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August 23, 1983

WRITER'S DIRECT DIAL NUMBER

822-1026

Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: MetEd (TMI-1), Docket No. 50-289

Dear Mr. Denton:

In your memorandum to your principal Staff members, dated July 11, 1983, you outlined the plans for NRR review of the GPU v. B&W lawsuit documents. Among other things the memorandum stated that "DL will contact and, if appropriate, will meet with outside organizations (e.g. Congressional Staff and hearing intervenors) to obtain their comments" on those documents. Similarly, by memorandum dated June 30, 1983, Staff counsel advised that counsel was planning to telephone each party to the TMI-1 restart proceeding in order to obtain identification of any of the litigation documents which the parties believe to be pertinent to the Staff review.

Licensee has apprised its counsel in the litigation, who are familiar in detail with the documents in question, of the NRC's ongoing review of the litigation documents and areas of particular interest as evidenced by pleadings filed in the Restart Proceeding. One such particular area of interest is the so-called "Mystery Man" issue and the question

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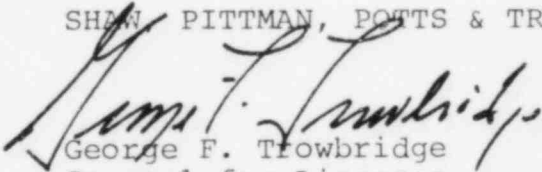
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of actuation of HPI following the TMI-2 accident. For your information I enclose a copy of a memorandum on this subject prepared by Kaye, Scholer, Fierman, Hays and Handler, dated August 16, 1983. Other memoranda, as appropriate, will be forwarded to the Staff for use in its review.

On behalf of Licensee, we request that undersigned counsel be notified of, and have an opportunity to attend, any meeting which your Staff or NRC counsel may have with any "outside organizations," including Congressional Staff and hearing intervenors, for the purpose of identifying or obtaining comments on any of the GPU v. B&W lawsuit documents pertinent to your review.

Sincerely,

SHAW, PITTMAN, POTTS & TROWBRIDGE


George F. Trowbridge
Counsel for Licensee

cc w/encl: Mary E. Wagner, Esq.

MEMORANDUM ON THE 5:41
HPI ACTUATION
"MYSTERY MAN" ISSUE

August 16, 1983

INTRODUCTION

The first reference to a so-called "Mystery Man" was in the opening statement in the GPU v. B&W trial by B&W's counsel, who coined the phrase in the context of his argument that (1) there was evidence in prior testimony that high pressure injection ("HPI") was actuated at about 5:41 a.m.; (2) if HPI had been maintained at that time, the core would not have been uncovered; and (3) since no one testified to having turned off HPI near that time, there must have been a "Mystery Man" who did so.¹

Prior to this assertion by B&W's counsel, none of the studies and investigations by the NRC and other independent bodies had found or even speculated as to the presence of a so-called "mystery man" in the control room. After the argument was raised at trial, GPU's trial counsel retained EDS Nuclear Inc., a firm of expert consultants, to perform an analysis of this issue. The EDS study conclusively determined, on the basis of hydraulic analyses, that there had been no actuation of high pressure injection during the time period in question. Since the high pressure injection was proven by scientific analysis not to have been actuated at about 5:41 a.m., no "mystery man" turned it off.

¹ Trial tr. 148-49, 159.

THE EDS ANALYSIS

EDS Nuclear Inc., an engineering consulting firm with an expertise in thermohydraulic analysis, provides engineering, design and analysis services to the electric power industry.² The EDS analysis of the alleged 5:41 full flow actuation of high pressure injection was conducted by Dr. James Holderness, who is the manager of an EDS group specializing in thermohydraulic analysis.³ Dr. Holderness' qualifications to perform the analysis consisted of ten years' past experience in performing hydraulic analyses, including seven years with Combustion Engineering, where Dr. Holderness was responsible for performing analyses in support of licensing applications for nuclear power plants and for verifying the efficacy of the models used in those analyses.⁴

Dr. Holderness' analysis of the alleged 5:41 actuation of high pressure injection was reviewed within EDS both by another EDS engineer and by the EDS Nuclear Quality Assurance Department.⁵

The objectives of the EDS analysis were to determine whether certain indications of operation of the emergency core cooling system, which were recorded on the day of the acci-

² Holderness, trial tr. 5590-91.

