leak rate tests because he thought that once a test had been declared invalid, there was no reason to keep it. Tr. 3490. Mr. Chwastyk believed that if the test result was not discarded, and it was later reviewed, it could not be determined at that later time if the test was in fact a valid test or not. Tr. 3490. Mr. Chwastyk now recognizes that recordkeeping practices at TMI-2 were deficient. Tr. 3535-36.

430. There is no evidence that Mr. Chwastyk was aware, in 1978-79, that unidentified leakage exceeded the 1 gpm LCO. Tr. 3528-30. Although Mr. Chwastyk was aware of problems in obtaining leak rate tests meeting the 1 gpm LCO, Tr. 3497, 3520, he attributed those problems to start-up and initial

operation, and to plant oscillations that affected leak rate test accuracy. Tr. 3520. Mr. Chwastyk believed that the problems with the leak rate test computer program that he had observed were being addressed. Tr. 3497.

431. In Mr. Chwastyk's opinion, his shift was structured such that the operator performing the required readings of control room instruments typically would also perform the leak rate test. Tr. 3517. He thought that there were communications between that operator and the operator "on the panel" concerning any additions of water or other evolutions that would affect the leak rate test. Id. Mr. Chwastyk believed that if there were water additions to the MUT during leak rate tests that were not logged, such omissions were unintentional. Tr. 3517-18. In Mr. Chwastyk's opinion, the members of his shift conscientiously performed their assignments. Tr. 3518.

432. Mr. Chwastyk recalled that there were periodic problems with the MUT level transmitters. Tr. 3520. Mr. Chwastyk preferred to have the more accurate of the two transmitters depicted on the MUT level strip chart, because of the importance of that indication. Tr. 3523. Although leak rate tests should not have been performed with an inaccurate or malfunctioning MUT level transmitter, it is difficult to be critical of Mr. Chwastyk for desiring the display of accurate MUT level information, because the technical witnesses agreed

with his assessment of the importance of that information. See ¶¶ 271, 288, supra.

433. Mr. Chwastyk performed an experiment to confirm the hypothesis, the source of which he can no longer recall, that hydrogen additions to the MUT during the leak rate test affected the test. Tr. 3411, 3419-20, 3424-25, 3442. There is little evidence that Mr. Chwastyk utilized other personnel in performing his experiment with hydrogen other than his speculation that he directed an operator to supervise the addition of hydrogen to the MUT. Tr. 3448-49. Similarly, there is little evidence that Mr. Chwastyk told other personnel what he was doing during the experiment. Tr. 3444, 3451-52. Mr. Chwastyk does not remember his shift being aware of his experiment, but he does remember later ordering that hydrogen not be added to the MUT during leak rate tests, and recalls that Messrs. Illjes and Conaway were in the room when he gave that directive. Tr. 3451, 3456. His turnover note documents that he communicated the results of his hydrogen experiment to the next shift supervisor. Tr. 3425-26, 3478. It is not consistent with an intention to deceive that Mr. Chwastyk would have memoralized his experiment in writing; therefore, we find that Mr. Chwastyk did not manipulate or falsify leak rate tests during his experiment.

434. There were no leak rate tests performed by his shift during which hydrogen was added to the MUT after this

date. Exhibit 5-B, Attachment 5, Table 11, pp. 17-21. Mr. Chwastyk acknowledged that Messrs. Illjes and Conaway might not have recalled his directive to refrain from adding hydrogen to the MUT during leak rate tests, because he did not involve them in the experiment (Tr. 3451-52), and when he gave them the direction to refrain from adding hydrogen during leak rate tests, it was extremely brief and was not followed-up with additional instructions or discussion. Tr. 3537, 3551.

435. Mr. Chwastyk recalled receiving some instruction on the meaning of LER 78-62/1T. Tr. 3502. He was told by the TMI-2 Supervisor of Operations, Mr. Floyd, that he was to enter the "Action Statement" of the Technical Specifications if his shift obtained a valid leak rate test result with unidentified leakage greater than 1 gpm. Tr. 3502, 3504. The LER did not change Mr. Chwastyk's interpretation of the Action Statement requirement. Tr. 3509. Therefore, Mr. Chwastyk did not instruct the operators on his shift on the meaning of the LER, because he assumed they already knew how to interpret the Technical Specifications. Id.

436. In Mr. Chwastyk's opinion, the March 16, 1979 TCN to the TMI-2 leak rate Surveillance Procedure solved the problem he had perceived with respect to leak rate tests. Tr. 3585, 3587. Mr. Chwastyk did not learn that the TCN was an incomplete correction to the Procedure until after the TMI-2 accident. Tr. 3587.

437. Other than his experiment on February 19, 1979, there is no evidence to associate Mr. Chwastyk with leak rate test falsification at TMI-2. We find that his experiment was not intended to be an effort at manipulation or falsification, because it was an experiment (Tr. 3411), there were no subsequent hydrogen additions to the MUT during leak rate tests on his shift (Exhibit 5-B, Attachment 5, Table 11, pp. 17-21), Mr. Chwastyk directed his shift not to add hydrogen to the MUT during leak rate tests, and his experiment was memorialized in his turnover notes. Tr. 3425-26.

438. We found Mr. Chwastyk to be a candid witness who freely acknowledged his lack of confidence in the leak rate test procedure. He admitted that, in retrospect, some of the TMI-2 leak rate testing practices were deficient. Because of his candor, and our finding that his experiment did not constitute falsification or manipulation, we exonerate him of involvement in, awareness of, or culpable neglect in connection with, leak rate test falsification or manipulation at TMI-2.

E. Mark S. Coleman.

439. Mr. Coleman began his employment with Met Ed as an AO at TMI-1 in January 1974. In 1976, he became a CRO at TMI-2, and subsequently received his RO license. Coleman Prep. St., p. 1, ff. Tr. 2579. Mr. Coleman was a CRO in TMI-2 until the date of the accident. Stier Report, Vol. VI(B), Tab C, 2/5/85 Coleman Interview, pp. 3-4. During part of 1978 and

through the 1979 accident, Mr. Coleman was assigned to "D" shift, under the supervision of Messrs. Hitz and Adam Miller. The other CROs assigned to the shift were Messrs. Olson and Wright. Coleman Prep. St., p. 1. In 1978, prior to Messrs. Hitz and Adam Miller serving as Mr. Coleman's shift supervisor and shift foreman, Michael Ross and Richard Hutchinson held these positions. Tr. 2578-79.

440. Mr. Coleman's training on the performance of leak rate tests was not extensive. It consisted of a fellow CRO or a foreman showing him how to perform a leak rate test on the job. Tr. 2582-83. Although the Technical Specifications required that a leak rate test be performed at least once every 72 hours, Mr. Coleman was instructed to perform one every shift. Coleman Prep. St., p. 2. Mr. Coleman believed that the operators were not required to enter the Action Statement unless 72 hours had elapsed from the time of the last satisfactory test result, an interpretation that he learned from other TMI-2 personnel. Tr. 2588; Stier Report, Vol. VI(B), Tab C, 2/5/85 Coleman Interview, pp. 20-21.

441. Shortly after Mr. Coleman began performing leak rate tests at TMI-2, he signed and turned in a test result showing unidentified leakage of over 1 gpm. He was then told by a supervisor (whose identity he could not recall and whom we could not identify) that they did not want to see tests that exceeded the 1 gpm LCO for unidentified leakage. That incident

prompted Mr. Coleman to discard leak rate test results exceeding the 1 gpm LCO. Coleman Prep. St., pp. 2-3; Tr. 2583-84. Mr. Coleman felt that he was under a lot of pressure to obtain a leak rate test result meeting the 1 gpm LCO when the 72-hour period since the last satisfactory leak rate test was about to expire. Tr. 2589.

442. Mr. Coleman's view of the leak rate test as a routine administrative requirement, together with the pressure he felt to obtain one leak rate test result meeting the 1 gpm LCO within a 72-hour period, influenced him to accept leak rate test results of less then 1 gpm unidentified leakage without corroborating their validity. Tr. 2589, 2592, 2631. Mr. Coleman did not believe the leak rate test results generated by the computer, and he disregarded them because other plant indications often did not appear to confirm them. Tr. 2593-94.

443. Mr. Coleman did not calculate leak rates by hand, in lieu of performing the calculation using the computer, because he did not believe that the manual calculation would produce a more accurate result. Tr. 2594. His testimony is consistent with that of the computer engineer, Mr. Fels, who confirmed that hand-calculated leak rates were significantly less accurate than computer-calculated leak rate tests. Tr. 4531-34. Mr. Coleman also did not apply Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to

leak rate tests, because he believed it was the shift foreman's responsibility to determine when that procedure was applicable. He was never instructed to attach such sheets to leak rate tests, but believed he was supposed simply to discard unsatisfactory test results. Tr. 2636.

444. Other than what he has learned through the post-accident investigation, Mr. Coleman has no recollection of 78-62/1T. Stier Report, Vol. VI(C), Tab C, 2/5/85 Coleman Interview, pp. 65-66. Prior to the accident, Mr. Coleman was never apprised of the directive of LER 78-62/1T to immediately invoke the Action Statement when leak rate test results depicted unidentified leakage over 1 gpm. Id., p. 65. Although Mr. Coleman knew that plant indications other than the leak rate test were not capable of precisely quantifying plant leakage, he never believed the plant was leaking in excess of the 1 gpm LCO for unidentified leakage. Tr. 2632-33. During 1978-79, Mr. Coleman was aware that efforts were being made to correct the inaccuracies which existed in the leak rate test procedure. Coleman Prep. St., p. 3; Tr. 2637.

445. During a shift turnover, Mr. Hartman informed Mr. Coleman that a hydrogen addition to the MUT just prior to the end of a leak rate test sometimes helped in obtaining a leak rate test result under 1 gpm for unidentified leakage. Tr. 2624; Coleman Prep. St., p. 4. At some other time, Mr. Coleman heard that water additions to the MUT, accounted

for in the leak rate test calculation, would have the same effect as hydrogen additions on the leak rate test results. Coleman Prep. St., p. 4. Mr. Coleman made hydrogen and water additions to the MUT several times during leak rate tests in an effort to obtain a result under 1 gpm. Id., p. 3; Tr. 2597-98.

446. During all of the TMI-2 post-accident investigations, Mr. Coleman has been forthright concerning his practices of adding hydrogen or water to the MUT in an effort to obtain test results under 1 gpm for unidentified leakage. Coleman Prep. St., p. 3; Tr. 2596; Stier Report, Vol. VI(B), Tab C, 2/5/85 Coleman Interview, p. 51. Mr. Coleman made a consistent practice of accurately including in the leak rate calculation the amount of any water addition to the MUT during a leak rate test. Coleman Prep. St., p. 3. Mr. Coleman was candid with the Board in acknowledging that he now believes that his behavior was wrong. Tr. 2629-30. In his present position as a training instructor at TMI-2, he refers to his leak rate experience in order to impress the trainees with the importance of strictly adhering to the requirement of the Technical Specifications and procedures in operating a nuclear power plant. Coleman Prep. St., p. 6, ff. Tr. 2579. In view of Mr. Coleman's admissions, we find that he manipulated leak rate tests during 1978-79 at TMI-2.

447. Although Mr. Coleman has admitted that he added hydrogen to the MUT several times in order to affect the

results of leak rate tests, NRR analysis of the Tests performed by "D" shift from September 30, 1978 through the date of the TMI-2 accident reflects no hydrogen additions to the MUT by that shift during those Tests. Exhibit 5-B, Attachment 5, Table 11. Further, the water additions to the MUT during leak rate Tests performed by Mr. Coleman were not prohibited by Surveillance Procedure 2301-3D1, ¶ 152, supra and in fact typically made leak rate test results more accurate. ¶ 251, supra. Therefore, despite his belief that he had done so, we cannot find that Mr. Coleman falsified leak rate tests at TMI-2.

F. William T. Conaway, II.

448. In 1973, Mr. Conaway began employment with Met Ed. He was an AO at TMI-1 until he was promoted to CRO at TMI-2 in 1975. In 1978, he was promoted to shift foreman at TMI-2. He is currently is Radioactive Waste Support Manager at TMI-2, and he no longer holds an NRC license. Conaway Prep. St., p. 1, ff. Tr. 3097.

449. Mr. Conaway was the foreman assigned to "B" shift. Messrs. Kidwell, Illjes, and Mell (who was a trainee) reported to him as CROs. Conaway Prep. St., p. 1.

450. Mr. Conaway knew that he was required to ensure that all surveillance testing, including leak rate testing, was conducted in compliance with TMI-2 Technical Specifications. Id., p. 2. His supervision of leak rate testing consisted

primarily of reviewing the results of leak rate tests. Tr. 3107. Mr. Conaway did not actively investigate the results to see if they were valid. Tr. 3110. The CROs reporting to him had the authority to discard invalid leak rate tests on their own and initiate another test. Tr. 3109-10. Mr. Conaway could not recall reviewing any leak rate tests with his supervisor, Mr. Chwastyk. Tr. 3110-11.

451. Mr. Conaway recalled that his shift discarded leak rate tests with results over 1 gpm unidentified leakage, Tr. 3110, because they had little faith in the validity of those tests. Tr. 3104. The frequent occurrence of apparently erroneous results convinced Mr. Conaway that leak rate test results were not indicative of plant conditions as he perceived them. Id. He now realizes that his review of plant parameters could not produce the precision required by the Technical Specifications. Tr. 3118-19.

452. Mr. Conaway could not recall receiving any training on the technical purposes of the leak rate test. Tr. 3104-05. Nor were the safety implications of the leak rate test ever fully explained to him. Tr. 3105.

453. Mr. Conaway recalled that, in an early phase of TMI-2 operation, an effort was made to ensure that operators searched for and measured leakage. Tr. 3109-10. He concluded that the recurring phenomenon of leak rate test results that did not comport with other indicators of leakage influenced

TMI-2 operators to regard leak rate test results exceeding the 1 gpm LCO as erroneous. Tr. 3110.

454. Mr. Conaway faults himself for failing to fully analyze or pursue the problems his shift encountered in performing leak rate tests. Tr. 3120-21, 3122-23. He presumed that his duty to report difficulties with leak rate testing was satisfied because his shift supervisor was aware of the problems with the tests. Tr. 3123. Mr. Conaway quite credibly stressed that, today, he would not operate that way. Tr. 3121, 3123.

455. Mr. Conaway had no recollection of why Administrative Procedures 1010 and 1012 were not applied to leak rate testing. Stier Report, Vol. VI(B), Tab C, 2/21/85 Conaway Interview, pp. 38-40. He now understands how, and why, those Administrative Procedures should have applied. Id.; Tr. 3108.

456. Between September 30, 1978 and March 28, 1979, Mr. Conaway approved eleven leak rate Tests with negative values for unidentified leakage. Stier Report, Vol. III(A), Table 2 (Conaway). Included among the Tests is one reflecting -8.5 gpm of unidentified leakage. Exhibit 5-B, Attachment 5, Table 11, p. 1, NRR Test No. 9; Stier Report, Vol. III(A), Table 2 (Conaway), Test No. 153. Mr. Conaway now realizes that he should have been more attentive to leak rate testing and he should have been more vigilant in questioning negative results.

Tr. 3120-21. If Mr. Conaway had given a higher priority to leak rate surveillances, he would not have approved so illogical a result as -8.5 gpm. Id. However, the other negative tests Mr. Conaway approved were within the range of -0.1 gpm to -1.0 gpm. Stier Report, Vol. III(A), Table 2 (Conaway). We have already concluded that control room personnel would have expected to see a reasonable range of negative values for unidentified leakage; therefore, Mr. Conaway was justified in accepting the remainder of these Tests. See ¶¶ 221-22, supra.

457. Mr. Conaway has maintained, consistently, that he was unaware of Mr. Chwastyk's experiment with hydrogen. Stier Report, Vol. VI(B), Tab C, 2/25/85 Conaway Interview, p. 22; Exhibit 6, OI Report, Exhibit 32, 11/8/85 Report of Conaway Interview, p. 1; Tr. 3111. Although Mr. Conaway did receive the results of two leak rate Tests on February 19, 1979 (Stier Test Nos. 34 and 33), and initiated the deletion in the Shift Foreman's log the first of the two results (Stier Report, Vol. VI(B), Tab C, 2/25/85 Conaway Interview, pp. 22-23), there is no direct evidence, based upon Mr. Chwastyk's testimony, that Mr. Conaway was aware that hydrogen had been added to the MUT during these Tests or that he had been involved in their performance. Mr. Chwastyk had no recollection of any role Mr. Conaway could have played in his experiment, other than his belief that Mr. Conaway had been in the control room when

Mr. Chwastyk issued his instruction to avoid the use of hydrogen during future leak rate tests. Tr. 3444, 3451-52. Mr. Chwastyk also stated that when he issued the directive to avoid hydrogen additions to the MUT, it was very brief and without follow-up instructions. Tr. 3537, 3551.

458. The testimony of Mr. Conaway's other shift members supports his belief that he did not participate in that experiment and that he had no recollection of Mr. Chwastyk's admonition against the use of hydrogen. Tr. 3072-73, 3079 (Illjes); Tr. 3393 (Kidwell). Mr. Mell also had no recollection of such an experiment or a directive to refrain from adding hydrogen, Tr. 3244, 3282, but it is probable that he was absent from the control room between February 12, 1979 and March 26, 1979 preparing for his NRC licensing examination. Tr. 3267; Stier Report, Vol. III(A), Table 1.

459. Mr. Conaway acknowledged that he must have seen LER 78-62/1T prior to March 28, 1979, because his initials are on the cover sheet attached to the version of that LER distributed to the operators and supervisors. Tr. 3115. It would have been his responsibility to ensure that his operators read that LER. Id. He had no recollection of the document, however, and no recollection of receiving instructions from the shift supervisor or from anyone else regarding the meaning of that LER. Tr. 3115-16.

460. In sum, we find no evidence that Mr. Conaway was aware of, or participated in, leak rate test falsification or manipulation at TMI-2. Tr. 3105. Mr. Stier agreed with this assessment. Stier Report, Vol. II(A), Conaway Assessment, p. 1. While NRR did not evaluate Mr. Conaway because he does not hold a license, Exhibit 5-B, Attachment 5, Table 1, Mr. Russell exonerated Mr. Conaway's CROs from participation in test manipulation. Tr. 1486-87. We also find no evidence that he was guilty of culpable neglect with regard to leak rate testing practices at TMI-2. We are confident that Mr. Conaway has learned the necessity for strict compliance with operating procedures and regulatory requirements. Conaway Prep. St., p. 7.

G. Joseph R. Congdon.

461. Mr. Congdon became employed by Met Ed in 1974 as an AO in Unit 1 after seven years of service in the United States Navy. He obtained his RO license in 1977 and was a CRO in TMI-2 throughout 1978-79. Congdon Prep. St., p. 1, ff. Tr. 2709. Mr. Congdon is a shift foreman at TMI-2, and he maintains an NRC license in that position. Exhibit 5-B, Attachment 5, Table 1.

462. During 1978-79, Mr. Congdon was assigned to "C" shift. His shift supervisor was Mr. Mehler; his shift foreman was Mr. Adams; his fellow CROs were Messrs. Cooper and Phillippe (a trainee). Congdon Prep. St., p. 1.

463. Mr. Congdon's training consisted of approximately five weeks on shift at TMI-1 as an observer, and some classroom instruction. None of his training focused on the leak rate test. Tr. 2713-14.

464. Mr. Congdon agreed that, in practice, the leak rate test was the only tool the operators had to quantify unidentified leakage; however, he did not believe it was reliable. Tr. 2714; Stier Report, Vol. VI(B), Tab C, 2/13/85 Congdon Interview, p. 14. Mr. Congdon therefore adopted the practice of many TMI-2 operators (see ¶ 328, supra) of monitoring RCS leakage by observing other plant parameters, such as atmospheric monitors, containment sump levels, and the makeup rate. Tr. 2715, 2780.

465. Generally, Mr. Congdon did not discard leak rate test results with unidentified leakage in excess of 1 gpm until he or a shiftmate had determined that the result was invalid based on an appraisal of other plant parameters. See Tr. 2715, 2780. At times they would obtain a subsequent satisfactory leak rate test result, leading them to invalidate the earlier unsatisfactory test. Congdon Prep. St., p. 3; Tr. 2715.

466. Prior to the TMI-2 accident, Mr. Congdon believed that he was required to enter the Action Statement of Technical Specification 3.4.6.2 only if a leak rate test result depicting unidentified leakage under 1 gpm was not obtained within a 72-hour period of plant operation. Congdon Prep. St.,

p. 2; Tr. 2718. That interpretation of the Technical Specifications did not change in response to LER 78-62/1T. Id. Indeed, Mr. Congdon does not recall ever being told that the LER was intended to change TMI-2 leak rate surveillance practices. Congdon Prep. St., p. 2; Tr. 2719-20.

467. At some point during 1978-79, Mr. Congdon became aware that hydrogen additions to the MUT sometimes affected the MUT level indicator. Tr. 2725; Stier Report, Vol. VI(B), Tab C, 2/13/85 Congdon Interview, p. 52. His recollection was that he heard about this phenomenon from operators on another shift. Id., p. 53.

468. To evaluate what he had heard, Mr. Congdon participated in an experiment in which the MUT level strip chart was deliberately marked at the time of an addition of hydrogen to the MUT. Congdon Prep. St., p. 4; Tr. 2729. Mr. Congdon believed that he performed his experiment during NRR Test No. 120 (id.), although he was unable to identify who wrote the words "pressurized MUT" (see Exhibit 18) on the MUT level strip chart for that Test; he did not do so. Tr. 2748-49. In other respects, however, Mr. Congdon's memory of that experiment is poor. For example, despite his recollection that he performed that experiment in Mr. Adams' presence, Mr. Congdon cannot recall ever discussing the experiment with Mr. Adams. Tr. 2734, 2758. Nor can Mr. Congdon recall whether Mr. Cooper participated in, or was aware of, that experiment.

Tr. 2734-35. Finally, Mr. Congdon cannot recall whether as a result of the experiment during NRR Test No. 120, Mr. Adams permitted subsequent hydrogen additions to the MUT during leak rate tests. Tr. 2759.

469. The Board finds that Mr. Congdon's recollection of the experiment during NRR Test No. 120 is too uncertain to conclude that either Mr. Adams or Mr. Cooper participated in that experiment. Mr. Congdon's testimony, together with the fact that he logged the hydrogen addition during that Test (Tr. 2726-27) leads us to find that Mr. Congdon was involved in that experiment. However, Mr. Congdon's logging of the hydrogen addition made during that experiment (id.) and his testimony that he was never informed of any prohibition against adding hydrogen to the MUT during a leak rate test (Tr. 2737) convince us that Mr. Congdon was not seeking to falsify NRR Test No. 120. The Board does not believe that Mr. Congdon would have logged the addition of hydrogen during NRR Test No. 120 if he had intended to deceive.

470. Of course, our previous characterization of NRR Test No. 120 as an "experiment" implicitly expresses our conclusion that Mr. Congdon did not intend to falsify that Test. Several factors convince us that NRR Test No. 120 was an experiment performed out of curiosity. See ¶ 260, supra.

471. Mr. Congdon candidly admitted that he added hydrogen to the MUT during leak rate tests on occasions other

than during NRR Test No. 120. Tr. 2757. However, Mr. Congdon was never informed during the course of his on-the-job training of any prohibition against adding hydrogen to the MUT during a leak rate test. Congdon Prep. St., p. 4; Tr. 2737. Moreover, as we found in ¶ 154, supra, the operators correctly assumed that hydrogen additions during leak rate tests were not a violation of the test procedure. Furthermore, TMI-2 Unit Superintendent Logan placed great emphasis on maintaining proper hydrogen overpressure within the MUT. E.g., Cooper Prep. St., p. 7, ff. Tr. 2835. For these reasons, we cannot fault Mr. Congdon or any other operator merely because they added hydrogen to the MUT during leak rate tests.

472. Mr. Congdon testified that he logged each hydrogen addition he made to the MUT during a test. Congdon Prep. St., p. 4. NRR agreed that Mr. Congdon's shift logged hydrogen additions to the MUT more frequently than any other shift. Tr. 1816. It is therefore not plausible that Mr. Congdon had any improper motive in making hydrogen additions to the MUT during leak rate tests. Tr. 1772 (Kelley, J.).

473. Our analysis of leak rate test records supports our finding that Mr. Congdon never surreptitiously added hydrogen to the MUT. NRR has alleged that hydrogen additions were made to the MUT during its Test Nos. 36, 39, 120, 126, 130, and 134. Exhibit 5-B, Attachment 5, Table 11, pp. 4, 5,

16-18. There are logged hydrogen additions during NRR Test Nos. 36, 120 and 134; there is considerable doubt as to whether a hydrogen addition occurred during NRR Test No. 39. Id. As to NRR Test No. 130, MPR concluded that a hydrogen addition to the MUT did not occur during that Test. Exhibit 5-B, Attachment 3, p. 2. Nor can we find any manipulation of NRR Test No. 126 (Stier Test No. 32), because MPR could not conclusively establish that a hydrogen addition to the MUT occurred during that Test. See Stier Report, Vol. IV(D), Test No. 32, MPR Summary Sheet (trace flattening typical of other times on same MUT level strip chart).

474. In sum, the Board finds that Mr. Congdon consistently logged hydrogen additions to the MUT, and that he was unaware of any prohibition against adding hydrogen to the MUT during a leak rate test. Accordingly, we find that Mr. Congdon did manipulate leak rate tests by adding hydrogen to the MUT, but we find that he was not "culpable", because his logging practice and lack of training indicate to us that his conduct was not surreptitious or improperly motivated.

475. NRR's other allegations against Mr. Congdon are similarly unpersuasive. We accord no weight to NRR's allegation that "feed and bleed" operations may have occurred during NRR Test Nos. 6, 29, and 112, because both NRR and Mr. Stier have concluded that "feed and bleed" operations were not used to manipulate any leak rate test results. Tr. 1316

(Capra), 1319 (Stier). We also accord no weight to NRR's allegation that NRR Test Nos. 18 and 24 may have been manipulated through water additions, because MPR disagreed with those conclusions (Exhibit 5-B, Attachment 1), and because Mr. Congdon did not perform those Tests. NRR agrees that Mr. Congdon did not manipulate leak rate tests through water additions. Tr. 1552, 1558 (Capra).

476. Similary, we disregard NRR's allegation that Mr. Congdon used an unstable MUT level transmitter (LT-1) during NRR Test Nos. 48, 53, and 86, in light of the investigators' conclusion that TMI-2 operators did not falsify leak rate tests by switching MUT level transmitters. Stier Report, Vol. I, p. 86; Tr. 1756. Mr. Stier's investigators told Mr. Adams that "C" shift did not, in their judgment, appear to have attempted to use the unstable level transmitter for leak rate tests. Stier Report, Vol. VI(A), Tab A, 3/13/85 Adams Interview, pp. 125-26.

477. NRR assumed that Mr. Congdon performed its Test Nos. 12D and 12E. Exhibit 5-B, Attachment 5, Table 11. There is no basis for that assumption, other than that Mr. Congdon was at work when those Tests were performed. Stier Report, Vol. III(A), Table 1. However, so was Mr. Olson (see NRR Test No. 14); it is no more reasonable to assume that Mr. Congdon performed those Tests than that anyone else may have done so. NRR's assumption is thus without basis. In any event, the only

"questionable" aspect of NRR Test Nos. 12D and 12E is that they were rounded off! Exhibit 5-B, Attachment 2 and Attachment 5, Table 11. Given that Mr. Haverkamp suggested the practice of rounding off (see ¶¶ 347-48, supra), the Board sees no reason why Mr. Congdon should be assigned any responsibility for that practice. Moreover, as to leak rate tests performed between October 15-19, 1978, the Board has previously found that TMI-2 personnel responded appropriately by doing what the "Action Statement" portion of the leak rate procedure required of them. See ¶ 343, supra.

478. Finally, we accord no weight to NRR's allegation that unstable plant conditions invalidated NRR Test No. 108, because MPR concluded that Test was valid. Exhibit 5-B, Attachment 3, p. 2.

479. Mr. Congdon did not apply the "Exceptions and Deficiencies" Procedure to unsatisfactory leak rate tests, or log the start and stop times of leak rate tests, because he was not advised to do so in his training. Congdon Prep. St., p. 3. This is consistent with the testimony of the other operators and supervisors. See ¶¶ 181, 322, supra.

480. The Board finds that Mr. Congdon's consistent logging of his hydrogen additions to the MUT and the lack of evidence of any attempt on his part to manipulate through any other means demonstrate that his conduct was not culpable even though his hydrogen additions to the MUT during leak rate tests

constituted manipulation. We found Mr. Congdon a candid witness who has evidently always admitted that he added hydrogen to the MUT during leak rate tests. However, because those additions may well have actually made the leak rate test results more accurate (Stier Report, Vol. IV(A), Section VII, p. VII; see ¶ 307, supra; see Tr. 1958), we cannot find that Mr. Congdon falsified leak rate tests.

H. Craig C. Faust.

481. In 1973, Mr. Faust began employment with Met Ed as an AO. He became a CRO at TMI-2 in 1977. He is currently employed in the GPU Nuclear training department as an Instructor IV, and he maintains an SRO license. Faust Prep. St., p. 1, ff. Tr. 2511. Mr. Faust was assigned to "A" shift during the 1978-79 period. Mr. Frederick was the other CRO on "A" shift, Mr. Scheimann was the shift foreman, and Mr. Zewe was the shift supervisor. Id. In 1978, Mr. McGovern was a CRO trainee on "A" shift. McGovern Prep. St., p. 2, ff. Tr. 3148.

482. Mr. Faust's shift generally divided its responsibilities by assigning one CRO to operate the plant and maintain the CRO log and the other CRO to perform surveillance tests. Tr. 2559-61. These duties were usually distinct, although as we found in ¶¶ 272-75, supra, organization of control room functions was not rigid.

483. If Mr. Faust were assigned to perform surveillances, he would usually conduct a leak rate test within

the first hour of his shift. Tr. 2526. He tried to obtain a leak rate test on a shiftly basis, if plant conditions permitted. Tr. 2542. He did recall that he performed leak rate tests on the day shift, if the computer was available. Tr. 2543.

484. Mr. Faust regarded the leak rate test as the principal way to satisfy the 1 gpm LCO for unidentified leakage. Tr. 2533. He did not question the accuracy of the leak rate test and he believed that the test had some relationship to actual plant leakage. Tr. 2533-34.

485. If a leak rate test result was under 1 gpm of unidentified leakage, or within a fairly narrow range of negative values, Mr. Faust would sign the test without detailed analysis. Tr. 2534. If Mr. Faust obtained a leak rate test result in excess of 1 gpm, he attempted to determine whether the result was valid. Tr. 2522. If he could invalidate the leak rate test result, he threw it away and started another test. Id. He did not need supervisory approval to discard the test. Faust Prep. St., p. 3.

486. Mr. Faust discarded leak rate test results regardless of the value for unidentified leakage if he had either conducted the test improperly, added water but inadvertently failed to account for it, or encountered a change in power level. Tr. 2524, 2571. If Mr. Faust could not invalidate a leak rate test result, he discussed it with the

shift foreman or placed it on the shift foreman's desk. Tr. 2524-25. At times, he would be ordered to check the test result further for inaccuracies or to search for leakage. Stier Report, Vol. VI(C), Tab F, 2/19/85 Faust Interview, pp. 122-23; Tr. 2524. Mr. Faust presumed that either he or the shift foreman found a reason to invalidate all leak rate test results not meeting the 1 gpm LCO, because excessive leak rate tests did not cause his shift to enter the Action Statement of Technical Specification 3.4.6.2. Faust Prep. St., pp. 3-4.

487. It became more difficult to obtain leak rate test results with unidentified leakage under 1 gpm as identified leakage from the pressurizer valves increased. Tr. 2540. Mr. Faust recalled that the need to perform frequent "feed and bleed" operations during February-March 1979 made it very difficult to find an uninterrupted period in which to perform a leak rate test. See id. However, Mr. Faust never felt pressured to obtain a satisfactory leak rate test. Faust Prep. St., p. 6.

488. Mr. Faust did not log the start or stop times of leak rate tests because he recorded only non-routine evolutions in the logbook. Faust Prep. St., p. 4; see Tr. 2351 (Capra). Nor did Mr. Faust apply Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to leak rate test results. Tr. 2544. He never associated AP 1010 with the leak

rate test, but he now agrees that the procedure should have been applied. Tr. 2546.

489. Mr. Faust associated the occurrence of negative leak rate test results with plant oscillations and instrument error. Tr. 2529, 2532. We have found that it was reasonable to expect negative leak rate test results because of normal instrument errors. See ¶¶ 220-22, supra.

490. The record contains four negative leak rate Tests signed and filed by Mr. Faust. They are NRR Test No. 98 (Stier Test No. 60); NRR Test No. 102 (Stier Test No. 56); NRR Test No. 118 (Stier Test No. 40); and NRR Test No. 149 (Stier Test No. 9). Exhibit 5-B, Attachment 5, Table 11; Stier Report, Vol. III(A), Table 2 (Faust). All of these Tests were within the range of -0.1 gpm to -0.9 gpm. Stier Report, Vol. IV(E) (Test Nos. 56 and 60); id., Vol. IV(D) (Test No. 40); id., Vol. IV(C) (Test No. 9). In light of Mr. Faust's awareness, in 1978-79, of the reasons for negative leak rate test results, and given that none of those four Tests was more than -1 gpm, we find that Mr. Faust acted reasonably in treating such tests as valid.

