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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	Docket No. 50-289 SP
METROPOLITAN EDISON COMPANY	)	(Restart)
	)	(Reopened proceeding)
(Three Mile Island Nuclear Station, Unit No. 1)	)	

LICENSEE'S COMMENTS ON THE REPORT OF THE SPECIAL MASTER

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LICENSEE'S COMMENTS ON THE REPORT OF THE SPECIAL MASTER

I. INTRODUCTION

1. Licensee herein submits its comments on the Report of the Special Master ("Report") dated April 28, 1982. Licensee has not attempted to respond to each and every statement in the Report with which it disagrees or to check all citations, but has selected for comment those statements which it judges to be most important to the conclusions reached by the Special Master, Judge Milhollin. Moreover, Licensee has sought to avoid merely repeating the position it stated in findings submitted to Judge Milhollin in January, 1982, but relies extensively in these comments on those findings (cited as "Lic. PF [paragraph number]" or "Lic. REPLY [paragraph number]"). Licensee also notes that it has not commented on those portions of the Report with respect to the extent of cheating by Messrs. O and W (Report at ¶¶ 10-25; 305-11), the NRC examination (Report at ¶¶ 260-87; 339-40) or the NRC Staff response to the cheating (Report at ¶¶ 288-302, 341-42). We rely on our findings with respect to these matters. See Lic. PF 34-45; 367-406.

II. THE EXTENT OF CHEATING

A. Introduction

2. As an introduction to this portion of the comments, Licensee thinks it important to put into perspective the testing and training environment from which individual operators have come to testify during these reopened proceedings. The period of time under consideration spans almost three years, from 1979 until late 1981. During this period, all of the TMI-1 operators took at least one NRC exam; most took more than one. All of these operators took several mock NRC exams, including the Kelly and the ATTS exams. All of these operators also were involved in weekly training sessions throughout this period, at intervals of at least every six weeks. During these training sessions, quizzes were given weekly, some of them make-ups. In short, these individuals were trained and retrained, tested and retested virtually continually for approximately three years. See Lic. Exs. 63, 80.

3. To prepare for this non-stop training and testing schedule, operators studied for literally hundreds of hours. They studied alone, together, on shift, at home and in class. They reviewed handouts, training materials, lecture notes, instructor corrections and textbooks. See, e.g., Lic. Ex. 80; Tr. 25,867-68 (Mr. H studied at home and on shift); Tr. 26,228-29 (Mr. O had study groups at his home); Tr. 26,309 (Mr. V studied quite a bit on his own); Tr. 26,465-66 (Mr. WW studied quite a bit on his own).

4. Under these circumstances, Licensee believes it is not surprising--indeed it is easily understandable--that witnesses sometimes forgot the source from which they were exposed to certain information, or forgot the basis on which they relied for a particular answer on a weekly quiz. To infer from this lapse of memory that witnesses were lying under oath, however, is simply unreasonable. Yet, Licensee points out the unfailing consistency with which Judge Milhollin equates witnesses' confusion, lapses of memory or mistaken recollections with lack of candor and dishonesty. See, e.g., Report at ¶¶ 46 (Mr. G's confusion about answers on hydrogen generation question); 93 (Mr. GG's speculation about how Mr. W might have copied Mr. GG's answers); 107-08 (Mr. P's confusion about verb tense of question asked of him during his deposition). The Licensing Board noted in its Tentative Decision which accompanied its May 5, 1982, Memorandum and Order Regarding Licensee's Motion to Reopen the Record ("Board Tentative Decision") at 10, with respect to Mr. Ross:

> "Within our experience it is not an uncommon phenomenon for truthful and credible witnesses, perhaps because of the fallibility of human perceptions and memories, to render some unbelievable testimony".

We endorse this view.

B. Messrs. G and H

5. Judge Milhollin discusses nine sets of parallel answers given by Messrs. G and H, and finds that five of those answers are the result of cheating. Report at ¶¶ 26-77.

6. Before discussing specific conclusions, Licensee reemphasizes what was said in the introduction to this section. The Board's view is particularly appropriate for Messrs. G and H, who admittedly gave some confusing testimony at times because their memories were hazy or because they were groping to articulate technical answers which they did not clearly understand. Lic. PF 55. Nevertheless, Licensee firmly believes that when all the evidence is weighed--the number of parallelisms, the confusion, the tendency of Messrs. G and H to memorize material, their frequent study sessions together, the fact that they did not sit next to each other during quizzes, and their repeated and unwaivering denials of cheating in the face of dogged questioning by investigators and exhaustive cross-examination under oath during these proceedings (Lic. PF 69)--the record simply does not support a finding of cheating.

7. Turning to specifics, Judge Milhollin looks first at ATOG Question No. 3 (natural circulation) and finds it impossible to reach a firm conclusion about the existence of cheating. Report at ¶¶ 29-33. Licensee believes that this specific parallelism can be explained on the basis of

memorization, as discussed in Lic. REPLY 70. In addition, Licensee discusses below at ¶¶ 136-38 Judge Milhollin's mistaken view of Mr. H's "striking ignorance of natural circulation." Report at ¶ 32.

8. The second similarity noted by Judge Milhollin concerns Lessons Learned Question No. 1 on "the two major areas of weakness noted by the Lessons Learned Task Force." Report at ¶¶ 33-37. Relying principally on the assumption that the training class of Messrs. G and H was taught around the answer key, Judge Milhollin finds that these two answers were produced by cooperation. Licensee disagrees. See Lic. REPLY 75.

9. To support his key assumption, Judge Milhollin does not cite the testimony of any instructors--no instructor who testified was asked about this matter. Instead, Judge Milhollin cites only the testimony by Mr. G that "the class was usually taught around the answer key." Report at ¶ 37. In fact, Mr. G did "not really remember" whether the class was taught around the answer key. Tr. 25,750 (Mr. G). Furthermore, from this tenuous statement by a trainee--not an instructor--who had no particular reason or opportunity to know if classes were actually taught around answer keys, Judge Milhollin rules out memorization as an explanation for Messrs. G's and H's responses because the responses don't correspond to the answer key. In fact, it is likely that the two did

memorize or have drummed into them the material from the lesson plan which in this case apparently was different from the answer key. See Tr. 24,514-15 (Wilson). Licensee therefore concludes that the evidence, although susceptible to differing inferences, does not support a finding of cooperation.

10. Judge Milhollin discusses a third parallelism on Lessons Learned Question No. 2 (primary deficiency in area of operational safety), which parallelism he finds was not a result of cooperation. Report at ¶¶ 38-39. Licensee agrees, and relies on its proposed findings. Lic. REPLY 76.

11. Judge Milhollin next discusses Accident Mitigation Question No. 3 (instruments used to measure narrow range and wide range pressure), and finds that the evidence does not conclusively show cooperation. Report at ¶¶ 40-43. Licensee agrees, and relies for its response on its detailed proposed findings. Lic. PF 58-63. Licensee also responds to Judge Milhollin's related criticism of the training program at ¶¶ 132-45, infra.

12. Judge Milhollin relies exclusively on Mr. G's testimony as a basis for finding the fifth parallelism on Accident Mitigation Question No. 4.a (hydrogen gas generation following a LOCA) to be an example of cooperation. Report at ¶¶ 44-48. Licensee stands by its proposed findings on this matter. Lic. PF 64-69.

13. Licensee admits that Mr. G's testimony on this hydrogen gas generation question was confusing, but finds unreasonable Judge Milhollin's conclusion that the testimony was therefore incredible. First, Mr. G.'s testimony supports the fact that he understood that neither aluminum nor sodium hydroxide alone can produce hydrogen. See Lic. PF 66; Tr. 25,780-81, 25,788-89 (Mr. G). Second, Mr. G's obvious and admitted confusion as to which element he had written on the first quiz and which he had written on the second indicates nothing more than an understandably faulty memory. Tr. 25,789-95 (Mr. G). Judge Milhollin's finding that such confusion constitutes "fabrication" is totally without support. Finally, although other operators did not use Mr. G's short-hand form for the sodium hydroxide-aluminum reaction, his use of this form is not surprising in view of his propensity towards writing short and often incomplete answers. Lic. PF 69.

14. Mr. H's testimony on this question is unambiguous and forthright and does not in any way support a finding of cheating. Lic. PF 68.

15. The sixth parallelism discussed involves ESAS Question No. 1 (list process lines isolated on reactor trip). Report at ¶¶ 49-52. Judge Milhollin's conclusion that the evidence points to cooperation on this question is based on

questionable premises. First, to flatly reject as incredible Mr. Husted's comments on the ordering of process lines (which were supportive of the operators) because of his admittedly "flippant" responses on a totally unrelated matter is both illogical in fact and unsupportable in principle. Report at ¶ 49; see Lic. PF 204. Second, Mr. H's inability to remember what ordering system he used more than eight months prior to this proceeding is, contrary to Judge Milhollin's view, understandable and totally credible. Lic. REPLY 74. Thus, Mr. G's explanation cannot reasonably be criticized in view of Mr. H's testimony. Lic. REPLY 73. On the contrary, Licensee finds Mr. G's explanation reasonable and believes that the evidence does not support a finding of cheating.

16. ESAS Question No. 1.b (location of new radiation monitors) is the seventh parallelism discussed, and Judge Milhollin's suggestion that Messrs. G and H cooperated here is not supported by the evidence. Report at ¶¶ 53-54. Whereas neither Mr. Trunk nor Mr. Wilson had previously called out these answers as parallelisms, Judge Milhollin himself spotted them and raised them during Mr. Wilson's testimony (Tr. 24,511-12 (Milhollin)). Yet, although Mr. Trunk and Messrs. G and H testified after Mr. Wilson, neither Judge Milhollin nor any of the other parties questioned any of these individuals about the two short and somewhat similiar answers. Thus, no

explanation for the similarity was obtained. The only evidence Licensee has found which indirectly relates to this matter comes from Mr. Trunk, who stated that "if it is a very short answer and it is not correct, although two people may have the same wording, you cannot conclude from that they have cheated." Tr. 24,871 (Trunk). Again this simply does not support a finding of cheating.

17. Licensee agrees with Judge Milhollin that the evidence with respect to the next parallelism, ESAS Question 2 (new radiation monitors and valves), does not conclusively indicate cheating. Report at ¶¶ 55-57. Licensee notes only that the following statements by Judge Milhollin are unsupported by any evidence of record: "They [Messrs. G and H] repeated their answers . . . without any apparent concern that they had become wrong," and "G and H must have ignored their training materials." Report at ¶ 57.

18. Judge Milhollin specifically discusses one last parallelism on Bernoulli's equation. Report at ¶¶ 58-66. Licensee urges the Board to reread with particular attention the section of Licensee's proposed findings which discusses this parallelism in great depth. Lic. PF 70-83.

19. Judge Milhollin's exclusive reliance on Mr. G's testimony provides insufficient support for his conclusion of cooperation, particularly because he mischaracterizes the

testimony. First, he claims that Mr. G "changed his testimony" after reading Mr. H's answer. Report at ¶ 61. In fact, Mr. G never deviated from his original position. He said Bernoulli's equation "would not be used" in the plant and that he "had never used [it] to calculate flow". Tr. 25,774 (Mr. G) (emphasis added). He later stated that the equation could be used, but he still "would not use it . . . to calculate flow." Tr. 24,776 (Mr. G) (emphasis added).

20. Next, Judge Milhollin states that Mr. G "proceeded to construct the theory" that he and Mr. H memorized the equation from one of Mr. H's textbooks. Report at ¶ 62. The implicit suggestion that Mr. G's admittedly unclear recollection as to the source of the definition caused him to fabricate an explanation or otherwise to give misleading or dishonest testimony is baseless.

21. Judge Milhollin again suggests dishonesty when he discounts Mr. G's statement that "the whole week was about Bernoulli's equation." Report at ¶ 63. A more plausible explanation is that Mr. G exaggerated what was indeed a training week emphasizing, among other things, the principles behind the equation. Lic. PF 77 (Mr. H remembered emphasis on equation). Similarly, Mr. G was exaggerating when he said "I do not study." Tr. 25,727 (Mr. G). He noted several times that he only studies at work, not at home (Tr. 25,728-29,

25,784 (Mr. G)), which clearly does not contradict his testimony that he learned Bernoulli's equation by studying with Mr. H. See also Lic. PF 53 (Messrs. G and H studied frequently together on shift).

22. Judge Milhollin's conclusion, based on Mr. G's somewhat confusing but certainly plausible testimony, that Mr. G "was trying to hide something" (Report at ¶ 66) is unsupported and unreasonable.

23. Judge Milhollin's recitation of several witnesses' testimony on the administration of and attitudes about weekly quizzes (Report at ¶¶ 68-72) relates more to Licensee's training program than to the very specific issue whether Messrs. G and H cooperated on certain specific answers. See ¶¶ 136-45, infra for a discussion of the training program. In any event, Messrs. G and H had views different from those of many of the other operators. These two (G and H) said weekly quizzes were well-proctored and there was no talking. Report at ¶ 72.[1/]

24. Finally, Judge Milhollin's rejection of memorization as an explanation for the parallelisms of Messrs. G and H

1/ The other individuals who were on the same shift and took their training with Messrs. G and H (Messrs. F, E, UU and QQ (Tr. 25,758 (Mr. G); Tr. 25,865-66 (Mr. H)) did not testify during this proceeding, so there is no evidence to confirm or deny Messrs. G's and H's views.

ignores the undisputed testimony by both operators that they frequently studied together on shift and often memorized material. Lic. PF 53.

25. In sum, Licensee finds that the evidence, although clearly susceptible to conflicting inferences at times, does not provide a basis for concluding that cheating occurred.

26. Nevertheless, if the Board agrees with Judge Milhollin's conclusions about Messrs. G and H (Report at ¶ 311), Licensee believes that to remove the two men from duties at TMI-1 on the basis of these proceedings is inappropriate. Rather, the Board should recommend to the Nuclear Regulatory Commission that it institute separate proceedings under 10 C.F.R. Part 2, Subpart B and 10 C.F.R. § 55.40 for the suspension or revocation of the licenses of these two operators. Absent such proceedings, Messrs. G and H would be deprived of their NRC licenses without the procedural rights afforded them under the NRC's regulations. If proceedings were to be recommended by the Board and instituted by the Commission, Licensee would remove Messrs. G and H from any licensed duties at TMI-1 pending the outcome of the proceedings against them.

C. Messrs. S and Y

27. Licensee relies on its proposed findings with respect to this matter. Lic. PF 98-100.

D. Messrs. GG, W and MM

28. Judge Milhollin concludes not only that copying by Mr. W must have occurred with Mr. GG's participation, but that Mr. MM must have cooperated on one answer. Report at ¶¶ 82-93. Licensee disagrees as to both Messrs. GG and MM. See Lic. PF 85-97.

