10,825

1	UNITED STATES OF AMERICA
2	NUCLEAR REGULATORY CONSTSTICT
3	x
4	In the matter of:
5	METROPOLITAN EDISON COMPANY : Docket No. 50-289
6	(Three Mile Island Unit 1) :
7	:
8	
9	25 North Court Street, Harrisburg, Pennsylvania
10	Thursday, January 22, 1981
11	Evidentiary hearing in the above-entitled
12	matter was resumed, pursuant to adjournment, at 9:04 a.m.
13	BEFORE:
14	IVAN W. SMITH, Esq., Chairman, Atomic Safety and Licensing Board
15	DR. WALTER H. JORDAN, Member
16	DR. LINDA W. LITTLE, Member
17	
18	
19	
20	
21	
22	
23	THIS DOCUMENT CONTAINS
24	FOOR QUALITY FALLS
25	
	8101260935 T

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1	APPEARANCES	•				
2	On	behalf omnenv	of the	e Licen	see, Metropo	litan Edison
3		GEOR	GF F.	RCWBRT	DCF. Est.	
4		THOM	AS A. I	BAXTEP	Potts and Tr	owbridge.
5		18 Va	00 M St	treet,	×.×.,	
6	On	behalf	of the	e Commo	wealth of P	ennsvlvania:
7		ROBE	RT ADLE	ER, Esc		
8		Asi 50	sistant 5 Execu	t Attor	ney General, buse,	
9		Har	rrisbur IAM DCE	NSIFE.	nsylvania	
10		Nuc	clear 1	Inginee		
11	On	behalf JAMES	of the	Regula	tory Staff: IV, Esc.	
12		JAMES	S TOURT	ELLOTT: Execut	E, Esq. ive Legal D	irector,
13		Un: Wa:	ited St shingto	ates No	iclear Regul	atory Commission,
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

ALDERSON REPORTING COMPANY, INC.

CONTENTS CROSS DIRECT CROSS REDIBECT RECROSS BOARD 3WITNESS: ON POI Laurence E. Phillips By Mr. Baxter 10,828 5By Mr. Dornsife 10,867 By Mr. Baxter 10,907 Robert Jones 7 Robert %. Keaten gFy Dr. Little 10,911 By Chairman Smith 10,920 Laurance E. Phillips By Dr. Jordan 10,925 11 By Mr. Dornsife 10,932 EXHIBITS FOR IDENTIFICATION 13 NUMBER IN EVIDENCE 14Licensee 24 10,852 Licensee 25 10,855

1

2

6

9

10

12

15

16

17

18

19

20

21

22

23

24

25

A

ALDERSON REPORTING COMPANY, INC.

10,828

# PROCEEDINGS 1 CHAIRMAN SMITH: Are there any remaining questions 2 3 of Mr. Phillips on the Special Board Question? ("o response.) 4 CHAIR AN SMITH: In that case, I guess we are 5 6 ready for cross examination on his prepared direct testimony. MR. BAXTER: I understand Mr. Adler would like me 7 g to go first since "r. Dornsife is not here, so I will. The Poard will note a typographical error on the 9 10 title page to my cross examination plan. It references UCS 11 Contention No. 37. It should be 7. CHAIRMAN SMITH: It just seemed like that many 12 13 Contentions. (General laughter.) 14 15 Whereupon, LAURENCE E. PHILLIPS, 16 17 called as a witness by counsel for NRC Staff, having 18 preciously been duly sworn by the Chairman, was further 19 examined and testified as follows: CROSS EXAMINATION 20 BY MR. BAXTER: 21 Mr. Philips, do reactor coolant system temperature Q 22 23 and reactor coolant system pressure indications supplemented 24 by the new saturation meters to be installed, enable the 25 operators at INI 1 to determine whether the reactor coolant

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 system is in a subcooled condition?

2 A Yes.

3 Q And if the operator maintains a subcooled 4 condition, is he assured that the core is being adequately 5 cooled?

6 A Yes.

7 Q Do the B&W operator guidelines for small breaks 8 applicable to THI 1 and operator training provide adequate 9 guidance to the THI 1 operators on the maintenance and/or 10 restoration of a subcooled condition during a loss of 11 coolant accident?

12 A My understanding is that that was the finding in
13 the SER.

14 Q Will saturation conditions in the hot leg 15 necessarily occur before the core can become uncovered?

16 (Pause)

17 A Well, thinking in terms of a large break, I am not 18 certain that that would necessarily be true. In general, 19 yes.

20 Q Would the operator in the TMI 1 control room be 21 alerted to a loss of his subcooling margin with the 22 instrumentation that will be installed prior to restart, and 23 if so, how?

24 A Yes, he would be alerted to loss in his subcooling 25 margin, and there are saturation meters that will be used

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 for that purpose.

Q And is there an alarm associated with those meters? 2 A I do not recall for a certainty, but I am pretty 3 4 sure there is. 5 Q Would the loss of the subcooling margin is 6 indicated by that meter and/or alarm dictate operator action 7 pursuant to the emergency procedures at TMI 1? A Yes. 8 Mr. Phillips, were you a member of the NRR TMI 2 0 9 10 Lessons Learned Task Force? A No, I was not. 11 Q Do you have a copy of NUSEG-0578 with you? 12 A I do not have a copy of the NUREG. I have 13 14 something with the position in it. (Counsel handing document to witness.) 15 16 Q If you would refer to the discussion in the 17 appendix of Item 2.1.3.b, instrumentation for detection of 18 inadequate core cooling in PWRs and BWRs -- it starts on 19 A-11. 20 A Yes. Q As Dr. Jordan pointed out in his questioning 21 22 Yesterday, it envisions a two-stage set of recommendations 23 or requirements, and for the second stage it discusses the 24 fact that there should be -- Licensee should study and 25 implement system modifications to provide more direct

1 indication, and the task force states at page A=12 that a 2 number of iteas have been discussed. They mentioned that at 3 the top of the page, and they mentioned some possibilities 4 they had in mind at the time and stated that detailed 5 engineering, however, is required before design requirements 6 for a direct level measurement system can be specified.

7 In the statement of position below, then, Item No. 8 2 requires a description of any additional instrumentation 9 or controls, to give an unambiguous, easy to interpret 10 indication of core cooling. I am interested in the word 11 "any" and I wonder if you know whether the task force firmly 12 determined at the time they issued this report that 13 additional device or devices giving an unambiguous, easy to 14 interpret indication of inadequate core cooling could 15 definitely be developed which would provide an overall 16 enhancement to safety. And if so, why did they include the 17 word "any" in the position?

18 A The task force recognized that level 19 instrumentation was not currently in place on PWRs, and they 20 also recognized that it was not perfectly straightforward 21 application, that it required evaluation. They also did not 22 want at that point to limit the considerations to level 23 instrumentation. They wanted to leave the technique or 24 their considerations open to anything that the vendors might 25 propose.

1 Also, there is a question in terminology, perhaps, 2 on whether some of the devices which can be used for level 3 indication such as thermocouples and so forth, would really 4 be called a level indicator. But I think the overriding 5 consideration was that until -- and it is still our position 6 -- that until we receive a design for a monitoring system 7 and see how that design is implemented, and see how it is 8 used, that we cannot make a pre-finding that it is 9 acceptable, and therefore we have taken the position that an 10 engineering evaluation is required.

11 We have certainly advanced from the point when 12 this document was prepared to the extent that we the staff 13 have in our continuing evaluation, have a great deal more 14 confidence at this point that level indication is feasible 15 and is valuable and would provide an enhanced margin of 16 safety.

17 C This recommendation, though, by the Lessons 18 Learned Task Force, is the genesis, is it not, of the Task 19 Action Item II.F.2 in 0737?

20 A That is right.

21 Q It did not originate from any of the other task
22 forces or investigative groups investigating the accident?
23 A That is correct.

24 Q You were not a member of the task force but do you 25 read this discussion of the recommendation and the language

ALDERSON REPORTING COMPANY, INC.

#### 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 itself as contemplating at least the possibility that these 2 studies would conclude that there is not any additional 3 instrumentation which could be developed to meet the 4 criterion of an unambiguous, easy to interpret indication of 5 inadequate core cooling which would overall provide an 6 enhancement to the safe operation of nuclear power plants?

7 A There was that possibility. I think the 8 possibility really hinged more on being unable to come up 9 with an acceptable system, that the staff felt that a more 10 direct indication was needed, and the water level would be a 11 valuable indication from day one. But the possibility of 12 not being able to come up with an acceptable system existed 13 at that time initially, and to a lesser extent, I think we 14 have made statements that we would judge 99 percent 15 probability that some of these devices would be found 16 acceptable.

17 So there would still be a small chance that the 18 staff ultimately would conclude that the final system, as 19 designed and installed, did not add to safety.

20 At this point we consider that a very, very, very 21 small possibility.

22 Q Do you plan to wait until they are designed and 23 installed to reach that determination?

A As I stated yesterday on the schedule that we
 25 provided, we plan to make a generic finding about the time

10,833

of installation, and we have already in our continuing dialogue with the Licensees, I think in various public meetings, hearings, I think we -- plus a commission paper we recently prepared, I think we have made clear that we regard two concepts at this point as highly promising. We do intend to wait until they are installed, calibrated and tested in the plant before we make a finding that a specific installation is acceptable and is to be incorporated in the emergency procedures.

10 Q I am confused about that. I would think the staff 11 -- and I ask you to respond to my reaction -- would be able 12 to make a much more objective assessment of whether these 13 devices do provide an overall improvement to safety, if they 14 reach that determination based on studies and examinations 15 before they are actually installed in operating plants.

A That will be part of the generic evaluation that we are undergoing now, and has already been carried out to some extent on the two systems that we partially blessed. And that will be the subject of the generic SER. So if we make a finding generically that a system is okay, then that finding will be made prior to the individual installations or about that time. Then it is a question of whether the specific installation is installing it properly and is using it properly, has the right facilities and is calibrating it properly.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 Q Describe for me where and how you are going to do 2 these generic studies or acceptance reviews of an actually 3 installed system based on the Westinghouse and Combustion 4 Engineering concepts you described yesterday.

5 A Yes. NUREG-0737 has a rather long list of 6 documentation that is required for the staff to review and 7 evaluate in connection with the specific designs that plants 8 are incorporating. And we the staff have offered the DOE 9 research facilities at EGEG Idaho such as the semiscale LOFT 10 facilities and also the transient heat transfer test 11 facility at Oak Ridge, and other government facilities as 12 they might be of advantage to assist the Licensee and the 13 veniors in evaluating their proposed systems under simulated 14 accident conditions. There is a great deal of testing and 15 general design work and testing that can be performed by the 16 developers at relatively low cost.

But to complete an evaluation including evaluating the behavior under simulated accident circumstances is a rather large undertaking, and that is the reason that we have offered to have these systems installed and tested in various facilities. In the Westinghouse Delta P measurement system, it has already been installed in semiscale and is scheduled for testing very soon.

24 In the recent LOFT tests, there were a number of 25 techniques under evaluation, some proposed by Licensees and

1 others just as a general evaluation. One in particular that 2 has been proposed by Licensees and has been installed at the 3 Farley reactor is neutron detectors above and below the 4 vessel which are calibrated in terms of level. Those were 5 installed for the recent LOFT tests that were alluded to 6 yesterday. I cannot say that the preliminary evaluation of 7 them was -- at least their behavior under that test was very 8 promising, and the evaluation is still going on as to what 9 went wrong because those systems have been tested on other 10 reactors and with reasonable results.

Some of the other systems that were evaluated in that test were conductivity probes. The LOFT has always had conductivity probes in the downcomer for measurement of level. They now incorporated them at three locations in the to core. Also in LOFT they have a direct thermocouple reading system. The thermocouples are located at discrete axial revels within the core and around the vessel, up in the upper plenum and close to the vessel head.

19 DR. JORDAN: By direct thermocouple readings, do 20 you mean on the fuel elements, or are they heated, or are 21 they just measuring water temperature?

THE WITNESS: By direct I meant that they are not heated. They are measured -- but actually they have them both on the fuel -- on the clad surface, and they have them had them in instrument thimbles where they would be

10,836

1 measuring coolant temperature, and above the core they are
2 located close to the vessel head, where when the --

3 DR. JORDAN: You mean the walls.

4 THE WITNESS: Yes, the walls, I am sorry, such 5 that when the level falls below the location of the 6 thermocouple, that the surface of the wall is no longer 7 being cooled, and so it tends to radiate to the thermocouple 8 and gives an indication of superheat in connection with 9 existing pressure, and the LOFT facility has, not just for 10 that test, but for some time now, several tests, had these 11 thermocouples interpreted in terms of deviation from 12 saturation, and from saturation conditions, and they are 13 reflected on a bar chart on the CRT, and they have been an 14 excellent follower of where the level is.