491. Mr. Faust knew that, at times, one of the MUT level transmitters was more erratic than the other. Faust Prep. St., p. 6. However, he believed that it was acceptable to use an MUT level transmitter to perform a leak rate test provided that it had not been tagged out-of-service. Tr. 2549.

He signed only one Test (NRR Test No. 85, Stier Test No. 73) during which the erratic transmitter (LT-1) was providing input to the computer. Exhibit 5-B, Attachment 5, Table 11, p. 11; Stier Report, Vol. III(A), Table 2 (Faust). However, that Test was run before LT-1 was tagged out-of-service on January 5, 1979 at 8:00 p.m. Tr. 2397 (Capra). While it would have been better to have compared instruments as a sound operating practice, Tr. 2552, there is no evidence that Mr. Faust knowingly performed NRR Test No. 85 with a malfunctioning MUT level transmitter. Exhibit 5-A, Enclosure 6, (Enclosure 1), p. 4; Stier Report, Vol. III(A), Table 2 (Faust); Tr. 2352 (Capra). Mr. Faust was not aware of anyone else on his shift switching MUT level transmitters so as to manipulate a leak rate test result. Stier Report, Vol. VI(C), Tab F, 2/19/85 Faust Interview, p. 34.

492. Mr. Faust never manipulated or falsified a leak rate test. Tr. 2547. The record is devoid of any allegations that he did so. Tr. 1486-87 (Mr. Russell exonerated Mr. Faust of any involvement in intentional leak rate test manipulation); Stier Report, Vol. II(A), Tab F, Faust Assessment, pp. 9-13.

493. Mr. Faust did not know, during 1978-79, that the addition of water could cause the MUT level strip chart to record a greater addition than the amount of water actually added. Faust Prep. St., p. 5. While he heard a rumor that hydrogen added to the MUT could affect the leak rate test, he

did not believe the theory and he never added hydrogen to the MUT during a leak rate test to determine its effect. Id., pp. 5-6.

494. Mr. Faust is aware of LER 78-62/1T only through subsequent investigations. Id., p. 6. He would not have changed his interpretation of Technical Specification 3.4.6.2 because of that LER, because he knew during 1978-79 that his shift would have to enter the Action Statement if they could not invalidate a leak rate test result in excess of the 1 gpm LCO. Faust Prep. St., p. 7.

495. In summary, we found Mr. Faust to be "a forthcoming and candid witness." Tr. 2577 (Kelley, J.). He readily admitted that he there were procedural shortcomings in his leak rate testing practices during 1978-79. He agrees now that he should not have discarded leak rate tests and that he should have complied with the requirements of Administrative Procedure 1012 by logging the start and stop times of leak rate surveillance tests. Mr. Faust also agrees that he should have used Administrative Procedure 1010 to document the reasons that a particular leak rate test was invalid. We do not doubt that Mr. Faust would now strictly comply with all applicable Administrative Procedures. The fact that Mr. Faust was not properly trained during 1978-79 concerning the requirements of AP 1010 and AP 1012 (see also ¶¶ 317, 322 supra) precludes a

finding that he was culpable for not applying those Met Ed procedures.

496. As Mr. Faust testified, he "didn't try to manipulate leak rate tests." Tr. 2547. It is also clear from the record that Mr. Faust never attempted to manipulate a leak rate test. On that basis, as well as his credible testimony, we exonerate Mr. Faust of all involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2.

I. James R. Floyd.

497. Mr. Floyd was the Supervisor of Operations of TMI-2 during the period relevant to this proceeding. Floyd Prep. St., p. 2, ff. Tr. 4894. Mr. Floyd reported to the Unit 2 Superintendent, Mr. Gary Miller, until December 1978, and Mr. Logan thereafter. Miller Prep. St., pp. 2-5, ff. Tr. 5039. He did not report at any time to Mr. Seelinger. Tr. 4625-26, 4769 (Seelinger), 5004-05 (Floyd).

498. Mr. Floyd "delegated the actual running of Unit 2 to the shift supervisors". Floyd Prep. St. p. 2; Tr. 4969. Mr. Floyd expected the shift supervisors to discuss any problems they had with him, including problems with leak rate testing. Floyd Prep. St., p. 2.

499. Mr. Floyd does not believe that he ever performed, or supervised the performance of, a leak rate test at TMI-2, although he frequently sat at the computer console and may have punched in the code "RCSL" to begin a leak rate

test for a CRO. Tr. 4897-99. We found no evidence that he did perform or supervise a leak rate test.

500. All leak rate test practices at Unit 2 originated in Unit 1, including the practice of running leak rate tests once per shift. Floyd Prep. St., p. 2; Tr. 4965. Mr. Herbein instituted the practice of running one leak rate test per shift as an administrative, not a legal, requirement, to detect RCS leakage more quickly than the 72-hour period set forth in the Technical Specifications. Floyd Prep. St., p. 2.

501. Similarly, throwing out "bad" leak rate tests originated at TMI-1, and the practice was carried over to TMI-2. Id., pp. 2-3. Mr. Floyd and all of the operators and supervisors who testified now believe that it would have been better practice if leak rate tests had not been discarded, but Mr. Floyd was not of that opinion in 1978-79, because many leak rate test results "had no connection with reality" (id., p. 3). Mr. Floyd thought that the NRC inspectors were aware of the practice of discarding leak rate tests because of their complete access to the control rooms and the fact that nothing was hidden from the NRC. Tr. 5014-16.

502. Mr. Floyd did not enforce the application of the "Exceptions and Deficiencies" Procedure (Administrative Procedure 1010) to leak rate tests; he was not of the opinion, in 1978-79, that the procedure applied, because of the frequency of performance of the tests and the erratic test

results. Id. Mr. Floyd now recognizes that it would have been better practice to have applied the "E and D" procedure to leak rate tests, but neither he nor the other operators and supervisors had that opinion at the time. Tr. 4992.

503. Mr. Floyd had essentially no involvement in LER No. 78-62/1T because he and Mr. Seelinger did not have enough time to review what each other was doing. Tr. 5002-03; 5017. Mr. Floyd also does not recall discussing leak rate tests on October 18, 1978 with Mr. Haverkamp. Tr. 4896-97.

504. Mr. Floyd issued Operations Memorandum No. 2-78-19 to carry out Mr. Seelinger's instructions on rounding off unidentified leakage values on leak rate tests, to instruct operators and supervisors to invoke the Action Statement of Technical Specification 3.4.6.2 when the 1 gpm LCO for unidentified leakage was not met, and to keep a list of known leaks for purposes of identifying RCS leakage. Stier Report, Vol. V(C), Test No. 37; Tr. 4934-37. In determining whether to invoke the Action Statement, the operators were to apply their judgment, not simply rely on the test results. Floyd Prep. St., p. 3. If the test results were invalid due to non-steady state conditions, changing power levels, or operator error, the leak rate test result was appropriately deemed invalid. Id., pp. 3-4; Tr. 4930. Otherwise, an excessive leak rate test result was cause for invoking the Action Statement and possibly

shutting down the Unit. Floyd Prep. St., p. 3; Tr. 4903-05; 4915-16; 4930.

505. Mr. Floyd candidly admitted in his testimony that he was remiss in not reviewing leak rate tests because he assumed that maintaining a list of leaks would solve the leak rate test problem. Floyd Prep. St., pp. 4-5; Tr. 5011-12. Mr. Floyd was not, however, aware of significant problems with the tests, Tr. 4976, and he was not aware of and did not participate in or condone leak rate test falsification. Floyd Prep. St., pp. 4-5; Tr. 4973-74.

506. Mr. Floyd explained that, although he was in the TMI-2 control room quite often, the leak rate test did not take much of the operators' time, and thus the performance of the test, and problems with it, did not come to his attention. Tr. 4976. As he testified, "Basically I was ignorant of what was going on here." Id. What appeared to him then to have been more important problems occupied his time and attention:

> "Let me just try to put in context where my mind was in those days in '78.
>
> "When you have a reactor coolant pump break and you are shut down most of the summer for that, when you have to change out 20 code safety valves off the main steam system, when you end up injecting sodium hydroxide into the reactor coolant system, not once but twice -- these were the broad-brush strokes that were demanding my time and I would not have gotten to this detail until it was called to my attention that we were having trouble with this. The fix would have been so simple just to push in an 8 when you run the thing, run it for eight hours instead of one hour and you would have probably had a much

> higher confidence in the number you acquired. It was a design feature we put into the system when we built the system in Unit 1 in the computer program and it was never used but it was an obvious, easy out. I didn't need to change anything. I just had to push a different button and I would have had much greater confidence in my results. But the problem never came to my attention so I never suggested that they do that."

Tr. 4982-83. We find the above-quoted testimony credible. It is regrettable that Mr. Floyd never spent the "several hours" (Tr. 4990) it took him in 1980 to conclude that the leak rate test procedure was "meaningless". Tr. 4989. There is no basis, however, for the U.S. Attorney's allegation, at the time of Met Ed's change of plea and sentencing, that Mr. Floyd was aware that the test was "meaningless" in 1978-79. Floyd Prep. St., p. 5.

507. Mr. Floyd testified that he was unaware, prior to the TMI-2 accident, that adding hydrogen to the MUT might affect leak rate test results. Floyd Prep. St., p. 6; Tr. 5026-27. Because of Mr. Floyd's understanding of differential MUT level transmitters, it is certainly plausible that he would not believe that hydrogen additions would have had such an effect. See Faegre & Benson Report, Vol. One, pp. 42-43. We find that Mr. Floyd was not aware of hydrogen additions to the MUT made during leak rate tests for the purpose of manipulation. See Tr. 5027-28.

508. Mr. Floyd did not dispute that the start and stop times of leak rate tests should have been recorded in the

CRO log, and that he should have been aware that the CROs were not doing so. Floyd Prep. St., p. 6. Nevertheless, because the practice seems to have originated at TMI-1 (Floyd Prep. St., p. 2), the Board cannot find that the failure to record start and stop times of leak rate tests was an effort at concealment, and there is no evidence that Mr. Floyd condoned, directed, or was even aware of the practice of not logging start and stop times of leak rate tests.

509. The evidence is clear that Mr. Floyd could have enforced the observance of procedures in the TMI-2 Operations Department better than he did, which he has acknowledged. Tr. 4973; Floyd Prep. St., p. 5. However, the evidence does not support the conclusion that Mr. Floyd was aware of, participated in, or condoned, leak rate test falsification or manipulation. The Board finds that Mr. Floyd's Operations Memorandum No. 2-78-19 carried out the interpretation of the leak rate Technical Specifications that Mr. Haverkamp conveyed to Mr. Seelinger on October 18, 1978. Because of confusion over the cancellation of that Memorandum when the "rounding off" policy was rescinded (see ¶ 355, supra), Mr. Floyd reasonably believed that operators and supervisors would comply with his directive because he did not realize that they did not understand that the portion of that Memorandum concerning the Action Statement was still applicable. Mr. Floyd was a candid witness who freely admitted that, in retrospect, he should have

corrected the procedural shortcomings that occurred with respect to leak rate testing at TMI-2. However, based on his candor and lack of knowledge of leak rate test manipulation, the Board finds that Mr. Floyd was not guilty of "dereliction or culpable neglect" and that he should be exonerated of any awareness of, or involvement in, leak rate test falsification or manipulation at TMI-2.

J. Edward R. Frederick.

510. Mr. Frederick began employment with Met Ed in 1973 as an AO. He obtained his TMI-2 RO license in 1977. He is currently an Instructor V for GPU Nuclear in its training department, and he holds an SRO license. Frederick Prep. St., p. 1, ff. Tr. 2447; Exhibit 5-B, Attachment 5, Table 1. In 1978-79, Mr. Frederick was assigned to "A" shift in TMI-2 as a CRO. His fellow CRO was Mr. Faust; Mr. Scheimann was his shift foreman and Mr. Zewe was his shift supervisor. Frederick Prep. St., p. 1.

511. As a licensed operator, Mr. Frederick realized that he had an obligation to ensure that TMI-2 was operated safely. He believed that one part of this obligation was to obtain a leak rate test result depicting unidentified leakage less than 1 gpm once every 72 hours while the plant was in operation. Frederick Prep. St., p. 2. He understood that to perform the leak rate test properly, he had to establish the appropriate conditions for the test. Id. While running a leak

rate test, he habitually monitored pressurizer level, MUT level, RCS average temperature, and other plant parameters, so that there was no disruption of steady state conditions. Tr. 2471. Mr. Frederick recalled knowing that the purpose of the leak rate test was to give the operator an indication of a developing leak which might propogate and thereby lead to a more hazardous condition. Tr. 2462.

512. Mr. Frederick recalled that he performed leak rate tests on the 11:00 p.m. to 7:00 a.m. shift and less frequently, on the 3:00 p.m. to 11:00 p.m. shift, but never on the day shift. Frederick Prep. St., p. 9. The record corroborates his recollection; seven of the twelve Tests he signed were performed on the 11:00 p.m. to 7:00 a.m. shift. Stier Report, Vol. III(A), Table 2 (Frederick), Stier Test Nos. 137, 77, 75, 74, 45, 3 and 2. Only four Tests were performed by Mr. Frederick on the 3:00 p.m. to 11:00 p.m. shift. Id., Stier Test Nos. 152, 135 (Test No. 135 was adopted by Mr. Frederick when relieving the 3-11 crew), 85 and 53. One leak rate Test was performed by another shift on day shift and completed by Mr. Frederick when he reported for the 3:00 p.m. to 11:00 p.m. shift. Id., Stier Test No. 50.

513. Mr. Cooper testified that on one occasion, upon relieving Mr. Frederick at the conclusion of the day shift, Mr. Frederick told him that "we don't do them [leak rate tests] on day shift (or words to that effect)." Cooper Prep. St.,

p. 5, ff. Tr. 2835. In light of that testimony and the foregoing documentary evidence, we reject Mr. Russell's suspicion that Mr. Frederick was lying in stating that he never performed leak rate tests on the day shift. See id.; Exhibit 5-A, Enclosure 7, pp. 3, 5, and 7; Frederick Prep. St., p. 9.

514. Generally, Mr. Frederick did not seek Mr. Faust's assistance in performing or interpreting leak rate test results (Tr. 2473), although they did inform each other of operator-caused changes that might have affected the test. Tr. 2474. After Mr. Frederick obtained a leak rate test result, he examined the printout for obvious inaccuracies. Tr. 2476. In examining a leak rate test result, Mr. Frederick went beyond merely verifying that the value for unidentified leakage was less than 1 gpm, because he regarded the test as a valid indicator of leakage. Tr. 2478.

515. Mr. Frederick had discussions with his shift foreman concerning the acceptability of negative leak rate test results. Tr. 2457. As a result of those discussions, Mr. Frederick believed that management level personnel were formulating a policy on the acceptability of negative leak rate test results. Id. Mr. Frederick gave all leak test results to his shift foreman (including any depicting negative unidentified leakage), Tr. 2459, although he did hold the belief that negative leak rate test results were attributable to normal instrument errors. Tr. 2458; accord ¶¶ 221-22 supra.

Mr. Frederick never received the guidance regarding negative leak rate test results that he had anticipated. Tr. 2459.

516. If Mr. Frederick determined that the leak rate test result was inaccurate, he gave it to the shift foreman, along with an explanation of the inaccuracy. Tr. 2477. He did not recall discarding any leak rate test, Frederick Prep. St., p. 9, because he left the ultimate decision about the validity of the test to his shift foreman. Tr. 2475. Mr. Frederick presumed that his shift foreman must have discarded leak rate tests that he invalidated. Frederick Prep. St., p. 6. Although Mr. Scheimann could not corroborate Mr. Frederick's recollection that he (Frederick) gave Mr. Scheimann all of his completed leak rate tests, Mr. Scheimann did acknowledge that he reviewed leak rate tests given to him by his shift, and that he (Scheimann) discarded tests he determined to be invalid. Tr. 2785, 2787, 2820 (Scheimann).

517. Mr. Frederick was neither aware of, nor involved in, leak rate test manipulation at TMI-2. Mr. Frederick has testified that he never manipulated leak rate tests in any fashion. Frederick Prep. St., pp. 8-10; see also Stier Report, Vol. II(A) Frederick Assessment, p. 1 (insufficient evidence that Mr. Frederick intentionally manipulated leak rate tests through either water or hydrogen additions to the MUT); Exhibit 5-A, Enclosure 7, p. 2 (Mr. Frederick's "testimony regarding his lack of personal involvement in leak rate test manipulation

or falsification is consistent with NRR's technical analysis.") We also find that Mr. Frederick was unaware of the methods by which leak rate tests were allegedly manipulated in 1978-79. He was not aware that leak rate tests could be manipulated through either hydrogen additions to the MUT (Frederick Prep. St., p. 7; Stier Report, Vol. VI(D), Tab F, 3/12/85 Frederick Interview, pp. 31-32, 68-69), or "underrecorded" water additions to the MUT (Frederick Prep. St., p. 7; Stier Report, Vol. VI(D), Tab F, 3/12/85 Frederick Interview, p. 33).

518. Mr. Frederick tried to avoid water additions to the MUT during a leak rate test. Tr. 2498. If he added water during a leak rate test, he did so only for legitimate operational reasons such as to maintain proper MUT water inventory or RCS boron concentration. Tr. 2497-98. Mr. Frederick could not recall whether it was the panel operator or the surveillance operator who typically made water additions to the MUT. Tr. 2499.

519. Mr. Frederick did not recall that leak rate test results meeting the 1 gpm LCO became more difficult to obtain in February and March of 1979. Frederick Prep. St., p. 4. Mr. Scheimann was also unaware that leak rate tests became more difficult to obtain in that period. Tr. 2826. However, Mr. Frederick sometimes had to refrain from beginning a test during this period, because of the instability caused by recirculation of the pressurizer. Frederick Prep. St., p. 4.

520. Mr. Frederick took precautions in setting up a leak rate test because he doubted that the test was perfectly accurate. Id., p. 3. We find that Mr. Frederick's diligence did produce a high percentage of valid results; in fact, of the twelve Tests labeled "questionable" in Exhibit 5-B, Attachment 5, Table 8, only five were signed by Mr. Frederick and none involved manipulation. Exhibit 5-A, Enclosure 7, p. 5; Tr. 1486-87, 1493 (Russell).

521. Mr. Frederick did sign two Tests during which the plant might have, arguably, been in non-steady state condition, but these are disputed; the first by Mr. Frederick, the second by MPR. The first Test, NRR Test No. 10, occurred while the shift began a reactor start-up. Exhibit 5-B, Attachment 5, Table 11; Stier Report, Vol. III (A), Table 2 (Frederick). Mr. Frederick disputed the contention that the start-up made conditions unstable. Tr. 2463. He emphasized that the start-up to criticality did not affect temperature or pressure, and that the numbers printed out at the beginning and end of the Test were steady. Id. According to MPR, the second Test, NRR Test No. 108, was also not performed during a period when plant conditions were unstable. Exhibit 1-B (Green Volume), Stier Test No. 50.

522. The only other time Mr. Frederick was involved in "questionable" leak rate test results was during the period when a MUT level instrument (LT-1) was malfunctioning.

Mr. Frederick signed three Tests (NRR Test Nos. 78, 83, and 84; Stier Test Nos. 85, 75 and 74) with LT-1 providing inputs to the computer, but before that level transmitter had been taken out of service. Exhibit 5-B, Attachment 5, Table 11, pp. 9, 11; Stier Report, Vol. III(A), Table 2 (Frederick); Tr. 2397 (Capra). Mr. Frederick was not aware that MUT level transmitters were malfunctioning at that time. Frederick Prep. St., p. 7; Stier Report, Vol. VI(D), 3/12/85 Frederick Interview, p. 29. It was his belief that he was entitled to use either level transmitter for a leak rate test if they were not tagged out of service. Tr. 2485-86. Mr. Frederick was unaware of any requirement to check the level transmitter prior to using it for a leak rate test. Tr. 2486; accord, ¶ 287, supra. Both NRR and MPR agreed that the malfunctioning MUT level transmitter affected the results for those leak rate Tests; however, both NRR and MPR also concluded that the use of the unstable MUT level transmitter did not constitute manipulation, Tr. 2352 (Capra); Stier Report, Vol. III(A), Table 2 (Frederick), and we agree with their conclusions.

523. NRR agreed that Mr. Frederick did not sign any tests involving a hydrogen addition to the MUT; however, NRR alleged that two of the Tests signed by Mr. Frederick involved an unrecorded or "underrecorded" water addition to the MUT. Exhibit 5-B, Attachment 5, Tables 7 and 11. As to the unrecorded water addition attributed to him by NRR (NRR Test

No. 98), MPR refuted NRR's conclusion that there was a water addition during the Test. Exhibit 1-B (Green Volume), Stier Test No. 60. As to the Test allegedly involving an underrecorded water addition to the MUT according to NRR, (Exhibit 5-B, Attachment 5, Table 11, NRR Test No. 149), MPR concluded that there was a legitimate reason to add water to the MUT during that Test. Stier Report, Vol. III(A), Table 2 (Frederick). Although NRR alleged that there was a water addition during Stier Test No. 150, MPR concluded that the Test reflected a "feed and bleed" operation. See ¶ 239, supra.

524. It did not occur to Mr. Frederick to apply the "Exceptions and Deficiencies" Procedure to leak rate tests, as established by Administrative Procedure 1010. Tr. 2460. He believed that if he had already found a leak rate test inaccurate or invalid, there was no need to attach an "E or D", because he had already resolved the problem. Tr. 2461. He understands now that AP 1010 should have been applied to leak rate tests. Tr. 2479. Mr. Frederick also did not log the start and stop times of surveillance tests. Tr. 2496. Mr. Frederick and Mr. Faust did not do so, Tr. 2351 (Capra), because they regarded the performance of the leak rate test as a routine surveillance not requiring such logging. Frederick Prep. St., p. 5. No reviewer of the CRO log ever told Mr. Frederick that his logging practices were incomplete. Id.

525. Mr. Frederick's shift apparently performed a leak rate test during the October 16, 1978 through October 18, 1978 period associated with the issuance of LER 78-62/1T. Exhibit 5-B, Attachment 5, Table 11, NRR Test No. 12A; Stier Report, Vol. III(A), Table 1, Stier Test No. 149. Mr. Frederick had no recollection of this leak rate Test or of hearing anything about its discovery by Mr. Haverkamp. Frederick Prep. St., p. 9. Although Mr. Frederick cannot recall the LER, he did sign the cover sheet attached to the version of the LER sent to the operators and supervisors. Stier Report, Vol. V(C), Tab 30.

526. Mr. Frederick stated that he was aware, during 1978-79, of the need to enter the Action Statement of Technical Specification 3.4.6.2 if his shift obtained a valid leak rate test with unidentified leakage in excess of 1 gpm. Frederick Prep. St., pp. 9-10. Mr. Faust had a similar understanding prior to the accident. Faust Prep. St., p. 7, ff. Tr. 2511. However, both Messrs. Frederick and Faust agreed that it was the shift foreman's decision whether to enter the Action Statement. Tr. 2475 (Frederick); Tr. 2524-25, 2556 (Faust).

527. We find that Mr. Frederick did overlook certain Administrative Procedures governing leak rate surveillances. As we have noted, he did not log the start and stop times of leak rate tests (AP 1012), and he did not apply Exceptions and Deficiencies (AP 1010) to document leak rate tests that were

not performed successfully. We cannot conclude that Mr. Frederick discarded leak rate tests, because of his and Mr. Scheimann's testimony that Mr. Frederick left such decisions to his shift foreman.

528. Despite these practices, we agree with Mr. Frederick's assessment of his leak rate tests: he had a good record, with a high percentage of valid leak rate tests. Frederick Prep. St., p. 10. He obviously tried to perform the leak rate tests with a degree of care, and the arguably invalid tests he performed are remarkably few, given the defects in the test procedure. Accordingly, we agree with Mr. Russell's and Mr. Stier's exoneration of Mr. Frederick of any involvement in the intentional manipulation of leak rate tests at TMI-2. Tr. 1486-87; Stier Report, Vol. II(A), Tab F, Frederick Assessment, p. 1. The Board finds, therefore, that Mr. Frederick should be exonerated of all involvement in or awareness of leak rate falsification or manipulation at TMI-2. Absent any evidence that Mr. Frederick was aware of any leak rate testing improprieties, we also find that he was not guilty of culpable neglect as a CRO at TMI-2.

K. Leonard P. Germer.

529. In 1977, Mr. Germer began his employment with Met Ed as an AO at TMI-2. Germer Prep. St., p. 1, ff. Tr. 5236. Mr. Germer became a CRO trainee assigned to "E" shift in October or November of 1978, and was transferred to "F" shift

in early January 1979. Id., pp. 1-2. As a trainee, Mr. Germer was permitted to perform leak rate tests only under the supervision of a licensed CRO. Id., p. 2.

530. In light of our finding that as a CRO trainee, Mr. Germer's involvement in leak rate testing at TMI-2 was minimal (Tr. 4169, Kelley, J.), we decided not to call Mr. Germer as a witness. Tr. 4541. Instead, we ordered that Mr. Germer's prefiled testimony be bound into the record as the testimony he would have given had he been called as a witness. Tr. 5236.

531. Mr. Germer was taught the various aspects of leak rate testing on the job. See id., pp. 2-3. He was told that the TMI-2 Technical Specifications required only one satisfactory leak rate test every 72 hours while the plant was in operation. Id., p. 2. Mr. Germer was also instructed to discard leak rate test results that had been invalidated by some operator action or plant transient, or that failed to meet the 1 gpm LCO for unidentified leakage. Id., pp. 2-3. Although he recalls that unsatisfactory leak rate test results were discarded, Mr. Germer does not recall any time when it was difficult to get a satisfactory leak rate test result. Id., p. 3. Thus, Mr. Germer does not recall any entry into the Action Statement of Technical Specification 3.4.6.2. Exhibit 6, OI Report, Exhibit 28, p. 19.

532. Mr. Germer has no recollection of the events leading up the filing LER 78-62/1T. Germer Prep. St., p. 3. Further, he cannot recall receiving any instruction associated with that LER requiring him to alter his existing interpretation of the Technical Specifications. Id.

533. Mr. Germer had very minimal involvement in the logging of leak rate tests during 1978-79, because that typically was a function typically performed by a licensed CRO. Id., p. 3. He has no present recollection of ever being instructed to conceal the fact that a leak rate test had been performed by not logging it. Id., p. 3.

534. Mr. Germer did not any falsify leak rate result during 1978-79, nor was he aware of any other operator who falsified any leak rate test during that time. Id., pp. 3-5. He also is unaware of Messrs. Booher, Hartman, Hemmila or McGovern ever falsifying a leak rate test. Id., p. 4.

535. In addition to Mr. Germer's prefiled testimony, we find ample support in the record for our decision to exonerate Mr. Germer of any involvement in, or awareness of, leak rate test falsification. Although Mr. Russell alleged that several of the leak rate tests allegedly involving Mr. Germer were "questionable" (Exhibit 5-B, Attachment 5, Table 8), Mr. Russell explicitly exonerated Mr. Germer (as well as his shiftmates on "F" shift Messrs. McGovern and Hemmila) of any involvement in intentional leak rate test manipulation

before this Board. Tr. 1486-87; see also Exhibit 5-A, Enclosure 10, p. 4 (finding that Mr. Germer's shiftmate Mr. McGovern did not intentionally manipulate tests).

536. What remains of NRR's allegations against Mr. Germer are leak rate tests that it has classified as "questionable" -- a label which, we believe is both misleading and unfair because it suggests wrongdoing without an adequate basis for such an implication. For example, in three of the nine leak rate Tests allegedly involving Mr. Germer that NRR has termed "questionable" (i.e., NRR Test Nos. 34, 52 and 96), the allegation is that an unstable or out-of-service MUT level transmitter was used to provide input to the plant computer during the leak rate test. Exhibit 5-B, Attachment 5, Table 11. The Board has already found that unstable MUT level transmitters were not used to falsify leak rate tests. ¶¶ 270-71, supra. Moreover, we note that Mr. Germer was the panel operator for those leak rate Tests. He did not sign the Tests, and there is no evidence that he was involved in the selection of MUT level transmitters by those who ran the Tests.

537. NRR Test No. 12 has also been classified by NRR as a "questionable" leak rate test, because it allegedly involved either a "feed and bleed" operation or a water addition that was not included in the leak rate test calculation. Exhibit 5-B, Attachment 5, Table 11. MPR concluded that there was "probably a feed and bleed" during NRR

Test No. 12 (Stier Test No. 150). Stier Report, Vol. IV(H), Test No. 150. Both Mr. Stier and NRR agreed that feed and bleed operations were not used to falsify leak rate tests (Tr. 1316, 1319), and thus we cannot find any manipulation in connection with NRR Test No. 12.

538. NRR Test No. 40 is yet another illustration of the lack of any substance behind NRR's allegation that certain leak rate tests are "questionable." Mr. Germen did not perform that Test. Exhibit 5-B, Attachment 5, Table 11. In any event, NRR categorized NRR Test No. 40 as "questionable" because plant evolutions affecting the MUT level occurred during the Test. Exhibit 5-B, Attachment 5, Table 11. On that basis, NRR declared it "invalid", although there is no allegation that the Test was intentionally manipulated. Id. MPR found NRR's allegations with respect to NRR Test No. 40 (Stier Test No. 118) "to be in error", and also noted that the "NRC apparently misinterpreted the printout" with respect to that Test. Stier Report, Vol. IV(G), Test No. 118.

539. In fact, Mr. Germer performed only three of the nine allegedly "questionable" Tests assigned to him by NRR. See Exhibit 5-B, Attachment 5, Table 11. None of them appear to have involved anything more than Tests performed simultaneously with other plant evolutions which were not alleged to have constituted manipulation. Id.; Stier Report, Vol. IV(H), Test No. 150 (disproving NRR analysis of NRR Test

No. 12). The fact that Mr. Germer performed so few Tests, and the examples just discussed, convince us that NRR's allegation of "questionable" Tests allegedly involving Mr. Germer is entitled to little or no weight.

540. In light of the foregoing, we cannot find that any "questionable" leak rate tests involving Mr. Germer are an adequate basis for concluding that he was involved in, or aware of, leak rate test falsification or manipulation. We accept Mr. Germer's unrebutted testimony as fact, and on the basis of that testimony and the conclusion of NRR about "F" shift, we exonerate Mr. Germer of any involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2. Particularly in light of his status as a trainee, we also find Mr. Germer not guilty of any culpable neglect in connection with his performance of leak rate tests at TMI-2.

L. Carl L. Guthrie.

541. Mr. Guthrie was a shift foreman at TMI-2 during the 1978-79 period. He had been employed by Met Ed since 1971. His first assignment was as an AO at Unit 1, then as a Unit 1 shift foreman. In January 1979, he was assigned to "F" shift in Unit 2, and he supervised Messrs. McGovern, Hemmila and Germer. Mr. Guthrie currently is a radwaste foreman at TMI-2. Guthrie Prep. St., p. 1, ff. Tr. 4413. He maintains an SRO license in that position. Exhibit 5-A, Enclosure 2, p. 11.

542. Leak rate tests were run by Mr. Guthrie's CROs under his supervision. Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, p. 7. Mr. Guthrie did not monitor their performance of the leak rate test, however. Moreover, he might not have been in the TMI-2 control room when a leak rate test was performed, because the selection of the time for running the test was a decision left to the operator. Id. Mr. Guthrie did not personally perform a leak rate test at TMI-2. Id. Mr. Guthrie's actual role in the leak rate surveillance process was to approve the test for filing. Tr. 4116. If he received a leak rate test with unidentified leakage under 1 gpm, he would approve it. Tr. 4117. If a leak rate test with unidentified leakage higher than 1 gpm were generated, Mr. Guthrie checked MUT level and sump level or searched for leaks. Id.

543. Mr. Guthrie spent substantial time attempting to detect plant leakage. Id. He measured leaks in accessible areas of the plant, id., and estimated leakage in inaccessible areas. Tr. 4118. Mr. Guthrie often found that leakage depicted by the leak rate test was inconsistent with his own assessment of plant leakage. Id. His inability to corroborate leak rate test results caused him to question the accuracy of the test. Id. Mr. Guthrie was also skeptical of the leak rate test because it did not produce consistent results. Id. He continued to use the leak rate test, however, because it was

the only method he was aware of to quantify unidentified leakage. Tr. 4119.

544. Mr. Guthrie's shift interpreted the leak rate Technical Specifications as requiring only one valid leak rate test every 72 hours while the plant was in operation; consequently, his shift did not enter the Action Statement in Technical Specification 3.4.6.2 on the basis of interim tests showing over 1 gpm of unidentified leakage. Tr. 4115, 4121. Mr. Guthrie assumed that his shift discarded most of leak rate tests in excess of 1 gpm that they obtained. Tr. 4115; Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, p. 25. He was unaware of the total number of these test results that might have been discarded, because his operators did not have to bring all test results to him for review. Tr. 4155. Mr. McGovern agreed that Mr. Guthrie might have reviewed only half of the leak rate tests performed by "F" shift. Tr. 3204.