29. First, Licensee points out that contrary to Judge Milhollin's finding, Mr. MM's answers were not "identical" to those of Messrs. GG and W. See Report at ¶ 89. Indeed, neither Mr. Trunk (Lic. PF 89) nor any of the parties in this proceeding found Mr. MM's answers sufficiently similar to those of Messrs. GG or W to support a conclusion that Mr. MM had cooperated. The language Mr. MM used admittedly was somewhat cumbersome, but absent the training materials or lesson plans utilized, Licensee is unable to determine whether memorization during training sessions accounts for these similarities. Moreover, absent any corroborative evidence tending to show that Mr. MM was likely to or was in a position to cooperate, and particularly in view of the weak similarities between Mr. MM's answers and the others, Licensee does not agree that the evidence supports a finding of cheating.

30. As to Messrs. GG and W, Licensee has admitted that cheating appears to be the only explanation (Wilson, ff. Tr. 24,478 at 11-12), and has also concluded that Mr. W was very likely to have cheated. Lic. PF 96-97; Lic. REPLY 63.

31. However, Licensee disagrees with Judge Milhollin's speculation, unsupported by citation, that Mr. GG or Mr. W copied the answer to Question 1 from training material or from other notes. In addition, Licensee disagrees with Judge Milhollin's statement, also unsupported by citation, that "memorization of such a clumsy string of words simply to answer a quiz" is unlikely. Report at ¶ 91. On the contrary, in addition to learning concepts related to plant operation, operators relied on memorization as one useful study technique (see Report at ¶ 75), and there is no reason to believe that either Mr. GG or Mr. W would refrain from memorizing any particular phrase if it would help him to pass a quiz.

32. As to who copied from whom, Judge Milhollin finds that Mr. W probably copied from Mr. GG, but it may have been Mr. GG who copied from Mr. W in view of a crossed-out word on Mr. GG's paper. Licensee suggests that Mr. GG's crossed-out word is equally susceptible to conflicting inferences. See ¶ 117, infra. Licensee also suggests that in view of Mr. GG's generally forthright manner (Lic. PF 94; Report at ¶ 313), and in view of the fact that he had no explanation for the

similarities between his answers and those of Mr. W (Tr. 25,695 (Mr. GG)), one cannot reasonably question his credibility because he guessed as to possible reasons for the parallelisms. Tr. 25,698 (Mr. GG). Weighing all the evidence, Licensee is not pursuaded that Mr. W's probable copying occurred with Mr. GG's knowledge or active participation.

33. With respect to Judge Milhollin's recommendation that some sanction less severe than removal from licensed activities "might be appropriate" for Mr. GG (Report at ¶ 313), Licensee respectfully disagrees with Judge Milhollin's opinion.

E. Mr. Shipman at the Coffee Machine

34. Judge Milhollin's discussion of the Shipman incident at the coffee machine (Report at ¶¶ 94-100, 314-15) subtly twists certain facts of record, and on the basis of this somewhat skewed factual presentation, reaches a conclusion that is both unsupported by the record and procedurally unfair.

35. As a first step, Licensee urges the Board to review with great care Lic. PF 102-113. The differences in the facts surrounding the Shipman incident as reported in Licensee's findings and in the Report are important to any determination on this issue.

36. In the Report at ¶ 94, for example, the Special Master states, incorrectly, that the Shipman incident occurred during either the NRC RO or SRO "A" exams given on April 21 and

22, 1981, respectively. The Special Master also states in the same paragraph that Mr. Shipman "said" the question asked of him was on the exam, and that Mr. Shipman "remembered" that only he and the questioner were present at the coffee machine. In fact, Mr. Shipman thought that the incident could have occurred either during one of the NRC "A" exams or during one of the mock ATTS exams. Lic. PF 104. Moreover, Mr. Shipman only assumed that the question was on the exam, Tr. 26,363 (Shipman), and only assumed that no one else was present at the time of the incident because the area around the coffee stand is small. Tr. 26,360 (Shipman). Thus, what Judge Milhollin set forth as undisputed facts are more appropriately characterized as uncorroborated assumptions. This is important since the definity of Mr. Shipman's recollection of some facets of his encounter are relied upon by Judge Milhollin to disparage his inability to remember others.

37. Judge Milhollin's conclusions regarding Mr. Shipman stem entirely from an unwillingness to accept Mr. Shipman's stated inability to remember the identity of the questioner. Judge Milhollin finds that because of Mr. Shipman's Navy background, his managerial position at TMI-1 and his feelings soon after the incident, his memory failure is incredible. Report at ¶¶ 97-100. Licensee disagrees.

38. Judge Milhollin obviously did not believe Mr. Shipman's statement that he could not name his questioner, and so put together an explanation for his position based on circumstantial evidence adduced during the proceeding. While this explanation may have some appeal, Licensee believes that its own explanation is more logical and, thus, more persuasive.

39. Licensee points out that it is totally incongruous for Mr. Shipman not to name his questioner if he knows him. Mr. Shipman holds the important position of Mr. Ross's right-hand man. Tr. 24,073 (Hukill). His seven years of unblemished service with Licensee (Lic. PF 107) belies any unwillingness on his part to be forthright about this question. Moreover, his voluntary disclosure of the incident to Mr. Hukill during an interview reflects the sense of responsibility he felt to reveal all that he knew. Having exposed himself to, and having suffered the criticism and suspicion which accompany this admission of wrongdoing (Tr. 26,389-90 (Shipman)), there is no plausible reason for him to withhold any information. In addition, there certainly is no reason, and none has been offered, to account for his lying under oath to protect the questioner. See Lic. PF 108.

40. Like Judge Milhollin, Licensee too was deeply concerned about the disparity in Mr. Shipman's recollection of specific facts related to the incident. Mr. Hukill questioned

and requestioned him on this subject. In the end, Licensee was convinced of Mr. Shipman's veracity. Lic. PF 108. The brief, spontaneous encounter during an exam which demands great concentration; Mr. Shipman's inability to remember not only the questioner but also the question asked, whether the question was on the exam and during which exam the encounter took place; Mr. Shipman's fine record with Licensee; and the necessary balancing in his own mind of committing a known crime of lying under oath versus protecting someone, simply do not add up to support Judge Milhollin's conclusion on this matter.

41. Even if the record does support a finding that Mr. Shipman lied under oath, however, Judge Milhollin's recommendation that Mr. Shipman be removed from licensed activities until he names his questioner or gives a "credible reason" for not naming him (Report at ¶ 315) is both unfair and so vague as to be impossible to comply with. A fair and appropriate response for the Board, if it agrees with Judge Milhollin, would be to recommend to the NRC that it institute an independent proceeding under 10 C.F.R. Part 2, Subpart B and 10 C.F.R. § 55.40 for the suspension or revocation of Mr. Shipman's license. See ¶ 26, supra (suggested) Board response with respect to Messrs. G and H). If such a proceeding is recommended and accepted, Licensee would, upon initiation of such proceeding, remove Mr. Shipman from any licensed activities at TMI-1 pending the outcome of the proceeding.

F. Mr. P and Mr. Husted in the Unproctored Room

42. Judge Milhollin recites in detail the facts relative to the possible solicitation of Mr. P by Mr. Husted during an NRC exam (Report at ¶¶ 101-105), and then states that the only way to resolve the conflicts between Messrs. P and Husted on the one hand, and Mr. Ward on the other, is to judge the credibility of the three individuals. Licensee agrees that credibility is a key factor here, but disagrees with Judge Milhollin's ultimate conclusion that Messrs. P and Husted were not credible witnesses and that Mr. Husted must therefore have solicited information from Mr. P during an NRC exam. Report at ¶¶ 106-11. Licensee's findings include an in-depth discussion of this matter (Lic. PF 143-65; Lic. REPLY 43-49), and the Board is requested to carefully compare Licensee's factual and character assessments with those of Judge Milhollin.

43. As for Mr. P, Judge Milhollin suggests that his credibility is somewhat undermined by Mr. OO who testified about a discussion with Messrs. P and Q on a math problem during a quiz. Report at ¶ 106. Mr. P testified that operators sometimes asked each other for clarification of questions, and that he infrequently had been asked to clarify or to explain how to answer a question. Lic. PF 136. In fact, as noted in Licensee's proposed findings (Lic. PF 134-38), Mr. OO could not recall the nature of the information exchanged, so Mr. P's credibility is not necessarily impugned.

44. Next, Judge Milhollin discusses Mr. P's concern about solicitation during exams (Report at ¶ 107), and concludes that Mr. P was not a forthright witness. Licensee relies for its response on its findings (Lic. REPLY 45-46), emphasizing that to focus on the answer to one relatively innocuous question in a deposition out of hundreds asked of him in the deposition, in interviews and at hearing, is unreasonable. Moreoever, Mr. P's interpretation of the verb tense of this one question is not relevant to the principal issue before the Board, viz., whether Mr. P was solicited by Mr. Husted during an NRC exam. Id. Finally, the cross-examination of Mr. P on this point was the most intense of any at the hearing, and Mr. P never faltered. Tr. 26,727-36, 26,745-53 (Mr. P). Because the Board has not had the benefit of hearing or observing Mr. P directly, Licensee suggests that the Board review thoroughly this portion of the transcript.

45. Judge Milhollin's assessment of Mr. Husted's credibility is not based on the latter's testimony with respect to this matter, which testimony consisted of consistent and unhesitating denials of any solicitation. Lic. PF 157; Lic. REPLY 49. Rather, Judge Milhollin's assessment is based on Mr. Husted's attitude and flippant manner with respect to the first and second OIE investigations. Report at ¶¶ 109-10. In response, Licensee reaffirms its proposed findings on Mr.

Husted's attitude and on the substance of the rumor concerning passing papers, noting particularly its disagreement with Judge Milhollin's statement that Mr. Husted may have "deliberately withheld" information. Lic. PF 199-205; Lic. REPLY 50-52. Licensee also questions the reasonableness of Judge Milhollin's conclusion that one who is flip is thereby dishonest--not only as to the issue in question but as to other unrelated issues as well.

46. Finally, Licensee notes Judge Milhollin's observation that both Messrs. Husted and P "had an interest in denying the solicitation." Report at ¶ 111. Even if one accepts this proposition as true, one cannot reasonably rely on such a speculative statement as evidence tending to show that these individuals would lie under oath.

47. Licensee strongly believes that Messrs. P's and Husted's lying under oath is not the only explanation for this situation. As pointed out in Licensee's proposed findings, a more likely explanation is that Mr. Ward's interview of Mr. P was confused. Lic. PF 164.

48. Based on Licensee's review of the record, Licensee does not find that Mr. Husted either solicited an answer from Mr. P during an NRC exam or that he withheld any information from the NRC. Therefore, Licensee respectfully disagrees with Judge Milhollin's recommendation that some sanction less severe

than removal from licensed duties is appropriate. Report at ¶¶ 316-17.

G. Mr. U in Mr. Husted's Office

49. Judge Milhollin does not conclude that Mr. U was stationed near the NRC examination room to assist examinees, as the rumors suggested, but that Mr. U "offered [Mr. OO] assistance." This conclusion is based on Mr. U's studying directly after the NRC "A" exams, Mr. U's choice of Mr. Husted's office in which to study, and Mr. OO's testimony about Mr. U. Report at ¶¶ 112-22. In its proposed findings, Licensee already has responded directly to virtually all of Judge Milhollin's statements on this matter, and requests the Board to review Lic. PF 183-98 and Lic. REPLY 56-57.

50. First, although Judge Milhollin's difficulty in believing that Mr. U began to study directly after the NRC exams might be understandable in other circumstances, Licensee points out that Mr. U did not have a choice; he was assigned to study as part of his full-time training rotation. Lic. REPLY 57.

51. Second, in response to Judge Milhollin's statement that Mr. U's reasons for using Mr. Husted's office are neither "convincing" (Report at ¶ 119) nor "plausible" (Report at ¶ 122), Licensee finds, to the contrary, that the abundance of reference material and easy access to beverage machines made

Mr. Husted's office a most desirable choice. See Tr. 26,918 (Mr. Husted acknowledged that it was more convenient to use his office than to use any of the classrooms that might have been available). Moreover, the fact that Mr. U could not recall studying in Mr. Husted's office before or after this NRC exam is easily explained by the fact that Mr. Husted, as a licensed operator instructor, normally used his office during the day when he was not teaching a class, so his office generally was unavailable.

52. Finally, Licensee believes that Judge Milhollin has misinterpreted Mr. OO's testimony. Whether or not Mr. OO was a credible witness, all that he was able to recall was that he saw Mr. U at the coffee pot and on the basis of a, "Hi, how are you doing?" (Tr. 25,988 (Mr. OO)), Mr. OO "jumped to the conclusion" Tr. 25,998 (Mr. OO)) that Mr. U was making an implied offer of assistance. Yet, from this testimony, Judge Milhollin concludes that Mr. U in fact offered Mr. OO assistance, and that such an offer was an act of cheating. This conclusion is not even in accord with the clear and unambiguous testimony provided by Mr. OO, much less in accord with other evidence of record.

53. Licensee disagrees with Judge Milhollin's recommendation that Mr. U be sanctioned. Report at ¶¶ 318-19.

H. Telephone Call to Mr. KK

54. Judge Milhollin concludes that Mr. U made a telephone call to Mr. KK during the period of an NRC exam to solicit information for Mr. O who was taking the exam, but that no cheating occurred because the question asked by Mr. U was not on the NRC examination. Report at ¶¶ 123-29. Licensee agrees that no cheating occurred and further believes that Mr. U did not make the call. Lic. PF 114-27.

55. Licensee has only a few observations about this matter. Judge Milhollin terms "suspicious" Mr. O's failure to confront Mr. U after Mr. O learned of the call to Mr. KK, and concludes that Mr. O was "not innocent." Report at ¶ 127. In view of the fact that the question was not on the exam Mr. O took, Licensee fails to understand what Mr. O might have been guilty of. Judge Milhollin also relies, in part, on Mr. Ward's testimony that it was "highly likely" that Mr. U made the call. Report at ¶ 128 citing Tr. 25,359-60 (Mr. Ward). Judge Milhollin fails to note, however, that Mr. Ward ultimately was convinced that Mr. U might have made a call to Mr. KK about a thermodynamics question, but not the call at issue. Tr. 25,381-82 (Mr. Ward).

I. Rumors About Mr. U

56. Judge Milhollin concludes that the rumors about Mr. U writing on his hand and taking crib sheets into the April, 1981 NRC exam are unfounded. Report at ¶¶ 130-32. Licensee agrees and relies on its proposed findings. Lic. PF 176-82.

J. Telephone Call to Mr. WW

57. Judge Milhollin finds no reason to doubt that the telephone call in question was made to Mr. WW or that cheating occurred. Report at ¶¶ 133-34. In response, Licensee relies on its proposed findings (Lic. PF 128-33), emphasizing that the question asked, contrary to Judge Milhollin's assertion, was not itself on the Kelly exam but was only related to an exam question (Lic. PF 129). Thus, cheating may not have occurred, and there may not be an uncaught cheater here.

III. MR. ROSS'S CONDUCT

58. Licensee agrees with the Board that the central issue with respect to the April, 1981 NRC exam changes proposed by Mr. Ross and the other Licensee reviewers, is whether the proposals were made in good faith, not whether they were correct. Board Tentative Decision at 13. Nevertheless, Licensee believes that there is evidence of record not discussed by Judge Milhollin to support the propriety of the two challenged changes in controversy: the answers to questions B.5.a and C.2.b.