³ Id. at 5591-92.

⁴ Id. at 5590-91.

⁵ Id. at 5592.

dent, could be analyzed to identify an actuation of high pressure injection and, if so, to determine whether an actuation occurred at or about 5:41 a.m.⁶

There are two potential emergency cooling water supplies to the high pressure injection pumps: the make-up tank and the borated water storage tank.⁷ EDS constructed analytical computer models which established that the response of the make-up tank level would indicate whether there was an actuation of high pressure injection.⁸ EDS confirmed the accuracy of its models, and of the conclusions derived from those models, by comparing those conclusions with data on make-up tank level acquired during undisputed actuations of high pressure injection.⁹

The EDS analysis found that make-up tank level could be used as an indicator of full flow high pressure injection,¹⁰ and further found that "the 5:41 response of the make-up tank level does not exhibit the characteristics of [an actuation of high pressure injection]."¹¹ The EDS analysis

⁶ "Analysis of Reactor Coolant System Make-Up During the Three Mile Island Unit 2 Event," EDS Nuclear Inc., December 29, 1982, p. 1. The analysis was marked at trial as GPU trial exhibit no. 2233.

⁷ Holderness, trial tr. 5594.

⁸ Id. at 5594; 5600.

⁹ Id. at 5600-01; 5608-09.

¹⁰ GPU trial exhibit no. 2223, p. 2.

¹¹ Id. at p. 3.

flatly concluded that the make-up tank level behavior at 5:41 a.m. established the absence of an actuation of high pressure injection.¹² Dr. Holderness, in testifying at trial, demonstrated that given the behavior of make-up tank level at or about 5:41, it was impossible for there to have been an HPI actuation at that time.¹³

OTHER INDEPENDENT STUDIES

The conclusion of the EDS study that there had not been a 5:41 actuation is consistent with the findings of other independent studies regarding the March 28, 1979 accident.¹⁴

Among the technical analyses of the Three Mile Island accident containing detailed sequences of events are the NRC Special Inquiry Group (SIG) Report¹⁵; NUREG-0600¹⁶; and

¹² Id. at p. 3.

¹³ Holderness, trial tr. 5637; 5700.

¹⁴ See discussion in the NRC staff's "Report of the Review of the Babcock and Wilcox - General Public Utilities Law-suit Trial Court Record," March 28, 1983, at pp. 6-9.

¹⁵ "Three Mile Island - A Report to the Commissioners and the Public," Nuclear Regulatory Commission, Special Inquiry Group (NRC-SIG), Volume II, Part 2, "The Accident and Its Analysis" ("SIG Report").

¹⁶ "Investigation into the March 28, 1979 Three Mile Island Accident by Office of Inspection and Enforcement," Investigative Report No. 50-320/79-10, NUREG-0600, July, 1979 ("NUREG-0600").

NSAC-80-1.¹⁷ None of the sequences of events in these studies include a 5:41 HPI actuation, and none of these studies concluded that there was such an event.

A GPU sequence of events, TDR-044,¹⁸ refers to a 5:41 full flow manual HPI actuation. That entry, however, was based on statements by operators, which are reviewed below. Significantly, the TDR limits the possibility of a 5:41 actuation to a maximum of five minutes, a conclusion consistent with the findings of GPU-sponsored studies of borated water storage tank levels that a 5:41 actuation could not have lasted for more than five minutes.¹⁹ As we will show, this maximum five-minute figure in itself casts doubt on the operators' ability to recall the timing of the full flow HPI manual actuation.