545. Mr. Guthrie had some misgivings about this interpretation of the 72-hour rule. Tr. 4121. He did discuss his misgivings about the treatment of leak rate tests showing unidentified leakage above 1 gpm with his immediate superiors. Tr. 4122-23. Their response consisted of encouragement to continue to look for unidentified leaks. Tr. 4122. Mr. Floyd confirmed that he encouraged searches for leakage and the development of lists of plant leakage, because he thought that shift foremen would have less trouble with leak rate tests if

they were attentive to identified plant leakage. Floyd Prep. St., p. 4, ff. Tr. 4894.

546. The safety implications of the leak rate test were not emphasized to Mr. Guthrie as part of his training. He was aware that pressure boundary leakage could not be tolerated and he learned, through experience, that small leaks always became worse, but he did not receive specific training on the reasons for performing leak rate tests. Id.

547. Mr. Guthrie did not experience pressure from management to refrain from expressing his concerns about the leak rate test. He did feel responsible, however, for correcting the problems of the leak rate test, although he was not able to discover the source of those problems. Tr. 4135.

548. Mr. Guthrie did not apply Administrative Procedure 1010 (Exceptions and Deficiencies) to leak rate tests. Tr. 4116. He also did not ensure that Administrative Procedure 1012 (logging start and stop times of surveillances) was followed. Tr. 4116. Mr. Guthrie believed that those Administrative Procedures were not applicable to leak rate tests because such tests were routine surveillances generated by the computer. Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, pp. 21-22.

549. Mr. Guthrie remembered that there was a time period when a MUT level transmitter was out-of-service. Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, p. 62.

He had no knowledge of anyone switching a MUT level transmitter to falsify a leak rate test result, however. Id. Mr. Guthrie approved three leak rate Tests with an allegedly erratic transmitter: NRR Test No. 34 (Stier Test No. 124); NRR Test No. 73 (Stier Test No. 85), and NRR Test No. 74 (Stier Test No. 84). Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Table 11, pp. 4, 9. Mr. Guthrie admitted that NRR Test No. 34 could have been detected as invalid, because a high MUT level reading of the end of the Test was obvious from the face of the leak rate test printout. Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, p. 53. However, the MUT level transmitter used for NRR Test No. 34 had not been tagged out of service, Tr. 2394 (Capra), and thus the operators under Mr. Guthrie's supervision were entitled to use that level transmitter. See ¶ 289, supra. Nor was the MUT level transmitter tagged out-of-service before the performance of NRR Test Nos. 73 or 74. Tr. 2395-97 (Capra). While NRR Test No. 73 shows some difference between the printout values for MUT level and the MUT level strip chart, an operator could easily have missed the disparity, even if he had checked the strip chart. Stier Report, Vol. IV(F), Test No. 85. MPR specifically noted that even if NRR Test No. 74 were run with the "bad transmitter" (LT-1) providing input to the computer, the Test results were in close agreement with the MUT level strip chart. Stier Report, Vol. III(A), Table 1; id.,

Vol. IV(F), Test No. 84; accord, Exhibit 5-A, Enclosure 8 (Enclosure 1), p. 4 (NRR stated that "the use of LT-1 in this case, may not have produced a signficant error in the leak rate calculation."). Mr. Guthrie, therefore, filed only one leak rate Test during which the existence of an erratic MUT level transmitter might have been detected. There is no evidence that his filing of this one Test amounted to anything other than a mistake.

550. In 1978-79, Mr. Guthrie did hear a rumor, from a source he has since forgotten, that the addition of hydrogen to the MUT during a leak rate test could affect leak rate test results. Tr. 4116. While in Unit 1, he had observed the effect of a hydrogen addition to the MUT, but he thought that the very temporary, very slight increase he observed could not affect a leak rate test result. Guthrie Prep. St., p. 4; Tr. 4139. Mr. Guthrie approved only two leak rate Tests involving hydrogen additions to the MUT: NRR Test No. 17 (Stier Test No. 140) and NRR Test No. 152 (Stier Test No. 6). Exhibit 5-B, Attachment 5, Table 11, pp. 3, 20; Stier Report, Vol. III(A), Table 1. (NRR Test No. 121 allegedly involved either a hydrogen or water addition to the MUT (Exhibit 5-A, Enclosure 8 (Enclosure 1), p. 5), although MPR concluded that that Test was valid. Exhibit 5-B, Attachment 3, p. 2.) In NRR Test No. 17, the hydrogen addition to the MUT was duly logged by the CRO. NRR concluded that the effect of the hydrogen addition to the

MUT was "uncertain", Exhibit 5-B, Attachment 5, Table 11, p. 3 and MPR was unable to conclude that the hydrogen addition to the MUT had any affect on the Test result. Stier Report, Vol. III(A), Table 1. While NRR concluded that an addition of hydrogen to the MUT affected NRR Test No. 152, MPR also could not verify that conclusion. Exhibit 5-B, Attachment 5, Table 11, p. 20; Stier Report, Vol. IV (C), Test No. 6. Once again, the addition of hydrogen to the MUT was recorded in the CRO log. Exhibit 5-B, Attachment 5, Table 11, p. 20. Mr. Guthrie was not aware of any TMI-2 operator who added hydrogen to the MUT to falsify a leak rate test result. Stier Report, Vol. VI(D), Tab G, 4/26/84, Guthrie Interview, p. 21; Tr. 4115-16. On the basis of MPR's analysis of NRR Test Nos. 17 and 152, and Mr. Guthrie's testimony, we are persuaded that there is no evidence to dispute Mr. Guthrie's statement that he was unaware of the fact that the addition of hydrogen to the MUT could affect leak rate test results.

551. Mr. Guthrie did not know until after the March 28, 1979 accident that a water addition to the MUT, even if accounted for in the leak rate test procedure, could produce a more favorable leak rate test result, nor was he aware of any operator who manipulated leak rate tests in that fashion. Stier Report, Vol. VI(D), Tab G, 2/12/85 Guthrie Interview, pp. 74-75; Tr. 4145-46. Mr. Guthrie was not aware of any unrecorded water additions to the MUT made to falsify a leak

rate test. See Tr. 4116. None of the operators on his shift talked about this phenomenon or acted as though this was a method they might use to manipulate leak rate tests. Id.

552. Mr. Guthrie approved NRR Test No. 150 (Stier Test No. 8); NRR Test No. 151 (Stier Test No. 7), and NRR Test No. 153 (Stier Test No. 5). Mr. Guthrie explained that the MUT level strip chart showed that water additions were being made very frequently during this time period, and that there appeared to be legitimate operational reasons for such additions. Tr. 4148-49. Mr. Stier agreed that there were bona fide operational reasons for water additions to the MUT during the time in which those Tests were run (March 16-28, 1979). Tr. 1848-49. We have concluded previously that water additions to the MUT during March 16-28, 1979 were made for the legitimate operational reasons. ¶¶ 254, 293, 303, supra. Neither MPR nor NRR concluded that those Tests showed a pattern of manipulation by "F" shift, and we agree that those Tests do not represent operator efforts to falsify leak rate test results. Stier Report, Vol. I, pp. 101-02; Tr. 1847-49 (Stier), Exhibit 5-A, Enclosure 8 (Enclosure 1), p. 7; Tr. 1486-87 (Russell).

553. Mr. Guthrie did not recall reading Licensee Event Report 78-62/1T during 1978-79. Tr. 4124. He believed that he had read it, because his initials were on the cover sheet attached to the version sent to the TMI-2 control room.

Id. He could not remember instructing his CROs about the meaning of the LER, or receiving any instructions from his shift supervisor about its meaning or implementation. Tr. 4124-25. Therefore, Mr. Guthrie believed that the LER had no effect on his shift's practices. Tr. 4125.

554. Our examination of the record reveals no evidence that Mr. Guthrie permitted the manipulation or falsification of leak rate tests or that such activity occurred on his shift. Each of the CROs under his supervision (Messrs. Germer, Hemmila and McGovern) has been exonerated of any involvement in the intentional manipulation of leak rate tests by the NRC. Tr. 1486-87. Nor was Mr. Guthrie aware of any falsification or manipulation of leak rate tests at TMI-2 during 1978-79. Stier Report, Vol. VI(D), Tab G, 3/27/84 NRC/OI Guthrie Interview, pp. 37-44. There is also no evidence that his conduct amounted to culpable neglect of standard operating practices. Although Mr. Guthrie did not ensure that Administrative Procedures 1010 and 1012 were followed with respect to leak rate tests, he candidly acknowledged that noncompliance. Based on hearing his testimony, we are confident that he would today demand strict adherence to the Technical Specifications and Met Ed Administrative Procedures, as a result of this experience. Accordingly, we exonerate Mr. Guthrie of all involvement in, or awareness of, or culpable neglect with respect to, TMI-2 leak rate test falsification or manipulation.

M. John G. Herbein.

555. None proposed.

N. Gregory R. Hitz, Sr.

556. Mr. Hitz began employment with Met Ed in 1969. After working as an AO and CRO, he was promoted to shift foreman in 1975 at Unit 1. He became a dual-licensed shift supervisor in 1977. Hitz Prep. St., pp. 1-2, ff. Tr. 3664. Mr. Hitz was assigned to supervise "D" shift. In TMI-2, during the latter part of 1978 and early 1979, "D" shift consisted of foreman Mr. Adam Miller and his CROs were Messrs. Coleman, Wright, and Olson. Id., p. 2; A. Miller Prep. St., p. 1, ff. Tr. 3608; Coleman Prep.. St., p. 2, ff. Tr. 2579.

557. Mr. Hitz recalled that he interpreted the leak rate Technical Specifications as requiring a leak rate test result depicting unidentified leakage below 1 gpm every 72 hours while the plant was in operation. Tr. 3718. If a satisfactory leak rate test result could not be obtained within that 72-hour period, they were required to invoke the Action Statement of Technical Specification 3.4.6.2. Tr. 3719. Mr. Hitz understood that leak rate tests depicting unidentified leakage in excess of 1 gpm were discarded by his shift, without entry into the Action Statement. Tr. 3720. Mr. Hitz assumed that before the operators on his shift discarded a leak rate test they, but not the foreman, engaged in a determination whether the test was valid. Tr. 3677. Mr. Hitz acknowledged, however, that he never observed his operators engaging in that

process. Tr. 3677-78. As a shift supervisor, Mr. Hitz did not perform leak rate tests. Stier Report, Vol. VI(F), 3/29/84 Hitz Interview, p. 10.

558. In 1978-79, Mr. Hitz knew that his shift at TMI-2 was having problems obtaining leak rate test results meeting the 1 gpm LCO. Tr. 3665. He recalled seeing highly variable leak rate test results. Tr. 3667. At the time, Mr. Hitz did not blame these problems on inaccuracies in the computer program used to conduct leak rate tests. Id. Rather, he attributed the difficulties to plant oscillations and to secondary side plant problems which, he believed, would be corrected over time. Tr. 3670. He acknowledged that, in retrospect, these problems prevented anyone from knowing, with certainty, whether the 1 gpm LCO for unidentified leakage was being met. Tr. 3695.

559. The existence of plant oscillations prompted Mr. Hitz to accept as valid leak rate test results depicting small negative numbers for unidentified leakage. Tr. 3680-81. He was convinced that such negative results were likely to occur, and were therefore acceptable. Tr. 3682, 3686; see Exhibit 21, p. 3; see ¶¶ 220-22, supra.

560. Mr. Hitz recalled receiving classroom training concerning the Technical Specifications, as well as the bases for those Specifications. Tr. 3707. When he became a shift supervisor, he received training by observing other shift

supervisors performing their administrative work. Hitz Prep. St., p. 2. He testified that there was no on-the-job training focusing specifically on the leak rate test, however. Tr. 3707.

561. Mr. Hitz had no recollection of the incident described by his CRO Mr. Coleman, in which three individuals emerged from the shift supervisor's office and told Mr. Coleman they did not wish to see leak rate tests with unidentified leakage in excess of 1 gpm. Tr. 3678. Mr. Hitz believed that it was not a fair assumption that he was the shift supervisor involved, because Mr. Coleman's uncertainty about the timing of this occurrence other than that it was "early on", made it likely that he was not yet Mr. Coleman's shift supervisor. Tr. 3678. The Board believes that Mr. Coleman's recollection is too vague to support the conclusion that Mr. Hitz gave Mr. Coleman the instruction in question, especially in the face of Mr. Hitz's denial.

562. Mr. Hitz remembered hearing of the MUT "loop seal" phenomenon after the March 28, 1979 accident at Unit 2. Tr. 3712. Prior to learning of that phenomenon, he was unaware that a hydrogen addition to the MUT could affect the leak rate test. Id. As a Unit 1 CRO, Mr. Hitz had seen a brief, temporary effect on the MUT level caused by a hydrogen addition, but he believed that the effect was insignificant. Tr. 3690, 3692.

563. In retrospect, Mr. Hitz could not justify the practice of not applying the "Exceptions and Deficiencies" Procedure to invalid leak rate tests. Tr. 3668-69.

564. Mr. Hitz could not remember the November 1, 1978 Licensee Event Report (78-62/1T), but recognized that his initials were on the coversheet for the version sent to the control room. Hitz Prep. St., p. 6; Tr. 3698. Mr. Hitz presumed that the LER had no effect on operations at TMI-2. Tr. 3722. He agreed that it would have been his responsibility to ensure that all those under his supervision knew the importance of this LER, and he agreed that after the issuance of the LER, he should have verified that his shift was entering the Action Statement upon obtaining leak rate test results over 1 gpm. Tr. 3721, 3723.

565. Mr. Hitz had no knowledge of any operator falsifying or manipulating leak rate tests. Tr. 3725. He was convinced that his shift foreman, Mr. Adam Miller, was also totally unaware of any pattern of falsification or manipulatin. Tr. 3728-29.

566. We know of no evidence that Mr. Hitz was aware of leak rate test falsification or manipulation. Mr. Coleman, for example, could not recall discussing his leak rate testing activities with Mr. Hitz. Tr. 2604. He was rarely involved even in the approval of leak rate tests, and signed only two Tests (Stier Test Nos. 16 and 21); therefore, it is

understandable that he would not have been aware of the practice of Messrs. Coleman and Wright, during February-March 1979, of adding water to the MUT during leak rate tests to affect test results. As Mr. Hitz explained, "once you [become] a shift supervisor, you kind of get removed from the Control Room Operator somewhat." Stier Report, Vol. VI(F), 3/29/84 Hitz Interview, p. 26. There is, therefore, no evidence that Mr. Hitz was aware of or involved in, leak rate test falsification or manipulation at TMI-2. We therefore exonerate him of any such allegation. Given his responsibilities for both TMI units at the same time, and his minimal role in and lack of specific knowledge of leak rate testing practices, we also find that he was not guilty of culpable neglgect with respect to leak rate testing at TMI-2.

O. Kenneth P. Hoyt.

567. Mr. Hoyt became employed by Met Ed at TMI in 1971 following almost ten years of service in the United States Navy. Hoyt Prep. St., p. 1, ff. Tr. 4233. After working first as an AO, Mr. Hoyt became a CRO at TMI-2 in 1976, and served in that position until 1977, when he became a shift foreman on "E" shift. Id. Mr. Hoyt's shift supervisor on "E" shift was Mr. Smith. Smith Prep. St., p. 1, ff. Tr. 4331. During 1978-79, Mr. Hoyt supervised Messrs. Hartman and Booher (CROs) and Messrs. Blessing and Germer (CRO trainees). Id., p. 1; Germer Prep. St., pp. 1-2, ff. Tr. 5236. Mr. Germer became a CRO

trainee on "E" shift in October or November 1978, but was transferred to "F" shift in early January 1979. Id. Mr. Hoyt remained as a shift foreman at TMI-2 until 1981, when he became a Decontamination Supervisor in Recovery Operations, which position he still holds. Hoyt Prep. St., p. 1.

568. As a shift foreman, Mr. Hoyt never performed a leak rate test. Hoyt Prep. St. p. 2; Tr. 4236; see Exhibit 5-B, Attachment 5, Table 11. Rather, it was Mr. Hoyt's responsibility to review leak rate tests conducted by those on his shift. Hoyt Prep. St., p. 2. Mr. Hoyt testified (id.), and the Board has found as a general rule (see ¶¶ 327-39 supra), that the erratic nature of the leak rate test, despite unchanged plant conditions and the lack of any indication of significant leakage, led him to look to a variety of other plant indicators to assure that unidentified leakage did not exceed 1 gpm. Because he did not rely only on leak rate test results to determine the amount of unidentified leakage, Mr. Hoyt never pressured the operators he supervised to obtain "satisfactory" leak rate test results. See Tr. 2248.

569. Mr. Hoyt believed that the results of the leak rate test were often inconsistent with other indicators of unidentified leakage. .d., p. 2; Tr. 4239, 4241. Mr. Hoyt attributed this discrepancy to inaccuracies in the computer program used to conduct the leak rate test. Id., p. 2; Tr. 4239, 4265. Mr. Hoyt believed that the computer program

was being corrected (Tr. 4261), and expected this to resolve the problem. Tr. 4268. During 1978-79, Mr. Hoyt was preoccupied with many other problems presented by the early operation of TMI-2. Tr. 4268.

570. Mr. Hoyt did appreciate the importance of ensuring that unidentified leakage did not exceed 1 gpm, and sought to compensate for the inadequacies he perceived in the leak rate test by monitoring plant leakage through a variety of other methods. Hoyt Prep. St., p. 2; Tr. 4242-47. Mr. Hoyt was instructed by the TMI-2 training department to assess leak rate test results against other indicators of leakage. Tr. 4252. Thus, Mr. Hoyt made a practice of periodically checking MUT level, pressurizer level, system temperature, and RCDT collection to monitor plant leakage. Tr. 4242, 4244-46. In using methods in addition to the leak rate test to monitor RCS leakage, Mr. Hoyt appropriately relied on multiple indicators of leakage. See ¶¶ 150, 376, supra.

However, as Mr. Hoyt testified:

> "I believed that despite inaccuracies in the leak rate test, I could nevertheless obtain a ballpark estimate as to whether we were operating within the one-gpm limit by observing the [other plant] parameters . . . and by tours through the plant looking at system leaks or other problems. I realize now that my review of these parameters did not enable me to determine precisely whether unidentified leakage exceeded one gpm. However, my primary concern was to operate the plant safely."

Hoyt Prep. St., p. 2; see also Tr. 4247, 4272. Mr. Hoyt spent at least one-half of his time on shift touring and inspecting

the plant, looking for inter alia, plant leakage. Hoyt Prep. St., p. 1; Tr. 4251, 4274 (plants tours were "a very religious thing"). Indeed, on one occasion Mr. Hoyt entered the reactor at power to inspect certain leakage. Tr. 4270; Stier Report, Vol. V(A), Tab 9 (radiation work permit). He also maintained a list of RCS leaks and recorded other indications of system leakage to maintain on an ongoing basis his knowledge of plant leakage. Hoyt Prep. St., p. 4.

571. Mr. Hoyt described Mr. Booher as his "right-hand man" when Mr. Hoyt was not in the TMI-2 Control Room (Tr. 4287), and also stated that Mr. Booher "was the one I could rely on because I knew I could trust him when I wasn't there." Tr. 4288. Mr. Hoyt's selection of Mr. Booher for this supervisory role resulted from his perception of Mr. Booher as "the more professional CRO on the shift." Tr. 4287.

572. In investigating awareness of, or involvement in, leak rate test falsification or manipulation at TMI-2, one of the issues explored by this Board has been the degree to which shiftmates communicated with each other. E.g., Tr. 3165-66. Although some TMI-2 shifts appear to have had no significant communication problems (e.g., Tr. 3308 (Mr. Kidwell's description of communications with Mr. Illjes to alert each other to the fact that a leak rate test was in progress), "E" shift presents a very different picture.

573. Mr. Hartman testified that Mr. Booher was not a good operator, suggesting jealousy toward Mr. Booher by Mr. Hartman. See ¶ 417, supra. We also found that neither Mr. Blessing nor Mr. Hartman were friendly with Mr. Booher, and that because of his dislike for Mr. Booher, Mr. Blessing performed most plant evolutions under Mr. Hartman's direction. Exhibit 5-A, Enclosure 13, p. 3. Mr. Blessing previously stated to the NRC that he did not have a good working relationship with Mr. Booher and that he and the other junior operators "would try to stay away from [Mr.] Booher. . . ." Exhibit 6, OI Report, Exhibit 6, p. 1. Finally, we note Mr. Smith's testimony that Mr. Hoyt was not "close to anybody", and in particular to Messrs. Blessing and Hartman. Tr. 4377. Thus, "E" shift was divided, with a lack of communication and rapport between Messrs. Hoyt and Booher on the one hand, and Messrs. Hartman and Blessing on the other hand. Tr. 4276-80; Exhibit 6, OI Report, Exhibit 6, pp. 2-3 ("poor communications" on shift) (Blessing).

574. The Board has exonerated Mr. Booher of involvement in, or awareness of leak rate test falsification or manipulation at TMI-2. See ¶ 423, supra. In contrast, Mr. Hartman has admitted to having falsified leak rate tests at TMI-2 by adding hydrogen to the MUT during the test. Tr. 2240-41. Moreover, it was Mr. Hartman's recollection before this Board that he did not know whether others on his

shift knew that he was adding hydrogen to affect a leak rate test result. Tr. 2286; see also Tr. 2241 (Mr. Hartman could not recall ever informing either Mr. Hoyt or Mr. Smith of his hydrogen additions to the MUT). In light of Mr. Hartman's testimony and the communication problems on "E" shift, as well as Mr. Hoyt's testimony that to his knowledge none of the CROs under his supervision manipulated leak rate tests by adding hydrogen to the MUT (Tr. 4283, 4284), we find no evidence that Mr. Hoyt was aware of Mr. Hartman's leak rate test manipulation.

575. Mr. Hoyt was aware, during 1978-79, that the Action Statement had to be invoked upon a reliable indication of unidentified leakage in excess of 1 gpm. Hoyt Prep. St., p. 3. Although leak rate test results depicting unidentified leakage in excess of 1 gpm were obtained on Mr. Hoyt's shift, Mr. Hoyt did not believe that those results were accurate in light of what other plant indicators showed, and in light of his skepticism about leak rate test results. Id. p. 3. Our findings concerning the defects in the leak rate test (see ¶¶ 184-224, supra) justify Mr. Hoyt's actions. Nonetheless, in view of his observation that his review of other plant parameters did not enable him to precisely quantify unidentified leakage, Mr. Hoyt stated that "there may have been instances when I should have entered the Action Statement but failed to do so." Hoyt Prep. St., p. 3. Hoyt testified that

"[t]oday I realize that was all wrong thinking, it was wrong training . . . ." Tr. 4249.

576. Mr. Hoyt discarded leak rate test results depicting unidentified leakage in excess of 1 gpm because they appeared to be invalid. Tr. 4273. In doing so, he was continuing a practice that began years earlier at TMI-1. Id., p. 3; Exhibit 7. However, Mr. Hoyt never instructed operators under his supervision to discard leak rate test results not meeting the 1 gpm LCO for unidentified leakage so that the NRC would not see them. Tr. 4251-52. Although Mr. Hoyt recalled an instruction not to leave "bad" tests lying around, he testified that there was no pressure to get "good" leak rate test. Tr. 4254.

577. Mr. Hoyt cannot recall being aware of LER 78-62/1T prior to the TMI-2 accident, nor does he recall any changes in leak rate testing practices as a consequence of that LER. Tr. 4253-54, 4259.

578. Mr. Hoyt did not apply Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to leak rate tests, and also did not log unsatisfactory leak rate test results. Hoyt Prep. St., pp. 3-4; see also Tr. 2268, 4236, 4238.

579. Mr. Hoyt testified that he had no awareness, during 1978-79, of any operator manipulating a leak rate test. Hoyt Prep. St., p. 4; Tr. 4237, 4285-86. Mr. Hoyt testified:

"I would have to make a special effort if I wanted to look over somebody's shoulder to take the time to watch and see what they were doing and I never felt that I had to do that with my operators." Tr. 4285. The poor communication among members of "E" shift, Mr. Hoyt's other duties, and Mr. Hartman's testimony that Mr. Hoyt was not aware of Mr. Hartman's actions, supports Mr. Hoyt's claim that he was unaware of that conduct. Mr. Blessing allegedly stated to the NRC in 1980 that he believed that Mr. Hoyt was aware of hydrogen additions during leak rate tests. Exhibit 6, OI Report, Exhibit 5, p. 2; Tr. 4281-82. However, in 1984, he stated to the NRC that "most of the supervisors knew what was going on with respect to the hydrogen additions but [Mr. Blessing] said this was not based on any actual witnessing of events or statements by any of the supervisors." Id., Exhibit 6, p. 3. Mr. Blessing failed to appear to testify at this proceeding. See ¶ 78, supra. Mr. Hoyt testifed that he was unaware in 1978-79 that Mr. Blessing added hydrogen to the MUT in order to falsify leak rate tests. Tr. 4282-83.

580. Accordingly, we exonerate Mr. Hoyt of any awareness of, or involvement in, leak rate test falsification or manipulation at TMI-2. Similarly, we cannot find that Mr. Hoyt was guilty of culpable neglect with respect to TMI-2 leak rate test practices, because of his lack of awareness of any misconduct.

P. Theodore F. Illjes.

581. Mr. Illjes began employment with Met Ed in 1971. He became a CRO at TMI-2 in 1976. Between March 1978 and March 1979 he was assigned to "B" shift in TMI-2. His shift supervisor was Mr. Chwastyk, his shift foreman was Mr. Conaway and his fellow CROs were Messrs. Mell, a trainee, and Kidwell. Illjes Prep. St., p. 1, ff. Tr. 3010. Mr. Illjes is still employed at TMI-2 by GPU Nuclear as a licensed shift supervisor. Id.

582. During 1978-79, Mr. Illjes viewed the leak rate test primarily as an administrative requirement. Tr. 3015. He regarded attainment of a satisfactory leak rate test as a difficult task and he thought that performing it interfered with the performance of other required operations. Tr. 3031. Mr. Illjes associated many of the problems he had with the leak rate test with the computer program. Tr. 3021. He knew that a computer engineer had been assigned to correct errors, and he was aware that some changes were made to the leak rate test computer program during 1978-79. Tr. 3021-22.

583. Mr. Illjes and his shiftmates tried to obtain a leak rate test every shift, Illjes Prep. St., p. 2, but there were times when it was difficult to find the required hour of steady state plant conditions. Tr. 3030. Mr. Illjes did sign one Test (Stier Test No. 127, NRR Test No. 31) on October 31, 1978, which was performed during unstable plant conditions.

Stier Report, Vol. IV(H), Test No. 127; Exhibit 5-B, Attachment 5, Table 11. While Mr. Illjes did not intentionally perform any test in the absence of what he considered steady state conditions, the lack of a precise definition of steady state added to his confusion in interpreting the procedure. Tr. 3030-31; see also ¶¶ 158-60, supra.

584. Typically, the fact that Mr. Illjes signed a leak rate test meant that he had performed the calculations required by the computer program, Tr. 3025, although sometimes more than one operator was involved in performing the leak rate test. Tr. 3024; see also ¶¶ 272-75, supra. Mr. Illjes frankly admitted that there were times when he signed the leak rate test without a detailed review of the test data or without looking at the MUT level strip chart, particularly if unidentified leakage was shown to be less than 1 gpm. Tr. 3027-29.

585. While Mr. Illjes was familiar with the leak rate Technical Specifications, he could not recall receiving any training concerning the safety significance of the performance of leak rate tests. Tr. 3082. He could not remember any questions on his NRC licensing examinations concerning leak rate tests. Tr. 3059.

586. Mr. Illjes relied on indicators other than the leak rate test to provide information about plant leakage, such as radiation monitors, MUT level and RCDT level. Tr. 3020,

3025, 3033. He did acknowledge that his reliance on these instruments did not allow him to know the precise amount of leakage. Tr. 3033.

587. Mr. Illjes discarded leak rate tests depicting unidentified leakage as higher than 1 gpm. Illjes Prep. St., p. 2. He did so because he believed that the Technical Specifications were satisfied if a leak rate test result meeting the 1 gpm LCO was obtained during a 72-hour period. Id., pp. 2-3.

588. Mr. Illjes did not apply Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to the leak rate test because of the routine manner in which the test was performed. Tr. 3018. Unlike other surveillance tests, the leak rate test did not have a separate printout tracking the procedure to be followed in a step-by-step manner, leading Mr. Illjes to overlook the fact that AP 1010 should have applied to tests that did not meet the acceptance criteria. Tr. 3018-20.

589. Mr. Illjes knew that he should avoid adding water during leak rate tests and he tried to make all necessary water additions to the MUT prior to the start of the leak rate test. Illjes Prep. St., p. 3; Tr. 3030. It was difficult to adhere to this practice when identified leakage increased in February-March of 1979, because boron concentrated in the pressurizer, and therefore in the RCS. Tr. 3090; see also

¶¶ 303-05, supra. Water additions made by Mr. Illjes during leak rate tests at that time were for legitimate operating reasons. Tr. 3094; see Stier Report, Vol. II(B), Tab I, Assessment of Mr. Illjes, p. 14.

590. Mr. Illjes signed one Test with a water addition to the MUT on March 14, 1979 (NRR Test No. 147, Stier Test No. 11). He mistakenly entered the water as a loss from the RCDT instead of an addition to the MUT (Tr. 3094-95); according to Mr. Stier, that Test is not indicative of the "underrecording" of water. Stier Report, Vol. IV(C), Test No. 11 (summary sheet); Exhibit 1-B (Green Volume), Stier Test No. 11. With respect to the one Test during which a water addition may have occurred but not entered into the Test calculation (Stier Test No. 43, NRR Test No. 115), we have already found that Test not to have been manipulated. See ¶¶ 238-41, supra; Exhibit 5-B, Attachment 5, Table 11, p. 15; Stier Report, Vol. III(A), Table 1.

591. After the control room mechanism for making hydrogen additions to the MUT became inoperable, hydrogen additions had to be made by an AO. Tr. 3063-64. Mr. Illjes' practice was to permit the AO to add hydrogen if required, as soon as the AO had the opportunity to do so. Illjes Prep. St., pp. 3-4; Tr. 3064. This process could take from five to fifteen minutes. Tr. 3069. If the hydrogen addition was not

logged, it was due to failed communications between Mr. Illjes and the AO. Illjes Prep. St., p. 4; Tr. 3065.

592. NRR Test No. 123 (Stier Test No. 35) was signed by Mr. Illjes; a hydrogen addition to the MUT may have occurred during that Test. See ¶ 261, supra; Exhibit 5-B, Attachment 5, Table 11, p. 16; Stier Report, Vol. III(A), Table 2 (Illjes). The addition of hydrogen was logged only by the AO. Id. Even assuming that the addition of hydrogen occurred during the Test, the fact that the addition was made by the AO with no evidence that Mr. Illjes determined the timing of the addition prevents us from making any adverse conclusion against him for that addition.

593. Mr. Illjes never added hydrogen to falsify a leak rate test (Illjes Prep. St., p. 3; Tr. 3095), and he did not become aware of the influence of a hydrogen addition on MUT level until after the TMI-2 accident. Tr. 3079. He had no recollection of any conversations with his shift supervisor, Mr. Chwastyk, about the effect of hydrogen on leak rate tests. Tr. 3073. Mr. Illjes agreed that it was possible that he was present in the control room when Mr. Chwastyk performed his hydrogen experiment, but believed that Mr. Chwastyk did not involve him in the experiment. Tr. 3079. Mr. Chwastyk testified that he gave only a brief instruction to his shift not to add hydrogen to the MUT during leak rate tests, and that Mr. Illjes may not have heard or understood the instruction.

Tr. 3537 (Chwastyk). Mr. Illjes' total lack of recall of participating in an experiment or receiving an insturction to refrain from the addition of hydrogen during leak rate tests is supported by the testimony of his shift foreman, Mr. Conaway, and his fellow CRO, Mr. Kidwell. Tr. 3111 (Conaway); Tr. 3387-88; 3393 (Kidwell). Mr. Mell also had no recollection of an experiment or a directive to refrain from adding hydrogen, Tr. 3244, 3282, but it is probable that he was absent from the TMI-2 control room between February 12, 1979 and March 26, 1979 preparing for his licensing examination. Tr. 3267; Stier Report, Vol. III(A), Table 1.

594. Mr. Illjes had no recollection of a faulty MUT level transmitter. Illjes Prep. St., p. 4. He never switched MUT level transmitters during a leak rate test to manipulate the results. Id.; see Tr. 2352 (Capra). Mr. Illjes signed five leak rate Tests with an oscillating MUT level transmitter. Of these five, NRR Test No. 56 (Stier Test No. 102) was started by a prior shift. Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Table 11, p. 7. A second Test, NRR Test No. 69 (Stier Test No. 89) had printout levels for the MUT approximating the strip chart levels. Stier Report, Vol. IV(F), Test No. 89. In any event, in most instances, he simply did not observe that an oscillating transmitter was providing inputs to the computer, and therefore did not know that the

values for MUT level on the leak rate test printout did not match the values on the strip chart. Illjes Prep. St., p. 4.

595. Mr. Illjes had no recollection of LER 78-62/1T. Tr. 3083. He also did not remember receiving any information about the LER or about operational changes that should have resulted from its issuance. Tr. 3084. His inability to recall changes as a result of the LER is consistent with the fact that his shift supervisor, Mr. Chwastyk, did not discuss that LER with his shift. Tr. 3509 (Chwastyk).