59. Question B.5.a on the "A" RO exam stated:

> a. What is the purpose of the #1 seal bypass line? Include how opening this line affects the #1 seal.

Staff Ex. 33. In order to understand what the right answer to this question should be, one must first understand the nature of the two questions posed. The first question asks the examinee to state the purpose of the #1 seal bypass line. As almost all of the answers provided by the operators indicate,[2/]

2/ The following individuals answered the first part of the answer to B.5.a as follows: Mr. B: "This would provide a minimum flow (1 gpm) to cool the radial bearing," Staff Ex. 37Q; Mr. D: "[No.] 1 seal bypass line provides more flow across radial bearing by lowering the pressure below the no. 1 seal," Staff Ex. 37K; Mr. E: "Purpose is to provide enough cooling flow to keep the pump radial bearing and [no.] 1 seal leak off temp within exceptable limits $< 225°F$," Staff Ex. 37E; Mr. F: "[No.] 1 seal bypass line is to increase the flow pass the Radial bearing for proper cooling at low pressures," Staff Ex. 37J; Mr. G: "The purpose of the [no.] 1 seal bypass line is to increase flow past the radial bearing to keep it cool when R.C. Pressure is > 100 psi and < 1000 psi." Staff Ex. 37H; Mr. H: "The [no.] 1 seal bypass line is provided to supplement cooling for pump radial bearing," Staff Ex. 37I; Mr. T: "The purpose of the seal [no.] 1 bypass line is to cool the radial bearing when the [no.] 1 seal is not open far enough to allow encugh flow to cool it," Staff Ex. 37R; Mr. U: "The purpose of the [no.] 1 seal bypass line is to allow more flow over the radial bearing of the pump to aid in cooling," Staff Ex. 37B; Mr. X: "To provide sufficient cooling water flow thru the reactor coolant pump radial bearing during times of low seal [no.] 1 leakoff flow," Staff Ex. 37A; Mr. BB: "Provides a means of providing adequate cooling flow through the RCP Radial Bearing when [no.] 1 seal flow is low, provided other conditions are met; see below," Staff Ex. 37D; Mr. CC: "Provides a flow path for seal injection to enable cooling of the radial bearing," Staff Ex. 37M; Mr. FF: "With a closed [no.] 1 seal, the bypass could be opened to assure that some (cooler) water movement around the radial bearing," Staff Ex. 37F: Mr. GG: "The [no.] 1 seal bypass line insures adequate cooling water

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when the bypass line, which is ordinarily not open, is opened, it allows more water to flow past the radial bearing thereby supplementally cooling the radial bearing. In fact, only one operator did not state this purpose. See Staff Ex. 37G.

60. The second portion of question B.5.a asks how opening the #1 seal bypass line affects the #1 seal. Thus, this portion of the question is not directed at the function of the bypass line. Instead, it concerns the secondary effect of opening that line on the #1 seal, which is bypassed, at least partially, by the diversion of water from the regular channel past the radial bearing and the #1 seal to the #1 seal bypass line. See Staff Ex. 33 (Master Exam), at page entitled "Exam B Answers."

61. The Staff's master answer to B.5.a stated:

> Lowers the pressure in the #1 seal area, offers lower head resistance to pump injection water, allows more injection flow to be diverted up shaft through the seal and past

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(Continued)

flow past the radial bearing," Staff Ex. 37C; Mr. QQ: "The purpose is to provide additional seal injection flow and cooling to the RC pump radial bearing," Staff Ex. 37O; Mr. RR: "[No.] 1 seal bypass provides a path for additional cooling flow through the RCP radial bearing," Staff Ex. 37P; Mr. SS: "The purpose of the [no.] 1 seal bypass is to increase flow thru the radial bearing to provide adequate cooling," Staff Ex. 37N; Mr. UU: "The purpose of the number [no.] 1 seal bypass is to provide additional cooling to the radial bearing and/or the [no.] 1 seal," Staff Ex. 37L; and Mr. Ross: "The bypass line is provided to ensure cooling for the RC pump radial bearing," Staff Ex. 35.

radial bearing. This prevents binding and contact of seal faces.

Id. The changes requested to the answer by Licensee's reviewers were to delete "through the seal and," and to add at the end of the first sentence, "for adequate cooling." Id. In addition, the answer key shows that the statement "lowers seal #1 P" was written over the top of the answer to this question. Id.

62. Judge Milhollin's findings are based solely on the testimony of Staff examiner Bruce Wilson who first stated that he could not recollect specifics on this change, although he might be able to so recollect in other particular instances. Tr. 25,597 (B. Wilson). Based on Mr. Wilson's further testimony, Judge Milhollin found that the reviewers argued that the last portion of the answer, which responded to the portion of the question asking about the effect on the #1 seal of opening the bypass line, was taught at other facilities but not at TMI. Report at ¶ 155; Tr. 25,598-99 (B. Wilson). Judge Milhollin also found that the answer as changed corresponded with the answer given by the three reviewers, as well as the answer given by six other individuals. Report at ¶ 155. However in Judge Milhollin's opinion, eight other candidates had included in their answers the statement that was changed, viz., "This prevents binding and contact of seal faces." Id. Judge Milhollin then finds that these individuals must have been

taught both effects; therefore, individuals who had only one-half the answer right received full credit because of Mr. Ross's incorrect and, in Judge Milhollin's view, improperly recommended change.

63. Licensee believes that Judge Milhollin has misread both the answer key and many operators' answers. First, Judge Milhollin appears to suggest that the addition, "for adequate cooling," requested by Licensee's reviewers was to the answer for the second portion of the question, concerning the effect on the seal. Report at ¶¶ 155-157. In fact, a review of the sentence as changed suggests that "for adequate cooling" was added as a concluding portion of the answer to the first part of the question concerning the bypass line; that is, the purpose of the bypass line is to provide adequate cooling to the radial bearing. This interpretation is borne out by the answers provided by almost all of the operators to the first portion of the question. See n.2, supra. While the answer as written by the Staff certainly suggests cooling, e.g., by reference to lower pressure and allowing more injection flow, cooling is not explicitly stated. Thus, "for adequate cooling" is a clarification of the first part of the answer to question B.5.a offered by Licensee's reviewers. See Report at ¶ 156.

64. Judge Milhollin then suggests that no answer is provided in response to the second portion of the question.

However, here the Special Master ignores the handwriting which appears on the answer key above the typed answer. That writing states: "lowers seal #1 ΔP." Staff Ex. 37. Without introducing additional evidence, it is difficult to establish why this apparent answer to the seal #1 portion of the question, and not the answer initially suggested by the Staff, is correct. Nevertheless, a review of the answers provided by the candidates provides insight into this matter.

65. Judge Milhollin asserts that candidates T, E, UU, QQ, D, SS, U and H answered the second portion of this question as the Staff would have the answer but for Mr. Ross's intervention. In Licensee's view, the answers provided by six of these eight individuals suggest that opening the line could cause rather than prevent binding and contact of seal faces. These answers also suggest that this potential damage would occur by lowering the ΔP, or equalizing the pressure on the seal, thereby producing the potential for excessive wear on the #1 seal (along with the #2 seal). Thus, Mr. T stated, "Opening the seal #1 bypass will decrease the inlet press. to #1 seal and therefore the ΔP across no. 1 seal will be lower and since #1 seal is a floating this could allow the seal to close or result in not enough sealing water to seal and cool the shaft." Staff Ex. 37R. Mr. E stated, "Opening the bypass could lead to cocking the #1 seal due to the back pressure being felt on the

#1 seal outlet line/#2 seal inlet. Could lead to seal damage." Staff Ex. 37E. Mr. QQ stated, "This would reduce the amount of seal injection flow up thru the #1 seal which could cause overheating, wear, and possibly failure of the #1 seal." Staff Ex. 37O. Mr. D stated, "Doing this may also cause the #1 seal to go closed because the $\triangle$P across the seal may not be great enough to keep it open." Staff Ex. 37K. Mr. U stated, "By opening the #1 seal bypass their would be less flow available for the #1 seal and it may cock and jam or drop either could cause #1 seal failure." Staff Ex. 37B. Mr. H stated, "By opening #1 seal bypass line it equalizes pressure across #1 seal as a result of this the inlet to #2 seal is pressurized which could cause damage to #2 seal." Staff Ex. 37I.

66. Moreover, neither of the two individuals who did not state that opening the bypass line could cause damage stated that damage would be prevented. Rather, Mr. SS suggests that the water flowing across the seal would remain sufficient to prevent this result: "While opening the bypass will decrease the leakoff thru #1 seal enough is still provided to prevent seal damage." Staff Ex. 37N. Mr. UU stated, "[W]hen this is opened it creates a lower press at the inlet of the #1 seal which will cause more water to flow past the radial bearing and because of its location more water through #1 seal due to a lower press. at its inlet (seal injection has lower pressure

[illegible])," see Staff Ex. 37L, thus explaining the pressure loss without reference to causing or preventing binding and contact of seal faces.

67. In summary, Licensee firmly believes, contrary to the findings of Judge Milhollin, that the changes proposed by Mr. Ross and his fellow reviewers to question B.5.a of the NRC "A" RO exam were proper. In fact, the original Staff answer to the second portion of the question was incorrect without the reviewers' suggested change.[3/] Certainly, Licensee does not agree with Judge Milhollin's assessment that answers provided by other operators support the Special Master's interpretation of this compound question and answer.

68. The second RO "A" exam answer change which Judge Milhollin determined was improperly requested by Mr. Ross and one of the other reviewers, Mr. Boltz, see Report at ¶¶ 161-66, was the answer to question C.2.b. That question stated:

> Control of pH is important to minimize corrosion of primary and secondary components.
>
> b. Primary pH can vary from 4.6 to 8.5. Describe the competing effects that determine primary pH and cause it to vary in this manner.

3/ Analogously, the first proposed change deleting "through the seal and," which was accepted by the Staff, corrected a technical error in the first portion of the answer to question B.5.a.

Staff Ex. 33. The answer to C.2.b provided on the Staff master key stated:

> Boric acid and lithium hydroxide concentrations compete. BA conc. varies over core life for [reactivity] control. BA causes pH to be lowered. LiOH is alkaline and causes pH to be increased. Decrease in BA over core life is dominant factor.

Id. The beginning of this answer references pages 5 and 7 of "Chem. Lecture," referring to chemistry lecture materials from the OARP. Tr. 25,611 (B. Wilson). Other annotations appear in the margins of the answer: "for good answers see Zewe and Boltz"; and ".2-2 ppm w/Li Control Lithiated demin bed." Id. At issue is the propriety of Mr. Ross's apparent suggestion that boric acid need not be part of the correct answer. As Mr. Wilson recollected,

> During our review, the three people involved expressed disagreement with the material that was contained in the chemistry lecture that we had in the OARP. To my recollection, they argued that that material was written by outside consultants and it was not, although it probably was theoretically correct, it was not the way they operated the power plant.

Tr. 25,611 (B. Wilson). While the Board does not find the proposed change, i.e., deleting the boric acid portion of the answer, to be "unconscionable," the Board does state that "[i]t is clear however that the answer based upon actual plant practice would not respond literally to the question." See Board Tentative Decision at 13. Licensee agrees with the

Board's view; however, Licensee does believe that the question is more confusing than it might appear at first blush. In Licensee's view, it is this confusion which explains the proposed change to this question.

69. Question C.2.b begins with a statement about the importance of controlling the pH level in the reactor. It then goes on to ask about "competing effects." While one of these effects may be boric acid, boric acid clearly is not varied in order to control pH; rather, lithium hydroxide serves this function. As the Staff's answer key suggests, boric acid concentrations are varied over core life to control reactivity. Staff Ex. 33. Thus, even though the specific question asks for "competing effects" that determine pH level, it is at least understandable why the reviewers would state that for purposes of controlling pH, i.e., chemistry control, varying boric acid "was not the way they operated the power plant." Tr. 25,611 (B. Wilson).

70. The varied answers to this question provided by the operators support this analysis. Judge Milhollin finds that Messrs. Boltz and Ross, two of the reviewers, answered the question incorrectly, in accordance with the change they suggested. Judge Milhollin also makes the following findings:

(i) Mr. Brown's (the other reviewer) answer was wrong;

(ii) only three other operators had answers similar to those of Messrs. Ross and Boltz;

(iii) seven operators had answers similar to the answer provided by the NRC Staff; and

(iv) "wrong answers" were provided by six other individuals.

Report at ¶ 162. Licensee does not agree with Judge Milhollin's assessment of the examinees' answers to this question.

71. In the first place, contrary to Judge Milhollin's Report, Mr. Boltz' answer was clearly correct--it described the effect of both boric acid and lithium hydroxide (see Mr. BB's answer in footnote 5) and was one of the two answers to which the grader is referred in the answer key for a good answer.[4/] See ¶ 68, supra; Staff Exs. 37D and 33. In addition, Licensee's review of the answers of individual operators results in a fairly even split between individuals who mentioned both lithium hydroxide and boric acid, and operators who left out the boric acid portion of the answer. Specifically, nine people--Messrs.

4/ Judge Milhollin also finds that Messrs. Ross and Boltz, but not Mr. Brown, the third Licensee reviewer, made an improper attempt to broaden the answer key. Report at ¶ 166. Apparently Judge Milhollin finds that the change was made by these two individuals since, in Judge Milhollin's opinion, both individuals would profit by the change. Id. Licensee does not believe there is any evidence supporting this theory. In fact, the only testimony presented on this subject suggests that all three reviewers recommended the change. See Tr. 25,611 (B. Wilson)("During our review, the three people involved expressed disagreement with the material that was contained in the chemistry lecture that we had in the OARP.")

X, T, B, E, SS, QQ, RR, BB and F--provided answers similar to the NRC answer in that both competing effects were stated.[5/] (In

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5/ Mr. X stated, "We add Boric acid to the coolant as a chemical shim. This boric acid tends to lower ph but at power the B_{10} will absorb a neutron & produce Li^{7}. Li^{7} is a Base which tends to raise the ph of the coolant." Staff Ex. 37A.

Mr. T stated, "The major competing effects that determine Pri. Ph is boron and Li prod. Boron lowers Ph, and Li tends to raise Ph. Li is produced in the Rx by boron capturing a $_{0}^{1}n$. One of the M.U. Demins. is also Lithiated. Ph varies due [to] boron removal in the M.U. Demin. If the Demin. is removing a lot of boron it is liberating Li and raising Ph. and vice-versa. In our plant Ph is a balance between boron removal and Li production. If a hi conc. of Li exists causing hi Ph., a new Demin. can be placed in service that is boron sat. this will remove the Li and liberates some boron." Staff Ex. 37R.

Mr. B stated, "Ph can vary due to the amount of Lithium Hydroxide in the primary as a result of Boron-neutron ineraction. Can vary due to the amount of Boron in the core. Ph will also vary depending upon the reference temperature it is taken at. Ph may vary depending upon the affectiveness of the Demineralizers in the MU system." Staff Ex. 37Q.

Mr. E stated, "The primary system has boric acid in solution and causes the PH to be lower. This boric acid concentration varies over core life and a reduction would tend to raise the PH. We allow the PH to vary and control the amount of Lit[h]ium in the primary. The [illegible] is .2 to 2 PPM. As long as we maintain a Hydrogen over pressure to scavenge the oxygen and keep Lithium within .2 to 2 PPM, PH will vary for 4.6 to 8.5 but corrosion [is] the thing we are trying to limit will be exceptable." Staff Ex. 37E.