Moreover, Dr. Holderness of EDS Nuclear discussed the EDS study with the principal author of TDR-044, Dr. Van Witbeck of Energy, Inc. After reviewing the EDS report, Dr. Van Witbeck concurred that no studies had been done in prepa-

17 "Analysis of Three Mile Island - Unit 2 Accident," Nuclear Safety Analysis Center, NSAC-80-1 (NSAC-1 Revised), March, 1980 ("NSAC-80-1").

18 GPU trial exhibit no. 2079, GPU Nuclear Technical Data Report, TDR-044, "Annotated Sequence of Events, March 28, 1979," February 6, 1981 ("TDR-044").

19 GPU trial exhibit 2079, TDR-044 at figure 60; Zewe dep. 821-22, 826-28, 830-37.

ration of the TDR which contradicted the EDS conclusion as to the absence of any 5:41 actuation.²⁰

OPERATOR STATEMENTS IN INTERVIEWS
REGARDING A 5:41 ACTUATION

In early interviews of the operators, their recollection of the approximately 15 hour accident sequence generally was not assisted by computer data or engineering analyses of the accident.²¹ Zewe testified at trial that soon after the accident he spoke to and was interviewed by "a great many people"; that he had had no opportunity to review data to confirm the accuracy of his recollections; and that some of these early interviews were conducted in motel rooms, cars and trailers.²² Moreover, as Zewe noted during the trial, the operators' post-accident recollection often tended to "compress" the timing of various actions taken on the day of the accident.²³ Zewe explained in an early interview: ". . . I was very far off in the times. Times were much longer and I felt that they were much shorter. . . . [O]n a few of the graphs and things that we have seen, we have noticed that the times there were a lot different than we have previously imagined."²⁴

²⁰ Holderness trial tr. 5659-60.

²¹ Zewe trial tr. 3031.

²² Id.

²³ Id. at 3032.

²⁴ TMI Staff interview, 4/6/79, p. 1.

evidenced by the fact that he related attempts to restart the reactor coolant pumps to the concerns about the increasing indications on the neutron detectors even though these were actually about an hour apart.²⁶

In order to delineate and understand the sequence of events in a nuclear plant transient, large amounts of data are recorded and then subjected to engineering analysis. As with the "black box" used in airplane accidents, it is more accurate to rely on engineering analysis of recorded data than on human recollection of numerous, technically complex events. No one person could be expected to recall precisely the time and sequence of the thousands of indications and actuations which occurred over a period of some fifteen hours on March 28, 1979.

Unfortunately, alarm printer data was not available for a period of time on March 28, 1979 that included 5:41 a.m.²⁷ The alarm printer data, where available, recorded each actuation and termination of high pressure injection. The alarm printer records one full flow manual actuation of HPI at

²⁶ Faust, I&E interview, 4/21/79, pp. 51-52. The computer alarm printouts place the attempts to restart the reactor coolant pumps at 6:46 to 6:54, and the increasing indications on the neutron detectors at 5:41 to 6:05. GPU trial exhibit no. 2084.

²⁷ GPU trial exhibit no. 2079, TDR-044, p. 42. (Alarm printer data not available from 5:13 to 6:48 a.m.)

7:20. This followed the shutting off of a reactor coolant pump at 7:13.²⁸

Faust

Craig Faust, an operator on shift on the day of the accident, stated in an NRC interview that manual HPI actuation occurred prior to the time of the shutting off of the reactor coolant pumps, at 5:41.²⁹ However, Faust later appeared to realize that his recollection of the manual actuation had been displaced in time, and that he had confused the 7:20 full flow manual actuation with the 5:41 time period.³⁰ In response to what an I&E interviewer characterized as a "monday morning quarterbacking" question about what he would have done differently, Faust stated that he had felt uneasy about turning off the reactor coolant pumps, and that, had he known at that time what he had learned after the accident, he would have tried high pressure injection rather than turning off the pumps.³¹ This conclusion is inconsistent with Faust's statement that full flow HPI had been initiated at the time of the 5:41 reac-