15 So that particular technique has not been proposed 16 by anybody, although I understand that at least in 17 connection with the heated junction thermocouples, that 18 direct reading thermocouples within the core at various 19 axial levels may be proposed in some instances to cover the 20 rest of the range.

They also had DP measurements on the LCFT facility, although they were not a commercial installation. The Combustion Engineering commercial heated junction thermocouple system has been tested at Oak Ridge. So this is development testing, I believe that you are alluding to,

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 and evaluation of systems, and that will be done this year, 2 and we expect to have that completed before the end of the 3 year, an SER issued on it.

As I said, as with many things, the plant specific 5 systems, the way that these concepts are installed and 6 employed, and calibrated and tested will be approved after 7 installation.

8 BY MR. BAXTER: (Resuming)

9 Q The generic SER will be issued at the end of 1982
 10 -- I mean 1981, excuse me.

11 A Yes.

12 Q And yet 0737 calls for individual Licensees to 13 have implemented this modification by January 1, 1982?

A Yes. There should be somewhere in 0737 -- it was there at one time, and it has been rather the staff position -- that, might at January 1, 1982, that in general does not mean stop, everyboly, and install on January 1, 1982. There is a consideration there of what the next refueling shutdown is, when it is convenient, if reasonable. By convenient, if reasonable, I mean it does not extend for another year and a half or forever or something like that, to put it in. So -and implement in that case really means install.

Q If Licensees are to meet the staff requirements in this area, will some Licensees have to begin the installation of these systems in their plants before the

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 staff has issued its generic SER approving the concept? 2 A Yes. As a matter of fact, some Licensees have 3 already begun installation. Q To recap your testimony --CHAIREAN SHITH: Before you leave that point, on 5 a what basis do you conclude that those Licensees who have 7 installed level meters have done so in a manner consistent a with safety? THE WITNESS: We do not -- the level meters will 9 to not be used and incorporated into the operating procedures 11 until we have made that judgment. CHAIRMAN SMITH: So there is no question of their 12 13 physical presence being a detriment to safety. THE WITNESS: If the Licensees themselves under 14 15 the current regulations make a determination that there is 16 no unreviewed safety question involved with their 17 installation, then that is legitimate. CHAIRMAN SMITH: You accept that. 18 THE WITNESS: Yes. 19 CHAIRMAN SMITH: How about the converse? 20 THE WITNESS: Then in that case we would have no 21 22 choice but to review it. BY MF. BAXTER: (Resuming) 23 Q If I understood your testimony, it was that 24 25 looking at the language of 0578 position that Licensees shall

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 provide a description of any additional instrumentation or 2 controls, that your understanding is that at the time the 3 task force wrote this, they recognized the possibility that 4 studies and investigations would reach the conclusion that 5 there was no additional instrumentation which would provide 6 an overall enhancement to safety, but that the staff has 7 learned a lot since then, and while that possibility still 8 eixsts, it is much smaller.

9 Is that accurate?

10 A That is right.

11 Q The staff, though, has not yet determined 12 definitively that additional instrumentation of some sort is 13 required for the detection of inadequate core cooling, is 14 that correct?

15 A That is correct. I would have to qualify that to 16 say again, to put a percentage on it, we have 99 percent 17 yes, 1 percent uncertainty.

18 Q The staff has not ordered the installation of any 19 additional instrumentation pursuant to this recommendation 20 at any operating reactor, is that true?

21 A Wall, ordered the installation? We have issued 22 several SERs which have -- I guess I would have to look at 23 the language again to say whether we have ordered 24 installation.

25 Q Are you talking about near term operating license

### ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 applicants?

A Yes. 2 0 I was speaking about operating plants. 3 Operating plants? A Well, we issued a letter and an SER also to you 5 6 which I think comes very close to doing that, if it doesn't 7 do it. Do you know whether it does actually direct the 0 8 g installation of any additional instrumentation? A Well, let me read you the language. 10 (Pause.) 11 This is from the September 24 letter to ir. Arnold 12 13 from Mr. Eisenhut which has been cited in previous 14 testimony, and it is alluding to our review of the EEW 15 report entitled "Evaluation of Instrumentation to Detect 16 Inadequate Core Cooling." This report concludes, "Existing 17 instrumentation adequately satisfies the intended purpose of 18 detecting and responding to inadequate core cooling. 19 However, our review and evaluation concludes that there are 20 major concerns with the conclusions of this report on this 21 subject. Particularly, we believe that there has been 22 insufficient effort to develop a level measurement system 23 which is sufficiently accurate to provide" -- and I have a 24 bad copy -- "to provide valuable advance warning of approach 25 to inadequate core cooling. Our evaluation provides a

1 current NRC position on this subject. Therefore, we require 2 that you develop such an instrumentation system. Acceptance 3 criteria of this instrumentation system is clarified in our 4 letter to you dated September 5, 1980, and there is similar 5 language in the SER itself.

6 So it requires you to develop a system. It 7 requires that, and NUREG-0737 very definitely requires you 8 to provide a system designed for this purpose and proceed 9 with plans to -- and it also requires you to install it by 10 January 1, 1982. That is a requirement in NUREG-0737.

11 Q Does WUREG-0737, as does the position I just read 12 to you from 0578, say any additional instrumentation should 13 be installed by January 1, 1982?

14 A Any additional instrumentation recommended, yes,
 15 whatever design you propose to us.

16 0 And any could still be none, isn't that true, 17 based on your previous testimony that the staff has not, 18 with 100 percent certainty, determined that there is going 19 to be instrumentation that improves the overall safety of 20 the plant?

A We do not accept none in the submittal. We require that you proceed with an effort to install a system, that you make a judgment of which of the available systems are best and provide us with a design that you plan to install, and proceed along that line. None is no longer an

1 acceptable answer.

2 Q When did none become a not acceptable answer, and 3 how did the staff reach that determination?

A The staff reached that determination in our 5 continuing evaluation, and at the time of the issuance of 6 NUREG-0737, and even -- well, prior to issuance, actually, 7 and certainly by the time of our review of your document we 8 had, after having evaluated some time before that, or having 9 had discussions with the various owners' groups, 10 Westinghouse owners' groups and CE owners' groups, I would 11 say if you want a time frame, probably in the spring of 1980.

12 Q And what kind of studies or analyses or 13 evaluations did you have available to you at that time about 14 additional instrumentation which led you to conclude that 15 definitely, or with 99 percent certainty, as I understood 16 your testimony, that some additional instrumentation would 17 be found that would improve the overall safety of plant 18 operations?

19 A We had some individual reviews conducted by the 20 staff for evaluation or some of the semiscale and LOFT test 21 data, primarily considering the feasibility of a Delta P 22 measurement system for PWEs, and we had presentations to us 23 by Westinghouse and their analyses and their conclusions 24 concerning the feasibility of a Delta P measurement system. 25 We had presentations to us by Combustion Engineering on the

1 heated junction thermocouple systems. We had studies,

2 ongoing studies and reports and testing on heated 3 thermocouple systems and other type systems performed by Oak 4 Ridge National Lab. We had presentations on the neutron 5 system that I had alluded to, above and below the core, plus 6 test data and test information on that system.

7 Q Has the staff documented the evidence which it 8 relied upon, the technical basis it relied upon for reaching 9 that decision in April and made it available for comment by 10 industry?

11 A Well, in the sense of have we put together a 12 document with conclusions and so forth and sent it out for 13 comment, no. All of the information has been available on 14 request and is in general in open literature. I cannot say 15 all of it is. Some of it is proprietary.

16 2 At the time -- according to evidence we heard 17 earlier this week, the BEW evaluation of nethods available 18 to indicate inadequate core cooling with additional 19 instrumentation beyond that plan was filed with the staff 20 August 15, 1980.

21 Had you received any evaluation from B&W or its
22 operating licensees when you made this decision in April?
23 A I am not sure I understand your question.
24 Q At the time you decided in roughly April 1980 that
25 no additional instrumentation would not be an acceptable

ALDERSON REPORTING COMPANY, INC.

1 position, it does not appear from what we have before us
2 that you had yet received Babcock and Bilcox's evaluation of
3 whether additional methods were feasible.

4 A Our evaluation to you that came out in the 5 September 24 letter was based on a report which you provided 6 to us in a meeting. It was B&W letter SC-68, "Report on 7 Additional Instrumentation to Detect Inadequate Core 8 Cooling," April 8, 1980, and let's see, Amendment No. 18 to 9 the TMI Restart Report, Metropolitan Edison, with 10 attachment, "Status Report on Additional Instrumentation to 11 Detect Inadequate Core Cooling." It is essentially the same 12 report that you are referring to which came out later in the 13 year.

If I might elaborate on my answer to the previous question, something did occur to me. Before we published NUREG-0737 we had meetings on our findings and cur conclusions at various sites around the country to which all the Licensee's were invited, and we gave presentations on the status of these systems and what our findings were and what we proposed to do -- come out with in the document, NUREG-0737 as finally issued. In fact, we had drafts of that document available with our conclusions, and we made presentations giving essentially the basis of our conclusions and our requirements and invited the industry to forment, and we also invited the industry at the

1 clarification meetings to attend a LOFT utility technology 2 transfer meeting in EG&G Idaho, where we had further 3 presentations on all these types of systems, and as a matter 4 of fact, demonstrations on some. So ones I have mentioned 5 and other ones in addition. And we did receive comments 6 from the industry at the clarification meetings. And as a 7 matter of fact, we revised the final clarification document, 8 NUREG-0737, to account for many of these comments.

9 And one of the revisions I might dite is the one 10 we were referring to yesterday concerning the use of 11 computers, and the removal of the seismic requirement, 12 because we had had several comments complaining about 13 unavailability and problems with produrement in that 14 connection.

15 So I think in that regard, a more correct answer 16 to your question is yes, yes we did provide the basis for 17 our conclusions. We did invite comments and receive 18 comments and acted on them.

19 Q The way I read -- and correct me if I am wrong --20 the correspondence that has gone on between the staff and 21 BEW and its Licensees in 1980 is a continuing staff 22 requirement right up until January 1 of this year that 23 Licensees continue to submit evaluations of the need for 24 additional instrumentation, which should include 25 consideration of reactor vessel water level.

If the staff determined informally in April of 1980

10,846

1 that the answer "no additional instrumentation is required" 2 would not be an acceptable answer, why haven't you just 3 proceeded to order Licensees through the issuance of an 4 order to show cause to amend their operating licenses to 5 require them to install such systems? Why continue to ask 6 for evaluations?

7 A Well, I believe NUREG-0737 does require -- it 8 definitely loes require that you install the system on 9 January 1, 1982, and it requires for you to submit the 10 design for that system on January 1, 1981, and it also asks 11 for your evaluations, if they have not already been 12 provided, which they should by now. We want to leave you 13 with the option of proposing the system. We do not want to 14 dictate that it has to be this system or that system. We 15 want additional instrumentation. We want to leave you with 16 the option of specifying which type.

17 C Was the decision that you reached in April of 1980 18 that it was feasible to develop additional instrumentation 19 to detect inadequate core cooling through means such as 20 vessel level instrumentation or did you determine as well 21 that it was needed?

DR. JOEDAN: I did not hear.
BY MR. BAXTER: (Resuming)
Did you determine as well that it was needed?
A I would say the other determination was really

made

10,847

1 earlier, and there I would hedge needed to the extent that 2 we wanted a more direct level, a more direct indication of 3 inadequate core cooling. We felt that this was needed in 4 order to enhance the safety margin. That would go back to 5 the task force, and I did have quite a bit of -- although I 6 was not a member of it, I had quite a bit of discussions on 7 the reasoning that went into the language of the task force, 8 and the qualification was there from the standpoint of we do 9 not want to order the Licensee to hang a system on just to 10 satisfy a requirement if that system is not effective, and 11 we made the decision early on that we needed an effective 12 system to enhance the safety margin.

13 The lingering doubt was on whether an effective 14 system could be developed. And that doubt just tended to 15 lisappear with time.

16 Q Did you have, then, in April 1980, or do you have 17 yet today from any Licensee or vendor operating procedures 18 and supporting analyses for how any such system is going to 19 be utilized?

- 20 A Yes.
- 21 Q From whom?

A Those submittals were due in January 1, and I have anot seen all of them that have come in. And there are various places of distribution within the organization. I sknow of generic Westinghouse submittals which I understand

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 represents about 30 Licensees, and which does include
2 procedures or use of the level instrumentation.