Mr. SS stated, "Ph can be raised by adding lithium hydroxide initially. During operation Boric acid tends to produce ph but when subjected to flux produces Lithium which causes ph to steadily increase requiring reduction by use of the makeup and Purification sys. demineralizers to reduce Lithium concentration." Staff Ex. 37N.

Mr. QQ stated, "The primary ph is controlled by the addition of lithium hydroxide which is used to raise ph but this is counteracted by the boron (boric acid) in the RCS.

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this list Licensee includes one individual, Mr. B, whose answer was marked one-half wrong for not including boric acid; however, since his answer stated, "[c]an vary due to the amount of Boron in the core," Licensee has included this individual in the list of individuals with a completely correct answer. See Staff Ex. 37Q.)

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Therefore the ph is lower at BOL (i.e. higher Boron conc.) and ph is higher at EOL (i.e. lower Boron conc.)." Staff Ex. 37O.

Mr. RR stated, "Boric Acid - lowers pH; LiOH - acts as pH buffer (holds pH up); RC Temp - raising temp causes lower pH." Staff Ex. 37P.

Mr. BB stated, "The presence of Boric Acid lowers pH of the Primary System. The $^{10}_{5}B + {}^{1}_{0}n \rightarrow {}^{7}_{3}Li + {}^{4}_{2}\alpha$ reaction removes Boron, produces lithium, changing pH as the lithium concentration increases due to its production.

"We control RCS within limits by controlling the Lithium concentration. The B&W Limits for Lithium corresponding to 4.8 - 8.5 pH are 0.2 ppm to 2.0 ppm. Our operating limits are 0.6 to 1.6 ppm Lithium. At 1.6 ppm we put the non-lithiated makeup and purification demineralizer in service until lithium is reduced to 0.6 ppm.

"Under abnormal low Lithium conditions we could inject LiOH into the primary system via the Makeup Purification System." Staff Ex. 37D.

Mr. F stated, "The Boric acid in the primary tries to reduce the ph toward the low end of the spec. The other contributor is Lit[h]ium Hydroxide which we add to make it go the other way. The additions of Li are every few due to the fact that we produced Li in RCS." Staff Ex. 37J.

72. In contrast, eight people--Messrs. U, H, UU, V, D, G, FF and Ross--did not mention boric acid in their answers.[6/] In

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6/ Mr. U stated, "Primary system pH is control[l]ed by the Lithium con[c]entration in the RCS. Lithium is made in the system by a neutron ineraction with Boron 10 $_5B^{10} + {}_0n^1 \rightarrow {}_3Li^7 + 2^4_2\alpha$ and is removed by processing the water through a Demineralizer that removes the Lithium." Staff Ex. 37B.

Mr. H stated, "The things that effect Primary PH are lithium. Lithium is produced in the coolant by $_5B^{10} + {}_0n^1 \; {}_3Li^7 + 2^4_2\alpha$ This causes PH to increase. We controll PH by demineralization, using a non-lithiated bed for short intervals." Staff Ex. 37I.

Mr. UU stated, "The factors which will affect RCS ph are the Lithium concentration present, the effectiveness of the makeup system demineralization, the ph of makeup water added and amount of dissolved H_2 in the RCS.

"As Lithium concentration is increased RCS ph is increased. The make[up] system demineralizers will affect ph depending on w[h]ether a Li saturated or Li free demin is used. If relatively low ph water is added it will dilute the Li concentration and lower the ph. If H_2 increase[s] the[re] will be more free hydrogen present and system ph goes down." Staff Ex. 37L.

Mr. V stated, "Ph in the Primary is affected by radiolidic decomposition of H_2O with resultant increase in the free hydroxial inventory. In addition the creation of $_3Li^7$ from $_5B^{10}$ by $_{15}B^{10} + {}_0n^1 \rightarrow {}_3Li^7$ + [illegible] causes a reduction the OH inventory since, Li^7 has a high affinity for -OH." Staff Ex. 37G.

Mr. D stated, "Lithium production causes pH to [illegible] RCS or demineralizer drain [illegible] to control pH. If we must remove Lithium we put the RCS thru the non-lithiated bed to remove the lithium bringing the pH down. If pH is low enough we pass the RCS thru the lithiated bed." Staff Ex. 37K.

Mr. G stated, "The main competing factors that alter pH in the primary are Boron concentration and LiOH concentration." Staff Ex. 37H.

Mr. FF stated, "The competing factors in the RCS which vary pH are the disassociation of water due to gamma flux in

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addition, two individuals, Messrs. Brown and GG, mentioned boric acid, but forgot lithium hydroxide.7/ See Staff Exs. 37M and 37C. Compare summary of Judge Milhollin, Report at ¶ 162, providing totally different summary of C.2.b answers.

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the core at power tending to leave an excess of hydro ions in the RCS tending to lower the pH. The other factor is the production of Lithium due to the boron-neutron reaction. This reaction tends to raise pH as Lithium is produced. This Lithium reaction is by far the more dominate factor in pH control and is varied by removing the Lithium by demineral. in the MU & P system." Staff Ex. 37F.

Mr. Ross stated, "PH primarily determined by Lithium Hydro[x]ide concentration in the RC system. Lithium is produced during normal operation due to exposure of boron to neutrons. Lithium builds up as power operation continues, when lithium approaches the upper limit (2 PPM) the non lithiated demineralizer is placed in operation. This tends to remove the lithium through ion exchange and reduce the RCS pH. When lithium is reduced (approaches .2 PPM) the nonlithiated demineralizer is taken out of service and the lithium saturated one put in. In that its already lithium saturated, lithium buildup starts again until the process is repeated. By doing this we control pH plus never have to pay for or add lithium to control pH." Staff Ex. 35.

7/ Mr. Brown stated, "1) Boron Concentration--soluable boron is used which is in the form of Boric Acid - high Boron yields a low pH. 2) dissolved H_2 concentration (1.5-40 cc/kg) this is used to scavenge O_2 and it forms Hydrogen ions and changes pH. 3) radiolytic decomposition - forms free H_2 and O_2 and reduces the Hydrogen ions and changes pH. 4) temperature also effects pH increase temperature higher pH." Staff Ex. 37M.

Mr. GG stated, "Primary pH is affected by: the presence of Boron (Boric Acid), any introduction of air (N_2) which could form Nitric Acid, the presence of corrosion by-products (could cause pH to go either way), the presence of any free H_2 or O_2 (introduction in makeup water, H_2 overpressure, radiolytic decomposition of water) which could cause pH to go either way." Staff Ex. 37C.

73. In summary, Licensee does not believe that it was unreasonable for Mr. Ross to challenge the Staff's answer to question C.2.b, given the focus of question C.2 on controlling pH. Certainly no bad faith on the part of Mr. Ross can be inferred from his suggested change.

74. A portion of Judge Milhollin's assessment of Mr. Ross's conduct in reviewing the answer keys in April of 1981 consisted of an indictment of Mr. Ross's credibility on the basis of statements made by Mr. Ross which Judge Milhollin found incredible. See Report at ¶¶ 146-151. While the Board is not prepared to attribute various of these statements to untruthfulness, it is nevertheless perplexed about the basis for at least some of Mr. Ross's testimony. Board Tentative Decision at 9-10.

75. Licensee will endeavor to shed some light on the statements of Mr. Ross which the Special Master found incredible. However, since Mr. Ross was never asked why he held the views he expressed on these matters, there is a paucity of evidence available to fully resolve these disturbing allegations. Nevertheless, various statements made by Mr. Ross and others suggest an explanation of Mr. Ross's thinking on these issues.

76. In Judge Milhollin's view, Mr. Ross was less than forthright in his recollections of Licensee's proposed changes

to the answer key, and the length of time he and others spent reviewing exams. Id. at 9-10 citing Report at ¶ 146. Judge Milhollin finds these recollections motivated by bad faith, in part because he believes Mr. Ross also disclaimed knowledge as to whether changes were made, overestimated the time that had elapsed since the exams and the review session had taken place,[8/] and disclaimed knowledge of the status of proctoring during the review sessions. Id. at 10. Licensee believes that Judge Milhollin draws unreasonable inferences from Mr. Ross's testimony. Certainly Judge Milhollin does not include in his analysis evidence and circumstances which establish that insofar as Mr. Ross's testimony is incorrect, it is attributable to anything more than faulty memory.

77. Mr. Ross recalled only the change to the answer to question B.4 on the RO "A" exam, which he had urged Mr. Wilson to make. Tr. 24,268 (Ross). While Mr. Ross was "sure" that the reviewers discussed other proposed changes as they went through this "A" exam, Mr. Ross stated, "On that exam that is the only one I can come up with right off the top of my head that I can remember." Tr. 24,277 (Ross). However, Mr. Ross did proceed to describe in detail proposed changes on the "B" exam

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8/ Mr. Ross later corrected his statement regarding the amount of time which had elapsed since his review of the April NRC exams and the time he appeared to testify. See Tr. 24,277 (Ross).

advocated by the reviewers. Tr. 24,279-300 (Ross). The RO "A" exam answer review took place before the RO "B" exam answer review. Tr. 24,164-69 (Ross). It is not surprising that Mr. Ross would recollect the proposed changes on the exam he last reviewed better than he was able to recall the changes to the exam first reviewed.[9/] Moreover, during the review sessions Mr. Ross's attention was required to be focused repeatedly on the "B" exams, in contrast to the "A" exams; for on each of the two review days, the reviewers first had to go through the "B" exam questions carefully so that if changes were necessary they could be effected immediately, while the "B" examination was in progress. Tr. 24,164-65 (Ross).

78. With respect to Judge Milhollin's second example of Mr. Ross's lack of credibility, it is likely that Mr. Ross underestimated the amount of time the review took, since the other review participants gave some longer estimates. Compare Tr. 24,277 (Ross) with Staff Ex. 27 at 2, 3, 19 and 22 (Wilson, Brown and Boltz). Mr. Ross's estimate, however, appears to be based on several factors which he indicated in his testimony. Whether or not Mr. Ross's estimate is correct, the basis for his estimate appears to be reasonable and properly motivated.

9/ Mr. Ross was not asked to review the master answer key to refresh his recollection about changes he might have suggested until the morning of the second day he testified. Tr. 24,205 (Adler, Ross). Perhaps the quick nature of his review of the four April exams over the lunch period contributed to his limited recollections.

79. Mr. Ross stated that in his experience, having reviewed four of five exams since he assumed the job of Supervisor of Operations, a "couple of hours or an hour and a half" was the average amount of time spent on each exam. Tr. 24,134 (Ross). Thus, normally when two exams were reviewed, it would take "about the same time" per exam, or 3 1/2 to 4 hours total. Tr. 24,149-50 (Ross). Mr. Ross perceived the April exams as requiring a "normal" review. Tr. 24,162 (Ross); Staff Ex. 27, at 12. It is therefore likely that Mr. Ross's time estimate was in part based on his general recollection of the amount of time necessary to review four exams requiring the normal amount of input.

80. In addition, although it is not apparent from Judge Milhollin's Report, Mr. Ross was not firm in his time estimate; rather, he stated that "approximately" three to four hours were spent reviewing exams in April. Ross, ff. Tr. 24,127, at 2. On the stand Mr. Ross stated that his recollection was "a little fuzzy"; however, he thought that three to four hours were spent each of the two days reviewing the exams. Tr. 24,167 (Ross). This recollection was buttressed by his recollection that 3 or 4 hours were spent the first day, and on the second day the review began early in the morning but was completed before lunch. Tr. 24,159, 24,163, 24,167 (Ross).

81. Finally, while it may be reasonable to assume that Mr. Ross is incorrect in his estimate and that more time than he estimated was in fact spent reviewing the answers with Mr. Wilson,[10/] during the first investigation conducted by the NRC (OIA), Mr. Wilson stated that "approximately 3 to 4 hours" were spent each of the two days reviewing the exams. Staff Ex. 24, interview of B. Wilson, at 2. While Mr. Wilson's recollection subsequently changed, see Staff Ex. 27 at 2, 3, it is not apparent to Licensee whose estimate of the time spent reviewing the exams is the most accurate. In summary, Mr. Ross's fuzzy recollection of the length of time of the review is neither surprising, under the circumstances, nor suggestive of anything less than complete candor.

82. With respect to Mr. Ross's knowledge about whether the changes he proposed to the exam were accepted, Licensee believes that the record reflects Mr. Ross's reluctance to state that he affirmatively knew that the changes were accepted, since it was not his responsibility nor did he have the authority to authorize these changes. See, e.g., Tr.

10/ Licensee notes that Judge Milhollin correctly states that Mr. Boltz estimated 6 hours spent on the first review day, and 5 hours spent the second day. Staff Ex. 27 at 22. However, Mr. Brown did not estimate "approximately eleven hours," see Report at ¶ 147 citing Staff Ex. 27 at 19; rather, Mr. Brown recalled anywhere from 9-12 hours total having been spent reviewing the exams. Staff Ex. 27 at 19.

24,161 (Ross: "I do not know that he [Wilson] made the changes either. We requested changes. I never know [sic] for a fact that any changes were made."); Tr. 24,334 (Ross: "I think the NRC examiners indicated they would consider it, but they never said this will be a change in the answer key."); Tr. 24,334 (Ross: "I think it would be safe to say that Mr. Brown felt that some changes were in fact made because they asked for the reference and we provided the reference, and then he thought it was over and done at that point, and there were other ones that they just said hey, we will consider that, and that was the end of it."). See also Staff Ex. 26 at 19 (Brown told Staff suggested changes and/or references were accepted by Wilson "for consideration"). Compare Report at ¶ 147. On the other hand, Mr. Ross also stated, "We assume [the answer key] will be changed, but we have no way of knowing that." Tr. 24,162 (Ross); see also Staff Ex. 26 at 12 (Ross would not know if proposed changes were accepted until he got his exam back).

83. Judge Milhollin's thesis about Mr. Ross knowing exam answers were changed is also based on Mr. Ross having "informed the control room operators that such changes were fairly made." Board Tentative Decision at 10 citing Report at ¶¶ 146-148. However, Licensee believes that the record does not reflect Mr. Ross's making such a statement to the operators. Specifically, Judge Milhollin states that the assurances made by Mr. Ross to

the operators "still amount to a statement that the key had been changed (see ¶ 143 above) and 'was going to be fair' (Tr. 24,180 (Ross))." Report at ¶ 1470. But if one refers to the citation on which Judge Milhollin relies, Mr. Ross's statement indicates only that Mr. Ross told his staff that he believed the exam, including the key which indicated what the Staff had been looking for in the way of answers, was fair. Tr. 24,180 (Ross: "I think my inference there would be I did review the key and the key was going to be fair. It was a move to try to show some interest on our part and make the operators feel that not all was lost. You know, we had something, we had looked at it. We still feel it was a fair exam, the key was fair.")