596. Despite Mr. Stier's conclusion to the contrary (Stier Report, Vol. II(B), Illjes Assessment, p. 1) we cannot find that Mr. Illjes was aware of, or involved in, leak rate test manipulation by the addition of hydrogen to MUT. We have already found that Mr. Illjes did not falsify leak rate tests using hydrogen additions to the MUT; Mr. Stier accused him of doing so with respect to Stier Test No. 35, but, as we have explained, due to either a time discrepancy between CRO log and MUT level strip chart, or because of imprecision in the actual time of the addition of hydrogen by the AO, the hydrogen addition may not have occurred during the Test. See ¶ 261, supra. In any event, we have found that Mr. Illjes may not have directed the timing of the hydrogen addition. See ¶¶ 261, 591 supra.

597. Contrary to Mr. Stier's conclusion, there is no clear evidence that Mr. Illjes was involved in, or aware of,

Mr. Chwastyk's experiment with hydrogen. See ¶¶ 262-63, supra. There were no demonstrated hydrogen additions to the MUT during leak rate tests on Mr. Illjes' shift after February 19, 1979, the date of Mr. Chwastyk's experiment. See ¶ 266, supra. Mr. Stier's adverse assessment against Mr. Illjes appears to be based only on Stier Test Nos. 33-35 that we have discussed (see Stier Report, Vol. II(A), Illjes Assessment, pp. 8-13), and we cannot find from that evidence that Mr. Illjes was aware of, encouraged, condoned, or was involved in, leak rate test falsification or manipulation at TMI-2. NRR concluded that Mr. Illjes did not manipulate leak rate tests. Exhibit 5-A, Enclosure 9, 8/20/85 Memorandum, p. 6; Tr. 1486-87 (Mr. Russell); in this instance, we agree with NRR. The evidence on which Mr. Stier relied simply does not allow a conclusion that Mr. Illjes manipulated leak rate tests.

598. Accordingly, we exonerate Mr. Illjes of allegations that he was so involved, particularly in light of his sworn denial and the lack of corroboration of any such involvement by others on his shift. Neither can we find him guilty of culpable neglect in his duties, because it is not clear that he did anything wrong during the Tests in which hydrogen may have been added on his shift.

Q. George A. Kunder.

599. Mr. Kunder is currently employed as the Manager-Generation Technical Support for Met Ed. Tr. 4799.

Mr. Kunder received his B.S. in mechanical engineering from Penn State in 1968. Tr. 4802. Shortly thereafter, he commenced employment as an engineer at Three Mile Island. Kunder Prep. St., p. 1, ff. Tr. 4800. He continued his employment at TMI until 1986. Id. In 1977, he became the Superintendent-Technical Support at TMI-1. Id. On December 1, 1978, he assumed the same position at TMI-2. Id.

600. As Superintendent-Technical Support for TMI-2, Mr. Kunder was responsible for supervision of the technical aspects of plant engineering. Id. He was also charged with coordinating the planning for the first refueling outage of TMI-2. Id. Mr. Kunder was not licensed on Unit 2, and he had no direct role in the operation of the unit and no responsibility for operational decisions. Id., pp. 1-2. His relationship to the TMI-2 Operations Department was advisory only. Id., p. 2. His contact with Operations personnel was limited to occasional meetings and intermittent conversations when specific engineering problems were brought up. Id. He usually learned about operating problems through people on his staff. Id.

601. Mr. Kunder described his workload in his new position as "very heavy, because [he] was attempting to not only take over the reins of . . . the engineering organization but also take care of the collateral duties of PORC chairmanship, beginning some preparation for the refueling

outages . . . , [trying to] deal with a myriad of issues and problems that existed at the time", and studying to prepare for his SRO license examination. Tr. 4803. He recalled that he worked considerable overtime, including weekends and holidays. Tr. 4803-04.

602. During the time that Mr. Kunder was assigned to TMI-2, he never ran, signed, or reviewed a leak rate test. Kunder Prep. St., p. 2. He had no recollection of ever being present in the control room while a leak rate test was being run. Id. Mr. Kunder never knew that control room personnel were discarding unsatisfactory leak rate test results. Tr. 4839-40. He was not aware of improper leak rate practices, such as test manipulation by operators, at TMI-2. Stier Report, Vol. VI(G), Tab K, 9/28/83 Kunder Interview, pp. 38-40, 44.

603. In December 1978, NRC inspector Haverkamp reviewed the leak rate test records at TMI-2 for the period October 1 through December 11, 1978. Haverkamp Prep. St., p. 9. Mr. Haverkamp found the test results acceptable. Id. Mr. Haverkamp's findings were discussed with Mr. Kunder at the exit interview following his inspection. Id., Ex. D, Encl. 2 (Inspection Report No. 50-289/78-23, et al.), pp. 2, 18. Mr. HaverKamp confirmed his favorable findings in his written inspection report, a copy of which was sent to Mr. Kunder. Id., Ex. D, p. 2. Thus, as of mid-January 1979, Mr. Kunder had

been assured by the NRC that there were no problems with leak rate testing at TMI-2.

604. Some time in 1979, Mr. Kunder became aware that there was some question whether leak rate test results accurately reflected plant conditions. Kunder Prep. St., p. 2. He recalled that the concern was that some defect in the leak rate calculation was producing erroneously high readings. Id. He also recalled that someone in his department was asked to review the leak rate procedure to determine if a problem actually existed, and, if so, to resolve it. Id., pp. 2-3. While Mr. Kunder had no independent recollection of the details, it is apparent to the Board that the problem was the incorrect calculation of RCDT density, and the solution was the TCN that was made effective March 16, 1979. See Tr. 4840-41; see also ¶ 188, supra. There is no evidence that Mr. Kunder was ever aware of other problems with the leak rate test procedure.

605. Accordingly, the Board finds that Mr. Kunder was not involved in leak rate falsification or manipulation at TMI-2, that he was not aware of and did not condone leak rate falsification or improper practices by the TMI-2 operators, and that he did not by dereliction or culpable neglect allow leak rate falsification at TMI-2.

606. When Mr. Kunder assumed the position of Superintendent-Technical Support at TMI-2, he also became

chairman of the TMI-2 PORC. Kunder Prep. St., pp. 1, 3. PORC was responsible for investigating non-compliance with Technical Specifications as brought to its attention, and for review of various procedures, tests, and system changes and modifications in TMI-2. Id., p. 3. The PORC charter appears in Technical Specification 6.5.1.6. Id.; see Stier Report, Vol. V(B), Tab 14, pp. 6-5 to 6-6. PORC's role was advisory in nature; it had no authority either to implement or enforce changes in plant procedures. Kunder Prep. St., p. 4. While PORC kept records of assignments and close-outs on corrective actions, it was not required independently to confirm the completion of assignments. Id. PORC normally did not undertake any independent steps to verify the implementation of action items. Id., p. 5. In short, to use today's jargon, PORC's role was reactive, rather than proactive.

607. Mr. Kunder has no present recollection of LER 78-62/1T or of PORC's disposition of it after he became Chairman. Id., p. 3. There is, however, adequate documentary evidence in the record to permit the Board to make findings concerning Mr. Kunder's involvement with the LER.

608. When Mr. Kunder became PORC chairman, PORC Action Item 2-78-053 (pertaining to the LER) was pending because the due date had been extended to December 15, 1978. See Haverkamp Prep. St., Ex. G, Attachment 4. The PORC action item was eventually closed out on March 5, 1979, by PORC

vice-chairman R. P. Warren. Id. That action is reflected in the PORC minutes for Meeting #79-10. Id. There was no regulatory requirement or Met Ed commitment to complete action at an earlier time. Id., Ex. G, p. 2.

609. PORC's action on the LER was reviewed in depth by the NRC. Mr. Haverkamp followed up on the LER in January 1979 and found that the corrective actions appeared sufficient. Haverkamp Prep. St., pp. 9-10. Mr. Haverkamp's review is documented in his inspection report. Id., Ex. E, Encl. Mr. Haverkamp selected LER 78-62/1T for on-site review. Id., p. 10. He verified that appropriate corrective action had been taken and that continued operation was being conducted within Technical Specification limits. Id., p. 11. Mr. Haverkamp discussed his conclusions in an exit interview with Mr. Kunder, Id., Ex. E, p. 1, and a copy of his inspection report was sent to Mr. Kunder. Id., p. 2. Thus, Mr. Kunder was assured by the NRC, as of the end of January 1979, that PORC was properly dealing with the LER.

610. After Mr. Hartman's allegations became public, Mr. Haverkamp conducted an additional review of PORC actions concerning the LER. Haverkamp Prep. St., p. 10. Mr. Haverkamp found that PORC review of the LER was performed as required. Id. Mr. Haverkamp's 1980 review is documented in his written report. Id., Ex. G.

611. Based upon the foregoing, the Board finds that Mr. Kunder was not guilty of culpable neglect or dereliction in connection with PORC's review of the LER.

612. In his evaluation of Mr. Kunder, Mr. Stier charged that Mr. Kunder "failed to ensure that appropriate action was taken in response to excessive reactor coolant system (RCS) leakage in January 1979." Stier Report, Vol. II(B), Tab K, p. 4. Mr. Stier further implied that Mr. Kunder was involved in a violation of Technical Specifications in January 1979. Id., p. 11. The Board has already reviewed Mr. Stier's analysis of events and plant conditions during January 4-15, 1979. See ¶¶ 231-33, supra. Our findings there establish that there was no violation of Technical Specifications and that the actions taken by plant personnel were appropriate.

613. In any event, Mr. Kunder did nothing wrong during January 1979. Mr. Kunder repeatedly denied knowing, or being told, that unidentified leakage in excess of 1 gpm existed in January 1979. Tr. 4826-27, 4837. He stated forcefully that he would have taken action to reduce leakage or shut down the plant if he had been aware of excessive unidentified leakage. Tr. 4826, 4837, 4885. Mr. Kunder was aware of a steam leak inside containment in January 1979, and he was concerned about the possible safety significance of the leak. Tr. 4827. He investigated to determine the safety

significance. Id.; Tr. 4836; (see Tr. 4270; Mr. Hoyt's entry into "D" ring inside containment to evaluate significance of leak). The record contains fragmentary notes made by Mr. Kunder reflecting his investigation. Tr. 4886; see Stier Report, Vol. I, pp. 117-18; id., Vol. II(B), Tab K, Kunder Assessment, pp. 9-10. Mr. Kunder has no present recollection of those notes or what they mean. Tr. 4828, 4837. The notes indicate only that there was a 2 gpm decline in the level of the MUT. It is not possible to tell from the notes whether the 2 gpm decline reflected identified leakage, unidentified leakage, or a combination of both. Tr. 4888 (Kunder). Because water lost from the MUT reflects both identified and unidentified leakage, the most that can be inferred from Mr. Kunder's notes is that he was aware that gross leakage was approximately 2 gpm. Since the LCO for identified leakage alone is 10 gpm (¶ 134, supra), the notes do not justify Mr. Stier's assessment of Mr. Kunder.

614. Based upon the foregoing, the Board concludes that Mr. Kunder was not aware of, and did not condone, any Technical Specification violations in January 1979, or at any other time.

615. Finally, the Board finds absolutely no basis for the NRC Staff's assertion in NUREG-0680, Supp. No. 5, §§ 5.22 and 13.2.2, that Mr. Kunder was "involved or implicated in the indictment [of Met Ed]". See Kunder Prep. St., pp. 5-7. The

Board agrees with Mr. Kunder that Staff's accusation is completely improper. See id.; August 13, 1984 letter from Mr. Kunder to Chairman Palladino, ff. Tr. 4800.

R. Walter J. Marshall.

616. During 1978-79, Mr. Marshall was employed by Met Ed as one of two operations engineers assigned to workup assistants to Mr. Floyd. Marshall Prep. St., p. 1, ff. Tr. 4380. He obtained an SRO license in 1978 because Met Ed required additional licensed personnel in the event of a union strike or other emergencies. Id. However, he rarely spent time in the TMI-2 control room and he cannot recall ever performing or approving a leak rate test. Id., pp. 2-3. There is no leak rate test in the record involving Mr. Marshall. Tr. 4381; see Exhibit 5-B, Attachment 5, Table 11; Stier Report, Vol. III(A), Table 1.

617. Mr. Marshall reported directly to Mr. Floyd and received his assignments from Mr. Floyd. Id., p. 2. These assignments included administrative tasks, such as the preparation of operations memoranda. See, e.g., Operations Memorandum 2-79-01 (Stier Report, Vol. V(D), Tab 55). However, from September 1978 through February 1979, Mr. Marshall devoted almost all of his time to the condensate polishers in the turbine building on the secondary side of the plant. Marshall Prep. St., p. 2; Tr. 4412. Thus he had little or no contact and familiarity with TMI-2 leak rate testing practices. Tr.

4385-86. Indeed, Mr. Marshall was not aware of any problems associated with the performance of leak rate tests, other than that in connection with LER 78-62/1T. Tr. 4413.

618. Mr. Marshall was only peripherally involved in the implementation of that LER. He did not participate at all in its drafting or editing. Tr. 4389. Nor did he attend any PORC meeting at which it was discussed. Tr. 4389-90. He was not involved in any discussions of the LER. Tr. 4411-13. However, the PORC Action Item assignment sheet for LER 78-62/1T states that Mr. Marshall was to document that the appropriate personnel were instructed on the requirements of the applicable sections of Technical Specification 3.4.6.2. Stier Report, Vol. V(C), Tab 30. This task merely involved placing the LER in the control room with a document review sheet for the operators to review. Tr. 4390, 4393, 4397-98. Thus Mr. Marshall performed only "an internal mail or carrying operation". Tr. 4398. This was standard procedure at TMI-2. Tr. 4400-01. Documenting that the appropriate personnel were properly instructed required no more of Mr. Marshall. Tr. 4399, 4414-15, 4420-21. Mr. Seelinger confirmed that Mr. Marshall did what he was instructed to do. Tr. 4664-68.

619. Ordinarily, Mr. Marshall would periodically check the LER review book in the TMI-2 control room to confirm that the operators had reviewed those documents; if they had not, he would remind them to do so. Tr. 4408-09. However, his

preoccupation with the condensate polishers in 1978-79 left Mr. Marshall with little or no time to perform these checks. Tr. 4423. Mr. Marshall did not prepare the document review sheet, Tr. 4394-95, which directed that the LER be reviewed by all of the operators by November 10, 1978. Stier Report, Vol. V(C), Tab 30. A subsequent PORC Action Item extension sheet, submitted by Mr. Bezilla, directed that the LER be reviewed by December 15, 1978. Id. Mr. Marshall cannot recall any involvement in this extension. Tr. 4407-08. It is not clear when review of the LER by the operators was finished, although PORC did not formally close the action item until March 5, 1979. See ¶¶ 367-68, supra.

620. In view of the foregoing, the Board concludes that Mr. Marshall was not involved in leak rate testing at TMI-2 in 1978-79 and played only a insignificant administrative role in the implementation of LER 78-62/1T. We consequently exonerate Mr. Marshall of any involvement in, or awareness of, leak rate test falsification or manipulation. Nor can we find Mr. Marshall guilty of culpable neglect, because his dissemination of the LER was performed in a satisfactory fashion pursuant to Met Ed procedures, as we found in ¶ 366, supra.

S. Hugh A. McGovern.

621. Mr. McGovern is currently employed by GPU Nuclear as Plant Operations Manager for TMI-2. McGovern Prep.

St., p. 1, ff. Tr. 3148. He maintains an SRO license in that position. Id., p. 2. He commenced his employment with Met Ed in 1976 as an AO at TMI-2, and he advanced to the position of licensed CRO at TMI-2 in late 1978. Id., p. 1. In January 1979, he was assigned to "F" shift in TMI-2 with fellow CROs, Mr. Hemmila, and Mr. Germer, a trainee. Id., p. 2. His shift supervisor was Mr. Bryan and his shift foreman was Mr. Guthrie. Id., p. 2.

622. Mr. McGovern understood that, as a licensed operator, he had to monitor and control plant leakage. Tr. 3219. However, he did not view the leak rate test as a reliable way to fulfill that duty. Tr. 3219-20. Although he was taught that the TMI-2 Technical Specifications required a leak rate test result demonstrating unidentified leakage under 1 gpm every 72 hours (Tr. 3151), he regarded the execution of that obligation as merely fulfilling a perfunctory administrative requirement. Id. He very candidly testified that, today, he views his attitude toward the leak rate test as "cavalier". Tr. 3199.

623. Mr. McGovern's casual attitude about leak rate testing was based on the fact that he did not believe that the results that he obtained reflected actual plant leakage. Tr. 3167-68. His disregard for the test was heightened by the random results it produced. Tr. 3168.

624. Mr. McGovern recalled that, if a leak rate test result depicted unidentified leakage greater than 1 gpm, the test was discarded and another test was initiated. Tr. 3204. Mr. McGovern discarded leak rate test results showing unidentified leakage over 1 gpm because he believed that he needed only one satisfactory test during a 72-hour period. McGovern Prep. St., p. 3. This interpretation of the TMI-2 Technical Specifications was common to many TMI-2 operators (e.g., Hemmila Prep. St., p. 3, ff. Tr. 4039), and as found in ¶¶ 365-68, supra, was never corrected. Those tests with results showing unidentified leakage less than 1 gpm were accepted and filed with less concern for their validity than Mr. McGovern now believes should have been the case. Tr. 3152.

625. Mr. McGovern's shift tended to have a division of responsibilities. For example, water additions to the RCS typically would be made by the panel operator (Tr. 3164-65), and the individual assigned to perform surveillance tests typically would complete the questions that were part of the computer-generated leak rate procedure. Tr. 3165. His shift-mates attempted to communicate with each other concerning the commencement of a leak rate test, and Mr. McGovern could not remember having communication problems with respect to leak rate testing. Tr. 3165-66.

626. Mr. McGovern could not recall receiving any lectures or other type of formal training on the subject of

leak rate testing. Tr. 3207. He was fairly certain that he learned how to perform the leak rate test from licensed CROs. Id. Mr. McGovern was quite sure that no one taught him the safety significance of leak rate tests. See Tr. 3218.

627. Mr. McGovern's shift did not apply AP 1010, the "Exceptions and Deficiencies" Procedure, to an invalid leak rate surveillance test because the leak rate test was considered to be different than other surveillance tests. Tr. 3221. Mr. McGovern explained that the frequency of performance of the leak rate test, its computer-generated paperwork, and the fact that it did not test the operability of plant equipment, as reasons for that practice. Tr. 3222. The testimony of the TMI-2 operators and supervisors made clear that all of them were likewise unaware that the "Exceptions and Deficiencies" Procedure should have been applied to leak rate tests. E.g., Tr. 2911-12; see ¶¶ 170, 315-26, supra. We find it regrettable that neither classroom nor on-the-job training at TMI-2 addressed that requirement (see ¶¶ 317, 322, supra), but in the absence of such training, we cannot criticize any operator for failing to follow the "E&D" procedure.

628. Mr. McGovern also had no recollection of complying strictly with AP 1012, which required the logging of start and stop times of all surveillance tests. McGovern Prep. St., p. 3. His failure to log the start times of leak rate tests reflected a misunderstanding of that Administrative

Procedure, rather than any intention to hide the number of tests initiated by his shift. Id.

629. Mr. McGovern believed that the Technical Support personnel in Unit 2 were working continually to improve the leak rate test. Tr. 3223. He recalled that personnel assigned to computer functions were working on the leak rate program. Tr. 3223-24. Thus, he believed that the problems he had observed with leak rate tests were in the process of being corrected.

630. Mr. McGovern knew that he was to avoid adding water to the MUT during a leak rate test unless there was an operational need to do so. Tr. 3152. The typical operational reasons for adding water during a leak rate test were to maintain proper inventory and to adjust boron concentration. Tr. 3225. Inventory adjustments were made routinely on his shift before a leak rate test was started. McGovern Prep. St., p. 6. Mr. McGovern was unaware that the MUT level strip chart could reflect an amount of water higher than the amount actually added to the MUT. Id., p. 5.

631. Mr. McGovern signed three leak rate Tests in which water was added during the course of the Test, and the amount of water recorded in the log was different than the amount reflected on the MUT level strip chart. They are NRR Test No. 150 (Stier Test No. 8), NRR Test No. 151 (Stier Test No. 7), and NRR Test No. 153 (Stier Test No. 5). These Tests

were performed between March 17-22, 1979. MPR found that the additions were not made with the intention to manipulate the Tests. Stier Report, Vol. I, p. 101. The need to make frequent water additions to the MUT during that period of high identified leakage has been recognized by both MPR (Stier Report, Vol. I, p. 102) and this Board (see ¶ 254, supra.). Based on these findings, the Board finds that none of the water additions made during March 16-28, 1979, including those made by Mr. McGovern, represent manipulation of leak rate tests.

632. Mr. McGovern was also unaware, during 1978-79, that the addition of hydrogen to the MUT could affect leak rate test results. Tr. 3167, 3202. As far as he was aware, hydrogen had to be added periodically to the MUT to maintain overpressure and to provide net positive suction head for the makeup pumps. Tr. 3201. Mr. McGovern did not deny that he may have added hydrogen to the MUT during a leak rate test; rather, he candidly stated only that he does not recall whether he ever added hydrogen to the MUT during a leak rate test. Tr. 3202. NRR has identified only one Test involving Mr. McGovern (NRR Test No. 121) during which it alleges hydrogen may have been added to the MUT. Exhibit 5-B, Attachment 5, Table 11, p. 5. We reject NRR's analysis of its Test No. 121. MPR was not convinced by NRR's speculation that there was a possible hydrogen addition during NRR Test No. 121, because the trace deflections on the MUT level strip chart did not show a

definite offset similar to the confirmed hydrogen addition on February 15, 1979 (NRR Test No. 120, Stier Test No. 38). Exhibit 1-B (Green Volume), Stier Test No. 37. Rather, MPR concluded that the MUT level strip chart trace deflections during NRR Test No. 121 appeared typical of other deflections that occurred on the same day. Id. MPR's conclusion thus bolsters Mr. Russell's conclusion that Mr. McGovern did not manipulate leak rate tests in any fashion (Tr. 1486-87)--a finding that we hereby adopt.

633. Mr. McGovern did recall that there were problems with Unit 2's MUT level transmitters (McGovern Prep. St., p. 6), and he observed that Instrumentation and Control technicians were working continually on those problems. Tr. 3223.

634. Mr. McGovern signed three leak rate Tests alleged to be invalid because they involved the use of a faulty MUT level transmitter. NRR alleged that its Test No. 50 could have involved MUT level transmitter switching during the course of the Test, but NRR declined to conclude that its Test No. 50 was an example of leak rate test manipulation. Tr. 1593, 1598 (Capra). MPR discounted NRR's ability to make any conclusions about NRR Test No. 50 based upon the MUT level strip chart, because the traces during that Test were similar to normal MUT strip chart variations appearing at other times. Tr. 1598-99 (Stier). NRR did allege that its Test No. 50 was performed

with the "bad" level transmitter (LT-1) providing inputs to the computer. Exhibit 5-B, Attachment 5, Table 11, p. 6. MPR's analysis of the MUT level strip chart convinced Mr. Stier that the evidence about that Test was inconclusive. Tr. 1598-99. Mr. Capra agreed that although LT-1 (if used for this Test) was tagged out of service until 1825 on December 8, 1978, the "difference in fluctuations" made it possible that maintenance work on that level transmitter was performed earlier in the day, and thus that LT-1 was again operating normally. Tr. 1596.

635. Three leak rate Tests were signed by Mr. McGovern, NRR Test No. 50 (Stier Test No. 108), NRR Test No. 64 (Stier Test No. 94), and NRR Test No. 74 (Stier Test No. 84) and run, according to NRR, with LT-1 providing inputs to the computer; also, according to NRR, its Test No. 64 (Stier Test No. 94) was performed while LT-1 was tagged out of service. Tr. 2397 (Capra). MPR's analysis shows that all three Tests showed close agreement between the printout and the MUT level strip chart, making Mr. McGovern's acceptance of these Tests understandable. Stier Report, Vols. IV(F) and IV(G), Test Nos. 108, 94, and 84. The MPR strip charts indicate that the MUT level transmitters were not switched immediately prior to commencement of those Tests; rather, the charts show operation with the same transmitter immediately prior to each Test. Id. The only other leak rate Test allegedly involving Mr. McGovern

and allegedly invalid due to an erratic level transmitter is NRR Test No. 73 (Stier Test No. 85). Exhibit 5-B, Attachment 5, Tables 8 and 11. Mr. McGovern did not perform that Test and MPR did not confirm NRR's allegation. Stier Report, Vol. IV(F), Stier Test No. 85. There is, therefore, no evidence that Mr. McGovern deliberately switched to MUT LT-1 immediately prior to running leak rate tests in an effort to obtain a satisfactory result, or that he negligently filed leak rate tests with a readily apparent disparity between MUT levels on the test printout and the strip chart. We cannot fault Mr. McGovern for using a MUT level transmitter that gave him level indications essentially the same as the other level transmitter.

636. Mr. McGovern had no recollection of seeing Licensee Event Report 78-62/1T when it was issued. McGovern Prep. St., p. 3; Tr. 3205. Nor could he recall participating in a briefing about the changes dictated by the LER. Id. He could only conclude that the LER had no effect upon the way he performed leak rate tests and upon the way he interpreted the Technical Specifications. Tr. 3206-07.

637. Mr. McGovern could not recall performing any analysis of the March 16, 1979 TCN to the leak rate Surveillance Procedure during the first leak rate test he performed subject to its guidance. Tr. 3196. He had been aware that the computer-generated leak rate program was

inaccurate, and he regarded the TCN as an attempt to correct a major problem with that procedure. Tr. 3178, 3196. Although the value for unidentified leakage on NRR Test No. 150 (Stier Test No. 8) was -0.9967, Mr. McGovern would have considered this result acceptable without further examination, because he ordinarily filed negative leak rate tests within the range of -0.1 gpm to -1.0 gpm. Tr. 3233. We find that practice acceptable. See ¶¶ 220-22, supra.

638. The documentary evidence available to this Board does not demonstrate that Mr. McGovern's leak rate tests depict a pattern of any intentional use of the MUT "loop seal" phenomenon to obtain satisfactory leak rate tests with either the addition of water or the addition of hydrogen. Additionally, there is no reliable evidence that Mr. McGovern negligently filed leak rate tests performed with an erratic MUT level transmitter or that he attempted to enhance the chances of obtaining a leak rate test by switching to an erratic MUT level transmitter during or prior to a test. Both Mr. Stier and NRR have exonerated Mr. McGovern of any involvement in, or awareness of, the falsification or manipulation of, leak rate tests. Stier Report, Vol. II(B), Tab M, McGovern Assessment; Exhibit 5-A, Enclosure 10, p. 4; Tr. 1486-87.

639. On the basis of the investigators' conclusions, as well as Mr. McGovern's candid testimony before this Board acknowledging his shortcomings concerning leak rate testing, we

exonerate him of any involvement in, or awareness of, leak rate test falsification or manipulation. While Mr. McGovern admitted that his attitude toward leak rate testing was "cavalier," we cannot find him guilty of culpable neglect because he did not knowingly or recklessly fail to do what was expected of him.

T. Brian A. Mehler.

640. Mr. Mehler commenced employment with Met Ed in 1967. From 1969 until September 1976, he was a CRO at TMI-1. Thereafter, he became a shift foreman at TMI-2, and a dual-licensed shift supervisor in April 1978. Mehler Prep. St., p. 1, ff. Tr. 3842. In 1978-79, Mr. Mehler supervised "C" shift in both Units. Tr. 3861. At TMI-2, his shift foreman was Mr. Adams and his CROs were Messrs. Congdon, Cooper, and Phillippe (a trainee). Cooper Prep. St., p. 2, ff. Tr. 2835.

641. As a shift supervisor, Mr. Mehler generally had little direct involvement in leak rate testing: "it was very unusual for [him] to run a leak rate test [himself]." Mehler Prep. St. p. 2; see Tr. 3858. Only when he was advised of a particular problem with a specific leak rate test, would he get involved. Although he recognizes now, with the benefit of hindsight, that the leak rate test was not reliable at TMI-2, at that time he was unaware of significant problems with the leak rate test procedures and he believed the test was the only tool available to quantify unidentified RCS leakage. Tr.

3852-67. During January-March 1979, Mr. Mehler knew that CROs were having a different time obtaining satisfactory leak rate test results; he attributed the problem to unidentified leakage from the pressurizer valves. Tr. 3862-63.

642. Mr. Mehler understood that his shift was required to demonstrate compliance with the Technical Specifications by obtaining one leak rate test depicting unidentified leakage less than 1 gpm every 72 hours during plant operation. Mehler Prep. St., p. 3. Mr. Mehler knew that if a satisfactory test result were not obtained within that period, it would be necessary to enter the Action Statement of Technical Specification 3.4.6.2. Tr. 3846. In fact, on October 18, 1978, he was preparing to shut down Unit 2 if, by the end of his shift, he was unable to obtain a satisfactory leak rate test. Tr. 3847-48; see Tr. 3878, 3896.

643. Mr. Mehler expected his operators to determine the validity of leak rate test results exceeding 1 gpm of unidentified leakage. Mehler Prep. St., p. 3. He testified that the operators did this by running another leak rate test, and by evaluating the leak rate test result against other plant indications. Id. Mr. Mehler was aware of the practice of discarding leak rate tests considered to be invalid. He relied upon the CROs under his supervision to determine the validity of a given test. Id., pp. 3-6. He believed that his operators

would have known to enter the Action Statement if a leak rate test exceeding the 1 gpm LCO appeared valid. Id.; Tr. 3854.

644. Mr. Mehler could recall LER 78-62/1T only through subsequent investigations; it did not change his understanding of the Technical Specifications. Tr. 3857-59; Mehler Prep. St., p. 6. The only reason he believes that he read the LER is because his initials are on the coversheet of the version sent to the control room. Tr. 3858.

645. Mr. Mehler did recall being on shift on October 18, 1978, the day of the events that triggered the LER. See Tr. 3879. He received the impression then from Mr. Floyd that Mr. Haverkamp had approved the rounding off of the value for unidentified leakage. Tr. 3880, 3883-94. After talking with Mr. Floyd, Mr. Mehler rounded off the result of NRR Test No. 13 (Stier Test No. 144). Tr. 3891.

646. At Unit 1, Mr. Mehler observed that an addition of hydrogen to the MUT produced a slight increase or decrease in the MUT level indication. This negligible change convinced him that adding hydrogen to the MUT would have no significant effect on leak rate test results. Mehler Prep. St., p. 7. During 1978-79, he had no knowledge of anyone adding hydrogen or water to the MUT to manipulate a leak rate test. Tr. 3845.

647. Mr. Mehler also was unaware that the MUT level strip chart could depict a water addition greater in volume than that actually added. Mehler Prep. St., p. 7. No one on

Mr. Mehler's shift manipulated leak rate tests through water additions to the MUT. E.g., Tr. 1485, 1552.

648. Mr. Mehler could not recall whether he was on duty on February 15, 1979, when the words "Pressurized MUT" were written on the MUT level strip chart. Tr. 3898. (Given his dual responsibilities for the two Units, and our observation that TMI-2 shift supervisors had little direct involvement in leak rate testing (see Tr. 3844) it is not surprising that Mr. Mehler would be unaware of the notation.) Mr. Mehler testified that the handwriting was not his. Tr. 3899. He could not identify the handwriting as that of his shift foreman, Mr. Adams, although he felt that he was familiar enough with Mr. Adams' handwriting to have been able to identify it. Id. Morevoer, Mr. Mehler testified that he would "find it hard to believe that he [Mr. Adams] could be a party to anything that was wrong." Tr. 3907. Mr. Mehler was not familiar enough with the handwriting of Mr. Congdon, Mr. Cooper or Mr. Phillippe to say whether the handwriting was theirs. Tr. 3899.

649. Mr. Mehler recalled that the practice of not applying the "Exceptions and Deficiencies" Procedure to invalid leak rate test results was carried over from Unit 1. Tr. 3870. It never occurred to him to question the practice and he could not say how or why it developed. Mehler Prep. St., p. 4; Tr. 3870.

650. Mr. Mehler could not recall receiving any specific training on the safety significance of the leak rate test. Tr. 3859-60. He did recall that he had general training on the Technical Specifications and their bases. Tr. 3860. However, most of his knowledge about the leak rate test came from his experience as a CRO in Unit 1. Tr. 3853.

651. Other than NRR Test No. 13, (Stier Test No. 144) the only leak rate Test in which Mr. Mehler appears to have been involved is NRR Test No. 68 (Stier Test No. 90). Exhibit 5-B, Attachment 5, Table 9. No investigator has alleged that it was manipulated. Exhibit 5-B, Attachment 1; Stier Report, Vol. IV(F), Test No. 90. Accordingly, we find that Mr. Mehler had virtually no direct involvement with leak rate testing at TMI-2, and we exonerate Mr. Mehler of any awareness of, or involvement in, leak rate test falsification or manipulation at TMI-2. Because Mr. Mehler lacked any awareness of leak rate testing improprieties during 1978-79, and could not reasonably have been expected to have known of such actions, we also exonerate him of culpable neglect concerning TMI-2 leak rate testing.