3 Q Is the Westinghouse submittal suggesting the use 4 of vessel level indication for any situation other than for 5 the use of operating the head vents which the staff has also 6 directed to be installed?

7 A Ch, yes.

8 Q Would you describe how the level indications are g to be used?

10 A I have not reviewed that to any extent. I only 11 glanced at it.

I might -- and I would fear that any statement I made about it without more detailed review may represent a misinterpretation. It very definitely is used, I can say, is in conjunction with the other ICC instrumentation as one of the inputs on which operating fecisions are made. It is related for -- it is cited for recovery actions, it is cited as a basis for in some instances of depressurizing the steam generator rapidly, that is, to get primary pressure down, level indication in conjunction with other signals.

21 Q Is there any operator action specified based on 22 level indication alone?

23 A I do not know, but I would expect that we would 24 find it unacceptable if it was.

25 Q Excuse me?

A I said I do not know, but I expect that we would
 2 find it unacceptable if it was based on one indication,
 3 level indication alone.

4 C Have you or others on the staff received any 5 advice or consultation or solicited any from competent human 6 factors engineers on the advisability of installing vessel 7 level indication in control rooms, based upon what you know 8 of its use and likely use?

9 A I have no direct knowledge of that. My duess 10 would be yes, but that is a Human Factors Branch business. 11 They have had consultants. I feel fairly confident that 12 they have consulted on this subject, but I do not have that 13 knowledge.

14 Q How many staff personnel are you aware of that 15 have formal training in human factors engineering in this 16 section you just referred to, or any others?

17 A I cannot answer that. I just do not know.
18 Q Has the staff considered the potential of vessel
19 level measurement inducing inappropriate operator actions,
20 and how?

A That is a continuing consideration, yes, and we have heard that argument, and it seems to me rather weak from some of the bases that are given. For instance, I have heard it cited -- and I guess in some testimony that you gave to me yesterday -- I am not sure who was giving the

1 testimony, possibly even a staff member had cited something 2 along this line, and I believe the testimony was given 3 yesterday that, well, here is an instrument that is normally 4 off scale, and if it comes back on scale, the operator would 5 tend to disbelieve it.

6 You could say that about the saturation meter 7 which you are normally not under saturation conditions. You 8 could say that about getting superheat on your 9 thermocouples. You could say that about almost anything.

I think if you couldn't train an operator to trespond to a level signal in conjunction with other indications, possibly high activity in containment or high pressure in containment, etc., that it would certainly give is not a lack of confidence you can train them in anything.

15 Q Yo are referring, believe, to the testimony I 16 provided you yesterday and distributed to the Board and 17 parties today that was given in Docket No. 312 before the 18 Nuclear Regulatory Commission, which is in the matter of 19 Sacramento Municipal Utility District, Bancho Seco Nuclear 20 Generating Station.

21 A Yes.

22 Q Another B&W operating licensee, a hearing held on 23 May 12, 1980, testimony given by Bruce A. Wilson of the 24 staff's Operating Licensing Branch.

25 I would ask that this excerpted transcript be

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 marked for identification as Licensee's Exhibit No. 24. CHAIRMAN SMITH: It was the transcript? 2 MR. BAXTER: Yes. 3 CHAIRMAN SMITH: Any objections? 4 MR. BAXTER: I am just having it marked, Mr. 5 6 Chairman. CHAIRMAN SMITH: All right. 7 (The document referred to was 8 marked Licensee Exhibit No. 24 9 for identification.) 10 MR. CUTCHIN: Mr. Chairman, I misrecollect. Did 11 12 Mr. Baxter identify the specific page numbers from that 13 transcript that are being marked? MR. BAXTER: Yes, the excerpts that I have 14 15 provided to the parties, the Board and the Reporter from the 16 session of May 12, 1980 are pages 3678, 3679 --CHAIRMAN SHITH: Wait a minute. We have 3876, 17 18 3877. MR. BAXIER: Mr. Chairman, I was starting with the 19 20 pagination on the cover sheet of the transcript, which is 21 page 3678, 3679. Then we have ir. Wilson's statement of 22 qualifications from his written testimony incorporated into 23 the transcript that day. CHAIRMAN SMITH: Which I would assume that would 24 25 precede in the transcript 3876. No, I guess no.

10,852

1 MR. BAXTER: No, it does not. There is a lot of 2 cross examination in between there, and then page 3876 and 3 3877, 3905 through 3908.

4 MR. CUTCHIN: Thank you, Mr. Chairman.
5 BY MR. BAXTER: (Pesuming)

6 Q As I read his statement of qualifications, Mr. 7 Wilson is a member of the Office of Nuclear Reactor 8 Regulation, Operator Licensing Branch. He was a licensed 9 reactor operator, and among his functions are reviewing 10 small break loss of coolant accident guidelines developed by 11 Westinghouse and B&W, and the auditing of operators and 12 their training.

13 Is that consistent with your reading of his 14 qualifications?

15 A Yes, I believe he was on the task force which went 16 out of business some time aco. And at that time, the 17 reviews that were going on would be in connection with 18 finding the guidelines for small break LOCA, and for other 19 events using existing instrumentation to make a finding on 20 whether they were adequate for the plants to continue 21 operation. Additional instrumentation was not involved at 22 that time.

23 Q Do you know that "r. Wilson has or has not 24 participated in any review of near term operating license 25 applications?

1 A He has not on this subject. I do not know the 2 gentleman, but he has not been involved in additional 3 instrumentation reviews.

4 Q He expressed a view, though, to that licensing 5 board, did he not, that in his opinion vessel level 6 indication is not required and that he was concerned that 7 operators would not believe such a level indication if it 8 came back on scale, as I believe you characterized it.

9 A Yes, that was his opinion which he expressed,
10 right.

11 Q Now, you mentioned you thought if operators could 12 not be trained to believe that indication it would raise 13 serious questions about their use of other instrumentation 14 such as the saturation meter.

Isn't it true that the oprators have been trained and can be expected to be monitoring that saturation meter rather regularly, and isn't it a meter that is going to be reading out all the time with information they are going to use? It is going to change when a reactor trip occurs, it s going to move. Isn't that a lot different than we are talking about an instrument that is going to be off scale most of the time?

A I do not think you will find that meter going
 saturated very often, and you certainly will not find the
 thermocouples going superheat very often.

0 That meter is going to be reading a margin to 2 saturation all the time, isn't it? A Yes. 3 Q And the operator is going to be following it and 5 paying attention to it and he is going to be trained on how e to take action on the basis of that reading, isn't he? A Yas. 7 (Counsel for Licensee conferring.) 8 MR. BAXTER: I also provided you yesterday and the 9 to Board and the other parties this morning with excerpts from 11 the NRC staff's proposed findings of facts and conclusions 12 of law in the form of an initial decision submitted to the 13 licensing board in the Rancho Seco case. These findings 14 were filed on August 22, 1980. The exc t I have provided and would ask be 15 16 marked for identia on as Licensee's Exhibit 25 are the 17 cover page, the tabl of contents, and pages 123 through 131 18 of the fill ,, which includes all of the staff's proposed 19 findings on instrumentation. (The document referred to was 20 marked Licensee Exhibit Vc. 25 21 for identification.) 22 BY MR. BAXTEP: (Resuming) 23 I call your attention to page 129 of those 24 of prop\_sed findings. The concluding sentence to paragraph

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 189, and then moving on to paragraph 190, the staff proposed 2 the following findings: "In the event conditions legrade to 3 the point where voids are formed, the operator can recornize 4 adequate core cooling by observing installed in-core 5 temperature thermocouples which are located at the top of 6 the reactor core."

7 "In answer, then, to the last portion of Board 8 Question H-C 22, there is no instrumentation which gives 9 reliable information on the water level in the core when the 10 primary coolant is not subcooled. However, there is no 11 evidence to indicate that the operators need such 12 information to undertake the required immediate actions. 13 These actions are dictated by the presence or absence of 14 subcooling, and not by the level."

15 Do you disagree with this staff position taken 16 before this licensing board in August of last year?

17 A I am not sure of the timeframe of that testimony
18 which the finding was taken in August.

19 Q The hearing began on February 26, 1980 and 20 concluded on May 15 or 16.

21 A Right.

Yes, I would agree that on Bancho Seco, that the afinding was based on existing instrumentation which did not include level instrumentation, and the staff did make a finding with that, and on other reactors, that it was safe

10,855

10 Isn't that what paragraph 190 says? 11 A Yes. I would add that I think the time frame of 12 the testimony was perhaps a little out of date in that the 13 people that were testifying were not involved in the 14 continuing evaluation, and so perhaps that did not fully 15 represent the staff's position at that time but did 16 represent the staff's position at an earlier time.

17 Q Are you familiar with Thomas Novak of the NRC 18 staff?

19 A Yes.

20 C Would you expect that he would have been aware of 21 the staff's position at the time he testified in this 22 proceeding?

23 A He was not, at that time, he was not directly and 24 deeply involved in what was going on with the evaluation. 25 Generally he was aware of what had gone out and so forth,

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 but I would say he was not completely up to date on what was 2 going on with the staff reviewers in this connection.

3 Q How about Mr. Robert Capra who also testified for4 the staff in that proceeding?

5 A Again, he had at that time, he had had no 6 involvement since the dissolution of the task force. We are 7 only talking about -- it is probably not worth quibbling 8 about. We are only talking about a short period of time 9 when change of position -- not really change but further 10 developing position from the time they were familiar to the 11 time they testified.

12 G You described yesterday in your rebuttal testimony 13 the state of development of concepts for additional 14 instrumentation to detect inadequate core cooling that had 15 been submitted to the staff by Westinghouse and Combustion 16 Engineering.

Have any of the customers of those vendors with no operating power plants committed to the staff to install such systems?

20 A Yes.

21 2 How many?

A I do not know. It is my understanding that the generic submittal by Westinghouse represented about 30 plants. But that was from a telephone conversation with Sestinghouse, and I have not confirmed individual submittals.

10,858

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

Q Could you compare for us the location of in-core
 thermocouples in Westinghouse plants with the location in
 3 B&W operating plants?

Are the in-core thermocouples in Westinghouse
5 plants located in the flow stream as they are in B&W plants?

6 A I do not believe there is any significant 7 difference. They are measuring core exit temperatures, and 8 other than the details of how they are incorporated. I do 9 not believe there is any significant difference as to what 10 they are measuring.

Essentially they are providing an cutlet map of the core outlet temperature.

13 Q Can you describe for me specifically where they 14 are located in Westinghouse plants and where they are 15 located in 36W plants?

16 A In both instances they are located at the outlet 17 just above the core. They are located just above the fuel, 18 and they are distributed radially in the core.

19 Q Has the staff performed any incremental 20 risk-benefit analysis of the installation and the use of 21 vessel level indication in nuclear power plants, or do you 22 intend to do so before you give final approval for the 23 operation of such systems?

24 A Would you characterize that evaluation again, the 25 risk-benefit did you say?

1 Q Incremental risk-benefit analysis to determine 2 whether or not the devices will provide an enhancement to 3 the overall safe operation of the plant, or whether they 4 might be a negative, a detriment.

5 A Our evaluation, we have made it -- we, the staff 6 and the Commission, have made a determination that such 7 instrumentation would provide a desirable enhancement of the 8 safety margin and is desirable. We have yet to perform a 9 review of the final systems as they are installed and the 1) way they are used in the operating procedures to make a 11 decision that they will enhance safety in that way, and we 12 will do that as part of our review, yes.

13 C It is pretty important, isn't it, to know how they 14 are going to be used before you can really do a risk-benefit 15 analysis?

16 A That is right, but we have to have the submittals 17 from the Licensees before we can review them. And those are 18 just coming in.

19 Q But you do intend to perform such an analysis, a 20 risk-benefit analysis on the use of these systems as part of 21 the safety evaluation?

A I do not know if I would characterize it as a risk-benefit analysis. We will review the way that the signals are used in -- both in the operating procedures and potential uses. We will consider whether there are
1 instances where they could be detrimental to safety. We
2 would expect Licensees to also make that consideration and
3 to point it out, and we certainly will review anything that
4 they point out. We will consider what value they are in the
5 way that they are being used, whether they enhance safety
6 and provide additional information to the operator on the
7 status of the plant under anomalous situations, unidentified
8 situations, if you will, as well as the stylized transients
9 which have been addressed by the Licensee here and in

I believe the answer to your question is yes, but 12 I am not certain as to the specific meaning of your 13 terminology and the way you are using it.

14 Q Will members of the Commission staff from the 15 operating licensing branch perhaps who are familiar with 16 plant procedures, training conducted at the facilities, and 17 the real operation of emergency procedures be consulted in 18 the staff review?