84. As to the proctoring issue, Mr. Ross's care in testifying accurately was akin to his careful testimony with respect to changes made to the exam: he was not able to state that he knew proctors were not in the room adjacent to the review session room. See, e.g., Tr. 24,173 (Ross: "I really do not know that anybody else was or was not in the room proctoring or what proctoring arrangement there was."); Tr. 24,342-43 (Ross: "I did not know that there would not be a proctor in that room, and I do not know that there was not anybody in there. I do know that Wilson was out of the room but in the immediate area a long period of time."); Tr. 24,156 (Ross: "I never really tried to look into the room and I do

not have any recollection of what was visible."); Tr. 24,156 (Ross: "Mr. Wilson made frequent trips and I do not know for sure there was not anybody else in the room that day."). This viewpoint is neither incredible nor unreasonable in view of Mr. Ross's experience in taking the April exams where Mr. Wilson, who proctored the room in which Mr. Ross sat, was relieved for a period of time by an I&E inspector. See Tr. 25,557, 25,579 (Wilson).

85. In conclusion, Licensee believes that Mr. Ross properly suggested changes to the answer key for the April, 1981, NRC exams; that Mr. Ross did not intentionally keep the proctor out of the room for a long period of time; and that Mr. Ross's recollections of the review session in no way impugn his character, or suggest that Mr. Ross attempted to whitewash incriminating evidence of which he was aware. See Lic. PF 216-229.

IV. LICENSEE'S RESPONSE TO CHEATING

A. Introduction

86. Judge Milhollin faults Licensee for responding inadequately or improperly to the known and rumored instances of cheating at TMI-1. Report at ¶¶ 185-237. Licensee strongly disagrees with these findings, and points out that Judge Milhollin gives Licensee no credit for the wide-ranging

activities which were in fact pursued in response to the O and W cheating incidents at TMI. After terminating Messrs. O's and W's employment, Mr. Robert Arnold himself met twice with the TMI-1 operators to discuss the cheating incidents and general company responsibilities (Lic. PF 268); Messrs. Hukill, Herbein and/or Richard Wilson met individually with every TMI-1 NRC licensed operator candidate, including licensed operator instructors and shift technical advisors to discuss any observations or known instances of cheating on exams and to discuss individual responsibilities and overall morale (Lic. PF 269, 272-74, 277); Licensee hired Mr. Edward V. Trunk to review numerous exams and quizzes to determine whether instances of potential cheating were evident (Lic. PF 243-48); Mr. John Wilson interviewed those operators with similar answers noted by Mr. Trunk and reviewed relevant documentary evidence (Lic. PF 249-51); Mr. Wilson interviewed numerous individuals with respect to rumors of cheating (Lic. PF 256-57); Mr. Arnold promptly reported to the NRC investigators any information Licensee learned about cheating (Lic. PF 168, 177, 260); and Licensee generally cooperated with these investigators by arranging to make individuals available at requested times and providing the investigators with copies of Licensee's documents (Arnold, ff. Tr. 23,590, at 5-6; Wilson, ff. Tr. 24,478, at 18-19). These activities, which required substantial amounts

of time and effort, were sufficiently thorough that despite extensive discovery and cross-examination during this reopened proceeding, no evidence of significant instances of cheating was uncovered beyond that already identified by Licensee and the NRC. Lic. PF 24, note 12.

87. Licensee also notes Judge Milhollin's concern that Licensee failed to investigate or to follow up on certain information. However, despite Judge Millhollin's views as to the potential importance of numerous lines of inquiry (see, e.g., Report at ¶¶ 214 (information on where Messrs. G and H sat during quizzes, etc.); 218 (misspelling of word "challenge" by Messrs. GG, MM and W)), neither he nor any of the parties asked even one of Licensee's witnesses the questions which now require answers.

88. Finally, we are again struck by Judge Milhollin's tendency to conclude that those who make mistakes or forget certain incidents cannot reasonably be believed as credible. See, e.g., Report at ¶¶ 194-95 (Shipman); 210 (Messrs. G and H). Licensee questions the reasonableness of this notion. See ¶ 4, supra.

B. Management Constraints on NRC's Investigations

89. Judge Milhollin addresses the issue of the existence and extent of Licensee management constraints on the NRC investigations of cheating at TMI in his Report at ¶¶ 185-188.

See Report at ¶ 3, Particular Issue (7). Licensee's views on this subject were set out in detail in our Proposed Findings. See Lic. PF 281-297. Licensee strongly urges the Board to review those findings since, in virtually all respects, they address the criticisms of the Special Master on this issue, referencing evidence which Judge Milhollin's Report does not take into account. Our comments here will be very brief.

90. There are only four areas which Licensee believes deserve special emphasis on the issue of management constraints. First, Judge Milhollin does not mention the very important fact that Mr. Arnold's request to Mr. Stello of OIE that a member of management be permitted to attend the investigatory interviews stemmed not only from Mr. Arnold's concern about the welfare of the individuals involved, but also from his knowledge that in the numerous past investigations at TMI, management had always been permitted to attend the interviews of Licensee's employees. See Lic. PF 296. Indeed, this OIE policy was institutionalized to the point that NRC advised interviewees of this right in written guidelines given to the interviewee before the interview. Id. Thus, from Mr. Arnold's vantage point, the Staff was suddenly reversing its previous position on this issue without discussing this reversal with Licensee's management. At the very least, it was Mr. Arnold's responsibility to discuss with Mr. Stello the fairness of and need for this change.

91. Second, Licensee disagrees with Judge Milhollin's statements that, "It seems clear that management did inhibit the flow of information. The opinion of the NRC investigators to this effect was unchallenged." Report at ¶ 187. Licensee was well aware of the views of the NRC investigators on this issue, and noted their opinions in our Proposed Findings. See Lic. PF 296. However, Licensee's management did challenge these opinions. For example, Mr. Hukill felt that his (or Mr. Christman's) presence during the interviews did not constrain the investigations; rather, it enhanced the interviewees' cooperation. Id. at PF 293.

92. Thus, Licensee disagrees that its management "knew," as Judge Milhollin states, that its presence would inhibit the free flow of information (in contrast to recognizing this potential). Compare Report at ¶ 188 with Lic. PF 292. Since inhibiting information flow clearly was not Licensee's intent, Licensee took measures to avoid this by not actively participating in the interviews. Lic. PF 291. Moreover, Licensee management did not perceive their presence as inhibiting. Thus, it is therefore difficult to understand Judge Milhollin's reasoning here. Furthermore, to Licensee's knowledge, none of the operators felt that Licensee's presence was inhibiting; to the contrary, Mr. W, on whose testimony Judge Milhollin relies (Report at ¶ 187) to support his determination of management

constraint, specifically stated that Mr. Hukill's presence did not affect his forthrightness with the NRC. Compare Tr. 26,094 (Mr. W); Tr. 26,098 (Mr. W); Tr. 26,116-17 (Mr. W); Tr. 26,126 (Judge Milhollin) with Tr. 26,164 (Mr. W). Compare also (on the issue of signing a statement) Tr. 26,096 (Mr. W) with Tr. 26,167 (Mr. W). Mr. O similarly stated that management's presence at his NRC interview did not affect his candor. Tr. 26,265 (Mr. O). See also Tr. 26,203, 26,205 (Mr. O).

93. Finally, Licensee believes Judge Milhollin's logic is faulty when he states that Mr. Arnold's concern about the operators' welfare was motivated by one of two equally improper concerns: that the operator not incriminate himself, or that the operator not say something detrimental about management. Report at ¶ 188. This interpretation is at odds with the evidence. Mr. Arnold stated his motivation for having a management representative attend a number of interviews: he was concerned about giving his employees moral support when the chips were down, and he was concerned about ensuring an accurate transcription was made of what was said at the interviews. See Lic. PF 292, 293. To satisfy these concerns, a management representative (Mr. Hukill or Mr. Christman) attended and took copious notes of the meetings, some of which reflect significant discrepancies with the OIE investigators' recollections. See Lic. PF 292.

94. In summary, Licensee does not believe management inhibited the free flow of information by attending the initial NRC investigative interviews; certainly, Licensee's management had no intent to or belief that their attendance would have this effect.

C. Management's Dealing with Messrs. O and W

95. Licensee admitted in its proposed findings, Lic. PF 265, that in retrospect, Mr. Arnold probably should have asked Messrs. O and W why they cheated. To suggest, however, that Mr. Arnold refrained from asking these questions because "management knew that it [the cheating] was caused by the operators' disrespect for the NRC examination" (Report at ¶ 198) is a truly remarkable inference, belied by the record with respect to management foreknowledge (Lic. PF 265); with respect to Messrs. O's and W's motivation for the cheating; and with respect to Mr. Arnold's description of the circumstances surrounding these interviews and his decision to attack all possible bases for Messrs. O's and W's actions. Lic. PF 266.

D. Management's Response to the Shipman Incident

96. Judge Milhollin finds Licensee's investigation of the Shipman incident inadequate because Licensee did not specifically ask any of the eight examinees in the smokers' room during the NRC "A" RO and/or SRO exams given in April, 1981

((Messrs. V, T, GG, U, UU, SS, Boltz and Brown), see Lic. Ex. 83), whether they had asked Mr. Shipman an exam-related question at the coffee machine. Report at ¶ 192. Licensee has admitted this fact (Lic. PF 261), and has explained that the group and one-on-one interviews of TMI-1 operators conducted by management should have been sufficient to ferret out any information relevant to the Shipman incident. Id. The record supports this judgment because three of these eight examinees were questioned on the stand about Mr. Shipman and/or about conversations at the coffee machine, and none of them could provide any probative information about the incident. See Tr. 25,713-15 (Mr. GG could not recall whether he saw Mr. Shipman at the coffee machine or whether he asked Mr. Shipman a question); 26,605 (Mr. T could not recall whether coffee machine was in the exam room or the hallway; he did not meet or talk with anyone in the hallway); 26,839 (Mr. U could not recall seeing Mr. Shipman at the coffee machine or anywhere else when he took NRC "A" RO exam).11/

97. Judge Milhollin's "problems" with Licensee's judgment not to pursue this matter are not supported by the record. His statement that two of the eight examinees who were training

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11/ Mr. V testified but was not asked about Mr. Shipman or the coffee machine. The other four examinees did not testify during this proceeding.

instructors (Messrs. Brown and Boltz) were not questioned by Mr. Hukill, (Report at ¶ 192) and thus, by implication, were not questioned at all, is simply wrong. The two instructors were questioned by Mr. Herbein and were asked specifically about awareness of cheating or possible cheating on exams. Lic. PF 261, 277. Second, Judge Milhollin's criticism of "broad questions" has been countered not only by the highly experienced NRC investigators Ward and Baci (Lic. PF 378), but also by individuals who are cited as illustrative examples of Judge Milhollin's position. See Lic. PF 131 (Mr. WW reported the telephone call he received during the Kelly examination in response to broad questions from Mr. Richard Wilson); Lic. PF 104 (Mr. Shipman admitted the coffee machine incident in response to a question by Mr. Hukill whether he had facilitated cheating). Finally, that a person who wanted to deny his or her recollection of the incident would be encouraged to do so by a broad question is speculation.

98. Licensee concludes, in retrospect, that although the eight examinees probably should have been asked specifically about knowledge of the Shipman incident in addition to asking them generally about cheating, failure to take this additional step in light of all the investigative activities undertaken by Licensee (see ¶ 86, supra) is not supportive of Judge Milhollin's determination that Licensee's investigations were inadequate.

E. Management's Response to Rumors About Mr. U

99. Judge Milhollin suggests that Licensee, particularly Mr. John Wilson, should have investigated more thoroughly Mr. KK's report of a rumor that someone had been stationed outside the exam room during the April, 1981 NRC exams to give assistance to examinees. Report at ¶¶ 198-99. Licensee disagrees, and suggests that its decisions not to continue these investigations were rationally based and supported by this record.

100. Immediately after learning of the NRC investigation of Messrs. O and W, Mr. Arnold decided that to ensure no actual or perceived interference with NRC activities, Licensee would not investigate a particular matter until the NRC had completed its investigation. See Arnold, ff. Tr. 23,590, at 5 (O & W investigation); Wilson, ff. Tr. 24,478, at 14 (KK telephone call); Tr. 24,607 (Polon general rumors). In one instance, after the NRC had completed its investigation of general rumors of cheating related by Mr. Polon (Lic. PF 167-69), Licensee wanted more information about how and when rumors were relayed within the Company. Tr. 24,607 (Wilson). Thus, Mr. Wilson reinterviewed Mr. Polon, who related a second rumor that Mr. U had written on his hand and had taken crib sheets into the NRC exam. Lic. PF 176. Contrary to Judge Milhollin's statement that Licensee investigated this second rumor after the NRC had

investigated it (Report at ¶ 199), the NRC in fact never investigated this specific rumor, although Mr. Stello was informed of it. Wilson, ff. Tr. 24,478, at 18. Moreover, Licensee never indicated any "unwilling[ness] to rely upon the NRC to investigate the rumor that Mr. U had written on his hand and used crib sheets . . . ." Report at ¶ 199. Licensee investigated the matter itself because the NRC investigators were not present at TMI at that time and prompt action was deemed important. Once the interviews were completed and the rumors found to be totally unsubstantiated, there was no need for further inquiry by Licensee or by the NRC.

101. With these facts clearly in mind, it is hardly "odd," as suggested by Judge Milhollin, that Licensee would rely on the NRC to investigate the rumor about someone stationed outside the NRC exam room. Indeed, after Licensee promptly informed the OIE investigators of the rumor (Staff Ex. 27, at Encl. 8), NRC investigators conducted a thorough investigation, found no information to substantiate the rumor and closed the matter.[12/] Lic. PF 195. With the overtones of potential management awareness of or involvement in someone's being stationed outside the exam room, this subject seemed

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12/ Licensee stands behind its proposed findings with respect to the adequacy of this and other NRC investigations. Lic. PF 368-80.

particularly appropriate for NRC pursuit and particularly inappropriate for management itself to pursue. Licensee deferred to the NRC's expert judgment and did not conduct any further investigations. No new information was provided during this proceeding which lent credence to this rumor. Lic. PF 183-95.

F. Management's Response to Cheating on Weekly Quizzes

1. Introduction

102. Judge Milhollin focuses in this section of the Report on Mr. Wilson's investigation of parallelisms noted by Messrs. Edward V. Trunk and his colleague Donald L. Miller. Whereas Judge Milhollin finds satisfactory the Trunk/Miller work as well as Mr. Wilson's investigation of the S/Y parallelisms, he criticizes Mr. Wilson's investigative techniques and conclusions with respect to Messrs. G and H, and Messrs. GG, W and MM. We question the accuracy of many of Judge Milhollin's factual findings, as well as the reasonableness of many of his inferences.