U. Charles F. Mell.

652. Mr. Mell became employed by Met Ed as an AO in 1976. Mell Prep. St., p. 1, ff. Tr. 3239. He became a CRO trainee in 1978. Tr. 3263. Mr. Mell received his RO license in the summer of 1979. Mell Prep. St., p. 1. He has not

retained that license in his position as a self-employed nuclear consultant. Exhibit 5-B, Attachment 5, Table 1; Mell Prep. St., p. 1. In January 1979, Mr. Mell was assigned to "B" shift in TMI-2, still as a trainee. Mr. Mell remained in that position through March 1979 when he took his NRC licensing examination. Mell Prep. St., p. 1; Tr. 3267. While a CRO trainee, Mr. Mell's shift supervisor was Mr. Chwastyk, and his foreman was Mr. Conaway. The other CROs on "B" shift were Messrs. Kidwell and Illjes. Mell Prep. St., p. 1.

653. Mr. Mell did not receive any classroom training on leak rate tests before he became a trainee. Tr. 3247. His leak rate test training consisted of instruction on activating the computer and answering the questions set forth on the test sheet. Id. He recalled that his instruction occurred under the supervision of the CROs or the shift foreman; he believed that they covered the requirements of the procedure with him. Id.

654. Mr. Mell's crew tried to obtain a leak rate test result depicting unidentified leakage under 1 gpm every shift. Mell Prep. St., p. 2. He saw this assignment as a mundane task. Tr. 3272-73. Mr. Mell was not aware of the "leak before break" terminology used by the NRC to describe the purpose of the test. Tr. 3274.

655. Mr. Mell understood that it was necessary to obtain a satisfactory leak rate test result every 72 hours

during plant operation. Mell Prep. St., p. 2. He did not believe that it was necessary to enter the Action Statement of Technical Specification 3.4.6.2 if a leak rate test depicted unidentified leakage over 1 gpm during the 72-hour period. Id.

656. Mr. Mell discarded all leak rate tests depicting a value for unidentified leakage greater than 1 gpm, but he tried to analyze plant conditions before he discarded the tests. Tr. 3251. He has difficulty today recalling what criteria he employed; however, he believes that he checked for steady state conditions, and that he observed level indicators, relevant pressures and temperatures. Tr. 3248. Based on that information, he made a judgment about the validity of the test. Tr. 3250. He did not show the tests he determined were invalid to the shift foreman. Tr. 3243. Mr. Mell's willingness to accept leak rate tests with unidentified leakage under 1 gpm is shown by his signing of a Test (NRR Test No. 9, Stier Test No. 153) with -8.5 unidentified leakage. Exhibit 5-B, Attachment 5, Table 11, p. 1; Stier Report, Vol. III(A), Table 1. We agree with Mr. Mell that his relative inexperience in the control room also influenced his submission of this Test. Tr. 3253-54. Mr. Mell signed four other leak rate Tests reflecting negative values for unidentified leakage. Stier Report, Vol. III(A), Table 1, Test Nos. 67, 58, 56, 44. These Tests, however, were within a -0.1 gpm to -1.0 gpm range. Id. We have already concluded that a limited range of negative values

would have been expected by the operators. See ¶¶ 220-22. Taken in context, therefore, his submission of these five negative leak rate Tests does not show a willful disregard for the accuracy of the results.

657. Mr. Mell had no recollection of LER 78-62/1T. Mell Prep. St., p. 4. That LER had no effect on the way he performed leak rate tests, and he could not recall receiving any instruction on implementation of the LER. Tr. 3245.

658. Mr. Mell knew that there was a problem with the stability of one of the MUT level transmitters. Tr. 3255. He believes that he knew that the unstable MUT level transmitter should not be used to provide data to the computer during a leak rate test. Id. Although he signed two Tests with an out-of-service MUT level transmitter providing data to the computer, there is no evidence that he did so to manipulate the Tests. Tr. 3254-55, 1756 (Russell).

659. Mr. Mell had no knowledge of the effect that hydrogen additions to the MUT could have on leak rate test results, and there is no evidence that he added hydrogen to falsify test results. Tr. 3243-44, 1486-87, 1492 (Russell), 1497-98 (Stier). He was unaware of the hydrogen experiment performed by his shift supervisor, Mr. Chwastyk (see ¶¶ 262-63, supra), and he was unaware of any instruction to refrain from adding hydrogen to the MUT during leak rate testing. Tr. 3244, 3282. Mr. Mell believed that by February 19, 1979 (the likely

date of Mr. Chwastyk's experiment), he was no longer on shift. Tr. 3267. He believed that he was studying for his NRC licensing examination which had been scheduled for March 1979. Id. Mr. Mell's name was not on leak rate tests or in the CRO log book between February 12, 1979 and March 26, 1979, Stier Report, Vol. III(A), Table 1, lending credence to his recollection.

660. There is no evidence that Mr. Mell performed a leak rate test involving water additions to the MUT to manipulate the test results. Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Tables 7 and 11; Tr. 1486-87 (Russell), 1497-98 (Stier). Mr. Mell failed to account for the addition of water during NRR Test No. 114 (Stier Test No. 44), but there is no evidence that his omission resulted from anything other than failed communications between the operators on shift. Tr. 3257. NRR alleged that its Test No. 28 (Stier Test No. 130) contained an unaccounted-for addition of 330 gallons of water during the Test; MPR disproved this assertion. Exhibit 1-B (Green Volume), Stier Test No. 130; see ¶ 242, supra. Therefore, as Mr. Russell did (Tr. 1486-87), we exonerate Mr. Mell of involvement in, or awareness of, leak rate falsification or manipulation at TMI-2. For the same reasons, we exonerate him of culpable neglect concerning leak rate test practices.

V. Adam W. Miller.

661. Mr. Miller is currently Plant Operations Manager at TMI-2. He holds a SRO license. Exhibit 5-B, Attachment 5, Table 1. Mr. Miller began employment with Met Ed in 1973 as an AO at Unit 1. He was promoted to CRO in August 1975 and shift foreman at TMI-2 in August 1978. Miller Prep. St., p. 1, ff. Tr. 3608. Between March and August 1978 he was a CRO at TMI-2. Tr. 3612. He appears to have been assigned to "C" shift during that period. Stier Report, Vol. III(A), Table 1.

662. Between August 1978-March 1979, Mr. Miller was the foreman on "D" shift in TMI-2. Miller Prep. St., p. 2. Messrs. Coleman, Wright, and Olson were "D" shift CROs and Mr. Hitz was the shift supervisor. Id., p. 2.

663. Mr. Miller was responsible for supervision of the monitoring of RCS leakage. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, pp. 9, 34; Miller Prep. St., p. 2. He relied on the leak rate test as a method of demonstrating compliance with the 1 gpm LCO for identified leakage. Id., p. 2. While he knew that his shift would have to enter the Action Statement of Technical Specification 3.4.6.2 if unidentified leakage really exceeded that limit, he did not believe that the leak rate tests he saw demonstrated that unidentified leakage exceeded 1 gpm. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, pp. 73-74. He believed that he would have known if the value for unidentified leakage on leak rate test results in

excess of 1 gpm was a reflection of actual plant leakage, because the AOs and he continually searched for leaks. Id.; see Miller Prep. St., pp. 2-3. Other indications of leakage monitored by Mr. Miller included instruments for reactor building atmospheric sampling, the leak detector channel in the reactor building air coolers, and the reactor building sump. Id. He now understands that his reliance on these other means of for leak detection did not enable him to determine precisely the amount of unidentified leakage. Id., p. 3.

664. Mr. Miller learned how to perform the leak rate test as a CRO at TMI-1. Tr. 3614. He believes that he understood that the 1 gpm LCO for unidentified leakage was related to plant safety, but he was not trained on the safety significance of the leak rate test. Tr. 3628; Stier Report, Vol. VI(I), 3/20/85 Miller Interview, pp. 18-23. He learned in his classroom training that the most sensitive leak detection system in the plant was the radiation monitoring system, and relied on the radiation monitoring system to alert him to the development of leakage. Id.; Tr. 3652. Mr. Miller learned after the TMI-2 accident that the radiation monitoring system was not as accurate as he previously had thought it to be. Tr. 3654.

665. Mr. Miller discarded leak rate tests himself. Tr. 3611, 3615. When he became a shift foreman, he permitted his operators to discard leak rate test results reflecting

unidentified leakage in excess of the 1 gpm LCO, and he did not conduct a review of the tests that the operators discarded. Tr. 3615; Stier Report, Vol. VI(I), 3/20/85 Miller Interview, p. 98. He filed all leak rate tests reflecting unidentified leakage under 1 gpm. Tr. 3646.

666. Mr. Miller believed that the leak rate test was inaccurate, because test results varied considerably despite no apparent changes in plant conditions, Tr. 3647; see, ¶ 335, supra, but he did not further investigate those inaccuracies. However, he now understands how desirable it would have been to have done so. Tr. 3647-48.

667. Mr. Miller did not believe that he was the shift foreman involved in the incident described by Mr. Coleman in which Mr. Coleman had submitted a leak rate test depicting unidentified leakage in excess of 1 gpm. Tr. 3629-30. Mr. Coleman recalled that he was then advised that his supervisors were not interested in seeing such results. Coleman Prep. St., p. 3, ff. Tr. 2579; Tr. 2585-86. Mr. Miller did not seem to be the type of individual who would have confronted subordinates in that manner. Tr. 3629-30. Moreover, based on Mr. Coleman's recollection that this incident occurred early in TMI-2's history and involved some of the first leak rate tests performed, it is not possible to identify Mr. Miller as the involved shift foreman, because he

did not become Mr. Coleman's foreman until August 1978. Tr. 2578, 2584 (Coleman); Miller Prep. St., p. 1.

668. Mr. Miller now understands that he should have applied Administrative Procedure 1010, the "Exceptions and Deficiences" Procedure, to leak rate tests. Tr. 3648. He did not apply the "Exceptions and Deficiencies" Procedure to invalid leak rate test printouts, because those printouts were not considered surveillance tests and were discarded. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, p. 76. Mr. Miller did not consider the leak rate test comparable to other surveillance tests. Tr. 3648-49.

669. Mr. Miller did not require his CROs to log the start and completion times of all leak rate surveillance tests. Tr. 3611. He did recall that his shift logged the completion of leak rate tests to keep track of the 72-hour period applicable to their performance. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, p. 81. His shift did not log unsatisfactory leak rate tests, because leak rate tests were not regarded as official surveillance tests until validated. Id., pp. 82-83. Based upon Mr. Miller's explanation, there is no evidence to conclude that his shift refrained from logging leak rate tests to hide the frequency of their performance.

670. Mr. Miller had no independent recollection of LER 78-62/1T, although he did initial the check-off sheet associated with it. Tr. 3618-19. He believes that the meaning

did not become Mr. Coleman's foreman until August 1978. Tr. 2578, 2584 (Coleman); Miller Prep. St., p. 1.

668. Mr. Miller now understands that he should have applied Administrative Procedure 1010, the "Exceptions and Deficiences" Procedure, to leak rate tests. Tr. 3648. He did not apply the "Exceptions and Deficiencies" Procedure to invalid leak rate test printouts, because those printouts were not considered surveillance tests and were discarded. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, p. 76. Mr. Miller did not consider the leak rate test comparable to other surveillance tests. Tr. 3648-49.

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670. Mr. Miller had no independent recollection of LER 78-62/1T, although he did initial the check-off sheet associated with it. Tr. 3618-19. He believes that the meaning

of that LER was never made clear to him, Tr. 3620, because he does not recall ever going into the Action Statement. Stier Report, Vol. VI(I), 3/20/85 Miller Interview, p. 55. He now understands that he should have communicated its message to his operators and insisted upon their compliance with it. Tr. 3619.

671. Mr. Miller approved five leak rate Tests that NRR claimed were questionable because they were performed with a faulty MUT level transmitter providing inputs to the computer. Exhibit 5-B, Attachment 5, Table 9; id., Table 11 (NRR Test Nos. 33, 35, 50, 66, and 70). Of the five, NRR speculated that NRR Test No. 50 involved switching from the stable MUT level transmitter (LT-2) to the erratic level transmitter (LT-1). Tr. 1593, 1596 (Capra). LT-1 was still tagged out of service when that Test was conducted; however, NRR agreed that it was possible that it had already been repaired by the time that Test was run. Tr. 1596 (Capra). We find that it is not possible to conclude that an erratic level transmitter was providing inputs to the computer during that Test. Tr 1599 (Stier). Moreover, the leak rate test sheet and the MUT level strip chart are in close agreement for that Test. Stier Report, Vol. IV(G), Stier Test No. 108.

672. As to the other four leak rate Tests in which a faulty level transmitter was allegedly used, the printout and MUT level strip chart for those Tests do not agree. Mr. Miller

would not have detected a discrepancy between a test result and the MUT level strip chart, because he did not review the strip chart together with leak rate tests. Tr. 3639. Mr. Russell conceded that there was no requirement that the MUT level strip chart be consulted vis-a-vis leak rate tests. Tr. 1077. In any event, Mr. Miller would have informed the operators if a level transmitter wre declared out of service, id., but he would have depended on the operators to discover, initally, a malfunctioning MUT level transmitter, id., and to evaluate a leak rate test accordingly. Tr. 3659. Therefore, we cannot find that Mr. Miller's acceptance of these Tests for filing can be viewed as culpable neglect. See Tr. 2352 (Capra).

673. Mr. Miller would not have disapproved of the addition of water during leak rate tests if an operator deemed the addition necessary, as long as the addition were logged and entered into the computer calculation. Tr. 3625. He shared a common perception on his shift that it was permissible to add water if it were accounted for. Tr. 3625-26; Tr. 2683 (Wright); Tr. 3927 (Olson). Mr. Miller approved nine leak rate Tests in which it is alleged that results were manipulated by the addition of water to the MUT in the latter part of each Test. Exhibit 5-B, Attachment 5, Table 11 (NRR Test Nos. 122, 129, 131, 133, 138, 139, 140, 141, and 146). NRR Test No. 132 (Stier Test No. 26) was omitted by NRR, because NRR believed that this Test was affected by a "feed and bleed" operation,

and its results were not manipulated. Tr. 1817-18 (Capra). NRR Test No. 144 (Stier Test No. 14) was omitted by NRR, because it involved an unconfirmed water addition. Exhibit 1-B (Green Volume), Stier Test No. 14.

674. Mr. Coleman admitted that he added water to the MUT close to the end of a leak rate test, because of its effect on the MUT level recorder. Tr. 2597-98. Mr. Wright testified that he added water to the MUT to make the test more accurate. Tr. 2678. Neither Mr. Coleman nor Mr. Wright discussed their reasons for water additions with each other, Tr. 2704 (Wright), Tr. 2604 (Coleman), or with Mr. Miller. Tr. 3644 (A. Miller), 2678-79 (Wright), 2604 (Coleman). Mr. Hitz was convinced that Mr. Miller was totally unaware of the leak rate test manipulation or falsification on their shift. Tr. 3628-29.

675. Mr. Miller did not notice any pattern of water additions made by his operators. Tr. 3644. The leak rate Tests in question were all performed during a period of high identified leakage from the pressurizer that necessitated frequent water additions to the MUT. See ¶¶ 293, 303, supra. Therefore, and given the relatively short duration of this period, we cannot find sufficient evidence to conclude that Mr. Miller was aware of the existence of manipulation or falsification. Exhibit 5-B, Attachment 5, Table 11, pp. 18, 19; Stier Report, Vol. III(A), Table 1.

676. Mr. Miller did recall that the leak rate test procedure did not prohibit the addition of hydrogen to the MUT during a leak rate test. Tr. 3625. He was not aware that such an addition could have an effect on leak rate tests until well after March 28, 1979. Tr. 3627. There is only one leak rate Test (NRR Test No. 36) performed by Mr. Miller's shift during which hydrogen was added. Exhibit 5-B, Attachment 5, Table 10. That logged hydrogen addition had no effect on the Test. Exhibit 5-B, Attachment 5, Table 11; Exhibit 1-B (Green Volume), Stier Test No. 122.

677. Mr. Miller was frank to concede that, in retrospect, the attitude that existed on his shift towards the leak rate test was not what it should have been. Tr. 3646, 3656. However, in the absence of any evidence that Mr. Miller was aware of the purpose for the water additions made by Messrs. Wright and Coleman to the MUT during leak rate tests, we exonerate Mr. Miller of awareness of, or involvement in, leak rate test falsification or manipulation at TMI-2. Mr. Stier and Mr Christopher did not conclude that Mr. Miller was aware of, or involved in, leak rate test manipulation or falsification. Stier Report, Vol. II(B), A. Miller Assessment, p. 1; Exhibit 6, OI Report, Enclosure 1, p. 28; Tr. 2384-85. In light of these findings, we reject NRR's conclusion that Mr. Miller must have known of the leak rate test practices of Messrs. Wright and Coleman. Exhibit 5-A, Enclosure 2, p. 17.

Mr. Miller was not guilty of culpable neglect toward the leak rate test because of his lack of knowledge of the purpose for those water additions and because the additions were made during a period in which they were necessary.

W. Gary P. Miller.

678. None proposed.

X. Frederick J. Scheimann, Jr.

679. During 1978-79, Mr. Scheimann was the shift foreman assigned to "A" shift. His CROs were Messrs. Frederick and Faust, and his shift supervisor was Mr. Zewe. Scheimann Prep. St., p. 2, ff. Tr. 2831. Mr. Scheimann currently is employed as a training consultant by Mechanical Equipment Consultants, and he is stationed at the Crystal River Nuclear Power Plant. Id., p. 1. He does not maintain a license to operate a nuclear power plant. Exhibit 5-B, Attachment 5, Table 1; Tr. 2790.

680. Mr. Scheimann complied with the 1 gpm LCO for unidentified leakage by obtaining at least one satisfactory leak rate test every 72 hours during plant operation. Tr. 2802. If one leak rate test meeting the 1 gpm LCO was obtained during a 72-hour period, Mr. Scheimann believed that he did not have to enter the Action Statement of Technical Specification 3.4.6.2, even if another leak rate test result exceeded the 1 gpm LCO during that period. Tr. 2802-03, 2805. However,

Mr. Scheimann did respond to leak rate test results depicting unidentified leakage in excess of 1 gpm by checking for operator error or searching for leakage. Tr. 2803.

681. Mr. Scheimann viewed the leak rate test as a tool to aid in the detection of RCS leakage. Tr. 2792-93. He did not recall that the leak rate test had inherent problems, or that satisfactory leak rate test results became increasingly difficult to obtain during February-March 1979. Tr. 2789. Presumably, Mr. Scheimann was not aware of problems with the leak rate test because he did not have to perform it, id., and because his shift encountered fewer difficulties than other shifts in obtaining leak rate test results meeting the 1 gpm LCO. Scheimann Prep. St., p. 5; Tr. 1493 (Mr. Russell concluded that "shift A did not have the high percentage of invalid or questionable tests that the other shifts had.")

682. Mr. Scheimann directed his shift to perform the leak rate test during every shift if conditions permitted. Scheimann Prep. St., pp. 2-3. As a general rule, if the CROs on his shift obtained a leak rate test result over 1 gpm, they gave it to Mr. Scheimann if they could not invalidate it. Tr. 2787. Mr. Scheimann did not dispute Mr. Frederick's assertion that he gave Mr. Scheimann all of his completed leak rate test results. Tr. 2785. Mr. Scheimann also agreed with Mr. Faust's recollection that Mr. Faust invalidated and discarded some leak rate test results on his own. Tr. 2818. Mr. Scheimann was

most likely to review test results sometime after they had been performed because he was frequently out of the control room. Tr. 2787-88. He never ignored leak rate test results (Tr. 2822), and he discarded only those test results that he deemed invalid. Tr. 2820. As part of his validation process, Mr. Scheimann reviewed MUT level and, on occasion, pressurizer level. Tr. 2788, 2830. In light of what he has learned during the investigation of the TMI-2 accident, Mr. Scheimann now realizes that relying too heavily on such plant indications is not prudent. See Tr. 2831.

683. It is also clear that Mr. Scheimann himself was unaware, during 1978-79, that leak rate tests could be manipulated by either "jogging" water into the MUT (Scheimann Prep. St., p. 4), adding water to the MUT and obtaining the "bonus" effect described in ¶¶ 249-54 supra (Tr. 2809), or adding hydrogen to the MUT (Scheimann Prep. St., p. 4).

684. Mr. Scheimann did not receive classroom training on the performance of leak rate tests. Tr. 2799. He learned how to perform the leak rate test on shift as a TMI-2 CRO. Scheimann Prep. St., p. 1; Tr. 2799. As a shift foreman, Mr. Scheimann generally did not participate in the training process. Id. If he had been asked to supervise a trainee, Mr. Scheimann would have directed his CROs to assume responsibility for leak rate test instruction. Tr. 2801.

685. Although Mr. Scheimann knew that the existence of a negative rate of leakage was theoretically impossible, Tr. 2798, he did approve negative leak rate test results for filing. Tr. 2789. Mr. Scheimann believed that negative leak rate test results were caused by normal changes in plant parameters, such as slight temperature increases, and as such were not aberrant. See Tr. 2788-89, 2798. His belief was well founded. See ¶¶ 221-22, supra. However, he did not approve negative leak rate test results in excess of -1.0 gpm of unidentified leakage. Tr. 2798; see Stier Report, Vol. III (A), Table 1 (Stier Test Nos. 9, 40, 56, 60, 75, and 152) (all between 0 and -1 gpm).

686. According to MPR, Stier Test No. 152 was performed during a reactor start-up, but Mr. Scheimann mistakenly logged the Test as completed just before the start-up began. Stier Report, Vol. III(A), Table 1. Mr. Scheimann certainly could have overlooked the performance of the Test during the start-up, and, given the time he logged it, remained unaware that the Test should have been questioned. In any event, however, Mr. Frederick disputed the effect of the start-up on the Test. Tr. 2463. The issue is a close one, but because there is no allegation that this method was used to manipulate leak rate tests, we do not make any adverse finding about it.

687. Stier Test Nos. 73-75 were performed with an erratic MUT level transmitter (LT-1). Exhibit 5-B, Attachment 5, Table 11; Stier Report, Vol. III(A), Table 1. Because LT-1 was not tagged out-of-service at the time Mr. Scheimann reviewed those Tests, Tr. 2397 (Capra), he would not have detected the error himself unless he had reviewed the MUT level strip chart when each Test was concluded (which he was not required to do, Tr. 1077 (Russell)). Mr. Scheimann did not do this; instead, he reviewed the MUT level strip chart only to assess MUT inventory trends. Tr. 2788. Only a painstaking measurement of the MUT level strip chart would have alerted Mr. Scheimann that Stier Test No. 74 showed an instrument variation. Stier Report, Vol. IV(E), Test No. 74. These few "questionable" Tests are no basis for adverse finding against Mr. Scheimann, particularly in light of the fact that the investigators do not allege that erratic level transmitters were used to falsify leak rate tests. See ¶¶ 270-71, 287-91; see also, Tr. 2352-57 (Capra).

688. To complete our analysis of Mr. Scheimann's filed leak rate tests, he did not approve any tests involving manipulation through either hydrogen or water additions to the MUT. Tr. 1484-94 (Russell); Tr. 1494-98 (Stier). According to NRR, Mr. Scheimann approved two Tests involving "questionable" water additions to the MUT: NRR Test No. 98 (Stier Test No. 60) and NRR Test No. 149 (Stier Test No. 9). Exhibit 5-B,

Attachment 5, Tables 9 and 11; Stier Report, Vol. III(A), Table 1.

689. NRR claimed that its Test No. 98 had a possible water addition to the MUT six minutes before the end of the leak rate test. Exhibit 5-B, Attachment 5, Table 11, p. 14. MPR did not agree that water was added during that Test because it appeared the trace deflections during the Test were similar to others around the time of the Test, and the level trace had a uniform overall slope before and after end of the Test. Exhibit 1-B (Green Volume), Stier Test No. 60.

690. NRR Test No. 149 involved an alleged water addition to the MUT nineteen minutes before the end of the leak rate Test which caused a 36-gallon differential between the amount of water recorded and the amount shown on the MUT level strip chart; nevertheless, we accept MPR's conclusion that a legitimate operational reason existed for that water addition, and note that this comports with our finding (¶¶ 293, 303, supra) that water additions to the MUT during February-March 1979 were needed to maintain proper boron concentration in the RCS. Exhibit 5-B, Attachment 5, Table 11; Stier Report, Vol. III (A), Table 1. Accordingly, we find no basis to agree with NRR's allegations about its Test Nos. 98 and 149.

691. NRR found that Mr. Scheimann's shift did not add hydrogen to the MUT during leak rate tests (Exhibit 5-A, Table

10) and Mr. Stier agreed. See ¶¶ 255-66, supra; Tr. 1494-98 (Stier).

692. During 1978-79, Mr. Scheimann never realized that he was not complying with Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, by not applying that procedure to invalid leak rate tests. Tr. 2794. His noncompliance did not result from management pressure to refrain from applying that procedure, but rather, it resulted from the fact that no one informed him that the procedure applied to leak rate tests. Tr. 2795.

693. Mr. Scheimann was not aware that his operators were not logging the start or the stop time of leak rate tests in accordance with Administrative Procedure 1012. Messrs. Faust and Frederick assumed responsibility for their logkeeping practices in stating that they considered the leak rate test a routine evolution that did not require logging. Faust Prep. St., p. 4, ff. Tr. 2511; Frederick Prep. St., p. 5, ff. Tr. 2447. Mr. Scheimann was following the consistent practice at TMI in not applying AP 1010 and AP 1012 to leak rate tests. See Floyd Prep. St., pp. 2-3, ff. Tr. 4894.

694. Mr. Scheimann agreed that it was his responsibility to communicate the meaning of an LER to his CROs. Tr. 2812. He was unable to recall whether he analyzed LER 78-62/1T, or instructed his shift about the interpretation of the Technical Specifications that it reported. Tr. 2807.

Mr. Scheimann was unsure whether he ever changed his interpretation that only one leak rate test result depicting unidentified leakage of less than 1 gpm was required every 72 hours. Tr. 2804-05. Both Mr. Frederick and Mr. Faust knew that the Action Statement of Technical Specification 3.4.6.2 would have to be invoked if their shift were unable to invalidate a leak rate test in excess of the 1 gpm LCO. Frederick Prep. St., pp. 9-10, ff. Tr. 2447; Faust Prep. St., p. 7, ff. Tr. 2475; Tr. 2524-25, 2556. While we cannot determine whether Mr. Scheimann had a similar understanding (Tr. 2804-05, 2830), we do find that "A" shift personnel took leak rate testing seriously and they did understand that a leak rate test in excess of limits required further scrutiny. Tr. 2817 (Scheimann); Tr. 2524 (Faust); Tr. 2475 (Frederick).

695. In summary, we find that Mr. Scheimann, was an accessible, conscientious shift foreman. Tr. 2557 (Faust). As we have found, the majority of the leak rate tests he approved for filing were valid (Exhibit 5-B, Attachment 5, Table 9); none of the leak rate tests he approved involved manipulation. Tr. 1484-94 (Russell); Tr. 1494-98 (Stier). Mr. Scheimann obviously conducted himself in a manner that encouraged the development of sound operational practices.

696. The investigators were unanimous in concluding that "A" shift did not falsify or manipulate leak rate tests. Tr. 1486-87 (Russell), 1494-98 (Stier); see Stier Report, Vol.

II(A), Tab F, Assessments of Messrs. Faust and Frederick. Therefore, and in the absence of evidence to the contrary, we exonerate Mr. Scheimann of any involvement in, or awareness of, leak rate test falsificatin or manipulation. Similary, there is no evidence of culpable neglect involving Mr. Scheimann.

Y. Bernard G. Smith.

697. Mr. Smith has been an employee of Met Ed and GPU Nuclear for 28 years. He was a shift foreman in Unit 1 and a dual licensed shift supervisor in both Units. Smith Prep. St., p. 1, ff. Tr. 4331.

698. During 1978-79, Mr. Smith supervised "E" shift at TMI 2. His shift foreman was Mr. Hoyt and his CROs were Messrs. Hartman, Booher, and Blessing (a trainee). Smith Prep. St., p. 1. As a supervisor, Mr. Smith was generally not directly involved in leak rate testing. Smith Prep. St., p. 2, ff. Tr. 4331; see Tr. 4333 (Kelley, J.). He could not recall ever having performed a leak rate test at TMI-2 in 1978-79. Smith Prep. St., p. 2, ff. Tr. 4331. There is no leak rate test in the record performed by Mr. Smith, and there are only two leak rate tests approved by him; one of these was performed by a different shift. See Exhibit 5-B, Attachment 5, Table 9. However, Mr. Smith has acknowledged that as a shift supervisor he was ultimately responsible for ensuring that leak rate tests were performed properly. Stier Report, Vol. VI(J), Tab S, 2/8/85 Smith Interview, pp. 6-7.

699. Mr. Smith believed that TMI-2 was required to obtain one leak rate test with unidentified leakage under 1 gpm every 72 hours during plant operation. Tr. 4354-56. Mr. Smith was committed to maintaining a safe plant (Tr. 4350), but he believed that the 1 gpm LCO was not directly related to plant safety. Tr. 4350-51; see ¶¶ 171-72, supra. Further, he observed that leak rate test results were often random (Tr. 4358), and he believed that the computer program used to conduct the leak rate test was inaccurate. Tr. 4352-53.

700. Mr. Smith, therefore, considered it important to search for leakage to verify leak rate test results. Tr. 4349. Leaks that were discovered would, of course, be measured or repaired. Id. Mr. Smith recalled that leak rate test results with unidentified leakage higher than 1 gpm were not discarded automatically; rather, such test results were discarded only if they appeared to be invalid. Smith Prep. St., p. 3. There was, as Mr. Smith testified, no ulterior motive that prompted the discarding of leak rate tests. Id. Moreover, Mr. Smith could not recall ever instructing Mr. Hoyt not to leave "bad" tests "lying around." Tr. 4364.

701. Mr. Smith was aware that his shift encountered difficulties in obtaining leak rate test results that depicted unidentified leakage below 1 gpm. He attributed the problem primarily to the TMI-2 computer's software. Tr. 4341. Mr. Smith believed that those who were technically competent to do

so were devoting time to correct the computer program. Tr. 4352-53; Smith Prep. St., p. 5. Mr. Smith believed that unidentified leakage never exceeded 1 gpm, Tr. 4258-60, and he never believed that it was unsafe to operate the plant. Stier Report, Vol. VI(J), Tab S, 2/8/85 Smith Interview, p. 76. During 1978-79, Mr. Smith was unaware of any period during which TMI-2 was not in compliance with the leak rate Technical Specifications. Tr. 4358.

702. Mr. Smith placed greater reliance on his ability to detect leakage through his visual review of plant parameters than he did on the numbers reflected on the leak rate test computer printout. Tr. 4367; Smith Prep. St., p. 4. He recognizes now that his over-reliance on his own ability to visually detect leakage was misplaced. Tr. 4360. As he stated before this Board, "[w]e have learned an awful lot since those days." Id.

703. Mr. Smith did not require that the start time of leak rate tests be recorded. Smith Prep. St., p. 3. Mr. Smith was unaware that his shift was not applying Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to leak rate tests. Tr. 4344. This was a practice initiated at Unit 1 for reasons he did not know. Tr. 4345-46. In addition, Mr. Smith could not recall any training to comply with Administrative Procedure 1010 insofar as leak rate testing was concerned. Tr. 4344. Mr. Smith testified that, in retrospect,

"[W]e didn't do things the right way at that time." Tr. 4347. Mr. Smith also testified that, in general, the training he received was very limited compared to present industry practices. Tr. 4361-62.

704. Mr. Smith was unaware of any falsification or manipulation of leak rate tests that may have occurred on his shift. Tr. 4374; Smith Prep. St., pp. 6-7. His lack of knowledge of such actions was confirmed by Mr. Hartman. Tr. 2241, 2286, 2292, 2303. Mr. Hartman has consistently testified that Mr. Smith was not necessarily aware of his leak rate test falsification. Stier Report, Vol. VI(F), 7/16/82 GPU v. B&W Deposition, pp. 1-2; id., 8/18/82 GPU v. B&W Deposition, p. 276. Mr. Smith testified that he was surprised by Mr. Hartman's and Mr. Blessing's admissions regarding leak rate test manipulation. Tr. 4374; Smith Prep. St., p. 7, ff. Tr. 4331.

705. Mr. Smith did hear some speculation concerning the effect of hydrogen additions to the MUT on leak rate test results. Tr. 4372. He could no longer recall with whom he discussed the subject, Tr. 4378-79, but he denied that he was aware that operators were adding hydrogen to the MUT to affect the leak rate test. Tr. 4373. Mr. Smith agreed that it would be possible for an operator to add hydrogen to the MUT without him being aware of it, because he did not personally supervise the performance of the leak rate test. Tr. 4375. As he

stated, "[b]eing a shift supervisor I was, you know, quite far removed from watching day-to-day, or hour-by-hour operators operate the console." Tr. 4372.

706. Mr. Smith did not believe that he or his shift foreman, Mr. Hoyt, could have detected the falsification or manipulation of leak rate tests. Tr. 4375-77. He stated that the leak rate test was the type of task which they should have been able to trust CROs to perform properly. Tr. 4377. Mr. Smith also testified that Mr. Hoyt probably would not have detected leak rate test falsification or manipulation, in part because he did not have the type of social relationship with his shift that might have made him aware. Id.

707. Mr. Smith did not recall any of the events leading up to the issuance of LER 78-62/1T, but he did initial the sign-off sheet attached to it. Tr. 4362-63. Mr. Smith recalled that his shift did not change its interpretation of the Action Statement after its issuance. Tr. 4363.