19 A Yes.

20 Q Will human factors engineers be consulted?
 21 A Yes.

22 Q Are the plants still going to have to have 23 hard-wired backup information in support of the data 24 processing kind of system you described yesterday for the 25 operator to use in case that system fails?

10,861

A Yes.

2 Q And while that data processing system, then, may 3 somehow, if it is feasible to do it, take consideration of 4 when in the transient level indication is not giving an 5 adequate reflection of the plant condition and will 6 substitute some other instrumentation or consider the input 7 from other instrumentation, if that system fails, the 8 operator is still going to have to diagnose the plant on the 9 basis of its hard-wired backup instrumentation, is that 10 true, and he will have to make those inferences on his own 11 of how the vessel level indication interacts with the other 12 information he is getting.

13 A Ye.

14 Of course, the hard-wired system can do a certain 15 degree of interpretation for him, too. So the extent of 16 what he has to do depends on the specific system, and that 17 will be reviewed, and that will be a consideration, and if 18 it is an untenable situation, of course we would look to 19 improve it.

20 0 Will both the Westinghouse and CE proposals, as
21 you understand them now, require rather sophisticated data
22 processing systems, or is it just the Westinghouse proposal?
23 A I have not seen the processing proposed for the
24 Combustion system at all, and I have not really looked at it
25 for the Westinghouse system either. It is just that I know

1 there are three levels of processing involved, depending on 2 what the customers elected.

As I understand your testimony, though, yesterday, 4 it is your current view that the addition of instrumentation 5 such as vessel level, which, because certain timeframes will 6 give false indications of plant behavior, will have to be 7 integrated with other instrumentation, and the output 8 processed by a data processor, and that no direct operator 9 action is going to be taken based upon vessel level 10 instrumnentation alone, that it is your view that this 11 enhances the unambiguity, if I may put it that way, or the 12 directness of the operator's diagnosis of when he has 13 inadequate Licensee. This adds clarity in your view?

14 A Yes.

15 I want to qualify that we will review anything 16 that is submitted to us and make a judgment on acceptability.

17 This is something -- the language you are putting 18 forth here is something we have discussed in clarification 19 meetings and so forth, and it is a consideration, yes.

20 Q But even so, you io not know exactly what system 21 is going to be required and you certainly do not know how it 22 is going to be used or whether your final analysis will even 23 show that it is an enhancement to safety. You made the 24 decision some nine months ago that something is going to 25 have to be added. Is that accurate?

A Well, I do not know that I would agree with the 1 2 part on whether we do not know that it is going to be an 3 enhancement to safety. If we accept it, it will be an 4 enhancement to safety, and we are confident that an 5 acceptable system can be provided. MR. BAXTER: I have no other questions. 6 CHAIRMAN SMITH: The nature of this testimony has 7 g raised some doubts about whether we can conclude in the time g that we though we would. The Soard wants to take a mid-morning break and 10 11 discuss it. (A brief recess was taken.) 12 13 14 15 16 17 18 19 20 21 22 23 24

25

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

CHAIRMAN SMITH: The Foard can probably defer - the problem that we have -- off the record.

3 (Discussion off the record.)

4 CHAIRMAN SMITH: Let's proceed.

5 BY MR. BAXTER: (Resuming)

6 Q dr. Phillips, I asked you the question whether any 7 of the Westinghouse customers with operating licenses had 8 committed to you, to the staff, to the installation of the 9 design or the system that Westinghouse has proposed. And I 10 think your answer was that you understood the generic letter 11 filed by Westinghouse was applicable to 30 of their 12 customers.

13 But my question is, have any of those customers 14 actually committed to install the system?

15 A Well, some of the NTOL's have that I am aware of, 16 and the individuals, in discussing with Westinghouse their 17 submittal procedure, they wanted to know if all the copies 18 would be required from each of the Westinghouse customers 19 and we settled on a procedure where they would provide the 20 necessary copies to us directly, and that the individual 21 customers would submit a copy for the docket.

And I just -- you know, I can say fairly certain that some of out of 30. That was the indication on the form, that about 30 would be doing this. But I just do not recall looking at any of these submittals.

1 Q The indication on the phone to you was that 30 of 2 the licensees would be committing to the installation of the 3 system? Yes. A 5 Q This was a telephone conversation with someone at 6 Westinghouse? A Yes. 7 But you cannot identify any today that you know 0 8 g for certain have committed? A Other than NTCL's, no. 10 And are there any NTOL's other than Alabama's Q 11 12 Farley plant that you are aware of? 13 A They did not put on a Westinghouse system. They 14 put on a different type of system. I believe Diablo Canyon 15 and Maguire and probably Sequoyah, one or all of those 16 have. MR. EAXTER: Thank you. 17 CHAIRMAN SMITH: Mr. Dornsife? 18 MR. DORNSIFE: First off, Mr. Chairman, I want to 19 20 apologize for being about an hour late this morning. We had 21 a bona fide emergency at Beaver Valley. They had a small 22 release. It has been terminated. It really did not exceed 23 the tech specs, so they went above their emergency plan by 24 even declaring an alert. They were just being

10,866

25 conservative.

So I was tied up with that. You could have seen
 our emergency plan in operation had you come over.

3 Xr. Adler did brief me, so I will try not to be 4 repetitive of anything that was covered this morning. If I 5 do get into some areas that you feel have been adequately 6 covered, please let me know.

7 CHAIRMAN SMITH: Well, this is an important issue, 8 and I do not want the remarks that I made when we were off 9 the record to suggest in any way that you should curtail 10 your examination. I just wanted you to be realistic.

MR. DORNSIFE: If I do get into areas that were covered adequately, I would like to be made aware of that, as I am not being redundant.

14 BY MR. DCENSIFE:

15 Q Mr. Phillips, yesterday, in testimony yesterday, 16 you had said that, I believe the CE system that is proposed 17 uses a heated thermocouple and Westinghouse uses 18 differential pressure meter; is that correct?

19 A Yes.

20 2 Specifically on the CE system, does that system 21 require additional tubing, instrument tubing, to place the 22 thermocouple, or do they use existing tubing?

A I believe they put in an additional tube. They
use existing penetrations in the head. I have not -- it has
been some time since I have seen their detailed proposal for

1 installation. The only thing I can recall is it does not 2 seem to present any great problem in the CE design.

3 Q Is it a system that just measures level from the 4 core and above? Does it go down into the core?

5 A The heated junction thermocouple itself will just 6 extend down to the top of the core. Now, that would have to 7 be -- the staff would require that that be supplemented by 8 something else, probably thermocouples, for measuring levels g within the core. And the thermocouples could possibly be 10 just the existing core exit thermocouples if they were 11 interpreted in terms of level, if there was a sophisticated 12 program which to our satisfaction interpreted the readings 13 in terms of level, or more likely it would be thermocouples 14 located axially -- at various axial positions within the 15 COLE.

Q You say that thermocouples on that plant, on the 16 17 CE design, to extend down into the core or they would have 18 to add additional thermocouples?

A Oh, they have instrument tubes which extend 19 20 through the core, yes. But their existing thermocouples are 21 only at the exit. I suspect that they could put them in 22 existing instrument tubes, the straight thermocouples.

General Electric has been considering this, I 23 24 know, and they would have no difficulty in putting them in 25 the existing instrument tubes.

10,868

Q On the current 36% design, would that be possible
 with the current existing scheme for instrument tubing?
 Could you, with the existing tubing, the existing
 penetrations, could you just install a thermocouple that
 would provide level indication?

6 A It is my understanding that you can. That would 7 be within the core only, of course.

g Q It would not extend above the core?

9 A Well, there are core exit thermocouples, but it 10 would not extend to any --

11 Q It would extend a couple of inches above the 12 core?

13 A Bight.

14 Q So the B&W plants would have to add additional 15 tubing to accommodate that particular design?

16 A Yes, I would say sc.

17 Q On the Westinghouse plant, the Westinghouse 18 modification or proposed modification, are you aware of the 19 necessity of adding additional penetrations to the reactor 20 vessel to allow that modification?

A I believe they are using existing penetrations,
using control rod drive housing and instrument thimbles, I
believe. Now, I am not sure about on the hot leg. That may
be a new one. I don't recall.

25 Q What was the one you guoted?

ALDERSON REPORTING COMPANY, INC.

## 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 A I believe the control rod drive housing and 2 instrument thimbles are used for penetrations on the vessel, 3 and I do not recall on the hot leg whether they needed an 4 additional tab there or not.

5 Q Are those same types of penetrations available on6 the B&W design for use?

7 A I do not know.

8 Q If they were not available, would that have any 9 influence on the staff's review of this particular 10 modification, if you had to add additional penetrations to 11 accommodate either of those two designs, assuming they were 12 the only two designs available?

13 A Well, certainly. The designer, the licensee, will 14 have to make a determination on whether he can safely put in 15 the penetrations and where they will be located. As I 16 indicated in previous testimony, if he makes a finding under 17 50.59, if he makes a finding that he is going to put them 18 in, but it will constitute an unresolved safety question, 19 then we will do that. If he raises a question that it would 20 relate to the safety, then we would review it.

But basically, we are looking to the designer to propose where he is going to install and how he is going to an install whatever instrumentation he will be installing. The installation itself is basically his design.

25 Q Well, I guess the thrust of the question is, if

1 you indicate that the staff has not really made up its mind 2 yet, what is the best way of doing this? They know there is 3 something needed, but they have not really decided what the 4 best way to do it -- some of these, these are more tests to 5 determine what is the best way, and then the staff will 6 decide whether it is acceptable or not.

7 Do you think, if you would require another 8 penetration in the vessel, that that would be in the 9 interest of public health and safety to do that, when it is 10 not really identified that that is a necessity at this 11 point?

A No, that was not the impression I intended to 13 convey. At this point we have come very close to evaluating 14 two methods, making a determination that those methods are 15 acceptable methods. They are extremely promising. There is 16 still some testing to be performed.

17 The installation, from what we have seen for 18 installations that have been proposed and in the way they 19 are being installed, the licensees have made determinations 20 that there is no safety problem involved with the 21 installation and they have not asked us to perform a review 22 prior to the installation.

23 On the Westinghouse design, adding the delta 24 pressure meter, has the staff considered the fact that there 25 is any difference now, instead of having just an instrument

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 tube there, you now have instrument tubing maybe going
2 further than it had been, and you now have a larger amount
3 of tubing exposed to pressurized water that could cause a
4 small leak from the reactor coolant system, and it is really
5 not in a place that was designed to have a leak? In other
6 words, it is not an area that is above the core, in rather a
7 unique area.

8 A It is hermetically sealed within containment. You 9 would have to look with a diagram. You would have to look 10 at the design. But they pretty well have taken care of that 11 consideration. You are alluding to the tap going outside 12 containment.

13 Q Not outside containment, just being a tap outside 14 the reactor vessel. If it failed, if the instrument tubing 15 failed, you would have essentially a small leak in the 16 bottom of the reactor vessel. And in order to remove fuel, 17 eventually you would have to fill up the containment 18 building to above the core.

19 A I did not catch the last part of your statement.
20 Q If you had a small leak in the bottom of the
21 reactor vessel, in order to refuel wouldn't you have to
22 flood up the containment building to above the level, not
23 only in the fuel pool but also in the cavity, above the
24 level of the fuel in order to refuel?

25 A No. I do not -- I am not sure I understand your

1 question.

2 Q While the tubing, at least from my understanding 3 of the way these things normally are aligned, the tubing 4 comes into the reactor vessel cavity, pumps out into the 5 reactor vessel cavity, which is underneath the seal plate, 6 which is only used during refueling; correct? So that if a 7 leak were to occur in that area, it would go directly into 8 the reactor building basement.

9 So in order to stop that leak to do refueling, you 10 would have to essentially flood up the building?

11 A You would not refuel while you have the leak. 12 Q You would have to eventually -- you would have to 13 stop the leak, and you could not stop the leak unless you 14 equalize pressure. I am wondering how you would stop a leak 15 in that particular line without equalizing pressure by 16 flooding the building to the level in the reactor vessel? 17 A Well, I cannot answer your question, but it would 18 be no different than any other le . off any other 19 penetration.

20 Q There are existing penetrations in the bottom of 21 the reactor vessel that are pressurized?

22 A There are instrument thimbles that go in the 23 bottom, yes.

24 Q They are all pressurized exterior to the reactor 25 vessel?

A No, nc.

1

2 Q Well, wouldn't this DP meter relying -- wouldn't 3 the delta pressure instrument tubing be pressurized to 4 reactor coolant system pressure outside of the reactor 5 vessel?