103. We begin our discussion by making some general observations. We must emphasize that Licensee did not merely decide to review just any "weekly quizzes" and NRC qualifying exams, as suggested by Judge Milhollin. Report at ¶ 200. In its effort to determine if further cheating beyond that of

Messrs. O and W had occurred at TMI-1, Licensee carefully determined that an appropriate and reasonable scope for its investigation would be to review those exams and weekly quizzes required for initial qualification or requalification for NRC operating licenses. See Lic. PF 243; Tr. 24,495, 24,587-88 (Wilson). Thus, the Kelly exams, Category T make-up quizzes, ATTS exams not previously reviewed by the NRC, Kelly non-Category T make-up quizzes and a 1979 mock NRC exam were chosen for review by Messrs. Trunk and Miller, with follow-ups of named individuals by Messrs. Wilson and Lloyd. Lic. PF 243. Although one can always claim that this or any other investigation could have been broader, the important question is how reasonably tailored was this investigation to achieve its purpose of ferretting out incidents of cheating. Licensee suggests that John Wilson's investigation was indeed reasonably tailored to achieve its purpose, particularly in view of the fact that other meetings and interviews were being conducted contemporaneously by Messrs. Arnold, Hukill, Herbein and Wilson. See ¶ 86, supra. Thus, at a minimum, we question the reasonableness of Judge Milhollin's complaint that Mr. Wilson did not consider how weekly quizzes were proctored, how they were perceived, and how they were actually administered. Report at ¶ 215. In fact, Licensee reviewed these issues. See ¶¶ 128-45, infra. In Licensee's view, the scope of Mr. Wilson's investigation was appropriate.

2. Messrs. G and H

104. We turn specifically to Judge Milhollin's assessment of Mr. Wilson's investigation of the parallelisms between Messrs. G and H. Judge Milhollin's first criticism involves Lessons Learned Question 1, for which Messrs. G and H answered on two separate quizzes, "Human factors, operational safety." Report at ¶ 203. Although an answer key was found and offered into evidence at these proceedings, no lesson plan or training material could be found for this question. TMIA Ex. 75, at 4, Attachment B. Mr. Wilson disclosed in his interview notes that the five possible responses listed in the answer key "include" (not "match" as stated by Judge Milhollin (Report at ¶ 203)) those given by Messrs. G and H, (TMIA Ex. 75, at 4) and Judge Milhollin agrees that the answers given could be considered approximations of some of the responses listed in the answer key. Report at ¶ 36.

105. Despite the fact that these two answers were not "a common response," (Tr. 24,520 (Wilson)), and despite the fact that Mr. H either didn't say or didn't remember why he chose these answers (TMIA Ex. 75, at 4), Mr. Wilson no doubt assumed that the two operators had memorized the same material which was taught somewhat differently from the answer key. See ¶ 9, supra. This explanation, contrary to Judge Milhollin's view, is not only "plausible," but is equally as plausible as one

that suggests cheating. After weighing all the other facts known about Messrs. G and H, Lic. PF 51-56, Licensee finds reasonable Mr. Wilson's judgment that these parallelisms did not constitute evidence of cheating.

106. Judge Milhollin's next criticism concerns the fact that Mr. Wilson did not ask the training department to verify Mr. G's explanation for his answer to the question on Rosemont transmitters and bourdon tubes. Report at ¶¶ 205, 206; see Lic. PF 58-63. Mr. Wilson believed that Mr. G understood the relationship between force balance and the Rosemont transmitter (Tr. 24,523 (Wilson)), when in fact Mr. G was confused. Lic. PF 59-60. Whether Mr. Wilson should have asked the training department about the accuracy of Mr. G's explanation to improve his (Mr. Wilson's) understanding of the question, Licensee strongly rejects the implication that Mr. Wilson should have spoken to the training department because a wrong explanation by Mr. G would have indicated dishonesty or incredibility. See Tr. 24,790 (Nelson Brown, supervisor of licensed operator training and instructor--the logical person to have been asked--in fact thought Mr. G978 believed his Rosemont answer was correct even though it wasn't; Brown did not infer that the answer was incredible); Tr. 24,790 (Judge Milhollin acknowledged that he used the word "incredible" to describe Mr. G's Rosemont explanation "without thinking through the implication

of the use of the word"; he noted that perhaps the only explanation for Mr. G's technical error was confusion). Thus, Licensee does not find significant Mr. Wilson's decision not to verify Mr. G's answer, and certainly does not find this decision to be "clear error". Report at ¶ 206.

107. Judge Milhollin next faults Mr. Wilson for believing Messrs. G's and H's denials of cheating with respect to Accident Mitigation Question No. 4a on generation of hydrogen gas following a LOCA. Report at ¶ 207. Contrary to Judge Milhollin's assertion that these answers were never explained, Licensee points out that they were indeed explained by both operators. Lic. PF 59-68; see ¶¶ 13-14, supra. Mr. Wilson's inability to find cheating here should not be criticized because he did not equate confusion, lapse of memory and some arguably facile responses by Mr. G with dishonesty. Lic. PF 55. Mr. Wilson spent several hours with these men, and his judgment--based on their general demeanor, their training sessions, and their denials of cheating (Tr. 24, 527 (Wilson)--cannot fairly be said to "lack any identifiable basis." Report at ¶ 207. Moreover, Judge Milhollin's statement that the demeanor of Messrs. G and H did not warrant belief in their denials is unsupported by any citation as to Mr. H, and supported only by a citation to a totally different parallelism as to Mr. G. See Report at ¶ 61-66 (question on Bernoulli's equation).

108. Judge Milhollin's strong language that Mr. Wilson "would not concede" the "similar[ity]" of two answers on the location of newly-installed radiation monitors (Report at ¶¶ 53-54, 208), and his conclusion that "Mr. Wilson's position contradicts the obvious meaning of these answers" (Report at ¶ 208) appear to be somewhat of an overreaction to a simple, spontaneous opinion. Mr. Wilson merely recognized that two wrong answers which have the same meaning but are worded differently are not necessarily parallel. Moreover, Judge Milhollin misstates the record by suggesting, absent citation, that "Mr. Wilson did not investigate this item because he did not believe the answers were similar." Report at ¶ 53. In fact, Mr. Wilson did not know of this so-called parallelism until he testified at this proceeding, at which time investigation would have been forbidden by the sequestration order. Lic. PF 21.

109. The next specific criticism of Mr. Wilson's investigation involves the question on Bernoulli's equation. Report at ¶ 210. Judge Milhollin relies on factual inaccuracies and makes highly questionable inferences to arrive at his startling conclusion that Mr. Wilson and Licensee sponsored misleading testimony.

110. Licensee urges the Board once more to review carefully Licensee's detailed proposed findings on the subject

of Bernoulli's equation. Lic. PF 70-83. Licensee repeatedly points out in those findings that both Messrs. G and H were obviously unsure of the source of their memorized definition, and changed their answers. Id. Judge Milhollin's presentation of this testimony as clear, unambiguous statements ignores a great deal of testimony which points up their uncertainties. Lic. PF 76-79. In light of the vagueness of these recollections, a statement that their testimony is contradictory is an oversimplification. Compare Lic. PF 76 with Lic. PF 78. To go on and conclude that Mr. Wilson must have known at the time of his interviews that Messrs. G and H contradicted each other is an unreasonable inference. Messrs. G's and H's testimony varied during the hearing, and it is most probable that the two operators provided subtly different explanations earlier, during the Wilson interviews. There is no reason to doubt, therefore, that their statements were exactly as described by Mr. Wilson in his prefiled testimony. These statements clearly are not contradictory, and need not have been so presented. Furthermore, Judge Milhollin has provided absolutely no corroborative evidence to support his conclusion that Mr. Wilson provided misleading testimony. On the contrary, in view of Mr. Wilson's professional obligation to uphold the law, his forthright testimony during this proceeding and his efforts to conduct a thorough investigation, Licensee finds Judge Milhollin's conclusions totally unjustified.

111. Judge Milhollin continues by criticizing Mr. Wilson's general theories with respect to the parallelisms between Messrs. G and H. Report at ¶¶ 211-12. We emphasize that these are theories derived from Mr. Wilson's common sense, his logic, and his assessment of the facts and the demeanor of Messrs. G and H. These theories are Mr. Wilson's opinions that attempt to fashion all of the relevant evidence into some kind of coherent pattern. Even if any one of Mr. Wilson's theories is "no more logical than its opposite," which we do not admit, each theory is, by Judge Milhollin's own reasoning, no less logical. Thus, we find Judge Milhollin's criticisms here to be misplaced.

112. We take issue, as well, with Judge Milhollin's claim that "the only way to determine whether similar answers on a given quiz were memorized or copied is to look carefully at the similar answers on that quiz." Report at ¶ 212. In fact, one must look at all relevant factual evidence and must assess the demeanor of the witnesses to determine whether answers were copied. Mr. Wilson did exactly that.

113. Finally, Judge Milhollin criticizes Mr. Wilson as "an advocate for the Licensee's interest" because Mr. Wilson found evidence that tended to show the absence of cheating but did not find evidence tending to show cheating. Report at ¶¶ 213-215. Licensee strongly disagrees with this position.

First, Mr. Wilson followed those factual leads that he reasonably believed were most likely to result in further probative evidence. The purpose of his investigation was not specifically to uncover exculpatory or incriminating evidence, but to uncover as much probative evidence as possible of whatever kind. Licensee sought out Edward Trunk, a technically trained and competent educator, to review exams, and Mr. Wilson then interviewed those individuals identified by Mr. Trunk, interviewed others he reasonably believed could provide useful information, located and reviewed relevant documents, and reported all of his findings, whether exculpatory or incriminating, to the parties and to Judge Milhollin. See Lic. PF 251-55; Lic. REPLY 24. Thus, Judge Milhollin's assessment of Mr. Wilson's investigation is neither accurate nor fair. Contrary to the Special Master's conclusions, Mr. Wilson did uncover as much evidence of all kinds as he reasonably thought relevant and probative; he did disclose and consider all evidence he found; evidence he chose not to pursue would not necessarily have incriminated any Licensee employee (the record indicates such evidence would not have been incriminating; see, e.g., ¶ 96, supra (Shipman incident); ¶ 106, supra (Mr. G's explanation for answers on Rosemont transmitters and bourdon tubes)); and he was not a biased witness because he judged that the evidence of record, although suspicious at times (see,

e.g., Lic. PF 47), did not provide a basis for concluding that cheating had occurred.

114. Judge Milhollin's criticisms about the scope of Mr. Wilson's investigation (Report at ¶¶ 214-15) are addressed in ¶ 103, supra. We emphasize that Mr. Wilson's report included all information he uncovered, and that this evidence was far more relevant to the issue of actual instances of cheating than was general evidence about quiz administration. We do not imply that the latter type of evidence was unimportant or unworthy of consideration; we simply suggest that Mr. Wilson's decision not to pursue such evidence was reasonable. In any event, Licensee willingly provided documents and witnesses for this proceeding to ensure, in part, that evidence of general quiz administration could be fully developed. See, e.g., Lic. Ex. 73; Long ff. Tr. 24,921, at 3, 25-26.

115. In conclusion, we find no evidence to support Judge Milhollin's finding that Mr. Wilson "failed to pursue, present, or consider important evidence of copying." Report at ¶ 215. We also find unreasonable the finding that Mr. Wilson had no "principled basis" for his conclusions, apparently because "he consistently interpreted [evidence] the same way, as not indicating copying." Id. As the record shows, Mr. Wilson's conclusions were based on weeks of interviews and numerous document reviews, and are worthy of strong consideration.[13/]

13/ In view of Mr. Wilson's work, Licensee takes great exception to Judge Milhollin's gratuitous comment that

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He therefore cannot be faulted for not acting as an "impartial investigator." Report at ¶ 215.

3. Messrs. S and Y

116. Judge Milhollin finds adequate Mr. Wilson's investigation of the similarities between Messrs. S and Y. Report at ¶ 216. Licensee agrees.

4. Messrs. GG, W and MM

117. Judge Milhollin questions the basis for Mr. Wilson's conclusion with respect to Messrs. GG and W, claiming that the evidence does not support Mr. Wilson's position. Report at ¶ 218. Judge Milhollin points first to Mr. GG's crossed-out word in one response, which Judge Milhollin finds indicative of Mr. GG's copying from Mr. W. Licensee suggests that an equally plausible inference is that upon writing the word "poor," Mr. GG decided to change his approach so he crossed out the word and wrote his response, after which Mr. W copied the

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(Continued)

"Licensee's litigation strategy was to maintain the credibility of its training program by characterizing the cooperation on the weekly quizzes as 'cheating' when the operators did not regard it as such at the time it happened." Report at ¶ 329. The facts, as uncovered by John Wilson, indicate that the operators with parallelisms noted by Mr. Trunk in fact vehemently denied that cheating had occurred. To imply that Licensee would have molded any witness's testimony contrary to the truth is highly objectionable.

response with no errors. This inference is particularly appealing because Mr. GG did not cross out any words in his response to the second question under consideration. See also Lic. PF 40 (Professor Molholt's assertions based on misspelled words equally susceptible to conflicting interpretations); Report at ¶ 18.

118. Next, Judge Milhollin points to the misspelling of the word "challenge" in all three answers, faulting Mr. Wilson for not investigating this information. Licensee points out that neither Judge Milhollin nor the other parties specifically questioned Mr. GG or Mr. W about this matter during this proceeding. (Mr. MM did not testify).

119. Finally, Judge Milhollin implicitly criticizes Mr. Wilson for testifying that there was no answer key when in fact a key existed. Lic. Ex. 68B. Judge Milhollin never questioned Mr. Wilson about his testimony, which apparently resulted from nothing more than an oversight. To infer more is unsupported speculation.

120. Mr. Wilson developed all evidence he reasonably thought relevant to this issue, and Licensee finds his efforts, particularly his intensive search for training materials, more than adequate. Lic. PF 92-96. Furthermore, in formulating his conclusion Mr. Wilson relied not only on Mr. GG's denials of cheating, but on his favorable assessment of Mr. GG's demeanor

(Judge Milhollin agreed that Mr. GG was forthright (Report at ¶ 313)) and the fact that Mr. W's inclination to cheat already had been established. Lic. PF 92-96. Licensee suggests that Mr. Wilson's conclusion, while subject to dispute, was reasonable in view of the conflicting inferences that could be drawn from the evidence.

5. The 1979 (VV and O) Incident

121. Judge Milhollin addresses the 1979 VV and O incident in his Report at ¶¶ 135 and 220-237. Almost without exception, Licensee's Proposed Findings address the points raised by Judge Milhollin. See Lic. PF 298-320. Nevertheless, several facts deserve emphasis here.

122. A major consideration in Licensee's actions in the 1979 VV and O incident was VV's openness about using the work of another individual, Mr. O, in answering the training test. Compare Lic. PF 318 with Report at ¶ 135. Of course, this does not justify Mr. VV's misconduct; nevertheless, it does interject a facet to the question of the appropriate action which should have been taken against Mr. VV which Judge Milhollin does not address. Indeed, Mr. Miller testified that had he viewed Mr. VV's conduct as cheating, he would not have certified Mr. VV. Lic. PF 318.

123. Licensee also believes that the Board should note the fact that Mr. VV no longer has supervisory authority in the

TMI-2 operations staff (and, obviously, does not work at TMI-1), see Lic. PF 313; that Mr. O has of course left Licensee's employ; that Mr. Miller is not a member of the TMI-1 operating staff but rather serves as the manager of the startup and test group in GPU Nuclear's Technical Functions Division, see Management PID, ¶ 479 (modified on September 2, 1981); and that Mr. Herbein no longer works for GPU Nuclear Corporation, see letter from Licensee's counsel (Blake) to the Appeal Board, the Board and the parties dated March 11, 1982. In sum, those who were directly involved in the 1979 incident no longer have responsibility for, much less supervisory authority over, TMI-1 operations.