708. Based on the above findings, there is no evidence that Mr. Smith was aware of or involved in, leak rate test falsification or manipulation at TMI-2. Given his lack of involvement in leak rate testing, we also cannot find that he was guilty of culpable neglect. Mr. Stier agreed that there was insufficient to conclude that he was involved in, or aware of, leak rate test falsification or manipulation. Stier Report, Vol. II(B), Tab S, Smith Assessment, p. 1.

Z. William H. Zewe.

709. Mr. Zewe began employment with Met Ed in 1972 as an AO. In 1973, he was promoted to shift foreman, and in 1976 he was promoted to shift supervisor. At Unit 2, he supervised "A" shift which was comprised of Messrs. Scheimann (the shift foreman), Faust, and Frederick. Zewe Prep. St., p. 1, ff. Tr. 2946. Mr. Zewe is still employed by Met Ed as Manager of Titus Generating Station. Id. He no longer holds a license to operate a nuclear power plant. Exhibit 5-B, Attachment 5, Table 1.

710. Mr. Zewe acknowledged that, as shift supervisor, it was his ultimate responsibility to ensure that unidentified leakage was below the 1 gpm LCO prescribed by the Technical Specifications. Tr. 2951. The shift foreman directed actual compliance with leak rate testing practices, however. Zewe Prep. St., p. 2. Mr. Zewe could not recall ever performing a leak rate test (Tr. 2949), and he never formally approved a test for filing from September 30, 1978 to March 28, 1979. Exhibit 5-B, Attachment 5, Tables 9 and 11.

711. Mr. Zewe knew that to comply with the Technical Specification requirement that unidentified leakage be kept within the 1 gpm LCO, his shift sought a leak rate test depiciting unidentified leakage of less than 1 gpm during a 72-hour period while the plant was in operation. He recalled that his shift tried to perform a leak rate test at least every

day and sometimes every shift. Zewe Prep. St., p. 2. He thought that his shift would have entered the Action Statement of Technical Specification 3.4.6.2 in response to a valid leak rate test result over 1 gpm (id.; Tr. 2972-73, 2979), although he does not recall his shift ever doing so. Tr. 2961, 2974.

712. Mr. Zewe testified that his operators were not authorized to discard leak rate tests in excess of the 1 gpm LCO, unless they had made a determination that the test was invalid. Tr. 2958; Zewe Prep. St., p. 3. Mr. Zewe expected his operators to make this determination on their own. Id. They did not have to explain their decision to Mr. Zewe or to his shift foreman, Mr. Scheimann. Tr. 2959. Mr. Zewe does not recall ever discarding a leak rate test. Tr. 2995.

713. The record does demonstrate that members of "A" shift were conscientious in evaluating leak rate test results against other plant parameters. Tr. 2817 (Scheimann); Tr. 2524-25, 2533 (Faust); Tr. 2475-78 (Frederick). Indeed, Mr. Zewe recalls that he personally investigated for, and inspected, leaks in the plant on many occasions. Zewe Prep. St., pp. 2-3.

714. Mr. Zewe thought that the 1 gpm standard for unidentified leakage was "too conservative", because of Unit 2's oscillation problems and because of the large volume of water in the RCS. Tr. 2955-56; see ¶¶ 171-72, supra. He recalls believing that it would be merely a matter of time

until the oscillations and inaccuracies in the leak rate test procedure were resolved, and the leak rate program and the new plant became compatible. Tr. 2953, 2957.

715. During 1978-79, Mr. Zewe was not aware of leak rate tests being manipulated through any method. Tr. 2691. Specifically, he had no awareness of leak rate test manipulation through the addition of either hydrogen or water to the MUT (Zewe Prep. St., p. 6; Stier Report, Vol. VI(K), Tab Z, 3/29/84 Zewe Interview, pp. 43-45), or through the switching of MUT level transmitters. Zewe Prep. St., p. 5. Prior to the TMI-2 accident, Mr. Zewe was not aware of the effect that hydrogen additions to the MUT could have on leak rate test results. Zewe Prep. St., p. 6; Stier Report, Vol. VI(K), Tab Z, 3/29/84 Zewe Interview, p. 50. Nor does he have any independent recollection of the malfunctioning of MUT level transmitters during 1978-79. Zewe Prep. St., p. 5.

716. Mr. Zewe did not require his shift to apply Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to invalid leak rate test results. Zewe Prep. St., p. 6; Tr. 2988. He could not explain why that Administrative Procedure had not been applied to leak rate tests. Tr. 2989. Mr. Zewe recalled that only the completion times of satisfactory leak rate tests were logged by his shfit, rather than the start and stop times of all leak rate tests. Tr. 2351. Messrs. Faust and Frederick assumed responsibility

for that interpretation of AP 1012 in light of their belief that "routine" surveillances such as leak rate tests did not have to be logged. Faust Prep. St., p. 4, ff. Tr. 2511; Frederick Prep. St., p. 5, ff. Tr. 2447.

717. Mr. Zewe could not recall any of the circumstances leading to the issuance of the November 1, 1978 LER concerning leak rate testing, although he does recall that leak rate test results were rounded to whole numbers for a short period of time. Zewe Prep. St., pp. 6-7; Tr. 2969-70. He did try to read all documents on the required reading list. Tr. 2969. It was Mr. Zewe's responsibility to see that his shift received and understood the information contained in the LER. Tr. 2968. In fact, both Mr. Faust and Mr. Frederick understood the proper interpretation of the Action Statement during 1978-79. Faust Prep. St., pp. 6-7, ff. Tr. 2511; Frederick Prep. St., pp. 2, 9, ff. Tr. 2447.

718. Mr. Zewe is now aware that the calculation accompanying the March 16, 1979 TCN to the leak rate Surveillance Procedure was incomplete, but he was unaware of that omission at the time the TCN was issued. Tr. 2988; see ¶ 191, supra.

719. We find that a substantial number of the leak rate tests filed by Mr. Zewe's shift were valid. Tr. 1484-94. The investigators have agreed that Mr. Zewe's shift did not manipulate leak rate tests. Tr. 1486-87 (Mr. Russell stated

that "there was insufficient evidence to support a conclusion that they [Messrs. Faust, Frederick et al.] engaged in intentional leak rate manipulation."); see Stier Report, Vol. II(B), Tab Z, Zewe Assessment, p. 1; Tr. 1494-98 (Stier). Accordingly, and in the absence of any evidence to the contrary, we find that there is no evidence that Mr. Zewe was aware of, or involved in, leak rate test falsification or manipulation at TMI-2. Based on the above findings, we also exonerate Mr. Zewe of culpable neglect with respect to the leak rate test practices at TMI-2.

X. The Non-Parties' Involvement in Leak Rate Testing.

A. John R. Blessing.

720. None proposed.

B. Kenneth P. Bryan.

721. Mr. Bryan began employment with Met Ed in 1967. He became a CRO at TMI-1 in 1974 and a shift foreman at TMI-1 in 1976. Between October 1978-June 1979 he was a dual-licensed shift supervisor. Bryan Prep. St., p. 1, ff. Tr. 4540.

722. Between October-December 1978, Mr. Bryan was a supervisor in training. Tr. 4573. He received a permanent assignment to "F" shift in January 1979. Tr. 4571-72. His shift foreman was Mr. Guthrie and his CROs were Messrs. McGovern, Hemmila, and Germer (a trainee). Mr. Bryan currently is a non-licensed, self-employed nuclear consultant. Bryan Prep. St., p. 1.

723. Mr. Bryan understood that his shift had to obtain a satisfactory leak rate test within a 72-hour period. Tr. 4543. He testified that if a valid leak rate test with unidentified leakage over 1 gpm had been obtained, his shift would have entered the Action Statement of the Technical Specification 3.4.6.2. Tr. 4544.

724. Mr. Bryan presumed that his operators knew as much as he did about Technical Specifications. Tr. 4546. He understood that training occurred on the job as well as during formal training classes. Id. Through his training, Mr. Bryan

was aware of the safety implications of the 1 gpm limit for unidentified leakage. Tr. 4580-81.

725. Mr. Bryan recalled that the validity of leak rate tests was determined by observing containment building radioactivity, containment sump levels, and MUT level. Tr. 4545. He explained that if those levels showed no trend changes, he did not suspect that a leak had developed. Id. He now realizes that his reliance upon these methods would have prevented his detection of a small, developing leak and that his emphasis on the use of trend detection was insufficient. Tr. 4546.

726. Mr. Bryan did not normally review leak rate test results. There are no tests from September 1978 through March 28, 1979 which he performed or approved. Exhibit 5-B, Attachment 5, Tables 9 and 11; Stier Report, Vol. III, Table 1.

727. Mr. Bryan was aware, in 1978-79, that the addition of hydrogen to the MUT affected MUT level; he observed that effect during a required addition of hydrogen to the MUT at Unit 1. Tr. 4556-57.

728. Mr. Bryan realized that adding hydrogen to the MUT could affect the leak rate test. Tr. 4563-64. He candidly testified that while he hoped that he had instructed his operators not to add hydrogen to the MUT during a leak rate test, he could not specifically recall issuing such an order. Tr. 4564. There are only two leak rate tests (NRR Test Nos.

121 and 152) performed by his shift during which NRR alleged that hydrogen was added to the MUT. Exhibit 5-B, Attachment 5, Tables 5, 6 and 11; Stier Report, Vol. III(A), Table 1. MPR disagreed with NRR's evaluation of NRR Test No. 121 (Exhibit 5-B, Attachment 3) because the trace deflections were typical of the pattern reflected throughout the day. Tr. 1660 (Stier). Mr. Bryan's shift logged the hydrogen addition during NRR Test No. 152 (Stier Test No. 6). Exhibit 5-B, Attachment 5, Table 11, and MPR did not conclude that the hydrogen addition had an effect on that Test. Stier Report, Vol. III(A), Table 1. We agree that neither of these Tests supports a conclusion that "F" shift's operators manipulated test results through hydrogen additions to the MUT. Tr. 1660 (Capra).

729. Mr. Bryan testified that his shift should have known not to change plant parameters during a leak rate test. Tr. 4564. He indicated that water should have been added prior to the performance of a leak rate test, and that he expected his operators to communicate with each other, if additions to the MUT were required. Tr. 4566, 4584-85. Mr. Bryan's recollection of his shift's communications about water additions is supported by NRR's conclusion that "F" shift included water additions in leak rate tests between January 1, 1979 and March 28, 1979. Exhibit 5-B, Attachment 5, Table 6.

730. Although Mr. Bryan witnessed the effect of a hydrogen addition on MUT level, he did not observe that a water

addition could produce a similar, false MUT reading. Tr. 4555. NRR found three instances where "F" shift "partially included" water additions during leak rate Tests. Exhibit 5-B, Attachment 5, Tables 6 and 10, NRR Test Nos. 150, 151, 153. These Tests were performed after March 16, 1979, Exhibit 5-B, Attachment 5, Table 11, pp. 20-21, during a period in which we have already concluded that water additions were required frequently. See ¶ 254, supra; Stier Report, Vol. I, pp. 101-02. Neither MPR nor NRR concluded that these Tests showed a pattern of manipulation by "F" shift, and we agree that these Tests do not represent operator efforts to falsify or manipulate leak rate tests results, Tr. 1486-87 (Russell); Tr. 1847-49 (Stier).

731. Mr. Bryan recalled that it was difficult to obtain leak rate test results meeting the 1 gpm LCO at TMI-2. Tr. 4570. He attributed the difficulty to the status of the ICS system, and he believed that the problems with the leak rate test would not be resolved until the ICS system was adequately tuned. Tr. 4570, 4608. Mr. Bryan did not believe that the difficulty with leak rate tests was due to a computer problem. Tr. 4607.

732. Mr. Bryan permitted his shift to file a leak rate test result depicting negative unidentified leakage if the result was a small negative number. Tr. 4570; accord, ¶¶ 220-22, supra. He could not remember the range of negative

values he would accept or whether there was a specific rule concerning an acceptable range. Tr. 4571. He considered that the status of Unit 2's development made it possible that negative leak rate tests would result. Tr. 4570. While he agreed that negative leak rate tests might not appear logical, he was convinced that the "swings" in instrumentation in the ICS made it just as likely to obtain a negative as well as a positive leak rate. Tr. 4596; accord, Exhibit 21, p. 3 (affidavit of Mr. Bettenhausen).

733. Mr. Bryan now understands that he and his shift should have recorded start times of leak rate tests, Bryan Prep. St., pp. 3-4, and that they should have applied the "Exceptions and Deficiencies" Procedure to invalid leak rate test results; he candidly attributed the lack of application of Administrative Procedure 1010 to poor judgment. Tr. 4588.

734. Mr. Bryan did not initial the sign-off sheet attached to LER 78-62/1T. Tr. 4608. Mr. Bryan believed that he did not read the LER, because someone else erroneously entered his initials alongside Mr. Bryan's name. Tr. 4609. Not surprisingly, therefore, Mr. Bryan had no recollection of that LER. Bryan Prep. St., p. 5.

735. Mr. Bryan recalled that the TCN to the leak rate Surveillance Procedure was implemented to correct an error in the leak rate test procedure and not to create an improper bias toward the production of favorable test results. Tr. 4597,

4605. He believed that he would not have noticed any problems in the TCN or objected to tests performed pursuant to it. Tr. 4596, 4605.

736. There is no evidence that Mr. Bryan's shift was involved in leak rate test falsification or manipulation (see, e.g., Stier Vol. II(A), Tab G, Assessment of Mr. Guthrie, p. 17; Tr. 1486-87 (Mr. Russell)); accordingly, and in the absence of evidence to the contrary, we exonerate Mr. Bryan of involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2. Similarly, there is no evidence that he was guilty of culpable neglect in the performance of leak rate tests at TMI-2.

C. Martin V. Cooper.

737. Mr. Cooper became employed by Met Ed at TMI-2 following six years of Naval service and employment with Stone & Webster Corporation as an engineering aide. Cooper Prep. St., pp. 1-2, ff. Tr. 2835. His first position at TMI-2 was as an AO; he became a CRO in 1977 and obtained his RO license in 1978. Id., p. 2. In 1980, he obtained an SRO license and became a shift foreman. Subsequently, he became a shift supervisor. He left the employ of Met Ed in 1982. He is now employed by Southern California Edison Company at its San Onofre Nuclear Station Units 2 and 3 as a Shift Supervisor. Id., pp. 1-2. He is not a party to these proceedings (id., p. 2) but appeared as a Board witness under subpoena. At the

Board's request, Mr. Cooper travelled to Bethesda to testify, although he had expressed a preference for testifying near his home or work. Tr. 2944.

738. During 1977-79, Mr. Cooper was assigned to "C" shift at TMI-2. During that period, his shift supervisor was Mr. Mehler and his shift foreman was Mr. Adams. For a time, he worked with Messrs. Adam Miller and Congdon as a CRO. After Mr. Miller was promoted to shift foreman, Mr. Phillippe worked with Messrs. Cooper and Congdon. Cooper Prep. St., p. 2. Mr. Mehler was assigned to TMI-1 during its refueling outage prior to the TMI-2 accident and at such times or when someone was sick, shift personnel might vary. Id., p. 3.

739. Mr. Cooper's duties as a CRO included conducting the actual operation of the plant and performing the switching and tagging operations and necessary surveillance testing. Id. Mr. Cooper described the respective responsibilities of the CROs, insofar as leak rate testing was concerned, as follows:

> "On my shift, leak rate tests were performed soon after we began our shift. The test was performed on the computer at the command of the operator. Normally, one control room operator had overall charge of operations and kept the CRO log. Another CRO performed the switching and tagging operations and performed surveillances. If we had a third CRO, he might have performed the surveillance operations. The leak rate test could have been done by any of the CRO's or the shift foreman."

Id. Mr. Cooper briefly described the manner in which the leak rate test was performed, as follows:

> "The leak rate test was performed by punching 'RCSL' into the computer, specifying the duration (1 to 8 hours), and allowing the computer to conduct the test. Normal practice was to conduct the test over a one-hour period. Sometimes tests were cancelled without generating a printout from the computer if plant changes or inadvertent operator-caused changes occurred while the test was in progress."

Id., pp. 3-4. Mr. Cooper recalled having difficulty with the leak rate test, including widely varying results from back-to-back tests despite there being no significant change in plant conditions. The erratic nature of the leak rate test results, despite unchanged plant conditions and the lack of any indication of significant leakage, led Mr. Cooper and his shift to believe test results for unidentified leakage under 1 gpm, and not believe those over 1 gpm (unless there were other indications to the contrary). Id., p. 4. Consequently, Mr. Cooper's shift discarded leak rate tests that they did not believe were valid indicators of plant conditions. Id.

740. As we have already discussed, Mr. Cooper's shift was on duty on October 18, 1978 during Mr. Haverkamp's discovery of leak rate tests depicting unidentified leakage over 1 gpm. Tr. 2936 (Stier Report, Vol. IV(H), Test No. 144, CRO log for 10/18/78, showing Mr. Cooper as CRO on log). The undisputed evidence is that personnel were looking for leaks, and had identified and repaired such leaks, at that time. Stier Report, Vol. I, pp. 112-13. Therefore, during the one period when actual unidentified leakage exceeded 1 gpm (see

¶¶ 225-36, supra), Mr. Cooper's shift and the other TMI-2 personnel on duty that day responded appropriately.

741. Mr. Cooper recalled that his interpretation of the leak rate Surveillance Requirement was that, after a test result was obtained depicting unidentified leakage less than 1 gpm, the Technical Specifications were satisfied if another satisfactory result was obtained within 72 hours. Cooper Prep. St., p. 5. Mr. Cooper candidly stated that he now believes that his 1978-79 interpretation was not consistent with the "spirit" of the Technical Specifications. Id.

742. Mr. Cooper recalls that several changes were made to the computer program for leak rate testing "to improve the leak rate calculations." Id., pp. 5-6. However, he continued to believe "that the tests were almost meaningless because we got such inconsistent results." Id., p. 6. Mr. Cooper's belief has, of course, been confirmed by all of the technical analyses since 1980. See ¶¶ 184-224, supra.

743. Mr. Cooper did not recall whether Mr. Haverkamp approved the rounding-off of unidentified leakage results in October 1978, but he did recall that Mr. Capra had told him that Mr. Haverkamp had done so, as the transcript of Mr. Cooper's September 28, 1984 NRR/OI interview (at page 70) confirms. Mr. Cooper explained that it is not surprising that he would not have known personally whether Mr. Haverkamp approved the rounding-off practice, because Mr. Haverkamp would

have dealt with more senior personnel on that type of issue. Id. Mr. Cooper also did not recall LER 78-62/1T. Id.; Tr. 2901, 2916-17.

744. Mr. Cooper recalled being aware, prior to the TMI-2 accident, that the addition of hydrogen might affect the MUT level, but he denied ever adding hydrogen to affect leak rate test results. Cooper Prep. St., pp. 6-7. Mr. Cooper explained:

> "If I added hydrogen during a leak rate test, it was because it was needed, not to alter the test results. Not only was the addition of hydrogen not prohibited during a test, but it was necessary to keep oxygen from entering the system and possibly causing corrosion. I remember that when Joe Logan became the TMI-2 Unit Superintendent, the one thing that he always checked when he came into the Control Room was whether we had enough hydrogen in the reactor coolant system. Therefore, our shift always tried to keep up the hydrogen level because of Mr. Logan's concern about hydrogen."

Id., p. 7.

745. We found no evidence to contradict Mr. Cooper's testimony, although NRR concluded that he had added hydrogen to affect leak rate test results. Exhibit 5-A, Enclosure 5, pp. 2-3. Mr. Cooper performed Stier Test No. 38 (NRR Test No. 120) during which hydrogen was added (see Stier Report, Vol. IV(D), Test No. 38); however, Mr. Cooper was not on the panel during that Test (see id., CRO log) and, therefore, there is no evidence that Mr. Cooper was aware of the hydrogen addition at 9 p.m. that day. Tr. 2879-80. Mr. Cooper testified that

"sometimes" he looked at the MUT level strip chart, and therefore he might well not have known that there was an apparent offset of the MUT level on the strip chart. Id.

746. As we discussed in ¶¶ 255-66 and 306-10, supra, there is no evidence to connect Mr. Cooper with any other leak rate test in which a hydrogen addition may have had an effect on the test result. NRR concluded, for example, that hydrogen was added during its Test No. 39 (Stier Test No. 119); the CRO log for that shows the hydrogen addition logged at "0415" and the leak rate Test having been completed at "0515". Stier Report, Vol. IV(G), Test No. 119, CRO log p. 327. Therefore, it is not at all clear that the hydrogen addition occurred during that Test. In fact, it was probably before the Test because, as Mr. Cooper explained:

> "During much of the time that TMI-2 was operational, hydrogen had to be added by an AO from outside the Control Room. Therefore, it is difficult to fairly accuse my shift of adding hydrogen to affect a leak rate test during that period because the operators could not control the timing of hydrogen additions. Based on our observations, hydrogen sometimes (but not always) had an effect on makeup tank level, but the effect was not consistent. In fact, I told Mr. Russell and Mr. Christopher that I never gave an AO instructions to add hydrogen to affect a leak rate test, and that is true."

Cooper Prep. St., p. 9. In any event, assuming that the hydrogen was added during the Test, MPR concluded that it had no effect on the Test. Stier Report, Vol. IV(G), Test No. 119.

747. Mr. Cooper denied adding water during a leak rate test and not accounting for it, and he also denied adding water to manipulate leak rate tests. Tr. 2921. NRR stated that:

> "Cooper also denied that he intentionally added water to the makeup tank during leak rate tests without including the addition in the leak rate calculations. This is in conflict with technical analysis of the leak rate test records, which show unrecorded water additions. Cooper's statement that he did not intentionally manipulate leak rate test results is not supported by other evidence."

Exhibit 5-A, Enclosure 5, p. 2. Inexplicably, however, Mr. Capra testified before the Board that "[w]e did not conclude that Mr. Cooper was involved in manipulation of tests through the use of water additions." Tr. 1552. We take that statement to apply to "underrecorded" as well as "unrecorded" water additions. In any event, MPR concluded that there is insufficient evidence to substantiate a conclusion that water was added during any of Mr. Cooper's leak rate tests to manipulate the results. See ¶¶ 238-43, supra. Therefore, we rely on Mr. Cooper's testimony, Mr. Capra's testimony, and MPR's supporting analysis, to conclude that Mr. Cooper did not manipulate leak rate tests through water additions.

748. Mr. Cooper denied using unstable MUT level transmitters to falsify or manipulate leak rate tests. Tr. 2906-07. He testified that both level transmitters were, at times, unstable, and that, therefore, he had to perform leak

rate tests using an unstable level transmitter; in any event, the Board agrees that he did not falsify or manipulate leak rate tests by using an unstable transmitter. Tr. 2906; see ¶¶ 270-71, 287-91, supra. We agree with Mr. Cooper that the evidence of record shows that both level transmitters were unstable and that they "were a constant problem." Tr. 2907. We cannot fault an operator for using the only equipment he had to work with.

749. Mr. Cooper did not apply the "Exceptions and Deficiencies" Procedure (AP 1010) to leak rate tests, Tr. 2911-15, although he now realizes that application of the "E & D" procedure "would have fixed the problem." Tr. 2911. He testified that it did not cross his mind to use them. Tr. 2911-12. Mr. Cooper testified that his shift did not apply the "E & D" procedure to leak rate tests because:

> "Computer-generated surveillances were a different animal. We had two different surveillances we ran on the computer: The nuclear instrument calibration, we do a heat balance on the secondary side of the plant and then calibrate our nuclear instruments by it. And we were required to check that the nuclear instruments agreed within 2 percent with the calimetric, once a shift. That was a 10-minute surveillance on the computer.
>
> "If it came out unsatisfactory, we didn't write Es and Ds. We called instruments right over to fix it, right away. And then we had got another one. I'm not sure if we turned in the bad ones or not. We had a clear path to follow. We didn't write an E or D. We approached the leak rate surveillance the same way. We didn't write Es or Ds. It came out of the computer.

"All our other surveillances, when we had to do them, we were told to do that by a computer generated sheet. There was a folder that came in once a week with a number of computer sheets in there that we used to track in all this stuff and we'd fill in all the little codes on there saying when we did the surveillance and who did it and our employee number, so they could keep track of all this in the computer. But we didn't have the computer-generated sheets for doing the inventory balance surveillance. So you didn't have to answer the questions on the computer-generated sheets which said are these surveillance satisfactory? Are there exceptions? Are there deficiencies? You didn't have to do that. And it never struck us, at least not me, that we never were answering those questions that we normally did when we performed a surveillance on some other other people of equipment."

Tr. 2912-13.

750. We find this explanation to be entirely plausible. Evidently, because of the frequent performance of the leak rate test, a mindset developed that this surveillance was different. The fact that the test had a "black box" quality associated with it added to the notion that it was different from most other surveillance tests at TMI-2. Although we conclude that the "E & D" procedure should have been followed, we cannot criticize Mr. Cooper for not doing so, because he was never told to do so.

751. NRR's labelling of many of Mr. Cooper's (and the other operators') leak rate Tests as "questionable" (id., Table 8) was, in our judgment, misleading and unfair. In Mr. Cooper's case, for example, NRR included Tests as "questionable" that were rounded off on October 18 (12D, 12E,

and 13) when Mr. Cooper did not sign any of them (he was on the CRO log that day, Tr. 2936) and he testified that he would not sign a Test such as Stier Test No. 144 and accept it as satisfactory by means of rounding off. Tr. 2944. The label "questionable" was also applied to Tests where NRR believed a "feed and bleed" operation may have occurred during the Test (e.g., NRR Test Nos. 6, 12E, 29, and 43) (see Exhibit 5-B, Attachment 1) and yet NRR and MPR agreed that operators did not falsify tests due to "feed and bleed" operations. Tr. 1316, 1319. Therefore, NRR's conclusion that 70 percent of Mr. Cooper's leak rate tests were "questionable" (Exhibit 5-B, Attachment 5, Table 8) is unfair, and could give an erroneous impression. (Table 8 of Exhibit 5-B includes many tests that the Board does not think should have been included as "questionable". Tr. 4971-72. The Commission should not rely on that Table for its conclusions about operators at least without careful analysis.)

752. Based on a careful review of NRR's allegations against Mr. Cooper, summarized in Table 8 of Exhibit 5-B, we believe that MPR has disproved the most serious allegations against Mr. Cooper. We find insufficient evidence to conclude that Mr. Cooper falsified or manipulated leak rate test results at TMI-2, or that he was guilty of culpable neglect with respect to such practices. We exonerate him of any contrary impression in the various investigative reports.

D. William J. Fels.

753. Mr. Fels was and is the person responsible for the leak rate test computer program (and all other computer programs) at TMI-1 and TMI-2. Tr. 4492. He is not a party to these proceedings, but appeared voluntarily, at the Board's request, because of his involvement in some of the issues surrounding this controversy. Tr. 4490-91.

754. Mr. Fels was often in the TMI-2 Control Room because that was the location of both the computer operator's and computer programmer's consoles, Tr. 4493, and because he often had to respond to operators' complaints about such things as faulty signals on the alarm printouts. Tr. 4493-94.

755. Mr. Fels recalled having resolved certain problems in the leak rate test computer program. Tr. 4492, 4494-95. However, Mr. Fels was not involved in, or responsible for, the leak rate test procedure; he "just implemented the software." Tr. 4495. He did recall being responsible for converting the TMI-1 leak rate test program for use at TMI-2. Tr. 4495-96.

756. Mr. Fels did not recall that operators approached him with complaints about the leak rate test computer program at TMI-2. Tr. 4496-97. In his view, "if there was a problem, there was a problem with the surveillance procedure. The test just mimicked the procedure." Tr. 4497. Problems with the test procedure would have been the

responsibility of the engineering department. Id.; see Tr. 4497.

757. Mr. Fels had some recollection of the TCN to the TMI-2 leak rate procedure that was implemented in March 1979, to accomplish a conversion to mass from volume in the test calculation. Tr. 4498-4500. He also recalled that the change was put into the computer software under a different name so that the operators would not have access to it until PORC approved the procedure. Tr. 4499-4501. It appears, that the existence of that additional program was not conveyed to the operators because from March 16, 1979 (when the TCN was implemented) until March 28, 1979, the operators performed the TCN volume-to-mass correction for the RCDT volumes by hand, as a review of those tests shows. See Stier Report, Vol. IV(C).

758. Mr. Fels explained that the leak rate test surveillance sheet was different from most of the other surveillance sheets the operators had to fill out, and conceded that the test sheet did not have a "remarks" section or place to note an exception or deficiency. Tr. 4507-08. He agreed that these differences from other surveillance test sheets may have contributed to the leak rate test problems at TMI-2, and the Board concurs. Tr. 4508.

759. Mr. Fels' involvement in TMI-2 leak rate testing, therefore, was simply to work on the computer-assisted aspects of the test and not to become involved in any

procedural deficiencies. Tr. 4510-11, 4514. Mr. Fels added cautions to the operators about decimal points and sign conventions, and changed the computer printout so that the computer would "see" the RCDT level in inches rather than in volts, but otherwise was not particularly involved in the events surrounding LER 78-62/IT. Tr. 4515-19; see ¶ 356, supra. The handwriting "corrected by Bill Fels" on NRR Test No. 14 (which was run on October 18, 1978, the day triggering the events which gave rise to that LER) is not that of Mr. Fels but evidently Mr. Fels was involved in that Test to the extent of telling someone to correct the algebraic sign for identified leakage. Tr. 4520.

760. Mr. Fels explained that the leak rate test results from the computer would not have been erratic if the inputs from the plant were consistent. Tr. 4531. Of course, as we found in ¶¶ 184-224, supra, inputs from the plant were inconsistent because of such problems as plant oscillations and instrument errors.

761. Mr. Fels also explained that the computer-performed leak rate test was more accurate than performing the calculation by hand, because the computer could "read" the data much more accurately. Tr. 4531-32. The difference in accuracy was essentially due to the difficulty in interpolating data from graphs corresponding to the inputs to the computer. Tr. 4532. A subsequent statistical analysis of

the leak rate test procedure confirmed that computer-calculated leak rate tests were always more accurate than hand-calculated tests, and that small errors in reading inputs could produce large changes in test results. Tr. 4533-34.

762. There have been no allegations that Mr. Fels was involved in leak rate test manipulation or violation of leak rate test procedures, and we are aware of no evidence to that effect. Accordingly, we exonerate Mr. Fels of any inference that he may have been so involved, or was aware of such falsifications or violations. Similarly, there is no evidence that he was guilty of culpable neglect with respect to leak rate testing.

E. Harold W. Hartman, Jr.

763. None proposed.

F. Earl D. Hemmila.

764. Mr. Hemmila appeared in response to a subpoena issued by the Board; he agreed to come to Bethesda to testify. He is currently employed as a contract consultant at Davis-Besse in the plant training department. Hemmila Prep. St., p. 1, ff. Tr. 4039. Mr. Hemmila was employed at TMI-2 from 1976 until 1982. Id., p. 2. In 1978, he was a CRO in training. Id. He received his RO license on December 6, 1978. Tr. 4043. Beginning on January 1, 1979, he was assigned as a CRO on "F" shift. Tr. 4044. Mr. Bryan was his shift

supervisor, Mr. Guthrie was his shift foreman, Mr. McGovern was the other CRO, and Mr. Germer was a CRO trainee. Hemmila Prep. St., p. 2.

765. During 1978-79, it was Mr. Hemmila's understanding that the TMI-2 operators were required to obtain a satisfactory leak rate test at least once every 72 hours during plant operation. Id., p. 3. Mr. Hemmila has no recollection of the incidents giving rise to LER 78-62/1T and does not recall any change in leak rate testing practices in response to the LER. Id., p. 4. At the time of the LER, he was studying for his RO examination and although physically present in the control room, was not working on shift. Tr. 4103.

766. Mr. Hemmila testified that he was not instructed to log the start and stop times of leak rate tests, nor was he ever told not to do so. Hemmila Prep. St., p. 3. He did not recall any rule at TMI-2 that required that unsatisfactory leak rate tests be logged. Id.

767. It was accepted practice on his shift to discard leak rate test results showing excessive unidentified leakage. Id., pp. 3-4. However, this was not done to conceal them from the NRC. Id., p. 4. Although he vaguely recalled TMI-2 Administrative Procedure 1010 dealing with "Exceptions and Deficiencies," Tr. 4076-78, he "never thought about filing an E or a D for this [leak rate] procedure." Tr. 4078.

768. Mr. Hemmila was aware that the leak rate procedure cautioned against the addition of water to the MUT. Tr. 4050. However, there were occasions when it became necessary to add water to the MUT during a leak rate test. Hemmila Prep. St., p. 4. For example, in March 1979 water was being added with increasing frequency to keep the MUT level above the required minimum or to keep the control rods within the proper operating band. Tr. 4051-52. TMI-2 had a low level alarm on the MUT. Tr. 4140. The alarm would sound if the operator let the level go below 60 inches. Tr. 4148-49. Mr. Hemmila's shift foreman, Mr. Guthrie, testified that a prudent operator would endeavor to replenish the MUT level before the alarm went off. Tr. 4151-52. The frequency of required water additions is illustrated by NRR Test No. 150, at which time water was added ten times to the MUT during an eight-hour shift. Tr. 4059. Similarly, in connection with NRR Test No. 153, water was added 12 times during an eight-hour shift. Tr. 4090-93. Based upon the log entries, Mr. Hemmila explained that frequent water additions to the MUT were necessary because of changing boron concentration. Tr. 4056-59.