6 A For a ways, yes.

7 Q You said the other instrument tubings are not, so g wouldn't that be unique?

9 A Well, there must be other instrument taps that
10 are. There are other pressure taps.

11 Q On the bottom of the reactor vessel?

12 A Not on the bottom, no.

13 Q Well, that is the problem I am having. That is a 14 unique location because if there is a leak on the bottom of 15 the vessel it presents you with the problem of not being 16 able to isolate that leak. You cannot get in there to do it 17 physically until you refuel, correct, or you take the fuel 18 out?

19 A I think we are getting beyond the scope of where I 20 can provide you with any answers that can be helpful. 21 Q Let's say if that were the case, if what I am 22 saying, what I am postulating, were indeed the case, would 23 that be considered by NRC to be an unreviewed safety 24 question that would need resolution before that design was 25 implemented?

1 A Well, the licensee makes a determination of 2 whether it is an unreviewed safety question or not, and 3 generally we accept his evaluation. If in the conduct of 4 our review, if this appeared to us to be a problem, then we 5 would have the right to go back and ask him the basis for 6 his determination and could disagree with him, yes.

7 Q I would be curious to see if that is indeed the g case.

9 I have another general question. You say that the 10 current instrumentation for TMI-1 is adequate for the 11 short-term for restart. And I am kind of wondering, what 12 criter; 'You use to determine that that is acceptable for 13 restar but not acceptable for the long term. What is the 14 difference?

15 A well --

16 O Generally, what criteria -- there are other 17 examples of this. And generally, to your knowledge, what 18 criteria does the staff generally use when they determine 19 whether something is acceptable for the short-term and not 20 for the long-term?

A Okay. The determination was made not really on 21 A Okay. The determination was made not really on 22 TMI-1, but on all the operating reactors as part of our 23 post-TMI review. It was one of the earliest parts of the 24 review, as a matter of fact, as to whether, in the light of 25 TMI, that reactors could be operated safely, could be 1 operated in a way to preclude any repeat of the TMI
2 incident, or whether they should be shut down until
3 modifications were made.

And the conclusions reached in that review were that with -- there were a few design changes that went out that were required. The orders went out. The changes were r implemented of a rather minor nature. And it was concluded a that, with proper operator training in the TMI incident what g to expect from that type of thing that the reactors could be n operated safely to preclude a repeat of that type of incident.

As part of our evaluation, it was recognized that the TMI-type event went beyond our conventional design analyses, whereby we normally consider a single -- an saccident with a single failure or a single operator error occurring in connection with an accident. And in the case of TMI it was compounded. It was an anomalous situation where there were a number of things that went wrong, including the operator error.

And so it was considered whether the entire review techniques should be changed, and there has been new considerations that went out in connection with this where there were fault tree analyses, et cetera, to consider the possibility of multiple failures. And it was also considered that level indication or something equivalent on

1 the detection of inadequate core cooling is something that 2 should be provided to detect anomalous situations, 3 unidentified situations, which we do not really -- cannot 4 really predict or have not predicted in our design 5 analyses.

6 Now, vesterday the testimony was directed at small 7 break or small break loss of coolant as the stylized type 8 transient which we are trying to detect inadequate core 9 cooling on. And of course, this is, if you go through a 10 mechanism, the mechanism would be, that you normally think 11 of, would be a small break to get into an inadequate core 12 cooling situation.

But we want to be able to detect transients in the behavior which has not necessarily been characterized in the sanalyses. In other words, you saw a lot of small break the curves in the way you would expect the reactor to operate. While these are all based -- I assume they are based on the single failure with one HPI going, maybe there is no HPI.

We felt that in the long range we should consider installing additional instrumentation which would give us a more direct indication of inadequate core cooling condition, plus would aid in the recovery from such a condition, to let us know that we are getting coolant into the core. And so it was recommended that we proceed to develop instrumentation of this nature for installation on the

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 longer range.

4

2 CHAIRMAN SMITH: May I interrupt for a few 3 questions on this point.

MR. DORNSIFE: Yes, sir.

5 CHAIRMAN SMITH: Mr. Phillips, who in your 6 organization made the decision to address the issue as far 7 as TMI-1 is concerned in this proceeding?

8 THE WITNESS: As far as TMI-1 restart 9 considerations, the staff has taken the position that TMI-1 10 is no different from any other operating reactor, and that 11 they can restart with the same requirements as is true for 12 other operating reactors; and that the additional 13 instrumentation is a dated requirement.

I guess addressing it comes out of contentions that were raised as to what the staff's requirements were concerning additional instrumentation. Perhaps Mr. Cutchin rould elaborate on that.

18 CHAIRMAN SMITH: Can you, Mr. Cutchin? 19 MR. CUTCHIN: Clearly, our reason for addressing 20 it in this proceeding as to whether or not water level 21 instrumentation was required arose out of the contentions 22 that were addressed by our testimony. However, as Mr. 23 Phillips has said, our position is with respect to core 24 water level measurement instrumentation no different on this 25 operating plant than on other operating plants. 1 CHAIRMAN SMITH: Would the staff not have 2 contested the issue had it not been for the contention --3 contentions in this case?

4 MR. CUTCHIN: At the time of writing the 5 testimony, I believe that is a true statement.

6 DR. JORDAN: Well, not quite, because you did 7 address it in the SER. At that time you pointed out that 8 they were not in compliance.

9 MR. CUTCHIN: Well, with respect to long-term that 10 is the question now as to -- let's be candid about it.

11 CHAIRMAN SMITH: Yes.

12 MR. CUTCHIN: The fact that they are contesting 13 whether or not they should develop water level 14 instrumentation I think clearly raises a question as to 15 whether they are showing reasonable progress toward 16 long-term compliance.

17 CHAIRMAN SMITH: All right. That is what we are 18 trying to get at. And I would hope that the Board could be 19 very thoroughly assured, among other things that we will 20 raise, that the staff is not using the restart -- unusual 21 circumstances of the restart proceeding to force their will 22 upon the Met Ed any different than they would upon other 23 operating licenses, unless it meets the standard set forth 24 in the order, and that is necessary and sufficient.

Can you give us that assurance?

25

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

MR. CUTCHIN: I cannot do so at this moment, sir. CHAIRMAN SMITH: I think we should have it.

3 MR. CUTCHIN: I agree with you and I will either 4 come back with that answer myself or bring the appropriate 5 person to give it to you.

1

2

6 DR. JORDAN: At the moment, I want to raise this 7 question. We are, of course, talking primarily about the 8 item 2. That item reads that: "The licensee shall provide 9 a description of any additional information and controls" 10 and so on. This is a category E item scheduled under 11 NREG-0578 for January 1981, which has passed.

12 It is also scheduled by 0737, that this analysis 13 and a description shall be provided by January 1981. 14 Therefore, it seems to me that at the moment the staff is 15 saying that they have not met the requirements for restart.

16 MR. CUTCHIN: I think again, sir, it is really a 17 question with respect to part <sup>n</sup> items as to whether they 18 have shown reasonable progress. And whether that January 1 19 date has some flexibility in it, I am unable to say right 20 now.

21 Many of those dates do have some flexibility.
22 Maybe Mr. Phillips knows if the January 1, 1981, date has
23 --

24 DR. JORDAN: I have heard nothing from the staff 25 that says that they have shown reasonable progress in

ALDERSON REPORTING COMPANY, INC.

## 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 supplying this particular item, namely a description of any 2 additional instrumentation and controls. Does the staff 3 believe that there is reasonable progress?

4 M3. CUTCHIN: That is what I just said a few 5 moments ago, sir. I think it raises a question as to 6 whether they have -- I cannot give you the staff's position 7 now. But I can bring in someone who can.

8 THE WITNESS: I think I can and I think cur 9 recommendation -- that is, the recommendation of the people 10 that are managing the review for inadequate core cooling and 11 in light or in the absence of any commitment on the part of 12 Met Ed, our recommendation would be that they not be allowed 13 to restart.

14 CHAIRMAN SMITH: Because they have not shown 15 reasonable progress?

THE WITNESS: Yes.

16

25

17 DR. JORDAN: And you will take the same position 18 now with respect to the operating plants, too, that have not 19 -- namely, other BEW operating plants that are supposed to 20 have met this requirement by January '81, also.

21 THE WITNESS: We certainly will go out with 22 something for operating plants that have not responded to 23 the requirement. It is yet to be determined exactly what we 24 will do, but we certainly will do something.

MR. BAXTER: Dr. Jordan, excuse me.

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 MR. CUTCHIN: Mr. Chairman, I think your question 2 goes further, and that is you want assurance that this 3 plant, because of its unique situation, is not being, to use 4 the term, held hostage.

5 CHAIRMAN SMITH: That is exactly right. I do not 6 understand how there can be any doubt that the staff can 7 say, you cannot restart TMI-1, but you cannot say what you 8 are going to do with the other EEN's who are in an identical 9 position.

10 MR. BAXTER: And which are operating.

11 CHAIRMAN SMITH: That is --

12 THE WITNESS: That is a good point.

13 CHAIRMAN SMITH: You bet.

14 THE WITNESS: And this plant and others certainly 15 will have to be considered together on that position.

16 CHAIRMAN SMITH: Well. So that decision has not 17 been made yet.

18 THE WITNESS: That is right.

19 CHAIRMAN SMITH: So you are not saying yet as of 20 this time that the staff's position is that reasonable 21 progress has not been made. We are going to have a decision 22 to write pretty soon, and the last time we are going to have 23 -- I doubt it, but the last time we are going to have to ask 24 the staff what we should do about it is perhaps this 25 morning.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 MR. CUTCHIN: Mr. Chairman, I assure you, I am not 2 certain that Mr. Phillips is in a position to give you an 3 unequivocal statement of position. I will assume the 4 obligation to get that statement from the appropriate level 5 of staff management.

6 CHAIRMAN SMITH: All right. That is fine. You 7 were not expected to be presented with that problem and that 8 is fine. We will be patient on that.

9 However, I would like to go another step further. 10 Can you tell me whether the proposed findings in Bancho Seco 11 that were cited to you are still valid, or is the staff 12 supplementing them?

13 THE WITNESS: They are still valid, and we would 14 -- if we put aside the question of the long-range 15 implementation on additional instrumentation, we would say 16 that those are also applicable to this reactor. We would 17 find the same thing about this reactor today.

18 CHAIRMAN SMITH: Now, as far as you are concerned, 19 Mr. Phillips, if you will look at the standard that the 20 Commission has required us to address before we can 21 authorize restart -- I might as well get the exact language 22 so there is no confusion about it.

(Pause.)

23

24 CHAIRMAN SMITH: "Whether the long-term actions" 25 -- and this is a long-term action -- this is on page 12 -- 1 "subjects to be considered at the" --

2 THE WITNESS: Page 12 of what, sir?
3 CHAIRMAN SMITH: Page 12 of the notice and order
4 for hearing. And I will read it. I doubt if you have it
5 available. Let me read it carefully:

6 "We are directed to decide in this case whether 7 the long-term actions recommended by the Director for 8 Nuclear Reactor Regulation, as set forth in a section of the 9 order which includes NUPEG-0758, which includes this subject 10 matter, which includes a plan by January 1981, 0578, are 11 necessary and sufficient to provide reasonable assurance 12 that the facility can be operated for the long term without 13 endangering the health and safety of the public and should 14 be required of the Licensee as soon as possible."

Now, you were testifying -- and this is my concern about it -- that you did not make the decision that these were even desirable until you determined whether the technology was feasible. So I am wondering if it is your opinion that it is necessary and sufficient to have these modifications, as compared to a reasonable improvement in the marginal safety.

I am not suggesting -- let me give you the context of my concern. I am not suggesting that the staff does anything wrong or -- when they see a way to improve safety and there is a good technology available to do it and it is

1 sufficient, they should do -- they must do exactly what they 2 are doing.

But our standard here is set out precisely as recessary and sufficient," and this seems to be elusive, how you apply that standard if you are applying it in this hearing. So I would like to have you just address it directly.

8 THE WITNESS: Yes. We feel that the path that we 9 are taking on the long-term requirements -- that is, proceed 10 to design the system that you are going to install, proceed 11 with the procurement and the installation on the schedule 12 that we have provided -- is reasonable and that it is 13 necessary.

14 CHAIRMAN SMITH: Necessary for what?
15 THE WITNESS: Necessary to obtain an additional
16 margin of safety which we feel is needed.