V. LICENSEE'S OPERATOR TRAINING AND TESTING PROGRAM

A. Introduction

124. Section (D) of the Special Master's Report, ¶¶ 238-251, is entitled, "The Licensee's Training and Testing Program." Here, Judge Milhollin addresses licensed operator training and testing conducted at TMI, of which he is highly critical.[14/] Licensee takes issue with many of the Special

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14/ Perhaps the most important facet of Licensee's training program at TMI is its program for training licensed operators. In addition, of course, Licensee has established extensive programs for training auxiliary (non-licensed) operators, shift technical advisors, maintenance technicians, radiological controls workers, chemistry technicians, security personnel,

(Continued Next Page)

Master's findings, as well as his conclusion about the present and future implications of past training practices. Rather than repeating our complete analysis of the evidence introduced during the reopened proceeding on the issue of training and testing, Licensee instead urges the Board to review Sections IV(A)-(C) of Licensee's Proposed Findings. In these comments, we selectively challenge the Special Master's analysis of TMI's training and testing program.

125. It is important to keep in mind the context in which the issue of licensed operator training and testing arose in the reopened proceeding. This context is vital because the

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(Continued)

radwaste personnel and general employees working at TMI (the GET program). Management PID at ¶¶ 208-224. Judge Milhollin's Report addresses only the licensed operator training program. Thus, insofar as the Special Master concludes that he "do[es] not believe that the Licensee's training program responded adequately to the Commission's Order of August 9, 1979," Report at ¶ 251, Judge Milhollin's conclusions relate only to the adequacy of Licensee's licensed operator training program; other aspects of training at TMI were not addressed during the reopened proceeding or by the Special Master.

(While Licensee's new training administrative procedure, see Lic. Ex. 73, applies to all training programs conducted at TMI, the only training subject tangentially related to the reopened proceeding was the adequacy of Licensee's operator training program. An issue was raised by the Aamodt Family concerning the administration of RWP tests at TMI; however, Judge Milhollin found the testimony of little probative value and the witness tendered on the subject lacking in credibility. The subject therefore was not substantively pursued. Report at ¶¶ 179-180.)

issues litigated before Judge Milhollin were quite narrow; yet they do touch upon the substantive adequacy of Licensee's training program and organization, broad subjects which were developed at length in the earlier management phase of the restart proceeding and to which the Board has devoted considerable attention. See Management PID at ¶¶ 163-276.

126. Judge Milhollin's discussion of training begins with a summary of Licensee's training and testing programs. This summary is somewhat out of context and, hence, potentially confusing. For example, contrary to the Special Master's observations, the TMI operator training program is not strictly exam-oriented. Training "all licensed operators for their periodic requalification examinations," Report at ¶ 238, is not the only purpose of Licensee's operator requalification program. Rather, as set forth in the Management PID, the requalification training program is also designed to keep operators aware of new developments; to review important subject matter in order to maintain the operators' level of knowledge; and to meet specific regulatory requirements, including a classroom training requirement. Management PID at ¶ 190.[15/] Licensee's program of instruction for requalifying

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15/ Similarly, OARP was not prompted by or conducted exclusively in response to the Commission's August 9, 1979 Order, nor was it limited in scope to the specific issues identified by the Commission in that Order. Compare Report at ¶ 239 with Management PID at ¶¶ 196-204, 227, 233-241 and Lic. Management PF 146-151.

operators, which was totally revised after the TMI-2 accident, far exceeds the NRC's regulatory requirements. See Management PID at ¶ 191. While passing required written exams, such as the NRC written exam, is of concern to the TMI Training Department, it is certainly not Training's only concern. Rather, the ongoing effort of operator training includes conducting regular classroom sessions on pertinent subjects, on a shift basis, to all licensed operators, and maintaining operators' control manipulation proficiency through simulator experience and control room exercises. See Management PID at ¶¶ 192-195; Lic. Ex. 62.

127. In sum, the approach taken by the parties to the reopened proceeding was to address operator training in the context of written examinations and quizzes since the issue in controversy was the administration of written qualifications exams, including the more substantive issue of whether these tests were amenable to defeat by means such as coaching or excessive memorization. See Report at ¶ 3, Particular Issue (9); Lic. PF 18 & n.9. But this perspective of Licensee's operator training program is not (and was not intended to be) a full picture of operator training at TMI; yet one could reach a contrary conclusion from reading Judge Milhollin's Report. Licensee's comments on Judge Milhollin's discussion of training and testing are topically divided into training administrative practices and the substantive adequacy of training.

B. Administrative Practices

128. In our prefiled testimony before the Special Master, and in our proposed findings, Licensee acknowledged what it considered to be very serious shortcomings in past training administrative practices at TMI, see Lic. PF 235-333, a fact which Judge Milhollin notes. Report at ¶ 241. Once this admission is made, it is critically important for the Licensing Board to determine the likely reason(s) for these shortcomings, and to assess the adequacy of Licensee's efforts to correct them. It is only after the Board has considered these elements of the issue of past training administrative practices that it can pass judgment on these practices and, more importantly, determine the adequacy of Licensee's plans for improving the administration of future Licensee qualification exams for licensed operators and candidates for operator licenses--the training issue in the reopened proceeding. See Report at ¶ 3, Particular Issue (9). But Judge Milhollin's Report does not step beyond the initial judgment that Licensee's past training administrative practices were inadequate.

129. Judge Milhollin's review of current test administration at TMI amounted to only a very cursory recognition of Licensee's new exam administrative procedure, see Report at ¶ 250, which is mentioned only in the context of the following concluding remarks:

> One should keep in mind, however, the fact that the Licensee adopted new training procedures once before. After the accident at TMI-2, the Licensee assured the Licensing Board that its training program would overcome the deficiencies in training which had existed before the accident . . . . Thus, poor test administration followed the Licensee's post-TMI-2 assurances. The Licensee's latest assurances must be viewed with that record in mind.

Report at ¶ 250. Licensee does not believe this position is supported by the record.

130. Licensee never stated, nor intended to suggest to the Board, the Special Master or the parties, that prior to the discovery of cheating on the NRC examinations, consideration had been given to establishing procedures to protect against cheating on examinations. To the contrary, a great deal of emphasis was placed by Licensee in its testimony and Proposed Findings on the failure of Licensee to identify this area of weakness in its training program. See Licensee PF 231-240, 326-328. While Licensee has expended enormous effort since the TMI-2 accident reorganizing its Training Department and establishing new programs of instruction, including the OARP and the replacement and requalification reactor operator and senior reactor operator training programs, see Lic. Exs. 60, 61 and 62, it is not reasonable to attribute to Licensee's efforts in these regards, as the Special Master does, an unfulfilled promise to establish testing administrative procedures.

Rather, Licensee embarked on an extensive reorganization and substantive redo of its operator training program. In hindsight, Licensee clearly erred in not including in its new programs procedures for guarding against cheating on exams and other administrative safeguards. But this failure represents no bad faith on the part of Licensee's management or the Training Department at TMI. It was an oversight--one with grave consequences of which Licensee now is keenly aware.

131. In summary, as Licensee stated in its Proposed Findings, Licensee's past testing administrative practices were "loose" in that no established procedures existed to ensure that exams and quizzes were administered properly; in fact, the evidence suggests that some quizzes may not even have been given as closed book tests of individual operators' knowledge, since discussion may have been permitted during some quizzes. See Lic. PF 329. But the absence of a procedure makes it speculative to conclude at this juncture, as the Special Master has done, that individuals were acting improperly during quizzes given at TMI. For it is also possible that while an informal atmosphere existed in the classroom during weekly quizzes, no improper conduct took place. Licensee has conceded these facts in its findings, to which it refers the Board. See PF 325-246. Consistent with the issue identified by the Board at the commencement of the reopened proceeding, however,

Licensee believes that the Board's attention should be at least equally focused on the adequacy of Licensee's commitments today to ensure proper administration of examinations. For the issue now is whether the Board has confidence that Licensee's management is competent to operate TMI-1 today, including whether operators are now trained and tested properly.

C. The Substantive Adequacy of Training

132. This brings us to the major thrust of Judge Milhollin's discussion of Licensee's training and testing program, namely, the substantive adequacy of operator training at TMI. Licensee questions the emphasis placed on the substance of operator training in the Special Master's Report, given the limitations placed on this subject by the Board at the outset of the reopened proceeding. See Lic. PF 324. Nevertheless, we also believe that the adequacy of the Training Department's methods is very important, that it is closely related to both testing and the substantive adequacy of training, and that it is difficult to draw the line clearly between the substance and the adequacy of a test. With these thoughts in mind, we address here our major disagreements with Judge Milhollin's findings on the substance of Licensee's operator training program.

133. Judge Milhollin's discussion of training begins with the statement that "[t]he most detailed testimony [on the

methods of instruction used in the training program] was given by G and H." Report at ¶ 242. Licensee does not agree with this statement. Most of Mr. G's and H's testimony was directed to their respective recollections of why they answered specific Category T quiz answers as they did. Their testimony on the quality of training is not more detailed or probative than any other operator's testimony. In fact, virtually every operator who testified during the reopened proceeding was asked to evaluate the adequacy of the operator training program at TMI through questions either expressly or implicitly seeking information on the adequacy of the trainers' methods and, generally, the quality of training. See Lic. PF 339. While there was some disagreement among the operators on this subject, by far the majority of the operators were satisfied with or complimentary of Licensee's operator training program. Id.16/

16/ Judge Milhollin states that "many of the operators did not respect the training program," referring to statements by Messrs. G and Shipman. Report at ¶ 247. This statement is not accurate and is very unfair. In the statements by Mr. G and Mr. Shipman to which the Special Master refers, the operators are criticizing the administration of the makeup Cat T quizzes. In fact, both of these individuals were generally complimentary about the overall operator training program at TMI. See Tr. 25,724-27 (Mr. G); Tr. 26,410, 26,413-14 (Shipman). Moreover, referring to two out of the 19 operators (excluding Mr. Ross) who testified to support such a broad proposition is unreasonable. A review of the views of the other operators who testified on this subject indicates that the prevalent view among them was that operator training had improved since the TMI-2 accident, and that it was satisfactory. See Lic. PF 339 for citation to views of other operators.

134. In addition, many of the operators were asked to comment on the amount of memorization required to pass the NRC exams, in contrast to the need to understand material conceptually. Id. See also Tr. 24,749-50 (Brown). In general, the operators felt both abilities were necessary. While this information is slightly different from the issue of method of instruction, it does suggest that operators were not solely memorization-oriented, and that if Training had taught primarily by requiring rote memorization of material, it would not have been adequate. Yet, most operators were satisfied with the operator training program.

135. Nevertheless, if we examine Judge Milhollin's basis for finding that "the method of instruction emphasized the memorization of word formulas, rather than an understanding of the concepts which the formulas stood for," Report at ¶ 251, namely, G and H's understanding of certain Category T quiz questions, it appears that the Special Master's coaching findings still are not well-founded.

136. Judge Milhollin finds it "quite remarkable" that the training program failed to teach Mr. H the "simple and important concept" of natural circulation. Report at ¶ 242. Judge Milhollin also states that Mr. H "could not" state the conditions of natural circulation when he testified. Id. In fact, as the Special Master acknowledged earlier in his Report, id.

at ¶ 31, Mr. H did reel off, on cross-examination, three of the four conditions for natural circulation. Moreover, Licensee believes that Mr. H also clearly understood the fourth condition, when probed. Specifically, the following exchange occurred between Mr. H and three questioners (counsel for the Commonwealth of Pennsylvania, counsel for the Staff, and Judge Milhollin) (Tr. 25,931-32):

(Mr. Adler) Q. Would the heat source need to be above the heat sink?

A. What do you mean by "above"?

Q. Would the source of heat in the system need to be higher than the heat sink?

A. No.

(Mr. Goldberg) Excuse me. Physically higher or temperature-wise?

(Mr. Adler) Physically higher.

A. No, no.

(Judge Milhollin) Could it be lower?

(The Witness) Yes, definitely.

(Judge Milhollin) Its position is irrelevant, is that your testimony?

(The Witness) Yes.

(Judge Milhollin) Its gravitational position, that is?

(The Witness) Yes, its gravitational position is irrelevant.

137. In the above exchange, Mr. H's initial answers to the questions about the physical relationship between the heat sink and the heat source correctly reflect the fourth condition of natural circulation; namely, that the heat sink must be higher than the heat source. See TMIA Ex. 75, Attachment A (lesson plan). Notably, counsel for the Commonwealth asked this question of Mr. H in the reverse manner from the way Mr. H answered it on the Cat T quiz, and the way that the lesson plan stated the condition, viz., "cold water above warm water." Report at ¶¶ 29-30. The question asked of Mr. H by counsel was whether the source of heat (warm water) needed to be higher than the heat sink (cold water). When the question is asked in this latter format, the correct answer is "no," since the reverse condition must exist to have natural circulation. Thus, when Mr. H was asked whether "it"--the source of heat--"could" be lower, he answered, "Yes, definitely." In fact, the source of heat definitely has to be lower than the heat sink to have natural circulation.

138. It is true that Mr. H went on to state that gravitational position was irrelevant--an answer at odds with his own previous answers. Licensee does not know whether Mr. H was confused at this point, did not know what "irrelevant" meant, or misunderstood the questions propounded by Judge Milhollin. But it is certainly not apparent to us, as it is to Judge

Milhollin, that "[f]or H at least, natural circulation is not a matter of common sense." Report at ¶ 31. To the contrary, Mr. H's ability to listen carefully to the (reversed) manner in which the natural circulation questions were presented to him by counsel for the Commonwealth and counsel for the Staff, and his seeming understanding of the concept until Judge Milhollin translated his answers as, "It's position is irrelevant, is that your testimony?", reflects very positively on his comprehension of the subject matter. At the very least, Licensee believes that Mr. H should not be faulted for his answers to this series of questions, asked of him by three different questioners without forewarning in the midst of a series of questions about his shift rotation schedule during the April NRC exams. See Tr. 25,929-31 and Tr. 25,932-33 (Mr. H). Nor does Licensee believe that this exchange establishes that the training program was inadequate because it "failed to teach H such a simple and important concept." Report at ¶ 242. Even if Judge Milhollin's evaluation of Mr. H's understanding of natural circulation were correct, Licensee would question the legitimacy of judging the overall adequacy of the operator training program on the basis of one operator's partially incorrect (1/4) answer to one quiz question.