28 GPU trial exhibit no. 2084, alarm printer data.

29 Faust, NRC I&E interview 4/21/79, pp. 48, 51.

30 Specifically, during an interview on May 25, 1979, Faust, after a lengthy discussion of what was unquestionably the 7:20 manual actuation of HPI, said "[t]his would be the manual actuation which would be right around when we were stopping the pumps. The one I could think of. So that would be earlier than what it should be." NRC I&E interview, 5/29/79, p. 10 (emphasis added).

31 NRC I&E interview 4/3/79, pp. 39-40, 48.

tuation of HPI when the remaining reactor coolant pumps were secured.³⁰ As of the May 25th interview, Zewe had attended several meetings at which Faust had mentioned a 5:41 actuation.³¹ Zewe's understanding of the time of the actuation apparently derived from the earlier statements of Craig Faust. For example, during the May 25th interview, in response to a question as to whether he was sure full HPI had been on around 5:41, Zewe stated that "I was not as sure as the operator who actuated it was. He is sure, Craig Faust."³²

Notably, Zewe's understanding that Craig Faust had actuated HPI was contradicted by Faust himself, who stated that he thought that high pressure injection had been initiated by Edward Frederick at the time that he, Faust, recalled having secured the reactor coolant pumps.³³

Frederick

Edward Frederick was the operator assigned to the HPI controls throughout the day of the accident.³⁴ He has never testified to a 5:41 actuation, either during the GPU v. B&W trial, during his deposition or in interviews. In an ear-

30 Zewe, TMI Staff interview 5/25/79, p. 31.

31 Zewe trial tr. 2760-62.

32 TMI Staff interview, 5/25/79, pp. 5-6; see Zewe dep. 824-26.

33 Faust, NRC I&E interview, 4/21/79, p. 39; Faust, President's Commission deposition, p. 158.

34 Frederick trial tr. 3492-96; Zewe trial tr. 2124.

ly interview, Frederick characterized the manual HPI actuation as having occurred during a time when Gary Miller, Station Superintendent, was present in the control room.³⁵ Miller arrived in the control room at approximately 7:05 a.m.

Frederick also placed the HPI actuation as occurring "after the relief valve had been isolated"³⁶ which was at 6:19 a.m.,³⁷ and as occurring "during the time when we had decided that we did not have natural circulation,"³⁸ which was at about 6:54 a.m. when reactor coolant pump 1B was restarted in an attempt to induce forced flow circulation, marking the point at which the operators ultimately were convinced that natural circulation was not going to work.³⁹ These statements establish Frederick's recollection that a manual actuation of full flow HPI occurred, not at 5:41 a.m., but rather after 7:00 a.m. -- conforming to the alarm printer entry at 7:20.

35 Frederick, NRC I&E interview, 4/23/79, pp. 48-57.

36 Frederick, U.S. Senate Subcommittee interview, 8/22/79, pp. 16-17.

37 GPU trial exhibit no. 2079, p. 47.

38 Frederick, U.S. Senate Subcommittee interview, 8/22/79, pp. 16-17.

39 Frederick, NRC I&E interview, 4/3/79, p. 36; Faust, NRC I&E interview, 4/21/79, p. 52; GPU exhibit no. 2079, TDR-044, p. 51.