769. In 1978-79, Mr. Hemmila was not aware of any phenomenon by which the volume of water added reflected in the MUT level strip chart was greater than the volume measured by the totalizer. Hemmila Prep. St., pp. 4-5; Tr. 4080. He

testified that neither he, nor any other operator to his knowledge, deliberately falsified leak rate tests by making unrecorded or under-recorded water additions to the MUT. Hemmila Prep. St., p. 5. He felt that a lack a communication between operators would account for any instances in which water was added during a test but not properly included in the test calculation. Id.

770. During 1978-79, Mr. Hemmila was not aware that the addition of hydrogen to the MUT during a leak rate test could affect the test result. There was no rule that prohibited the addition of hydrogen during a leak rate test. On the contrary, Mr. Hemmila was aware that Unit 2 Superintendent Logan checked hydrogen levels frequently, and so Mr. Hemmila believed that maintaining proper hydrogen pressure was very important. During 1979, when he was a licensed operator, it was not possible to add hydrogen from the control room. The addition had to be done manually by an AO. It is possible that an AO may have added hydrogen to the MUT during a leak test without the CROs knowing about it. Id.

771. Mr. Hemmila stated that he never added hydrogen to the MUT in an effort to falsify leak rate tests and that he had no knowledge that other operators had done so. Id., pp. 5-6. There is only one Test (NRR Test No. 152) signed by Mr. Hemmila during which it is alleged that hydrogen was added. See Exhibit 5-B, Attachment 5, Table 11, p. 20. The hydrogen

addition was duly noted in the CRO log, id., and there is no evidence that it was made with intent to manipulate or that Mr. Hemmila even knew about it (he was not on the panel). See Stier Report, Vol. IV(C), Test No. 6, CRO log, p. 70.

772. During March 1979, it became more difficult to obtain a satisfactory leak rate test result. Hemmila Prep. St., p. 6. Indeed, tests on and after March 16, 1979, frequently indicated unidentified leakage in excess of 1 gpm. Such tests were corrected pursuant to the TCN to the leak rate Surveillance Procedure. Tr. 4044-48. Mr. Hemmila and his co-workers did not question the TCN, because it had been authorized by the plant engineers. Tr. 4071-76.

773. During 1978-79, Mr. Hemmila was not aware that one of the MUT level transmitters was malfunctioning. Hemmila Prep. St., p. 6; Tr. 4068. Mr. Hemmila did not compare channels before selecting a MUT level transmitter for use in a leak rate test. Tr. 4106. He assumed that he could use either channel unless one instrument was tagged out of service. Hemmila Prep. St., p. 6; Tr. 4109. Mr. Hemmila signed three leak rate Tests (NRR Test Nos. 58, 71, and 76) in which NRR found that a faulty MUT level transmitter had been used. The Board finds that Mr. Hemmila did not do this knowingly and had no intention to falsify or deceive.

774. The Board further finds that water additions made during leak rate tests run in March 1979 were made for

legitimate operational reasons (see ¶¶ 293, 303, supra), that Mr. Hemmila's shift attempted properly to account for such additions, and that the additions were not made to falsify or deceive. In addition, there is no pattern of intentional, unrecorded water additions by Mr. Hemmila at any time. In light of Mr. Russell's exoneration of Mr. Hemmila and his shiftmates on "F" shift of involvement in "intentional leak rate manipulation" (Tr. 1486-87), we recommend that Mr. Hemmila be exonerated of any misconduct or culpable neglect in connection with the administration of leak rate tests at TMI-2.

G. John M. Kidwell.

775. Mr. Kidwell began employment with Met Ed in 1974 as an AO at TMI-1. Kidwell Prep. St., p. 1, ff. Tr. 3285. In 1978, he was promoted to CRO at TMI-2. Id. Mr. Kidwell left Three Mile Island in 1980, and he does not hold an NRC license in his current position. Exhibit 5-B, Attachment 5, Table 1. He was originally a party to this proceeding, but later withdrew. See ¶ 74, supra.

776. Mr. Kidwell was assigned to "B" shift with Messrs. Illjes and Mell. His shift supervisor was Mr. Chwastyk and his shift foreman was Mr. Conaway. Kidwell Prep. St., p. 1. Mr. Kidwell previously had worked under Messrs. Smith and Hoyt and with Messrs. Booher and Hartman. Id., p. 2.

777. The bulk of Mr. Kidwell's training occurred on shift and consisted of another operator showing him how to

begin the test on the computer and how to answer the necessary questions. Tr. 3289-90.

778. Mr. Kidwell recalled that, at TMI-2, it was necessary to demonstrate that unidentified leakage was less than 1 gpm every 72 hours during plant operation. Kidwell Prep. St., p. 2. He believed that each leak rate test result he obtained with unidentified leakage under 1 gpm initiated a new 72-hour period. Id. Interim tests with leakage over 1 gpm were discarded based upon his assessment of plant leakage gained from observing sump level changes, MUT changes, airborne particulate activity, and steam generator activity. Id.

779. Mr. Kidwell considered the leak rate test a significant surveillance test because it was required by the Technical Specifications and because it directed an operator's attention to small leaks that might not be detected by other plant instruments. Tr. 3293. To him, however, the MUT level recorder was a more valuable trend indicator than the leak rate test. Tr. 3298-99. He preferred to rely on MUT level because he could assess quickly whether a large leak had developed. See Tr. 3301.

780. Mr. Kidwell's shift generally divided assignments; for example, the CRO assigned to switching and tagging usually performed the leak rate surveillance. Tr. 3306. In practice, the CROs on Mr. Kidwell's shift often shared responsibilities. Id. If Mr. Kidwell were assigned to

the panel during the performance of a leak rate test, he wanted to be apprised of any addition made to the MUT during the test. Tr. 3311. To facilitate such communication, operators on his shift placed signs on the computer and the control panel indicating when a leak rate test was in progress. Tr. 3308.

781. Mr. Kidwell's view of the review process for leak rate tests was as based on a relationship of trust; that is, the shift foreman expected him to have performed the leak rate test properly. Tr. 3310.

782. Mr. Kidwell was imprecise in his recordkeeping habits. Tr. 3317. As he candidly admitted before this Board "[o]ne thing that you can smack me for is recordkeeping." Id. He did not always use the exact time when he calibrated the strip charts. Tr. 3320. On occasion, he estimated the time when he made his log book entries. Tr. 3379. Mr. Kidwell never did this to mislead, and he emphasized that he has since learned the importance of accurate time-keeping to facilitate reconstruction of important events. Tr. 3381-82.

783. Mr. Kidwell signed one Test (NRR Test No. 87, Stier Test No. 71) that relied on data furnished by an out-of-service MUT level transmitter. Exhibit 5-B, Attachment 5, Table 7, Table 11, p. 12; Tr. 2397 (Capra); Stier Report, Vol. III(A), Table 1. MPR's summary sheet and MUT level strip chart show that Mr. Kidwell did not switch to the out-of-service instrument prior to running that Test. Stier

Report, Vol. IV(E), Test No. 71; Exhibit 1-B (Green Volume), Stier Test No. 71. The continuity of the trace and the fact that this is Mr. Kidwell's only Test with an out-of-service transmitter, justify the conclusion that this Test does not constitute leak rate falsification or manipulation. Tr. 1756 (Russell), 2352 (Capra).

784. As a rule, Mr. Kidwell refrained from adding water to the MUT during the performance of a leak rate test. Tr. 3365. As he explained, "I do not add water. I do not add anything to the makeup tank when I'm doing a leak rate. That's one of my laws." Id. He signed one Test that both NRR (Test No. 115) and MPR (Test No. 43) agree contained an unlogged, unaccounted-for water addition. Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Table 11; see ¶¶ 238-41, supra. Mr. Kidwell insisted, and we agree, that this Test is representative either of operator communication problems, or of the investigators' inability to accurately judge the precise time of water additions based upon log book entries. Tr. 3308, 3317-20, 3368.

785. Mr. Kidwell did not use hydrogen to manipulate leak rate test results and the record contains no evidence that he was aware of the falsification of leak rate tests in this manner until after the Hartman allegations were publicized. Tr. 3388, 1486-87, 1492 (Russell), 1496-98 (Stier). He signed four leak rate Tests that may have involved hydrogen additions

to the MUT. The first (NRR Test No. 23, Stier Test No. 134) contained a logged hydrogen addition that had no effect on MUT level. Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Table 11, p. 3. The second (NRR Test No. 119, Stier Test No. 39) also showed no effect, according to MPR, and the hydrogen was added by an AO 5 minutes after Mr. Kidwell relieved the shift that actually initiated the Test. Stier Report, Vol. III(A), Table 1; Exhibit 5-B, Attachment 5, Table 11, p. 16. The last two Tests with alleged hydrogen additions (NRR Test Nos. 124 and 125, Stier Test Nos. 34 and 33) were performed on February 19, 1979, the date of Mr. Chwastyk's hydrogen experiment. Tr. 3419-20, 3424-25 (Chwastyk); Stier Report, Vol. III(A), Table 1; id., Vol. IV(D), Stier Test Nos. 34, 33; Exhibit 5-B, Attachment 5, Table 11, p. 16. We previously found that no adverse conclusion could be drawn concerning Stier Test No. 34 (NRR Test No. 124), because the evidence showed that it was conducted only as an experiment. We agree with MPR that the addition of hydrogen could not be confirmed in Stier Test No. 33 (NRR Test No. 125). See ¶¶ 262-63, supra.

786. Mr. Kidwell had no recollection of aiding Mr. Chwastyk in performing a leak rate test involving a hydrogen addition to the MUT. Tr. 3387-88. His sole recollection of the subject of hydrogen additions is a memory of Mr. Chwastyk discussing the addition of hydrogen, possibly

with Mr. Hartman. Tr. 3387. Mr. Kidwell could not link this discussion to the events Mr. Chwastyk recalled as occurring on February 19, 1979. Tr. 3387-88. Mr. Chwastyk had no recollection of Mr. Kidwell's presence in the control room during the time he performed the experiment, or afterwards when he cautioned his shift to avoid the addition of hydrogen during leak rate tests, Tr. 3471, justifying our conclusion that Mr. Kidwell remained unaware of hydrogen's potential to influence a test result.

787. Mr. Kidwell could not recall reading LER 78-62/1T; however, he agreed that he must have reviewed it because his initials were on the cover sheet attached to the version that the operators reviewed. Kidwell Prep. St., p. 4. Mr. Kidwell had no recollection of receiving an explanation of the contents of the LER, and he could not recall being directed to change his interpretation of the Action Statement in response to the LER. Id. His recollection is supported by Mr. Chwastyk, who did not bring the LER to his shift's attention because he did not believe that it constituted a change in the interpretation of the leak rate Technical Specifications. Tr. 3509 (Chwastyk).

788. We found no evidence to support a conclusion that Mr. Kidwell was involved in or permitted leak rate test falsification or manipulation at TMI-2. Mr. Russell has exonerated him of any involvement in the manipulation of leak

rate tests at TMI-2. Tr. 1486-87. Accordingly, we exonerate Mr. Kidwell of any involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2. For the same reasons, we find him not guilty of culpable neglect with respect to his involvement in those activities.

H. Joseph B. Logan.

789. None proposed.

I. Thomas D. Morck.

790. In 1978-79, Mr. Morck was an engineer assigned to "Technical Support" at TMI-2 and was responsible for the development of the March 16, 1979 TCN. Stier Report, Vol. V(C), Tab 21. Mr. Morck was invited, through his counsel, to testify about the TCN. Tr. 4950-55. He declined the invitation, and the Board decided it did not need to call him. Tr. 5037-38.

791. The Board stated at the hearings that, based on the evidence known to it, it would not find that Mr. Morck prepared the TCN to falsify leak rate tests (Tr. 5037-38), and we reiterate that finding here. We do find, however, that the TCN corrected only a part of the problem of a lack of a density correction in the leak rate test procedure, and that it should also have made density corrections for additions to the RCS and other identified leakage. See ¶¶ 188, 191, supra. Aside from the incompleteness of the TCN, there are no other allegations

about Mr. Morck's involvement in leak rate testing irregularities. Accordingly, we exonerate him of involvement in, or awareness of, leak rate test falsification or manipulation at TMI-2. There is no evidence that Mr. Morck was aware of the need for additional corrections to the TMI-2 leak rate test procedures. Therefore, we exonerate him of culpable neglect with respect to leak rate testing.

J. Dennis I. Olson.

792. Mr. Olson is not a party to these proceedings; he testified under subpoena. Nevertheless, he filed a prepared statement explaining his involvement in leak rate testing at TMI-2. Olson Prep. St., ff. Tr. 3911.

793. Mr. Olson became employed by Met Ed at TMI as an AO in 1971, after 8 years of Naval service. After approximately five years an an AO, he became a CRO at TMI-2 in 1976. He received his RO license in 1978; during 1979, he was assigned to "D" shift. His shift supervisor was Mr. Hitz, his shift foreman was Mr. Adam Miller, and his fellow CROs were Messrs. Coleman and Wright. He left TMI in 1981. At that time, he became employed by Louisiana Power and Light Company at its Waterford III reactor, where he was a control room supervisor with an SRO license. He resigned from Waterford III in 1985. He no longer holds an NRC RO or SRO license. Id., pp. 1-2; Tr. 3914.

794. Mr. Olson has been accused, along with Messrs. Wright and Coleman, of having falsified or manipulated leak rate Tests by adding water or hydrogen to the MUT during the Tests. Exhibit 5-B, Attachment 5, Tables 8 and 11. Specifically, NRR has alleged, and MPR has confirmed, that a large number of Tests, most of which were performed by "D" shift in February-March 1979, were manipulated by such additions. Id.; compare MPR analysis of the same Tests in the Stier Report, Vols. IV(C) & (D).

795. There is no dispute that water was added to the MUT during many of the "questionable" Tests on "D" shift during that period; the Tests include water additions entered into the computer calculation, and the CRO logs for those Tests show water additions during them. Mr. Olson did not deny that fact, but explained:

> "If I added water during a leak rate test, I would log its entry. The fact that a leak rate test was being conducted was not an impediment to a water addition. I recall that I would inform the individual performing the test of my addition of water. I realize that my shift's leak rate tests filed in February and March of 1979 show that water was added on a routine basis during the tests. I can no longer recall why water was added, or explain its addition based on available plant records. I do not recall knowing on my own or through discussions with the other operators that water addition could produce a "bonus" in the makeup tank level reading. I do know that I never falsified leak rate tests by this or by any other method."

Olson Prep. St., pp. 4-5. There is credible evidence to support Mr. Olson's explanation. He is correct, as we have

found in ¶¶ 151-55, supra, that water additions were not prohibited during leak rate tests. Tr. 3969-70, 3972. We found no evidence that Mr. Olson failed to log, or enter into the computer calculation of the RCS leak rate, the approximate amount of water that the investigators have concluded was added during the Tests. The fact that "D" shift's water additions to the MUT were almost always recorded in the CRO log and entered into the leak rate test calculation confirms Mr. Olson's recollection that communications from him to Messrs. Wright and Coleman about water additions were such that water additions to the MUT during leak rate tests were accounted for in the leak rate test calculation.

796. It is not surprising that Mr. Olson cannot recall why he or others on his shift added water to the MUT during leak rate tests in February-March 1979; after all, seven years has passed since those routine evolutions were performed, and the operators' recollections of specific tests is nearly universally non-existent. Tr. 3918, 4022-23; see Tr. 3915 (Mr. Olson described test as "routine part of my job that had to be done.). The question, insofar as Mr. Olson is concerned, is whether it is plausible that he did not know that Mr. Coleman or Mr. Wright were adding water to the MUT during leak rate tests to affect the test results. See Tr. 3971. Of course, as we have discussed at length, the addition of water to the MUT during a leak rate test offset the error in the test

calculation attributable to the lack of a density correction for leakage into the RCDT, especially during February-March 1979, when high identified leakage was occurring. See ¶¶ 254, 293, and 303, supra.

797. To answer the question whether Mr. Olson knew that Messrs. Coleman and Wright were making water additions to the MUT to affect leak rate tests results, we first discuss the shift responsibilities and communications on "D" shift. That shift had three licensed CROs in 1979. Mr. Olson explained that:

> "... generally one was responsible for surveillance performances, one controlled the log book, and one performed switching and tagging. As things worked out these jobs could be changed during the shift; for example, anyone could walk over to the computer and start a leak rate test. If I were in charge of the leak rate surveillance for the day, I tried to keep my shift mates informed that I had initiated a test. I believe that at the end of the hour needed for the test, I would ask if anyone had added water. I would then enter any additions in the computer. If I had responsibility for the log, I would enter the satisfactory performance of the surveillance."

Olson Prep. St., pp. 2-3. Mr. Olson's description of the division of responsibilities on his shift suggests that he may not, as he claimed (Tr. 3971, 4031-32), have known that water additions were being made to the MUT to influence leak rate test results (as Messrs. Coleman and Wright admitted) rather than for operational reasons, because evidently none of those three CROs felt any reluctance to avoid a water addition during a leak rate test (so long as the addition was entered into the

calculation). There is no dispute that water additions were necessary at frequent intervals in February-March 1979 because of a leaking valve on the pressurizer. Tr. 3930; see also ¶ 303. Water additions during a leak rate test would not have surprised Mr. Olson, or any other CRO, during February-March 1979, because of the high rate of identified leakage, and therefore Mr. Olson would have had no reason to suspect that Messrs. Wright and Coleman may have timed water additions and leak rate tests so that the two would coincide.

798. The division of responsibilities for leak rate testing on "E" shift was such that Mr. Olson, when he was the test performer, may not have known that water was added until the end of the test. Tr. 4031-32. Conversely, if Mr. Olson "had the panels" (i.e., was typically the one to manipulate the controls of the plant) he might have added water to the MUT and not have known that the test was being performed until the end of the one-hour period during which it was run. Tr. 3985, 4003. There is no dispute that the exact amount of water added to the MUT was entered into the computer calculation at the end of most of the tests on Mr. Olson's shift. Exhibit 5-B, Attachment 5, Table 10; see also Tr. 3927-28. Accordingly, Mr. Olson correctly answered the test procedure question concerning the amount of water added to the MUT.

799. NRR's analysis generally attributed to each person on Mr. Olson's shift all of the tests performed by that

shift. Tr. 3971-72; see Exhibit 5-B, Attachment 5, Table 8; Tr. 1639-49. We cannot accept that analysis for Mr. Olson (or any other operator) without evidence that he was responsible for the addition of water or hydrogen to the MUT during a leak rate test for the purpose of affecting the test result. See Tr. 4003-04. Because of the division of responsibilities, and Mr. Olson's denial that he was aware that water additions were made by others on his shift to affect leak rate test results, we cannot find that he was aware of, or involved in, such practices. There is no evidence that he was, other than that he was probably in the TMI-2 Control Room while those Tests, and the water additions, were performed. Neither Mr. Wright (see Tr. 2703) nor Mr. Coleman (see Tr. 2604, 2620) testified that Mr. Olson knew that they were adding water or hydrogen to the MUT for leak rate test purposes, and Mr. Olson denies being so aware.

800. According to NRR's analysis, Mr. Olson was never involved in a hydrogen addition during a leak rate test. Exhibit 5-B, Attachment 5, Tables 7 and 10. The only Test involving Mr. Olson's shift during which a hydrogen addition was made was NRR Test No. 36, which did not involve Mr. Olson. Id.; Table 11, p. 4.

801. Mr. Olson recalled discarding leak rate tests for a time, but that the practice changed and thereafter he did not discard excessive leak rate tests. Tr. 4007. He recalled

giving all leak rate test sheets to his foreman, and stated that he did not know what became of them. Tr. 4007-08. Once they were given to the shift foreman, of course, it would not have been Mr. Olson's responsibility to apply AP 1010, the "Exceptions and Deficiencies" Procedure.

802. Mr. Olson was aware that, for a time, the two MUT level transmitters did not provide consistent level indications. Tr. 3934. Mr. Olson agreed that NRR Test No. 122, which he signed, may be "questionable" because the MUT level indication on the strip chart is erratic (Tr. 3933-34); however, he also pointed that whether that Test is "questionable" is a matter of judgment (Tr. 3934) and we agree, because with the two MUT level transmitters in disagreement during such a Test, there is simply no way to know now which (if either) was accurate. It would appear that, if the erratic level transmitter was connected to the MUT level strip chart, the other (presumably more accurate) level transmitter was providing input to the computer for the leak rate test calculation. Therefore, NRR Test No. 122 provides no basis to be critical of Mr. Olson. In any event, he explained that he compared the two level transmitters as part of his switching and tagging responsibilities; therefore, we find that Mr. Olson was attentive to the need to be aware of his plant indications, which is certainly good practice. See Tr. 3934.

803. Mr. Olson did not recall LER 78-62/1T, but he believed that the directive he received not to throw out leak rate tests emanated from that LER. He also associated with that LER a policy that leak rate tests depicting negative unidentified leakage were no longer acceptable. His only basis for believing that he saw that LER stems from his initials on its coversheet. Tr. 4008-09.

804. Mr. Olson testified that his training at TMI-2 consisted of knowing what the Technical Specifications were, rather than what the safety rationale was for the Technical Specifications. Tr. 4009-10. He testified that, when he studied for his NRC license in 1978, it "was more or less a self-study program" which he summed up as ". . . basically: You are on your own." Tr. 4010. His training after he left Three Mile Island was far more comprehensive, and informed him of the underlying purposes for Technical Specifications. Tr. 4010-11.

805. We find Mr. Olson to have been a credible witness who was frank to concede that leak rate test practices on his shift were "sloppy" and "routine". Tr. 3931-32. That is consistent with most of the other operators' testimony. However, there is insufficient evidence that Mr. Olson was aware of, or involved in, leak rate test falsification or manipulation. Hence, we exonerate Mr. Olson of any involvement

in, awareness of, or culpable neglect with respect to, leak rate testing at TMI-2.

K. Mark D. Phillippe.

806. Mr. Phillippe appeared at the Board's request; he waived the issuance of a subpoena. Mr. Phillippe is presently employed a a Quality Engineer-Nuclear at Waterford 3. Phillippe Prep. St., p. 1, ff. Tr. 4432.

807. Mr. Phillippe began employment at TMI-2 in 1976 as an AO. He commenced training to become a CRO in May 1978 (Tr. 4435) and received his RO license in July 1979. During late 1978 and until March 28, 1979, Mr. Phillippe was assigned to "C" shift as a CRO trainee. His shift supervisor was Mr. Mehler, his shift foreman was Mr. Adams, and his fellow CROs were Mr. Cooper and Mr. Congdon. Phillippe Prep. St., p. 1. Beginning in February 1979, he was taken off shift to study full time for his NRC examination for his license. Tr. 4435-36.

808. In the course of his training, he was taught that the Technical Specifications required a demonstration of unidentified leakage of less than 1 gpm at least once every 72 hours during plant operation. Phillippe Prep. St., p. 2. It was accepted practice on his shift to perform at least one leak rate test per shift to satisfy that requirement. Id.

809. Mr. Phillippe observed that leak rate test results were sometimes erratic, and he came to regard the

results with skepticism. Id. In particular, he and his co-workers felt that it was necessary to corroborate the computer results by examining other plant parameters and by identifying and quantifying leaks. Tr. 4466. If they believed that a leak rate test did not reflect actual unidentified leakage, it was deemed invalid and discarded. Phillippe Prep. St., p. 2. Mr. Phillippe was not aware of any test result showing unidentified leakage in excess of 1 gpm that was not found to be invalid. Id., p. 3. When asked by the Board whether his shift had ever entered the Action Statement in Technical Specification 3.4.6.2 because of unidentified leakage, Mr. Phillippe responded that he believed they were entering the Action Statement whenever they obtained a result in excess of 1 gpm and initiated a search for leaks. Tr. 4438-39. Mr. Phillippe testified that his shift never applied Administrative Procedure 1010, the "Exceptions and Deficiencies" Procedure, to unsatisfactory leak rate tests. Tr. 4439.

810. Mr. Phillippe testified that if a water addition was made to the MUT during a leak rate test or water was removed from inventory during the test, it was the practice of his shift to invalidate the results and discard them. Phillippe Prep. St., p. 3. He said that he was never aware of anyone on his shift adding water to the MUT during a leak rate test in order to falsify the test result. Id.

811. Mr. Phillippe had a general recollection of being informed that the addition of hydrogen to the MUT during a leak rate test could improve the test result. Tr. 4440-42. He did not recall who informed him of this phenomenon. Id. Questioned specifically about whether he had discussed the effect of hydrogen additions with his co-workers, Messrs. Congdon and Cooper, he denied having done so. Tr. 4443-55. Mr. Phillippe stated that he did not learn about the effect of a hydrogen addition through participation in an experiment conducted on his shift to determine the effect of adding hydrogen to the MUT during a leak rate test. Phillippe Prep. St., p. 3. It appears from the CRO logs and plant daily attendance records that Mr. Phillippe was not on shift following February 11, 1979, and consequently was not present when the hydrogen experiment was performed on his shift on February 15, 1979. Tr. 4445, 4451-53.

812. Mr. Phillippe stated that he never added hydrogen to the MUT during a leak rate test for purposes of falsifying the test result. His testimony is borne out by the fact that the experts found no evidence of hydrogen additions to the MUT during any of the six Tests that he submitted. See Exhibit 5-B, Attachment 5, Table 11. Mr. Phillippe further stated that he had no knowledge that others on his shift added hydrogen to the MUT during a leak rate test for the purpose of falsifying the result. Tr. 4440. Mr. Phillippe's recollection

is consistent with our finding that his shift logged its hydrogen additions more than any other shift. Tr. 1816. When he was asked specifically when he first learned that Mr. Congdon had admitted that he intentionally added hydrogen to the MUT during leak rate tests, Mr. Phillippe stated that he had not been aware of Mr. Congdon's admission until the evening before he testified. Tr. 4488. Asked what his reaction was to this knowledge, he responded emotionally, "It upset me quite a bit." Tr. 4488-89. The Board accepts Mr. Phillippe's testimony as candid and truthful, and finds that he was not involved in leak rate test falsification through the addition of hydrogen to the MUT, and that he was unaware that others on his shift might have been purposely adding hydrogen during leak rate tests.

813. Mr. Phillippe was aware that one of the MUT level transmitters was unreliable on occasion. Phillippe Prep. St., p. 3. He assumed that his superiors were also aware of such problems and observed that an I&C technician was working on the MUT level transmitters. Tr. 4470. He further assumed that a MUT level transmitter would be tagged out of service if it were unfit for use. Tr. 4474. He stated that he never used a MUT level transmitter that was tagged out of service to perform a leak rate, and that he never switched MUT level transmitters during a leak rate test for the purpose of improving the result. Id., pp. 3-4.

814. Mr. Phillippe was confronted by the Board with two leak rate tests that he performed and signed with test results of -3.8 gpm and -2.4 gpm, respectively. Tr. 4467, 4476. Mr. Phillippe explained his signing of those Tests by stating that "Chuck Adams . . . was a stickler for details, conscientious, and that if it [those Test results were] acceptable to him, then it was acceptable to me." Tr. 4468. At the time he conducted the Tests, Mr. Phillippe did not believe he was certifying to their accuracy when he signed them, only that he had performed the Tests. Tr. 4478-79. He also stated that he had never been taught to check or compare MUT level transmitters before conducting a leak rate test. Tr. 4470.

815. Mr. Phillippe had only a vague recollection of LER 78-62/1T. He could recall no change in the way his shift interpreted the Technical Specification requirements as a result of the LER. Phillippe Prep. St., p. 4. He stated that there was no discussion of the LER on his shift; he received no instructions concerning it from his shift supervisor or shift foreman. Tr. 4455. Questioned about his training in general, Mr. Phillippe indicated that he was not comfortable with the on-the-job, teach-yourself approach to training at TMI-2. He said he "thought it was a lot on an individual's back to have to do it that way." Tr. 4485.

816. Mr. Phillippe was involved in seven leak rate Tests that were analyzed by NRR. NRR Test Nos. 27, 43, 80, 82, 19, 79 and 89). Exhibit 5-B, Attachment 5, Table 8. There were no water or hydrogen additions to the MUT during six of them. Exhibit 5-B, Attachment 5, Table 11, p. 5. The seventh Test (NRR Test No. 43) was deemed invalid by NRR because they felt that a "feed and bleed" operation was conducted during the Test. Id. However, MPR could not confirm that a "feed and bleed" operation occurred during that Test (Stier Report, Vol. IV(G), Test No. 115). In any event both Mr. Capra and Mr. Stier concluded that "feed and bleed" operations were not used to intentionally manipulate leak rate tests. Tr. 1316, 1319.

817. Based upon the foregoing, the Board finds that Mr. Phillippe never falsified or manipulated a leak rate test and had no awareness that others may have been doing so. Although his actions in running two leak Tests with a faulty MUT level transmitter and uncritically accepting the results may have been careless, the Board finds that he had no intention to manipulate those Tests or to deceive anyone. Consistent with Mr. Russell's finding (Tr. 1487), we exonerate Mr. Phillippe of any involvement in, or awareness of, the falsification or manipulation of leak rate tests at TMI-2. For the same reasons, we also exonerate him of culpable neglect in the performance of leak rate tests.

L. James L. Seelinger.

818. Mr. Seelinger was Superintendent-Technical Support of TMI-2 during 1977 and most of 1978. Seelinger Prep. St., p. 1, ff. Tr. 4623. During that time, he was also Chairman of the TMI-2 PORC. Tr. 4628-29. During much of November 1978, TMI-2 was not in operation (Tr. 4475) and Mr. Seelinger was not at work during part of that month because of physical problems. Tr. 4669, 4784. He stopped working at TMI-2 at approximately the end of November 1978 and became Superintendent of TMI-1 on or about December 1, 1978. Seelinger Prep. St., p. 1. At no time was Mr. Seelinger "acting" Unit 2 Superintendent. Compare id. at pp. 3-4, 6-7 and Tr. 4626, 5004-05 with G. Miller Prepared Testimony, p. 4, ff. Tr. 5039, and Tr. 5047-54. At no time while Mr. Seelinger worked at TMI-2 did the Operations Department report to him (Tr. 4625-26, 4769); rather, it reported to Mr. Gary Miller. Tr. 4625.

819. Mr. Seelinger never performed a leak rate test at TMI-2. Seelinger Prep. St., p. 4. It also appears that he never supervised such a test because he would only have had ultimate responsibility for such tests on one day in April 1978 (id.), and there is no allegation that he supervised a test considered questionable by any investigator. Therefore, the Board finds that Mr. Seelinger never performed or supervised any false or questionable leak rate tests at TMI-2, and we

conclude that he should be exonerated of any possible perception that he was involved in such activities.

820. Mr. Seelinger was involved in the events associated with LER 78-62/1T, concerning leak rate testing at TMI-2. Tr. 4630-4729. Mr. Seelinger promptly reported the failure of TMI-2 Operations Department personnel to invoke the Action Statement requirement of the Technical Specification 3.4.6.2 when unidentified leakage appeared to exceed 1 gpm. Tr. 4780-82; Stier Report, Vol. V(C), Tab 31. His actions in doing so were appropriate under NRC reporting requirements and TMI-2 Technical Specification 6.9.1.8.b. 10 C.F.R. § 50.36(c)(7); Stier Report, Vol. V(B), Tab 14.

821. Mr. Seelinger also was involved in the decision to "round off" unidentified leakage on leak rate test results from October 18, 1978 until October 27, 1978. Seelinger Prep. Test., p. 7; Tr. 4771-73. Mr. Haverkamp initiated the idea (id.; Tr. 2113, 5241, 5250), and the Board has found that Mr. Seelinger would not have adopted the "rounding-off" practice had Mr. Haverkamp not suggested the idea. Seelinger Prep. St., p. 7; Tr. 4770-73; see ¶¶ 347-48, supra. Mr. Seelinger's bona fides on the subject are demonstrated by the fact that, when Mr. Haverkamp advised Mr. Seelinger that rounding off was not appropriate, it was promptly terminated. Tr. 4773-74; see Exhibit 4 (see ¶ 104, supra); Haverkamp Prep. St., p. 9; Seelinger Prep. St., p. 7; Tr. 4771-73.

822. Mr. Seelinger's October 19, 1978 "reportable occurrence" letter to NRC Region I was sent to confirm that the 1 gpm LCO for unidentified leakage had been exceeded, but that the leakage was "reduced to [Technical Specification] limits at 0735 on October 18, 1978." Stier Report, Vol. V(C), Tab 31. That statement was correct because on October 19, 1978 the rounding-off practice suggested by the NRC inspector was in effect (see ¶ 348, supra); thus, the allowable limit was 1.4999 gpm, and NRR Test No. 12D (Stier Test No. 146) depicted unidentified leakage below that amount. See ¶ 340, supra. Mr. Seelinger's letter says that "[a] situation considered reportable under technical specification 6.9.1.8.b. was discovered at 1000 on October 19, 1978"; the language was intended to refer to the final decision to report the events of the day before, not the events themselves, because the NRC had brought the matter to his attention and Mr. Seelinger and PORC first had to evaluate its reportability. Tr. 4724-27, 4780-82. The poor choice of the word "discovered" may have given rise to the erroneous first date and time in the LER Narrative, but the poor choice of words is not significant. See Tr. 4708-09, 4782 (Kelley, J.). Obviously, there was no motive to deceive the NRC as to the date of the events in question, because the NRC inspector was well aware of them, having called them to Mr. Seelinger's attention in the first place. See ¶¶ 345-49, supra.