139. Judge Milhollin goes on to indict the operator training program for relying "simply upon memorization,"

involving "very poor instruction," and showing "a definite lack of interest in the operators' actual knowledge" on the basis of Mr. H's alleged ignorance of the principles of natural circulation as well as two other mistakes by Messrs. G and H to two other Cat T quiz questions. See Report at ¶¶ 243-245. Licensee in its Proposed Findings discusses at length these individuals' answers to the two questions, involving pressure gauges and the generation of hydrogen gas following a LOCA. See Lic. PF 58-61 and 64-69; see also ¶¶ 11-14, supra. What is most important to emphasize here, however, is that whether or not G and H misunderstood the distinction between a Rosemont and a Bourdon tube (force balance) transmitter, or properly understood the important concept of the formation of hydrogen gas in the reactor coolant system and reactor building following a LOCA, these deficiencies do not in and of themselves establish a pervasive inability by the Training Department to teach operators what they need to know. Licensee is disappointed and surprised by the failure of the Special Master to even refer to the following facts before castigating Licensee's entire operator training program: the assessment of Licensee's overall operator training program by the operators, the operators' belief that memorization is not enough to pass the NRC exams, and the results of the NRC exams given at TMI. See Staff Ex. 32 and letter of April 12, 1982, from counsel for

the NRC Staff (Goldberg) to the Board, the Special Master and the Parties. At the very least, the exam results belie the Special Master's conclusions: all previously licensed operators certified in accordance with Licensee's new procedures passed the NRC exam(s) either in October, 1981 or February, 1982. See Staff Ex. 32 and letter of April 12, 1982 from counsel for the NRC Staff (Goldberg) to the Board, the Special Master and the parties (attached exam results). Of the five new candidates who took an NRC exam for the first time in February, 1982, only one failed and in only one catogory; that operator's overall score was 90.4%. Moreover, the four other new operators taking the RO exam each received an overall score of over 90%. These exams covered Category T subject matter--another fact which is at odds with Judge Milhollin's analysis. See Report at ¶ 281. Moreover, the impact of the failure of Judge Milhollin to consider these factors is compounded by the absence of any acknowledgement in his Report of the limited nature of the evidence introduced in the reopened hearing on the substantive adequacy of training in contrast to the extensive record developed on this issue before the Board. See ¶¶ 125-27, supra.

140. Thus, the Special Master's review of the substantive adequacy of Licensee's operator training program was unjustifiably limited to his comments about the poor quality of the

first two rounds of the Category T makeup quizzes and expressions of doubt about Licensee's November, 1981 Category T makeup quizzes. Report at ¶¶ 246, 249. As to the initial two makeup quizzes, Licensee does not fundamentally disagree with Judge Milhollin's comments;[17/] in fact, Licensee was highly self-critical about this subject in its own Proposed Findings. See Lic. PF 341-346. We do, however, find totally unjustified Judge Milhollin's criticisms of the November, 1981 Category T makeup tests.

141. The November, 1981 Category T makeup test was an exam to which Licensee committed all of its operators who had not passed with 90% proficiency the original Kelly Category T section, or who had not taken the Kelly exam. Lic. PF 344. By making this commitment, Licensee nullified the passing (90%) grades on all of the makeup tests given since the Kelly exam

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17/ In view of Judge Milhollin's focus on only the Category T makeup quizzes, rounds one and two, it seems only fair that the record reflect the supervisor of licensed operator training's recognition of the poor practice of repeating questions on the Cat T makeup quizzes from week to week of the training cycle, Tr. 24,806-07 (Brown), along with his recollection that, at the time, he considered the practice acceptable because the operators rotated shifts simultaneously. Thus, there was no ready opportunity to review the quiz questions given to operators on other shifts who attended training during a different week. Id. Probably even more important than this observation is that the issue of cheating on exams simply was not focused upon by the Training Department prior to the discovery of cheating on the April, 1981 NRC exams. See Lic. PF 235 (views of Messrs. Arnold and Long).

was administered in March of 1980. This action was taken by Licensee, on its own initiative, after the discovery of cheating or the NRC exam and the possibility of collusion on certain of the Category T makeup tests. Id. The November Category Ts--there was an initial test and a makeup for one operator who did not achieve 90% on the initial exam--were made a part of the reopened proceeding record, along with the instructor's notes used to teach the review session, and the handout which was given to the students during that session. See Lic. Exs. 69A-69D.

142. As Licensee stated in its Proposed Findings, Lic. PF 345, the November Category T quiz was both thorough and conceptual in nature. It required knowledge of design and procedure changes introduced at TMI-1 as a result of the TMI-2 accident, see, e.g., Lic. Ex. 69A, questions 1 and 7 and Lic. Ex. 69B, question 3; an understanding of the reactor conditions which led to the TMI-2 accident, see, e.g., Lic. Ex. 69A, question 2 and Lic. Ex. 69B, questions 1 and 6; and an appreciation of how to control such an event if it happened at TMI-1, see, e.g., Lic. Ex. 69A at questions 5, 6 and 8 and Lic. Ex. 69B at questions 5, 8 and 10.

143. A review of the best evidence--the quizzes, the handout given to the students and the notes of the training instructor--indicates that passing the quiz administered at the

end of the review session required more than simple memorization; at a minimum, the key "lessons learned" from the TMI-2 accident had to be understood. Judge Milhollin faults Licensee particularly for not conducting extensive retraining on Category T subjects, but instead conducting a review session followed by a study period, followed by the administration of the quiz. Report at ¶ 249. But the "lessons learned" from the TMI-2 accident included subjects covered in depth throughout Licensee's initial and requalification training programs as well as during the OARP. See Management PID at ¶¶ 192, 196-198; Lic. Ex. 60 at 3-8; Lic. Ex. 61 at 4-7; Lic. Ex. 62 at 5.0-8.0. The purpose of Licensee's November session was to summarily review and integrate a broad spectrum of materials introduced at various times throughout the training program. This review was not intended to re-teach from scratch all Category T subject matter.

144. For example, while Judge Milhollin correctly cites Mr. H as responding "yes" to the question, "And did the instructor encourage you to memorize certain answers during that review session?"[18/] see Report at ¶ 249, Mr. H went on to state, "No, [the instructor] did not write questions [down on

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18/ Here, Mr. H was referring to the July, 1981 Cat T review session which he attended; however, he later stated that the teaching methods used in the review session conducted in November were "about the same." Tr. 25,907 (Mr. H).

the blackboard]. He just explained what Lessons Learned was all about, as far as where it came from, gave us more of a background to it." Tr. 25,907 (Mr. H). Thus, a fair reading of Mr. H's statements about the November Category T review session does not suggest, as Judge Milhollin indicates, that Licensee's efforts in November represent a careless treatment of this subject matter. Similarly, while it is true that Mr. G, upon whose statement the Special Master also relies, stated that the review session covered the material on the Cat T test, Mr. G also stated that there might have been training prior to that on the subject matter covered by the quiz, Tr. 25,746 (Mr. G), which indeed there would have been, and that in November, "the Training Department did an excellent job." Tr. 25,745 (Mr. G). Moreover, while Judge Milhollin refers repeatedly to Mr. Shipman's criticisms of the early Category T makeup quizzes, Report at ¶¶ 247 and 248, he does not acknowledge Mr. Shipman's views of the November, 1981 Category T test:

> That test was quite a bit different than any other of the previous category T exams I took. I think most of the--there was a lecture before the exam was given, and I do not feel that some of the questions on that test were covered by that lecture. But the exam was one in which the issues of the Lessons Learned in Unit 2 were more on the line, and you had to respond to those issues, and in that sense I could respond to those questions at that time even though it was not in the lecture. I could respond correctly to those questions. I thought it was a better exam.

Tr. 26,407-08 (Shipman); see also Tr. 26,409 (Shipman). In summary, Licensee does not believe that the evidence, taken as a whole, supports the Special Master's summary dismissal of Licensee's November, 1981 Category T retest.

145. In conclusion, the Special Master did not consider a great deal of material evidence in his analysis of Licensee's operator training program. Here, Licensee has not even relied upon the judgments about the TMI operator training expressed by the new training managers, such as Dr. Long and Mr. Newton--individuals with significant experience in other educational environments (the university and the Navy, respectively), each of whom recognized shortcomings in Licensee's training program, but nevertheless testified that in their opinion it is a good program. See Lic. PF 334-337, 341. Nor are the views of Mr. Boger, from the NRC Staff, considered by the Special Master in this section of his Report. See Lic. PF 338. We believe that if the evidence is considered as a whole, it does not support the conclusions reached by the Special Master.[19/] In Licensee's view, the training issues identified by the Commission in its August 9, 1979 Order have been satisfactorily resolved. See also n.14, supra.

19/ We note that the Special Master does not address the issue of the need for the independent administration and grading of exams at TMI, one of the subissues identified at the start of the reopened proceeding. See Report at ¶ 3, Particular Issue (9). Licensee refers the Board to its Proposed Findings, Lic. PF 353-355, for Licensee's views on this subject.

D. Licensee's System for Certifying Operator Candidates

146. Judge Milhollin's review of Licensee's certification process is equivocal. See Report at ¶¶ 252-259. While the Special Master is critical of Licensee's past certification process for several specified reasons, he also acknowledges that "[b]eyond that, the Licensee's certification process appears to have been adequate." Report at ¶ 259. The Special Master then states, however, that "[t]he evidence on this subject was insufficient to warrant any findings other than the brief ones just stated." Id. While Licensee relies primarily on its Proposed Findings on this subject, see Lic. PF 356-366, we will take this opportunity to comment on several points made (or not made) by the Special Master.

147. Licensee does not believe that the Special Master's Report squarely addresses the certification issue in question in this proceeding; namely, the sufficiency of management criteria and procedures for certification of operator license candidates to the NRC with respect to candidates' integrity, and the sufficiency of certification procedures with respect to candidates' competence. See Report at ¶ 3, Particular Issue (12). For example, the Special Master does not discuss certifying operators' integrity, which was a subissue of the certification question and the specific subject of testimony. See Ross, ff. Tr. 24,127 at 7-9. While Judge Milhollin

suggests that there was insufficient evidence introduced to resolve the certification issue, id. at ¶ 259, in fact his Report ignores much of Licensee's testimony on this subject, including Licensee's explanation of why its certification process is structured as it is, and the inherent limitations in any certification process. See Lic. PF 359-365.

148. Licensee also takes issue with Judge Milhollin's one-sided view of Licensee's decision to certify four operators (Messrs. R, G, H and S) to take the April, 1981 NRC exams. Report at ¶ 255. While Judge Milhollin is correct that Mr. R did very poorly on one section of the ATTS exam, and got less than 70% in two other categories, Judge Milhollin does not mention that Mr. R received 85%, 95% and 91% on those respective three categories when he took the October NRC exam. Staff Ex. 32. (Mr. R did fail one other category, however, receiving a 63% on Category H, which Mr. R subsequently passed in NRC's February, 1982 makeup exam. See Staff Ex. 32 and letter of April 12, 1982, from counsel for the NRC Staff (Goldberg) to the Board, the Special Master and the Parties (attached exam results).) In addition, when asked about Mr. R's certification in light of his very low grade on one category and failure of two others, Mr. Newton, the Operator Training Manager, stated:

> In that particular test [ATTS], in that particular individual a lot of discussion took place. I think we learned, if I recall correctly, that Mr. R had essentially become very frustrated. He knew he was not doing

> well on the test, and I think that he left the classroom and turned in the test before he completed that particular section . . . . He was specifically assigned during that timeframe to his shift supervisor, who was Mr. O, and it was upon his shift supervisor's report to Mr. Ross that from what I remember of our meeting with Mr. Ross and Mr. Toole and Mr. Hukill, that Mr. Hukill decided to go on and let individual R sit for the examination.

Tr. 24,760 (Newton). Judge Milhollin does not take this information into account in his Report, either. Finally, while Judge Milhollin challenges the benefit of Mr. R being tutored by Mr. O, one of the shift supervisors who cheated on the NRC exams, see Report at ¶ 255, obviously, this assignment was made before Licensee knew of Mr. O's misconduct. Such a retrospective criticism also ignores Mr. O's demonstrated technical and training capabilities. See, e.g., Report at ¶ 10 (Mr. O "was known as a 'head pounder' (Staff Ex. 26 at 37) and he had a reputation of studying more than anyone else at the plant (Tr. 25,568 (Mr. I))."") In sum, the record does evidence a high degree of care in certifying individuals which is not reflected in Judge Milhollin's Report.

149. Similarly, while Messrs. G and S did poorly on various sections of the ATTS exam--a test which, in Mr. Newton's view, was a poor indicator of how operator candidates would perform on the NRC exams, see Tr. 24,722-23 (Newton)--these operators passed the April NRC exam, and did not do so badly on the October NRC

exam to warrant the conclusion that certification was unjustified: G and S each failed one category of the October exam (receiving scores in one category of 64% and 62% respectively). See Lic. Ex. 64 and Staff Ex. 32.[20] At issue here are the circumstances under which individuals who have worked for an extended period of time to retake a license exam should be denied that opportunity. In the case of Messrs. G and S, both individuals had previously passed the NRC exams. See Tr. 24,734 (Newton). Surely this fact must be included in considering whether certification is appropriate.

150. With respect to Mr. H, while Judge Milhollin correctly states that Mr. H failed numerous categories on the ATTS exam, the Special Master fails to mention that Mr. H was previously licensed, had an Associate degree in nuclear engineering, Tr. 24,760-61 (Newton) and, while he failed the the April NRC exam, Mr. H passed the October exam with flying colors, receiving an overall grade of 86.6%, including above 90% on four sections of the exam. See Staff Ex. 32; see also Tr. 24,335-40 (Ross explanation, in response to Milhollin question, of certification of Mr. H); Lic. PF 366.

20/ Messrs. G and S passed the February, 1982 NRC re-examination on the respective categories each had failed. See letter of April 12, 1982 from counsel for the NRC Staff (Goldberg) to the Board, the Special Master and the parties (attached exam results).

151. Judge Milhollin next finds Licensee's certification system unreliable because of Licensee's partial reliance on operators' performances during training, as indicated by quiz scores, and because the training data upon which Mr. Hukill relies is not always accurate. See Report at ¶ 256-257. Here, the Special Master repeats his legitimate criticism of Licensee's poor past quiz administration. But Licensee does not believe this criticism should overshadow all other considerations, such as whether the certification process, if conducted properly, and considering Licensee's new procedures, is satisfactory. Finally, Judge Milhollin cites Training's referral to Mr. Hukill of Mr. H's inaccurate quiz score, which score was considered in certifying Mr. H, in stating an "example" of how Mr. Hukill's certifications were based on inaccurate information. While Licensee does not dispute this incident or its negative reflection on Licensee, see Lic. PF 363, Licensee does believe that Judge Milhollin's summary is potentially misleading since this incident was the only such error brought to light during the reopened proceeding. And certainly one error in transmitting quiz scores does not establish that Mr. Hukill generally relies on unreliable data.

152. In summary, Licensee believes that the record reflects that certification of individuals to take the April, 1981, and the October, 1981, NRC exams was conducted in the past in a

proper manner, albeit with several noted weaknesses, viz., reliance on poorly adminstered quizzes prior to the April exams, and the one error in the calculation of an operator's quiz grade. The record also establishes that Licensee's current method of determining an operator's attitudes and technical competency, which has been formalized into a certification procedure, is appropriate and satisfactory.

VI. Shift Staffing

153. Licensee finds in Judge Milhollin's Report no discussion of the issue of control room staffing. See Report at ¶ 3, Particular Issue (11). Licensee refers the Board to its Proposed Findings on this subject. See Lic. PF 407-410.

Respectfully submitted,

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