"GPU v. B&W" DEPOSITION AND TRIAL TESTIMONY

Faust

Faust's deposition testimony further confirms that he did not have a sound basis for his earlier statement regarding a 5:41 full flow HPI actuation. He testified that "before" they took the pumps off, high pressure injection was initiated; that he did not physically do it, but he heard it was done or was going to be done; that he did not know if it was at full flow; and that he was primarily involved with the secondary side of the plant.⁴⁰

Zewe

During his GPU v. B&W deposition, after he had had access to relevant technical data, Zewe testified that he had recalled that "we did high pressure injection at or about the time we secured the second two pumps. But I cannot void myself of everything else that has happened and what is fact from other sources," referring to studies of borated water storage tank level responses to actuations of HPI.⁴¹ Thus, Zewe was unable to distinguish in his mind between what he had previously said based on what he had heard from Faust, and facts that he knew to be scientifically accurate.

Zewe's trial testimony further indicates that his recollection of a 5:41 actuation derived from Craig Faust's

⁴⁰ Faust dep., pp. 525, 540.

⁴¹ Zewe dep., 821-24.

statements. Thus, Zewe testified at trial that Faust had said, referring to a 5:41 actuation, that he, Faust, "felt sure that's when it was" and that Zewe had then said: "if you are sure that's when it was, then that's when it was. . . ."42 Zewe also testified regarding his own early recollection of the time of the manual HPI actuation: "I for one could not remember exactly when it happened. One of the operators, as I recall, was pretty sure of the exact time."43

During the GPU v. B&W trial, GPU's counsel asked Zewe a series of questions which he had not been asked in any of his prior testimony or interviews by the NRC or GPU personnel, i.e.: How many HPI actuations had there been? How many of these were automatic? How many of these were manual? Zewe testified that he recalled four full flow actuations, three of which were automatic and one of which was manual.44 Specifically, Zewe recalled a single manual actuation; the initial automatic actuation a few minutes into the accident; an automatic actuation "after the declaration of the site and general emergency"; and an automatic actuation in the early afternoon associated with the hydrogen burn.45 Zewe recalled that the manual actuation was the second actuation of the four.46

42 Zewe trial tr. 2761.

43 Zewe trial tr. 2173, 2761.

44 Zewe trial tr. 2115-18, 2153, 2156.

45 Zewe trial tr. 2115-18; 2153, 2156.

46 Zewe trial tr. 2117, 2121-22.

automatic actuation a few minutes into the accident; an automatic actuation "after the declaration of the site and general emergency"; and an automatic actuation in the early afternoon associated with the hydrogen burn.⁴⁷ Zewe recalled that the manual actuation was the second actuation of the four.⁴⁸

This recollection is corroborated by recorded plant data. Computer alarm data establish three automatic actuations of full flow HPI: at two minutes into the event; at 7:56 a.m., or 30 minutes after the general emergency declaration; and at 1:50 p.m., the same time as the hydrogen burn.⁴⁹ The computer alarm data lists only one manual actuation of full flow HPI, at 7:20 a.m. Thus, the manual actuation was the second HPI actuation, just as Zewe recalled.

Zewe's trial testimony also brought out for the first time that a full flow manual HPI actuation would have started the emergency diesel generators, setting off large alarm bells in the control room, and necessitating the dispatch of an operator to shut down the diesels. Zewe testified that he did not recall doing this in or about the time period following the shutoff of the reactor coolant pumps.⁵⁰

⁴⁷ Zewe trial tr. 2115-18; 2153, 2156.

⁴⁸ Zewe trial tr. 2117, 2121-22.

⁴⁹ GPU trial exhibit no. 2084, alarm printer data.

⁵⁰ Zewe, trial tr. 2120-21; see also Frederick trial tr. 3391.

Zewe also testified that the manually initiated full flow HPI that he recalled had been maintained "for a considerable period of time,"⁵¹ which he stated meant from ten minutes to half an hour.⁵² This accords more closely with the recorded 7:20 a.m. actuation, for seventeen minutes, than with the five-minute possibility at 5:41 a.m. in TDR-044.⁵³

Zewe's ultimate conclusion at trial was that the closest that he could pinpoint his recollection of the single manual high pressure injection actuation at full flow was that it occurred after the reactor coolant pumps were turned off (at 5:41 a.m.) but before the second automatic actuation (at 7:56 a.m.).⁵⁴

The operators' earlier confusion may have resulted in part from the fact that some time after the reactor coolant pumps were shut off, the operators began to inject borated water into the reactor coolant system in order to regulate the boron concentration. This action was necessary to counteract symptoms that the reactor was returning to criticality.⁵⁵ Furthermore, the 7:20 manual actuation was -- according to the recorded data -- in fact juxtaposed to the turning off of a

51 zewe trial tr. 2115.