823. Mr. Seelinger also participated in drafting or editing LER 78-62/IT. Tr. 4630-64; 4775-76. The "Narrative" portion of that LER contains certain erroneous times and dates. Seelinger Prep. St., pp. 7-8. We have already found that those inaccuracies were unintentional and not material. See ¶¶ 358-62, supra; see Tr. 4682-4708. Mr. Seelinger edited the LER draft in several respects. Tr. 4615-18, 4644-51. Mr. Seelinger, however, appears to have questioned the erroneous times and dates, which mistakes were not corrected in by other Met Ed personnel. Tr. 4617, 4663-64. Confusion over the sequence of events that gave rise to the LER led to inadvertent errors in the Narrative. Tr. 4780-82.

824. The Narrative did instruct operators and supervisors to immediately invoke the Action Statement of Technical Specification 3.4.6.2 when the 1 gpm LCO for unidentified leakage was not met. Tr. 4708-20. Stier Report, Vol. V(C), Tabs 28-30. It thus appears that Mr. Seelinger attempted to carry out the interpretation of Mr. Haverkamp, the NRC's TMI-2 Inspector, concerning the Action Statement requirement of TMI-2 Technical Specification 3.4.6.2. See Seelinger Prep. St., p. 8. Mr. Haverkamp testified that Mr. Seelinger was, in Mr. Haverkamp's opinion, very responsive to NRC requirements, and intent on carrying out his reporting obligations to the NRC. Tr. 2113. The evidence just described supports Mr. Haverkamp's opinion of Mr. Seelinger.

825. Mr. Seelinger's unrebutted testimony is that he attempted, by a variety of means, to ensure that both TMI-1 and TMI-2 abided by the Action Statement requirements of each Unit's Technical Specifications. Seelinger Prep. St., p. 8. As Mr. Seelinger put it, ". . . I never tried harder on any LER, and I have stated that before, to personally get involved to get the word out." Tr. 4680. It is clear to the Board that the TMI-2 operators and supervisors did not "get the word", (Tr. 4674-81), but that does not appear to have been because Mr. Seelinger did not make several efforts to do so. Tr. 4670-74. Thus, we find that Mr. Seelinger carried out his obligations with respect to the TMI-2 leak rate issues when problems with leak rate testing and Technical Specification interpretation were brought to his attention.

826. Mr. Seelinger volunteered to this Board that, following his first awareness of the "72-hour rule", he originated the instruction not to leave excessive leak rate tests "lying around" where the might be seen by the NRC. Tr. 4756-57. He described the reasoning behind his instruction as follows:

> "My thinking that, much as I don't like to say it, sir, was that I felt like I was not too -- I did not particularly care for the interpretation when we started out. It was not my interpretation. I allowed that interpretation. I had intentions of trying to resolve that interpretation with Unit 1, and I was not particularly crazy on having the NRC involved

> with that interpretation or finding out about that interpretation."

Tr. 4756. He explained that the "out-of-spec" tests were to have been retained. Tr. 4757. However, as Mr. Seelinger explained, "on October 18th [1978,] I tried to implement something to change what I have just discussed." Tr. 4758. Mr. Seelinger recalled that the interpretation that led to the "72-hour rule" was to have been changed as a result of Mr. Haverkamp's instructions, and that his interpretation not to leave leak rate tests lying around also should have changed at that time. Tr. 4758-60. However, he did not recall explicitly stating that his instruction was rescinded:

> "I don't recall, sir -- I don't recall in terms of putting the word out to the shift supervisors in my discussions, any discussions relative to the results. Perhaps in my discussions I presumed too much."

Tr. 4579. Therefore, the erroneous "72-hour" interpretation of the leak rate Technical Specifications, and the instructions not to leave excessive leak rate tests lying around, may not have changed (insofar as the operators were concerned) on or about October 18, 1978, even though Mr. Seelinger may have so intended.

827. Mr. Seelinger also volunteered that he was approached by one or two shift supervisors who expressed the need for relief with respect to the leak rate test procedure or Technical Specification interpretation. Mr. Seelinger believed that the 1 gpm LCO was inflexible, given Mr. Haverkamp's interpretation, and it did not occur to him that there might be

a problem with the TMI-2 leak rate test procedure because he thought it was based on the TMI-1 procedure. Therefore, he believed that he could not offer any relief. Tr. 4736-37.

828. The fact that Mr. Floyd's Operations Memorandum No. 2-78-19, concerning the rounding off issue and "4-hour" interpretation of the leak rate Technical Specifications, was cancelled after the NRC informed Met Ed that rounding off could not be used, suggests that the cancellation of the Memorandum may have misled Operations personnel concerning the practices to be followed with respect to leak rates. Tr. 4680-81. We find, however, that Mr. Seelinger did not do anything to create that confusion, and that he was not involved in leak rate testing at TMI-2 after November 1978, because of his transfer to TMI-1 on or about December 1, 1978. Seelinger Prep St., p. 1; see ¶¶ 354-55, supra. Because most leak rate tests as to which allegations of falsification or manipulation have been made were performed after December 1, 1978, we find that Mr. Seelinger had no responsibility for leak rate test falsification or manipulation at TMI-2.

829. His involvement in LER 78-62/1T and the "rounding off" issue give the Board no cause for criticism of him, for the reasons set forth above. His decision to allow the "72-hour" interpretation to remain in effect for a brief time in early October 1978 and his instruction not to leave leak rate tests "lying around" where the NRC might find them do

not lead us to criticize him because of his efforts, on and after October 18, 1978, to change TMI-2 leak rate test practices once Mr. Haverkamp's interpretation was provided to him. Mr. Seelinger's testimony, and the high opinion Mr. Haverkamp and Mr. Gary Miller had of him (Tr. 2113, 5079-80, 5095), lead the Board to conclude that Mr. Seelinger did in fact make several efforts to implement Mr. Haverkamp's interpretation of the Action Statement requirement and therefore should not be the subject of any criticism by the Commission.

M. Lynn O. Wright.

830. Mr. Wright began employment with Met Ed as an AO at TMI-1. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 4. In 1975, he began training for his CRO license at TMI-2, and he received his license in 1977. Id. While at TMI-2, Mr. Wright was assigned to "D" shift with Messrs. Olson and Coleman, shift foreman Adam W. Miller and shift supervisor, Mr. Hitz. Id., p. 5. Mr. Wright left TMI-2 in 1984 to open his own business. Id. He no longer holds a license to operate a nuclear power plant. Exhibit 5-B, Attachment 5, Table 1.

831. Mr. Wright recalled that his shift assigned duties to each operator; for example, the primary panel operator controlled normal operations and logging, and the secondary operator was assigned to supervise the secondary

plant AOs, the turbine generator, the ICS, and the feedwater system. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, pp. 9-10. The third operator performed surveillances. Id., p. 11. Responsibilities did overlap, however, and thus two operators would often work in concert. Id., p. 10; see also ¶¶ 272-79, supra. The determination as to which operator initiated the leak rate test was based on who had the lightest work load. Tr. 2699. Either the panel operator or the surveillance operator tended to run the leak rate test, and the responsibility for running the test was equally divided between the two. Tr. 2699.

832. Mr. Wright recalled that he had little faith in the computer-generated leak rate test. Tr. 2670. He personally observed many leak rate test results that had no connection to actual plant leakage, or that were directly contradicted by a subsequent leak rate test result. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 30.

833. Mr. Wright recalled that it was always difficult to obtain a leak rate test result meeting the 1 gpm LCO. Tr. 2704. He believed management personnel were aware that it was difficult to obtain reliable leak rate test results from the computer. Tr. 2676. He assumed that leak rate testing problems were unavoidable, recognizing that TMI-2 was a new plant. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 33; see also ¶ 205, supra. He recalled feeling

some pressure if his shift were approaching the "72-hour surveillance deadline", and he reacted by doing the best he could to obtain a satisfactory leak rate test result. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, pp. 109, 128. He had, however, no recollection of being directed to run leak rate tests continually in an effort to obtain a "good" result. Id. p. 128; but see Tr. 2589 (Coleman). Mr. Wright did not feel that any adverse action would have been taken against him if he were unable to obtain a "good" leak rate test within the 72-hour period. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 110.

834. Despite Mr. Wright's misgivings about the leak rate test, Tr. 2670, he was aware of the importance of monitoring plant leakage. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 34. To fulfill that goal, Mr. Wright examined pressurizer level, MUT level, and sump level. Id., p. 32. Although Mr. Wright was convinced by his review of those parameters that TMI-2 did not have a leakage problem, he now realizes that his review could not pinpoint that the plant was in compliance with the 1 gpm LCO for unidentified leakage. Id., p. 33.

835. Mr. Wright could not recall a requirement to log start and stop times of leak rate tests. Id., p. 42. He recorded only the satisfactory tests that had been conducted. Id. However, Mr. Wright never conducted his logging practices

in this manner so as to disguise the number of tests that were being run on his shift. Id. Mr. Wright also could not recall applying the "Exceptions and Deficiencies" Procedure to leak rate test results. Id., p. 54. Mr. Wright's training failed to instruct him how to comply with those Administrative Procedures. Tr. 2672; see also ¶¶ 317, 322, supra.

836. Mr. Wright was aware that there was a problem from time to time with a MUT level transmitter and that occasionally one would be tagged out of service. Tr. 2691. He signed only one leak rate Test involving an erratic MUT level transmitter and there is no evidence that the Test involved manipulation. Exhibit 5-B, Attachment 5, Table 11, p. 4 (NRR Test No. 35); Tr. 2352 (Capra); Stier Report, Vol. III(A), Table 1 (Stier Test No. 123).

837. Mr. Wright believed it was permissible to add water to the MUT during a leak rate test. Tr. 2683; Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 71; accord ¶ 152, supra. Either the primary CRO or the surveillance CRO could add water to the MUT; however, the primary operator was responsible for logging its addition. Tr. 2702. Mr. Wright recalled that water additions to the MUT were frequently required so as to maintain proper boron concentration within the RCS. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 73; accord, ¶¶ 293, 303, supra.

838. Another reason that Mr. Wright added water to the MUT during leak rate tests was to bring the MUT back up to its original level to compensate for instrument inaccuracy. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 78. He visually calculated the amount of water needed to make beginning and ending MUT levels identical. Id., pp. 78-79. Mr. Wright testified that he never intended to receive an artificial credit for more water than he had actually entered. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, pp. 78, 104. His sole intent was to make the MUT level identical at the beginning and end of the leak rate test, and thereby enhance the accuracy of the test result. Id., p. 94. Mr. Capra agreed that in the Tests he reviewed it did appear that Mr. Wright had that purpose. Id., p. 104.

839. It was not until after the TMI-2 accident that Mr. Wright became aware that a loop seal phenomenon could cause an increase in MUT level, and he was totally unaware that Mr. Coleman had discovered this "glitch" in the system which he used to manipulate leak rate test results. Id., pp. 88-89, 104. Mr. Coleman agreed that he never discussed his manipulation of leak rate test results with his shiftmates. Tr. 2604, 2620. Mr. Wright did not discuss his own practice of adding water during leak rate tests with either Mr. Coleman or Mr. Olson. Tr. 2703. Mr. Wright added hydrogen to the MUT during some leak rates tests for the same reason that he added

water during leak rate tests; namely, to ensure that hydrogen overpressure was about the same at the beginning and end of the leak rate test. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 131. However, Mr. Wright was not aware that adding hydrogen to the MUT was a technique that could be used to manipulate leak rate test results. Id., p. 105. He could not recall any discussions with Mr. Coleman about the effect of adding hydrogen on leak rate tests. Id., pp. 130-31.

840. The record shows that Mr. Wright was on shift when one leak rate Test (NRR Test No. 36, Stier Test No. 122) was performed involving a logged hydrogen addition to the MUT. On the next shift, the Test was signed by Mr. Congdon and approved by Mr. Adams. We agree with NRR and MPR that the hydrogen addition had no significant effect on the Test result. Exhibit 5-B, Attachment 5, Table 11, p. 4; Stier Report, Vol. III(A), Table 1; Exhibit 1-B (Green Volume), Stier Test No. 122.

841. Mr. Wright had no independent recollection of Licensee Event Report 78-62/1T. Exhibit 6, OI Report, Exhibit 18, 3/27/85 Wright Interview, p. 46. Mr. Wright's initials are on the coversheet attached to that LER. Id., p. 48. Mr. Wright did not receive any instruction in the aftermath of that LER that altered his interpretation of Technical Specification 3.4.6.2. He recalled that for a short period of time he was told to keep all leak rate tests, but he

could not connect that brief period with the events surrounding the LER. Id., pp. 145-46. Mr. Wright could not recall ever being told that he was to discard leak rate tests to hide them from the NRC. Id., pp. 40, 124.

842. We cannot find that Mr. Wright falsified leak rate test results by the addition of water or hydrogen to the MUT. See ¶¶ 249-51, 292-305, supra. His understandable desire to make the leak rate test more accurate prompted him to develop his own method of establishing ideal conditions for conducting a test. Tr. 2678-79; 2683. We have no reason to conclude that Mr. Coleman shared his recognition of the phenomenon that has been identified as the loop seal phenomenon with Mr. Wright. Tr. 2703 (Wright), 2604, 2620 (Coleman). Consistent with our understanding of the Commission's use of the term manipulation, we find that Mr. Wright's practice of adding water to the MUT during leak rate tests did manipulate the test results. However, Mr. Wright believed that those additions generally made the test results more accurate and, in fact, he was correct. See ¶¶ 249-51, supra. We recommend, therefore, that Mr. Wright should be exonerated of awareness of, or involvement in, leak rate test falsification at TMI-2. For the same reasons, we exonerate him of culpable neglect with respect to leak rate testing at TMI-2.

XI. ANSWERS TO THE COMMISSION'S QUESTIONS.

843. In CLI-85-18, the Commission posed four series of questions that it directed us to answer. 22 N.R.C. at 880-81. To the extent that the evidence of record permits, we answer those series of questions below.

A. Technical Specification Interpretation and Implementation.

844. The first series of questions posed by the Commission was as follows:

> "How were the Technical Specification 3.4.6.2 requirements for reactor coolant system unidentified leakage interpreted and implemented by control room operators (CROs), shift foremen, shift supervisors and onsite and offsite management? Following the discovery by an NRC inspector in October 1978 that Technical Specification 3.4.6.2 requirements were not properly interpreted or implemented, what corrective action was taken by management personnel? Was the corrective action taken sufficient to ensure compliance with the Technical Specification 3.4.6.2 by the personnel performing and reviewing the leak rate surveillance tests?"

22 N.R.C. at 880.

845. The answer to the first question is that, with few exceptions, TMI-2 operators and supervisors interpreted Technical Specification 3.4.6.2 as requiring at least one valid leak rate test depicting unidentified leakage below 1 gpm every 72 hours (in Modes 1, 2, 3, and 4). See ¶¶ 156-61, supra. As we have found, Technical Specification 3.4.6.2 requires no more. ¶¶ 134-35, supra. In fact, the operators' and supervisors' interpretation and implementation was conservative

because Technical Specification 4.4.6.2 required only that a leak rate test be performed every 72 hours, not that a satisfactory leak rate test result be obtained. Technical Specification 3.4.6.2 merely required that unidentified leakage be below 1 gpm. The result of the leak rate test was not determinative, because there were other means of leakage detection specified in Technical Specification 4.4.6.2, and other means were used to attempt to determine whether unidentified leakage exceeded allowable limits. See ¶¶ 134-45, supra.

846. The answer to the second question is that several corrective actions were taken by Met Ed management personnel following the NRC inspector's involvement in leak rate testing at TMI-2 in October 1978. Mr. Floyd issued Operations Memorandum No. 2-78-19 to inform the TMI-2 operators and supervisors that a leak rate test depicting unidentified leakage over 1 gpm (he used the figure of 2 gpm because of the round-off practice in place at that time) required that the "4-hour clock" in the Action Statement of Technical Specification 3.4.6.2 be invoked. See Stier Report, Vol. V(C), Tab 37 (enclosure to Floyd letter). However, as we have found (in ¶ 355, supra) Mr. Floyd's Memorandum was cancelled after the round-off practice was terminated. Thus, although Mr. Floyd understood that, under Mr. Haverkamp's interpretation, the Action Statement had to be entered if the

value for unidentified leakage depicted on a leak rate test exceeded 1 gpm, most operators and supervisors did not.

847. Mr. Seelinger implemented several corrective actions in response to his discussion with Mr. Haverkamp. Seelinger Prep. St., p. 8, ff. Tr. 4623; see ¶¶ 350-52, supra. Mr. Seelinger edited the Narrative to LER 78-62/1T and was responsible for the following instruction therein:

> "The appropriate personnel will be instructed on the requirements of the applicable [Technical Specifications] and the requirement to immediately invoke applicable action statements when the provisions of limiting conditions for operation are not met."

See Seelinger Prep. St., Attachment (handwritten Narrative), ff. Tr. 4623. This instruction comported with Mr. Haverkamp's interpretation. See ¶ 346, supra. It was satisfied by Mr. Marshall placing the LER (including the Narrative) in the "required reading" book in the TMI-2 control room, and by Mr. Floyd's Memorandum. See ¶¶ 353-54, 366, supra; Tr. 4664-58. However, because most of the TMI-2 operators and supervisors did not even recall LER 78-62/1T (see ¶ 150, 355, 366, supra) and none changed his interpretation of the Action Statement requirement based on that LER, the LER did not adequately instruct them on the NRC inspector's interpretation. Mr. Floyd's Memorandum also did not do so, presumably because all of it was cancelled (rather than just the first paragraph concerning rounding off). See ¶¶ 354-55, supra.

848. The answer to the Commission's final question in its first series of questions is that the corrective actions (other than minor computer program changes, see ¶ 356) taken by Mr. Seelinger and Mr. Floyd were "not sufficient to ensure compliance with the Technical Specification 3.4.6.2 by the personnel performing and reviewing the leak rate surveillance tests" because their practices did not change as a result. However, the effect of that failure to change was not consequential because, as we have explained, Technical Specification 3.4.6.2 was not violated thereafter. See ¶¶ 227, 232, and 234, supra. Nevertheless, the TMI-2 operators and supervisors now recognize that they could not have been certain that unidentified leakage was, in fact, below 1 gpm. Thus, it is clear to the Board that better training, clearer procedures, and more straightforward guidance from management than what actually took place at TMI-2 is necessary at nuclear plants.

849. The Board further finds that a root cause of the problems with leak rate test performance and compliance with Technical Specifications at TMI-2 was the existence of fundamental flaws in the Technical Specifications themselves. No corrective action by the TMI-2 Operations Department, the TMI-2 Superintendent-Technical Support, or higher levels of Met Ed management could have resolved those inherent deficiencies, for which the NRC and its Staff are responsible.

850. The TMI-2 leak rate Technical Specifications were the Commission's standard technical specifications for B&W reactors. The standard leak rate technical specifications are supposedly based on the Commission's Regulatory Guide 1.45. ¶¶ 138-45, supra. In fact, they differ from the Reg. Guide in two significant respects. See ¶ 144, supra. The standard technical specifications also do not take normal instrument error into account. See ¶¶ 198-201, supra. Regulatory Guide 1.45 does not address this problem. The standard technical specifications do not expressly provide for measurement of leakage at room temperature (20° C), see ¶¶ 379-80, supra, even though that is the industry standard set forth in ISA S67.03 and applied at other nuclear plants. See ¶ 380, supra. The NRC Staff does not permit the inclusion of an evaporative loss factor in leak rate calculations for plants with standard technical specifications, even though the evaporative loss exists and can be quantified, and it was recognized and permitted at other reactors. ¶¶ 206-08, supra. Finally, the imposition of a 1 gpm limit for unidentified leakage is essentially arbitrary. See ¶ 171, supra.

851. The Board has little doubt that if the TMI-2 leak rate Technical Specifications had been written to recognize the foregoing considerations, the operators would have encountered few, if any, problems in consistently obtaining valid, satisfactory leak rate test results. Because

some or all of the same deficiencies exist in the leak rate technical specifications for other power plants, this is a generic problem. We recommend that the Commission require its Staff to consider appropriate revisions to Regulatory Guide 1.45 and the standard technical specifications to take account of these issues.

B. Difficulties Experienced by the Operators.

852. The Commission also asked the following series of questions:

> "What difficulties, if any, were operators experiencing when conducting leak rate surveillance tests required by Technical Specification 4.4.6.2.d? Who knew about these difficulties? What corrective actions were taken? Did operators feel pressure to obtain leak rate surveillance test results which did not exceed technical specification limits? If so, what type of pressure was perceived or exerted and who was responsible?"

22 N.R.C. at 880.

853. It is clear that the operators were experiencing great difficulties with the leak rate test procedure; they were virtually unanimous in explaining that they had little confidence in the test, and that it gave them inexplicably inconsistent results, even in back-to-back tests run under virtually unchanged plant conditions. See ¶¶ 327-29, supra.

854. It is hard to be certain who knew of these difficulties, beyond the operators and shift foremen. The shift supervisors knew that results were inconsistent, but the

shift supervisors had little or no involvement in the tests themselves; only a few are signed by the shift supervisors, who had responsibilities for both TMI units. See Stier Report, Vols. IV(C)-(K) (reproducing each test). Mr. Floyd knew that test results were being discarded, and knew test results were inconsistent, but believed that the test results were "a valid indicator of leakage". Tr. 4911-12. He did not know until long after the fact that the test procedure was "inaccurate and meaningless", as the U.S. Attorney alleged. Floyd Prep. St., p. 5, ff. Tr. 4894; cf. Stier Report, Vol. V(A), Tab 2, p. 8 ("functionally unusable"); Indictment of Metropolitan Edison Company in United States v. Metropolitan Edison Company, Crim. No. 83-00188 (M.D. Pa., November 7, 1983), Count 1, p. 7.

855. Mr. Seelinger knew that test results with unidentified leakage over 1 gpm were being obtained in early October 1978. Tr. 4745-47. He was also aware that leaks were identified and repaired on October 18, 1978. Tr. 4687-91. His instructions as of that date were clear to him (Tr. 4670-74), if not clear to the operators (Tr. 4675-80); he was not aware, after that date, that operators experiencing difficulties with the leak rate test were not invoking the Action Statement when test results for unidentified leakage were over 1 gpm. Tr. 4680-81.

856. Mr. Seelinger volunteered that, some time after October 18, 1978, he was approached by one or two shift

supervisors seeking relief with respect to the leak rate test procedure or Technical Specification interpretation. Mr. Seelinger believed that the 1 gpm LCO on unidentified leakage was inflexible and believed that he had no relief to offer because he thought that the TMI-2 leak rate test procedure was based on the TMI-1 procedure. There is no evidence that Mr. Seelinger was aware of any difficulties with leak rate testing thereafter. Mr. Seelinger left TMI-2 at the end of November 1978 (during much of which month leak rate tests were not being run, Stier Report Vol. IV(A), Section V, Table V-1) and had no involvement in TMI-2 leak rate testing matters. Seelinger Prep. St., p. 6, ff. Tr. 4623.

857. Mr. Kunder became aware sometime in 1979 of a problem with the leak rate calculation procedure. ¶ 604, supra. The problem was the incorrect calculation of RCDT volume, which was resolved by the March 16, 1979 TCN. Id. There is no evidence that Mr. Kunder was ever aware of other problems with leak rates. Id.; see ¶ 602, supra.

858. Corrective actions could have been taken to eliminate many of the defects in the leak rate test procedure noted and discussed in ¶¶ 184-224, supra. The mistake in calculation of the density of water in the RCDT was finally recognized sometime in February 1979 and corrected by the TCN made effective on March 16, 1979. See ¶¶ 186-88, supra. The other defects in the calculation were never recognized in

1978-79 and therefore no corrective action was taken. See ¶¶ 189-91, supra. More importantly, as discussed in ¶¶ 849-51, supra, fundamental flaws in the leak rate Technical Specifications themselves were not and could not have been corrected, because the deficiencies were imposed by the NRC.

859. The answer to the final two questions about pressure on the operators is that there is evidence that some operators and shift foremen felt such pressure from their superiors. E.g., Tr. 2586 (Coleman); Booher Prep. St., p. 3, ff. Tr. 4175; see Stier Report, Vol. I, pp. 124-25. However, there is no evidence that operators felt adverse action would be taken against operators for failure to obtain satisfactory leak rate tests. E.g., Booher Prep. St., p. 3, ff. Tr. 4175. The pressure was perceived as related to the desire to keep the plant on line. Stier Report, Vol. VI(B), Tab C, 2/21/85 Conaway Interview, pp. 37-38; id., Vol. VI(G), 2/7/85 Illjes Interview, pp. 57-58; Exhibit 6, OI Report, Exhibit 30, Guthrie Interview, pp. 45-46. We did not sense that the pressure was undue, or that the operators believed that they were violating Technical Specification requirements in operating the plant despite the fact that some leak rate tests depicted unidentified leakage in excess of 1 gpm.

C. Discarding Leak Rate Tests.

860. The Commission also asked us to answer the following questions:

> "Were unacceptable leak rate surveillance test results required by Technical Specification 4.4.6.2d discarded? If so, who knew of, condoned or directed this practice? Were unacceptable leak rate surveillance results discarded in an attempt to hide them from the NRC?"

22 N.R.C. at 880. Strictly speaking, the answer to the first question is that leak rate surveillance tests required by the Technical Specifications were not discarded, because the tests were required to be performed "at least once per 72 hours during steady state operation" and that requirement was satisfied. See Stier Report, Vol. I, p. 51; id., Vol. III(A), Table 1.

861. Nevertheless, numerous leak rate tests were discarded. Stier Report, Vol. I, pp. 58-60. Most CROs and shift foremen engaged in this practice, although the practice varied from shift to shift whether the CROs would do so, or give them to the shift foremen, who would do so. The shift supervisors, and those senior to them, do not appear to have done so (with possible occasional exceptions).

862. Those who knew of the practice of discarding leak rate tests (beyond those performed and filed to meet the 72-hour requirement) appear to have included most CROs, shift foremen, shift supervisors, and Mr. Floyd. Mr. Seelinger did know of the practice after he first became aware of the problem in early October 1978; his directive was to retain all such tests, but ultimately they could be discarded. Tr. 4755-56. Mr. Seelinger believed that the practice would change after he

gave his directions in mid-October 1978 to follow Mr. Haverkamp's interpretation; however, he frankly conceded that he might have "presumed too much" at that time. Tr. 4759-60.

863. Mr. Kunder did not know that leak rate tests were being discarded. Tr. 4839-40; see ¶ 602, supra.

864. There is no evidence that leak rate tests were "discarded in an attempt to hide them from the NRC." Mr. Seelinger did recall that he told one or more shift supervisors in early October 1978 not to leave leak rate tests "lying around" where the NRC might find them, Tr. 4756, but he did not testify that he instructed them to discard them in an attempt to conceal them from the NRC. It is evident that his instruction not to leave them "lying around" had no effect, because the operators did leave test results "lying around" on October 18, when Mr. Haverkamp observed them. Other witnesses did not recall any such instruction and denied that tests were discarded to conceal them from the NRC. E.g., Tr. 4251-54 (Hoyt); Smith Prep. St., p. 4, ff. 4431; Illjes Prep. St. , p. 5, ff. Tr. 3010; see Stier Report, Vol. VI(F), 3/29/84 Hitz Interview, pp. 52-53.

865. Mr. Floyd testified that he "never knew that the NRC was unaware that we were discarding leak rate[] [tests]." Floyd Prep. St., p. 3, ff. Tr. 4894. We agree with Mr. Floyd that it was "inappropriate" to do so (id.) but we must find

that such a practice did not violate Technical Specifications, for the reasons stated herein.

D. Leak Rate Test Manipulation.

866. Finally, the Commission asked us to answer the following series of questions:

> "Did operators manipulate data or take other actions during leak rate surveillance testing in an attempt to improperly influence test results? Who performed, condoned, directed or was knowledgeable of data manipulation or other improper actions during leak rate surveillance testing? This would include, but is not limited to the following:
>
> (i) inputting the wrong data into the plant computer;
> (ii) adding hydrogen gas to the make-up tank during the test in an attempt to influence make-up tank level indication;
> (iii) adding water to the make-up tank during the test and either not including the addition in the computer calculation or underrecording the addition in the computer;
> (iv) taking advantage of differences or inaccuracies in plant instrumentation (e.g., make-up tank level indicators) in an attempt to influence parameters critical to the leak rate surveillance test calculation;
> (v) taking or failing to take any action in violation of technical specification requirements?"

22 N.R.C. at 880-81.

(i). Inputting the Wrong Data into the Computer.

867. We have found no evidence that TMI-2 operators intentionally entered "the wrong data into the plant computer"; the only person accused of doing so by Mr. Hartman was

Mr. Booher. We have found no evidence to conclude that Mr. Booher did so. See ¶¶ 411-17, 423, supra. There were six Tests analyzed by NRR in which MPR found, and we have agreed, that water was added during the Test and not entered into the computer. See ¶¶ 238-48, supra. We found that those Tests were not intentionally manipulated. See ¶ 241, supra.

(ii). Hydrogen Additions to the MUT During Leak Rate Tests.

868. There is evidence that operators added "hydrogen gas to the make-up tank during the test in an attempt to influence make-up tank level indication". Messrs. Hartman, Blessing, Congdon, and Coleman admitted doing so, although Messrs. Blessing, Coleman, and Congdon thought that what they were doing was not inappropriate. See ¶¶ 20-22, 417, 445-46, and 467-73, 480, supra; Exhibit 6, OI Report, Exhibit 6, p. 2.

869. All other operators (except Mr. Chwastyk) denied doing so, and, as our individual findings demonstrate, there is insufficient evidence that any of them did.

870. Mr. Chwastyk did testify that he performed a leak rate test experiment involving the addition of hydrogen to the MUT on February 19, 1979. See ¶ 262, supra. Thereafter, Mr. Chwastyk instructed his shift not to do so. See ¶ 263, supra. We found that this experiment did not constitute falsification. See ¶ 262, supra. Although Mr. Chwastyk's experiment may come literally within the scope of the

Commission's question with respect to hydrogen additions, we find that Mr. Chwastyk did not act improperly, particularly in light of the fact that there was no subsequent addition of hydrogen during a leak rate test by his shift, and in light of his instruction that his shift not add hydrogen during leak rate tests. Stier Report, Vol. III(A), Table 1; Chwastyk Prep. St., p. 5, ff. Tr. 3407.

(iii). Water Additions to the MUT During Leak Rate Tests.

871. We have already addressed whether water additions to the MUT intentionally were not entered into the computer calculation for the leak rate test; we found that no TMI-2 personnel did so. With respect to the Commission's use of the term "underrecording" with respect to water additions, we must first add a note of caution; NRR and MPR used the term "underrecorded" to refer to an entry of the amount of water added, while the computer "saw" and recorded a different and higher amount because of the MUT level problems we have previously described. See ¶ 249, supra. If the Commission meant by "underrecording" the definition used by MPR and NRR, the phenomenon often occurred, but we found no evidence that most of the operators or supervisors were aware of it or took advantage of it. If, however, the Commission meant by its use of the term that operators entered less water than they

actually added, we found no evidence that such a practice ever occurred.

872. Messrs. Coleman and Wright admitted adding water to the MUT during a leak rate test and entering the exact amount into the computer. See ¶¶ 445-47, 837-39, 842, supra. The value for unidentified leakage was reduced by doing so. See ¶ 249, supra. However, that reduction offset a similar penalty introduced into the calculation by virtue of the water lost during the test. See ¶¶ 249-51, supra. Thus, such tests were made more accurate by such additions. Id. Mr. Olson denied adding water to the MUT during leak rate tests to influence test results. See ¶¶ 795-99, supra. We found insufficient evidence that he did so. See ¶¶ 799, 805, supra.

(iv). Taking Advantage of Instrument Inaccuracies.

873. We found no evidence that operators switched MUT level transmitters to affect leak rate test results. See ¶¶ 270-71, 287-91, supra. There is evidence that the less accurate of the two MUT level transmitters provided data to the computer calculation of the leak rate (id.) but no evidence that the choice of the less accurate transmitter was made to influence test results. See ¶ 291, supra.

(v). Violations of Technical Specification Requirements.

874. Finally, there is no evidence that actions were performed in violation of the Technical Specifications, other

than during October 16-18, 1978. As we have explained, a satisfactory leak rate test was not required; rather, unidentified leakage had to be maintained below 1 gpm. We found that it was, except for that brief period during October 16-18, 1978 that was reported to the NRC in LER 78-62/1T. See ¶¶ 225-36, supra; see Stier Report, Vol. V(C), Tab 29. While the operators and supervisors at TMI-2 may not have known at all times that unidentified leakage was below 1 gpm, they believed that it was. See ¶¶ 327-39, supra. Their belief was reasonable, in light of the evidence of record.

876. While it obviously would have been better to have had a leak rate test procedure and test practices to assure that unidentified leakage was below 1 gpm, the Commission only imposed the legal obligation that unidentified leakage in fact be below 1 gpm or that there be a leak rate test so indicating that it was. That obligation was met after October 18, 1978, until the TMI-2 accident. See ¶¶ 225-36,

supra. Accordingly, and based on all evidence of record, we cannot find that TMI-2 Technical Specifications were violated.

Respectfully submitted,

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