17 CHAIRMAN SMITH: All right. An additional margin
 18 of safety which you feel is needed.

19 THE WITNESS: In the light of TMI, yes.

20 CHAIRMAN SMITH: If it should develop that, for 21 example, for technical reasons you cannot simply -- simply 22 cannot do a BEN reactor, if that industry closed down, 23 then?

24 THE WITNESS: If for technical reasons we simply 25 cannot do it and we cannot enhance the margin of safety,

1 then I think the time will have come where a reconsideration 2 of whether a long-range operation should be permitted.

3 CHAIRMAN SMITH: On this particular issue? I am4 talking about this particular issue.

THE WITNESS: Yes, yes.

5

6 CHAIRMAN SMITH: So your answer then -- would you 7 repeat your answer? I am sorry. The time would come then 8 what?

9 THE WITNESS: The time would come that, for P&W 10 reactors, that the same margin of safety could not be 11 provided that is provided on other reactors because of some 12 peculiarity in the design, that then a decision would have 13 to be reached on whether long-range operation of the 14 reactors were in the interests of the public.

15 CHAIRMAN SMITH: If we were to walk cut of this 16 hearing room at this moment, I do not know how this Board 17 can find that the staff has concluded that today that, 18 without the modification that you are urging, that we cannot 19 make the finding that the long-term action is necessary --20 that we could make -- let me start again. Strike that.

21 If we should stop receiving evidence on this point 22 now, I do not think that the Board could find, as the staff 23 urges, that the long-term action referred to by the level 24 indication are necessary and sufficient. The staff has not 25 decided that.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

You said if it should develop you would have to 1 2 consider it in the future. You see, I am trying to point g out the particular assignment that this Board has compared 4 to the assignment that you have. Perhaps in show cause, in 5 operating licenses, tech amendments, we have a particular 6 assignment. And of course we need very strong help. THE WITNESS: Yes. 7 Sir, perhaps the staff letter to the 8 g Commissioners, a draft copy of which I have, might be of to some help. It provides our reasoning for proceeding on the 11 schedule that we have indicated, and I do not know the 12 procedure. But maybe that should be introduced. CHAIRMAN SMITH: I think you should have an 13 14 opportunity to consult with counsel before you do it. DR. JORDAN: Is this the letter you mentioned, a 15 16 proposed Commission paper? THE WITNESS: Yes. 17 DR. JORDAN: I was going to ask about that 18 19 anyhow. MR. CUTCHIN: I to not have a copy of that before 20 21 me. nor am I familiar with it. CHAIRMAN SMITH: It is up to you. 22 MR. CUTCHIN: Without even seeing it, Mr. 23 24 Chairman, I am not sure that that in itself would be

25 sufficient for the Board. I think the Board needs a more

10,887

1 direct answer to the Board's question.

2 CHAIRMAN SMITH: I think we do. I think we need a 3 very, very careful explanation of precisely what the staff 4 believes and the reasons for it.

5 DR. JOPDAN: Could I explore just a little bit 6 your question, which I agree is very central? Is it your 7 position, Mr. Phillips, that the additional instrumentation 8 for dealing with the problem of inadequate core cooling is 9 necessary? You further said, I believe, that if BEW failed 10 to supply it, that the question of whether BEW reactors 11 should continue to operate is then brought forward.

Now, you're not in the position to make the a decision as to whether the B&W plants should be shut down; a isn't that correct?

THE WITNESS: That is correct.

15

DR. JORDAN: On the other hand, would it be your position now that you would recommend that if the B&W plants do not comply, that they should not be allowed to operate in the long run, as your personal recommendation?

THE WITNESS: Yes, I can -- may I expand a little the on my answer? Yes, I feel that we have -- went through a reasonable procedure in reaching the determination that this instrumentation is required. It of course is an outcome of the TMI action plan which has been blessed by the Commissioners, and I am in the position of evaluating the

1 Licensee's responses to what the Commission has deemed is a 2 requirement for long-term operation.

If the Licensees do not in my judgment respond in an acceptable manner and do not take what steps they prudently can to comply with what I regard as a Commission requirement to enhance safety, I have to report that finding. And my recommendation would be to take whatever action is necessary to enforce the requirement.

9 CHAIRMAN SMITH: It could very well be, Mr. 10 Phillips, that some day you may sit before this very Board 11 or members of us in another proceeding in which we have 12 before us whether or not such a modification is prudent. I 13 am trying to -- I am trying to establish that the very 14 unusual standards of this case, "necessary and sufficient to 15 provide reasonable assurance that the facility can be 16 operated in the long run," is met compared to, it is a 17 justifiable -- it is a justifiable improvement in the margin 18 of safety that the Commission should order.

19 Those are two different things. I do not want to 20 suggest by my questioning to you that the Board harbors a 21 view to the contrary. You know, it is just that we have --22 the standard that we are looking at here and the testimony 23 you are giving seems to completely come back to it is 24 necessary to enhance the margin of safety. That is how you 25 use the word "necessary."

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

THE WITNESS: Yes.

1

16

2 CHAIRMAN SMITH: I don't know how that fits. 3 THE WITNESS: The "sufficient." I do not think 4 there is any question about the "sufficient."

5 CHAIRMAN SMITH: That is not the -- that is not 6 being litigated.

7 THE WITNESS: Right. The "necessary," I can only 8 come back that in our review the Commission has decided that 9 it is necessary on the long range to provide this 10 modification to enhance the safety of the plant.

11 MR. CUTCHIN: Mr. Chairman, at the risk of maybe 12 further confusing things, I have a question in my mind. And 13 we keep using this word "necessary." And clearly, under the 14 Act the Commission may impose requirements that are not only 15 necessary, but also requirements that are desirable.

CHAIRMAN SMITH: Exactly.

17 MR. CUTCHIN: And I am not sure that Mr. Phillips 18 is able to distinguish between those two for the Board this 19 morning. And I would really like at this point to let's go 20 back home and come forward with a clear staff position on 21 that.

CHAIRMAN SMITH: You made that point and we want athe But the reason I am pressing Ir. Phillips on it is that we want something more now than the staff position. The staff position is nice, but it is not hard evidence. 1 Now here is a man who knows the technology which is at 2 issue, and if all he has is staff position, that is one 3 thing.

But I am trying to determine from Mr. Phillips what his view is in the distinction between necessary for health and safety and necessary for enhancing the margin of rafety. And if he has a view on it, I would like to know it, professionally. Not staff position, professionally, as 9 a professional engineer.

10 THE WITNESS: Yes. Well, as a professional 11 engineer, my view is that a viable liquid level monitoring 12 system would provide very direct and real enhancement to the 13 operation of a reactor. It would tell you the status under 14 -- ncc only under predicted and anticipated transient 15 conditions, but unler any situations which you have not 16 identified that you might get into, and would be a real 17 benefit which should be incorporated on operating reactors.

18 CHAIRMAN SMITH: All right, I think that is 19 helpful. I think I understand your position.

Mr. Dornsife?

20

21 MR. DORNSIFE: I think you covered a lot of my 22 concerns, Mr. Chairman. Thank you.

23 BY MR. DORNSIFE: (Resuming)
24 Q Getting back to my original question, though, let
25 me understand from your answer: Are you saying that, at

1 least in your opinion, anyway, that the current

2 instrumentation that is available at TMI-1 is sufficient to 3 respond to TMI type accidents and is adequate for those type 4 of accidents, but may not be adequate for other 5 unidentifiable accidents?

6 A Yes.

7 Q And that is the reason for requiring a water level g instrument?

g A Yes.

10 Q In the original statement, you had said that the 11 Licensee must provide an analysis of alternative ways of 12 determining adequate core cooling. First of all, has the 13 Licensee done anything, provided any type of analysis other 14 than just the statement they will not install a core level 15 water meter?

16 A Well, I heard in the testimony yesterday that they 17 have, but they have not submitted to us for review. And 18 other than the statement that they cannot identify any other 19 actions. So we cannot say that we could identify -- would 20 agree or disagree with their conclusions and the 21 completeness of their review, unless we had a detailed 22 description of the review.

23 Q Has the staff identified anything other than a 24 water level meter that may acceptably meet this position? 25 Is there anything in the back of your mind that could 1 acceptably meet -- is water level the only thing that would 2 satisfy the staff?

A I guess it depends on your -- what you call water
4 level meter. We have several techniques.

5 Q Something that would measure somehow water level 6 in the vessel?

7 A That is the only thing I have in mind.
8 Q How about something like if you could possibly
9 measure cladding temperature directly? Could that possibly
10 be an acceptable alternative?

11 A Well, no. I do not feel so, because it does not 12 give you the advent of the condition. It has the same 13 weakness as the core exit thermocouples currently do. You 14 are already into a bad situation before you start 15 recognizing it and possibly have lost up to hours of 16 identifying a situation earlier.

17 Q On page 4 of your testimony, in your answer to 18 question 8, the last sentence, you say: "Core exit 19 thermocouples provide an indication of the magnitude of 20 steam superneat when the core is uncovered." And then you 21 added some statements there, a phrase.

22 My question is, do you feel -- does the staff feel 23 that the core exit thermocouples are a better way of 24 detecting inadequate core cooling once it occurs than a 25 water level meter? Is that the ultimate way of detecting

1 inadequate core coolinc?

2 A Yes, yes.

3 Q So that even if the water level -- you would still 4 need the core exit thermocouples to satisfy the staff 5 concerns?

6 A That is very true. But I think you really want 7 both pieces of information in confirmation of what is going 8 on.

9 Q Are you familiar enough with the designs of CE and 10 Westinghouse that they are submitting to tell me what the 11 reliabilities are? Are they safety grade? Are they highly 12 reliable?

13 A NUREG-0737 goes into great detail in specifying 14 what the requirements are. And they are for -- pretty close 15 to your definition of safety grade in the conventional 16 sense. But there are provisions for them not to meet all 17 the most stringent requirements in some instances. But that 18 addresses the additional instrumentation, the in-core 19 thermocouples, and it has extracts.

This is basically instrumentation for monitoring the course of accidents, proposed accident monitoring, which is the subject of Reg Guide 1.97, which has not been published, and the extracts from Eeg Guide 1.97 which are included in 0737. And that, in conjunction with the 2.F.2 section, will tell you what the design requirements are.

1 They are close to safety grade.

2 Q I guess specifically, like for the T-sat meter was g identified, but the sensors are not safety grade. Has the 4 staff reviewed that, the qualifications of those meters, and 5 determined if they are indeed reliable enough for that e important function? 7 A Yes, we have reviewed some, some on the NTOL's g primarily. And in general, those meet our criteria as g specified in NUREG-0737. Q You mean the sensors that are used on the TMI-1? 10 On TMI-1? A 11 0 Yes. 12 The sensors themselves I believe would meet the A 13 14 criteria, yes. Some of the equipment outside, there is 15 modifications still required. I believe that the Licensee had testified they 0 16 17 were not safety grade instruments, the sensors? The thermccouples? A 18 Q Yes. 19 You are speaking of the thermccouples? A 20 The thermocouples that input into the "-sat Q 21 22 indication. A Yes, they meet our requirements as specified in 23 24 0737, I believe, the sensors themselves. These are 25 chromel-alumel thermocouples, are they not? I believe they

1 would meet our requirements there. There may have to be 2 something done to them as far as the junctions and the 3 wiring, the cabling, and et cetera, the readout and so 4 forth. And those have been addressed, I believe, in the 5 SER. And there is probably still further work to be done.

6 Q Considering your prior testimony about the fact 7 that the in-core thermocouples are critical for determining 8 inadequate core cooling, would you find it desirable to have 9 an alternative way other than the computer for determining 10 what the thermocouples are reading?

11 A We do require a way other than the computer, yes.
12 Q So that Licensee would have to provide some
13 procedure for doing that prior to restart?

14 A Yes.

15 Q Your testimony on page 5, response to Question 9, 16 you say at the first -- not the first full paragraph, but 17 the first paragraph on page 5, the last sentence, you say 18 that: "Peactor vessel water level is not an appropriate 19 input to the safety injection system."

20 And then you say -- you go on to say that that is 21 because corrective action is initiated by low pressure 22 signal well in advance.

I guess my question is, first of all, is that the only reason for not doing that as an input to the safety injection system?
A Well, I think that the low pressure signal in 2 general is a much more reliable signal. It is perfectly 3 adequate to initiate safety injection on, and it is a more 4 reliable indicator.

5 Q Wouldn't it provide some diversity and enhancement 6 to safety to use this as a backup if it were available for 7 initiation of safety injection?

8 A In my opinion, no. I do not think it is needed.
9 C So the reason is primarily that and not that the
10 system -- signal itself may be too unreliable for input into
11 the safety injection system, the SFAS system?