52 zewe trial tr. 2173-77.

53 GPU trial exhibit no. 2084, alarm printer data; GPU trial exhibit 2079, TDR-044, figure 60.

54 zewe trial tr. 2117, 2121-22.

55 zewe trial tr. 2110-13; Frederick trial tr. 3477-79.

At trial, B&W's counsel examined Frederick on the issue of a 5:41 actuation pointing out that Frederick had been present in post-accident interviews when Faust and Zewe referred to a 5:41 actuation.⁵⁷ Frederick consistently denied ever having agreed that there was a 5:41 actuation,⁵⁸ and B&W produced no statements of Frederick to the contrary. Frederick testified:

I just never disagreed with [Zewe] that's all. Until we put all the data together, there was nothing to disagree about. . . . I think that they think I agreed because I didn't disagree."⁵⁹

Frederick also testified to data concerning the behavior of make-up tank levels. On cross-examination, B&W submitted a chart, prepared by its engineers during the prior few days, reflecting the behavior of make-up tank levels at 7:20, which B&W's counsel claimed was similar to the pattern at 5:41 a.m. In order to resolve the issue in a reliable and definitive way, GPU's trial counsel decided to call in EDS Nuclear. As discussed above, Dr. James Holderness testified to the EDS Nuclear study which established that it was not possible for HPI to have been actuated at full flow at or about 5:41 a.m. in light of the analysis of make-up tank levels. In particular, Holderness explained that while the 5:41 a.m. and 7:20

⁵⁷ Frederick trial tr. 3876-77.

⁵⁸ Frederick trial tr. 3877-79; 3883-84.

⁵⁹ Id. at 3888.

a.m. make-up tank level patterns might appear similar to the naked eye, computer analysis plainly showed critical differences and disproved any 5:41 a.m. actuation at full flow.⁶⁰

CONCLUSION

The alarm printer data show an undisputed manual actuation of high pressure injection at 7:20.⁶¹ Thus, the allegations of a 5:41 manual actuation must hypothesize an additional manual actuation. Yet, uncontradicted trial testimony establishes that both Zewe and Frederick had a clear recollection of there having been only one manual actuation.⁶² Frederick recalls specific circumstances that place the manual actuation near to the 7:20 time recorded on the alarm printer; Zewe accurately places the one manual actuation as being the second of the total of four HPI actuations, as is recorded on the alarm printer at 7:20. The recorded 7:20 actuation followed a shut-off of a reactor coolant pump, also recorded in plant data, at 7:13. Accordingly, the trial testimony is consistent both with the available alarm printer data, and with the conclusion of the EDS technical analysis that there was no 5:41 actuation.

⁶⁰ Holderness trial tr. 5637, 5700; GPU trial exhibit no. 2223, p. 3.

⁶¹ GPU trial exhibit no. 2084, computer alarm data.

⁶² Zewe trial tr. 2153; 2156. Frederick trial tr. 3493; 3876.

Earlier statements made by another operator, Craig Faust, and relied upon by his superior, William Zewe, misplaced the time of the manual actuation back by an hour and forty minutes, to an earlier shutting off of the reactor coolant pumps, at 5:41 a.m. In the absence of data, this was an understandable confusion of recollection.

Since the EDS analysis scientifically proves that that there was no full flow manual actuation of high pressure injection at or about 5:41 a.m., the colorful charge that a "mystery man" turned it off was conclusively rebutted.