12 A It is not as well defined a signal as low pressure 13 is, right. It would be -- there is some -- under the best 14 of circumstance, there is some uncertainty or considerable 15 -- when considering your measurement and what would you key 16 off of, what level. I think that low pressure is a much 17 more definitive and reliable initiator of your automatic 18 safety actuation, and it does the job quite well.

19 Q When you say "not well defined," you do not mean 20 totally that it is not reliable enough then?

A No, I mean that, first of all, that in the level
monitoring system you will have some uncertainty on where
the level is for the pumps running. It is measuring mass,
voids. It would -- and there are a number of different
types of events. And to define at what -- at what level or

at what measurement or what degree that you are going to
 initiate the safety signal off of that I think would be
 somewhat difficult.

4 Q So this indication would only be for operator 5 action through a procedure? That is the only use for it?

6 A For operator information and action, and for 7 monitoring the course of recovery from an accident, yes.

8 Q Considering the unreliability of operators 9 interpreting the signal -- you know, that has been brought 10 out in previous testimony many times in this proceeding --11 do you feel that the operator's ability to interpret this 12 signal correctly and take the proper actions, considering 13 their unreliability, is an important enough of a change to 14 require the shutdown of that facility if it is not 15 implemented?

16 A Well, if the system is implemented, the system --17 the review of acceptability of the system will include the 18 factors relating to interpretation of the signal by the 19 operator, as well as the operator training in the use of the 20 signal. So we would not find the system, a specific system, 21 acceptable without that consideration being taken into 22 account.

23 0 But it stills need to go through the operator 24 interpretation, which has been perceived --

25 A Not necessarily. The interpretation might be

ALDERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 entirely automatic.

2 Q Explain. I do not understand what you mean. 3 A Well, by way of computer. Maybe all he -- maybe 4 all the interpretation that would be required, if you were 5 giving the operator instructions to look at the signal, that 6 signal and another signal, and to take that into account in 7 a certain way, that could all be done for him on a 8 computer.

9 9 But he could still have to take -- this does not 10 provide any automatic action. He would still have to take 11 the necessary manual actions?

12 A Yes, yes. I am talking about interpretation 13 only. The interpretation, it could be very simple as far as 14 he is concerned, in looking at his meter as to what 15 interpretation is required.

16 Considering the fact that in this plant, at least, 17 TMI-1, that all the systems that are used to recover from 18 inadequate fore cooling are not safety grade equipment, and 19 that therefore would not, if the regulations would require 20 that be a design basis, would not meet the regulations, do 21 you think that this meter, even though it would only tell 22 the operator to implement non-safety systems, is still 23 important enough to require the shutdown of the facility? 24 A I am not sure what you are alluding to. 25 Q You said that there is a good possibility or at

1 least the staff would consider, if this plant would not 2 implement or the other BEW plants would not implement, an 3 alternative way of determining adequate core cooling -- you 4 said the only way you could probably do it is water level --5 that the decision would have to be made whether or not to 6 shut those plants down.

A That is right.

8 Q Now I am saying, you still, even though the 9 operator action that is going to be taken if somebody uses 10 this instrument and determines there is inadequate core 11 cooling are non-safety grade equipment, do you still 12 consider, you know, even though they may not be as reliable 13 as safety grade equipment, do you still consider that this 14 is important enough to require the shutdown of those 15 facilities?

A Well, I think any actions that are taken will for the most part involve safety grade equipment. As far as any allusion to the shutdown of the facility, I back off of that g statement. We will have to consider what should be done if some or all of the reactors cannot comply with the requirement. So I think it would be premature at this point for me to answer that type of question.

23 Q Are you familiar with the Licensee's inadequate 24 core cooling procedures?

25 A With this Licensee?

ALDERSON REPORTING COMPANY, INC.

Q Yes.

1

2 A I am familiar with the guidelines that were a submitted.

4 Q You said you believed that they used for the most 5 part safety systems for recovering from inaiequate core 6 cooling; is that correct?

7 A Yes.

8 Q Is that based on your review of the procedures?
9 A It is based on my familiarity with the
10 guidelines.

11 Q Were you here yesterday when Mr. Jones and the 12 Licensee said that all the steps do rely on non-safety 13 systems to remove decay heat, that all the systems that are 14 used to recover from inadequate core cooling do rely on 15 non-safety systems for removal of decay heat?

A Well, they -- they rely on the safety injection ry system, which is a safety grade system, the high pressure in jection system and the low pressure injection system, if they have to depressurize to get to it. Those are the primary systems they rely on and those are safety grade systems.

22 Q But the system you use to depressurize to get to 23 those systems, is that a safety grade system?

A It depends on your -- no, I would say in general,
 25 no. If you use a secondary system to depressurize, no, I

1 cannot say for certain, but I do not think so.

2 Q But getting back to the original question, in view 3 of that, do you still feel that this -- a change is that 4 important that it could require the shutdown of the facility 5 if it was not implemented?

A Yes.

7 Q Your answer to Question 10, on page 5, you state: 8 "The instrumentation that is available at TMI to detect 9 inaiequate core cooling" -- where are these specific 10 instrumentations -- where was that taken from, that 11 information that you quote there? Do you recall?

12 A No, I do not recall. It was taken originally from 13 a submittal by the Licensee and possibly extracted from an 14 SER. Originally, it would have come from a submittal from 15 the Licensee.

16 Q Would you agree, looking at the latest inadequate 17 core cooling procedure, that in addition to those you 18 mentioned there, that reactor coolant flow and neutron 19 detectors would also be instruments that are used for --

20 XR. CUTCHIN: Mr. Chairman, for a moment -- the 21 latest inadequate core procedure, I am not sure that that is 22 clearly identified for the record. If it was, then I missed 23 it.

24 "R. DORNSIFE: It was Procedure 1202-39, handed 25 out yesteriay. I ion't know if it was given a number.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

MR. CUTCHIN: I am not sure. I do not recollect
 that being an exhibit.

3 BY MR. DORNSIFE: (Resuming)

4 Q Let me just slightly alter my question. Would you 5 agree that the instrumentation I mentioned -- would there be 6 other instruments that could be used to detect inadequate 7 core cooling?

8 A What were the two, again?

g Q Reactor coolant flow and the neutron detectors,
10 out of core detectors.

11 A They could be used.

12 Q They are at least as reliable as the reactor 13 coolant pump current?

A I do not know how the reactor coolant flow is
15 being used. I assumed you were alluding to reactor coolant
16 pump current.

17 Q There is a special flow monitor device.

18 A I have not reviewed that.

19 Q Your answer to Question 12 on page 7, you say in 20 the last paragraph of that answer that: "In addition, it is 21 intended to isolate the new wile-range TH signals from the 22 existing control signals."

23 A This is in my answer to Question 12?
24 Q Yes, on page 7, right near the end of that answer,
25 the last paragraph, in the middle of that paragraph.

A Yes. Which part of that, please?

2 Q "In addition, it is intended to isolate the new 3 wide-range TH signals from the existing control signals."

And my guestion was, do you know the existing --5 what they are currently used for, those control signals? 6 And what will the control system use instead of these, or 7 will they still use these signals?

8 A All right. Now, could I have your question again, 9 please?

10 Q Okay. My question is: What are these existing 11 control signals used for, and will they still be used --12 inputted into the same control system? I assume it is the 13 ICS that's --

14 A I assume --

1

15 Q Would they still be used for the ICS in addition 16 to providing this indication for inadequate core cooling? 17 A Yes. I think the meaning is -- is simply, the 18 signal was picked off of that control signal, it does to an 19 isolator such that it is electrically isolated from the 20 other signal. And I do not believe the way they are used 21 now in the control system would be affected.

22 Q You have stated earlier that you had some 23 familiarity with the LOFT -- the instrumentation for water 24 level measurement in the LOFT facility. Could you maybe 25 comment on how this instrumentation relates to the two 1 proposals, either by Westinghouse and Combustion

2 Engineering, and how reliable it has been typically in the 3 LOFT facilities, and whether the operators routinely rely on 4 this indication for their procedures?

5 A In LOFT they have not tested the Westinghouse --6 the Combustion Engineering heated junction thermocouples. 7 That was done elsewhere. They do have DT measurements on 8 the LOFT facility. They have other means, primarily 9 historically their thermal conductivity monitors for 10 following water level; plus they have regular thermocouples 11 which have ione a very good job. I described those 12 earlier.

I would say they do not really rely on their DT. They look at their more direct indicating instruments. I do not think the thermal conductivity monitors -- it is probably not feasible for commercial reactors. I cannot offhand say why, but they have never received any great deal not consideration.

19 Q Which one do they usually rely on for the most 20 part?

A Well, historically the conductivity monitors have been their primary means of determining level. But the thermocouples are more recent that they put in, and they are thermocouples are more recent that they put in, and they are in good agreement generally, and I would say they probably follow those during the event more closely.

These are not the same thermocouples as CE? 0 1 A Just ordinary thermocouples. They are installed 2 3 in such a way that they are processed through a computer to 4 measure deviation from saturation in the form of a bar 5 chart, such that when the level falls below the thermocouple 6 you get an indication of superheat, and you can see by the 7 bar chart going down on the CRT display where the level is. Q You said that the conductivity instruments would 8 g not be applicable to commercial plants. Is there a reason 10 why? 11 A I said probably not. I do not know why, except 12 possibly they are maybe not suitable for the long term that 13 they would be required in a commercial plant. They have not 14 received any great deal of consideration and I'm sure there 15 must be a basic reason why. They have been shown to be the most reliable in 0 16 17 that particular test? They work well in LOFT, yes. A 18

MR. DGRNSIFE: I have no further questions.
CHAIRMAN SMITH: Mr. Cutchin?
MR. CUTCHIN: I have no further questions at this
time, Mr. Chairman.
(Board conferring.)
MR. BAXTER: I have one or two, based on Mr.
Dornsife's.

(Board conferring.)

1

MR. CUTCHIN: All richt, Mr. Paxter. Mr. Baxter, 2 a the way it has turned out, it seems like it is important for 4 Dr. Little to catch the airplane because the later one is 5 not available for sure. So if we have to we will come back s to the issue. But if you can keep a brisk pace, it will be 7 helpful. MR. BAXTER: Yes, sir. 8 BY MS. BAXTER: (Resuming) 9 Mr. Phillips, on the LOFT facility isn't the 2 10 11 primary indicator the operator uses to ensure that the core 12 remains in a safe configuration the thermocouples on the 13 fuel rods rather than the conductivity probe? A Well, during the actual operation I do not know. 14 15 The display is rather prominent of the thermocouple level 16 monitor. I do not recall having seen the conductivity 17 monitor on the display. I am sure there must be one. But I 18 guess I cannot answer that. Of course, these are all planned transients. T 19 20 can't -- I io not know. Q You testified just a little bit ago that 21 22 alternatives to computer readouts for the in-core 23 thermocouples would be required at THI-1 prior to restart. 24 We discussed this with Mr. Ramirez this week also. Do you 25 know whether the staff is requiring such alternative display

1 of any other operating reactor prior to January 1, 1982?
2 A I do not know. That is kind of interweaved in the
3 current review of submittals describing the entire system.
4 I believe that we have -- and it is a question of requiring
5 what people have volunteered and we reviewed and found
6 acceptable.

7 I cannot recall that we have ordered someone to 8 have a computer display available. I think there are 9 some.

10 C Referring again to the staff's evaluation attached 11 to the September 24, 1980, letter from Mr. Eisenhut to Mr. 12 Arnold in which you evaluated the BEW position on additional 13 instrumentation for detection of inadequate core cooling, if 14 you have that. I am going to look at page 4, item 3. Staff 15 stated:

16 "Staff agrees that the individual methods
17 considered in the referenced reports appear to be deficient
18 in one or more of the criteria of the staff position.
19 However, combinations of the methods do provide the
20 information which has the potential to satisfy the staff
21 criteria. It is probable that additional data processing
22 and display equipment would be needed to aid in the
23 interpretation of the available information through
24 appropriate correlations or by integration of necessary
25 data."

1 And yesterday in your testimony, at page 10,811, 2 you made the following statement, which I will read: "We 3 feel that the processing of the data and the display to the 4 operator is a very important part of that system, and as 5 such, until the systems are installed and the operating 6 methods have been identified and the callibration and the 7 test data is available and the staff is certain that these 8 systems are indeed a plus as far as safety goes and are not 9 providing information which would lead to unsafe actions, we 10 cannot say in advance a system is acceptable."

11 So is it still your testimony that until all those 12 things are ione you do not even know for sure that these 13 systems are going to indeed enhance safety?

14 A We are doing a generic evaluation and a plant 15 specific evaluation. Our generic evaluation may well be 16 complete before those things are done, and say that there 17 are acceptable systems which can be installed.

18 As far as the specific evaluation, the answer to 19 your question is an unequivocal yes.

20 MR. BAXTER: I have no other questions. 21 CHAIRMAN SMITH: The specific answer to his 22 question is an unequivocal yes?

23 THE WITNESS: As far as the plant specific
24 evaluations go, yes, the answer is yes. I think we can make
25 a generic finding without actually having completed all

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 that. CHAIRMAN SMITH: Anything further of Mr. 2 3 Phillips? (No response.) CHAIRMAN SMITH: Okay. Thank you, Mr. Phillips. 5 (Witness excused.) 6 CHAIRMAN SMITH: I think we have time to come back 7 g to Yr. Keaten and Mr. Jones on Dr. Little's question. MP. BAXTER: While they are taking the stand, I 9 10 will make an announcement that I have provided the Board and 11 we have served today a letter on human factors engineering 12 that was discussed in testimony early this week and late 13 last week on Licensee's position on NUREG-0752 and in 14 response to its own control review team's human factors 15 report. I think the record was left with the Poard 16 17 interested in having Licensee's position on the 18 recommendations of both the staff and our own control room 19 report. I would at some point like to offer this into 20 evidence. I call it to the Board's attention now because I 21 22 would like them to review it at some point and advise us 23 whether they will have questions. And I will ask Mr. Sholly 24 as the lead Intervenor as well whether he does. And if 25 there are none, I would ask for a stipulated offer; if there

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 are, I would think witnesses at the appropriate time. CHAIRMAN SMITH: A rearradie approach. Any 2 a objections? MR. CUTCHIN: No objection to that approach, Mr. 5 Chairman. CHAIRMAN SMITH: All right. 6 7 Whereupon, ROBERT JONES 8 ROBERT N. KEATEN, 9 10 recalled as witnesses by the Board, having previously been 11 duly sworn by the Chairman, were examined and testified 12 further as follows: POARD EXAMINATION 13 BY DR. LITTLE: 14 The question is phrased on page 10,825 of the Q 15 16 transcript. It is whether or not having a program in place 17 which would help interpret the information from the reactor 18 level instrumentation would alleviate some of the concerns 19 that you expressed yesterday. And I want to go further and ask you if, when you 20 21 made your evaluation of in-core -- or inadequate core 22 cooling indications, and you looked at the reactor water 23 level instrumentation and you decided that not only was it 24 not necessary, but it would be undesirable because it may be 25 misleading, when you arrived at that decision had you

10,911

1 considered the possibility of having a computer program
2 which would assist the operator in interpreting the
3 information from the instrumentation?

A (WITNESS JONES) Let me try to answer the 5 questions. I think first I would like to answer the second 6 one, which is how we did the evaluation of the water level. 7 What was done when it was reviewed was, we assumed we had a 8 perfect instrument. That is, the operator would know if the 9 two-phase mixture in the core was ten feet, he would know 10 it. And we tried to see if we could identify anything 11 different that he would do based on having that additional 12 piece of information.

It always came back to the point where, if I had a 14 level indicator in the core, I would still, in order to 15 determine the status of the cooling of the core, I still had 16 to fall right back into the core exit thermocouples, the 17 in-core thermocouples, in order to be able to determine the 18 status of the core cooling.

19 It is like I pointed out, I think it was 20 yesterday, where if I knew I had a level of ten feet in the 21 core, two-phase mixture level, I could not tell -- it would 22 be iependent upon the power shape within the core at that 23 particular point in time to be able to tell how hot the fuel 24 rod would be getting. If the power shape was peaked toward 25 the bottom of the core and there was very low power in the

1 steam-covered region of the core, you would get very low
2 temperatures.

If you had a high power region in the upper regions of the core, you could get very high temperatures. And the thermocouple will pick that up, because if you have low power in the upper portion you are coing to get very little superheated steam. But if you have a very high power sone, you are going to get a lot of superheating of the steam.

10 So the thermocouples actually provide the 11 conformance or can tell you whether or not the core is being 12 adequately cooled. Now, in trying to figure out a display 13 system for the operator to interpret the core water level, I 14 ran into exactly this type of problem every time. Let's say 15 I had a DT system, which is the Westinchouse-proposed 16 system. The Westinghouse-proposed system would tell me 17 where the solid water level was in the vessel and would be 18 able to infer where, if all the voids in the two-phased 19 mixture were eliminated, you could tell where the water 20 level would fall to within the vessel.

Now, if that is the information I have available to me, if that indicator said 11 feet of solid water in the core, I would expect under almost every circumstance the core would in fact be adequately cooled because of the two-phased mixture in the core region. And in trying to

display this to the operator, I would have the program make a check of what does the core water level say, if it says it is below the core, and look at the core exit in-core thermocouples to see whether they are showing superheat, before I would be able to tell anything about the status of how adequate the core was being cooled.

7 Now, there is another approach that could be 8 utilized in this program, which would be to feed in data 9 from the prior plant history, operating history, so that you 10 have a little routine to calculate the decay heat at the 11 time, a routine that has built into it or gets information 12 such that it could determine the axial power profile within 13 the core, a routine that would also have to know something 14 about the radial profile within the core, so that you could 15 figure out all level powers and then compute from the solid 16 water level instrument the actual uwo-phase level within the 17 core.

Now, that would be useful at least in the sense that you would know whether indeed the core was becoming uncovered or not. But again, I ran into the brick wall of, is o if the two-phase mixture is at 11 feet or 10 feet, is the core being adequately cooled or not? It is dependent on the in-core thermocouple readings.

24 So I never have been able to figure out a way that 25 I do not end up right back at the in-core thermocouples and

1 could use the water level alone. And I think when you look 2 at it, you do not really have -- you know, everything -- the 3 real key decisionmaker for you is the in-core thermocouple. 4 That is why I have trouble.

5 Mr. Phillips even implied today that one thing 6 that could be done for the operator is to take the in-core 7 thermocouple readings and back out the water level in the 8 core, and then decide your operator action. And that to me 9 does not make any sense, because you are really only relying 10 on that one instrument to infer something about the way the 11 level is in the core, and then go take an action. But your 12 actions really only are being taken on the in-core 13 thermocouple.

14 G Were you surprised when Westinghouse and 15 Combustion Engineering came out with "instrumentation," 16 parents, "et cetera"?

17 A (WITNESS JONES) Well, we had heard about the 18 heated junction thermocouples of Combustion Engineering. I 19 have been aware of those for several months. We have 20 problems with that system from the standpoint of, they have 21 a penetration directly down to the vessel head. And one of 22 the criteria we wanted to look at was not to make additional 23 penetrations, because then you have other potential 24 problems. They might leak on top of the vessel head; 25 maintenance problems, refueling problems, depending on how

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 this system was installed.

2 So we did not see any use to us of the heated 3 junction thermocouple. The delta P system we had 4 investigated and we looked at it and we know it is feasible, 5 and you would get information as to what the solid water 6 level is. The problem is, it does not really tell you where 7 the water level is in the core. It does not tell you 8 because it is going to give you that collapsed water level 9 rather than the most significant item, if you wanted it, is 10 where is the two-phased mixture level.

So we discarded, on that basis, the Westinghouse delta P measurement. And in fact one of the Westinghouse swners has asked the Commission for relief on this item, because Westinghouse will not contractually guarantee that they can sell this to the Commission, that they could really guarantee that they could make this system fly to the Commission. And I do not know the basis for it, but my understanding of the letter was that it then went on to guiscuss the problems with delta P instruments, mostly along the type of lines which we have developed, which is it does in not tell you where the real water level is in the vessel; it tells you where a collapsed water level would be. It is an artificial measurement.

24 Q You implied yesterday that not only was it not 25 necessary to have information on the water level, but it

1 might be misleading. Does this apply to Westinghouse and CE
2 plants as well, reactors as well?

3 A (WITNESS JONES) I would expect it would. But 4 they do have a substantially different response to a small 5 break LOCA than we do. And quite possibly there may be some 6 use to them that makes it maybe a little less ambiguous. 7 But at least as a discriminator of an accident initially, it 8 is a very bad system.

9 As far as when to go into the inadequate core 10 cooling guildlines, what we have not heard is how they are 11 coupling the water level system to the other 12 instrumentation. As I said, if I had to put one in and I 13 have water level and I could put in a display that would at 14 least interpret it to minimize what the operator sees, I 15 would have the display -- I would have the computer program 16 check water level versus in-core thermocouple and then print 17 out, water level X, thermocouple saturated, no action 18 required, so the operator would be alerted, you know, would 19 not be confused by it, that it would tell him something 20 about his actions.

It would be that type of display that I would prefer to use, rather than something that might alarm the operator that the core is uncovered without him checking the thermocouples to see whether indeed he has an inadequate core cooling situation possibly occurring.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

(Poard conferring.)

1

2 CHAIRMAN SMITH: "r. Baxter, what would be the 3 position of the Licensee if we find that water level 4 indication in the long term is necessary to provide 5 reasonable assurance that the plant can be operated safely, 6 and the position of Met Ed remains that they do not think it 7 is necessary and therefore they have no plans to install 8 any?

9 Can we find, then, that you have made reasonable 10 progress? What if you lose on the "necessary"?

MR. BAXTER: Well, the difficulty I have, I guess 12 I do not know that anyone has testified that it is necessary 13 yet.

14 CHAIRMAN SMITH: I understand. This is one of the 15 problems I have had with this entire presentation. It is 16 almost impossible to divide a point away from another point 17 which I want to address to this panel, too. Assume we find 18 it is necessary within the meaning of the order.

19 MR. BAXTER: Then the question would be whether we 20 make reasonable progress toward meeting that finding by the 21 Board. And I would think that there could be argument made, 22 at least, of having looked at some of the individual 23 methods, discarded them.

24 CHAIRMAN SMITH: And analyzed them.
25 MR. BAXTER: And analyzed operator actions for

1 inadequate core cooling situations, that there still could 2 be a finding that we have made some progress, reasonable 3 progress, although we have not proposed yet a design for 4 level instrumentation.

5 CHAIRMAN SMITH: Would the panel be able to tell 6 us whether the Licensee continues to evaluate the problem? 7 MR. BAXTER: I am sure.

8 WITNESS KEATEN: I can answer that. In fact, I 9 can do so with reference to a statement that I made to the 10 ACRS TMI Subcommittee at its most recent meeting, with the 11 full concurrence of all the GPU management, that although we 12 continue to believe that level instrumentation was not 13 necessary, on the other hand we recognize that that is an 14 item in which there is a difference of opinion in the 15 technical community, and that we were prepared to continue 16 to pursue possible methods of measuring level in the reactor 17 vessel.

18 We intended to pursue this primarily through the 19 BEW Owners Group in conjunction with the other owners. We 20 would take additional actions toward development if those 21 proved to be reasonable.

22 So we have not closed the door on doing any 23 further work. Quite to the contrary.

24 (Poard conferring.)

25 CHAIRMAN SMITH: There is confusion among the

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 Board members themselves as to what the state of the 2 testimony is. As I understand from listening to the 3 testimony yesterday, that even if you were to have a perfect 4 and reliable water level indication, you do not want it 5 because it can cause an operator to take correct 6 information, but motivate him to arrive at incorrect 7 conclusions and take an improper action.

BY CHAIRMAN SMITH:

9 Q Is that correct?

10 A (WITNESS JONES) No.

11 Q I am glad to hear you clarify it, because I am 12 having a lot of trouble with what I heard yesterday.

13 A (WITNESS JONES) What we are saying is, first off, 14 we do not believe right now there exists such an instrument 15 that could do this.

16 C Ckay.

8

17 A (WITNESS JONES) But even given such an instrument 18 that perfectly measured the water level, we do not know or 19 see anything that the operator would do differently --

20 Q I understand that.

A -- with that information that he would not use the 22 in-core thermocouples to back up anyway and take the 23 action.

24 Q Please, Mr. Jones. I thought you expressed that 25 yesterday so articulately, and several times, and I think I

1 understand that. You do not know how to use it if you had 2 it.

But there was a large part of your testimony yesterday that said that not only is it useless, you wouldn't change your process, but you do not want it because, even if it is accurate -- and if I misunderstood rit, I want you to correct it -- even if it is accurate, you do not want the operator to have it because he may make wrong conclusions as to plant conditions.

10 DR. JORDAN: That was from a human factors 11 standpoint.

12 BY CHAIRMAN SMITH: (Resuming)

13 Q From a human factors standpoint; therefore, and
 14 take the wrong action.

A (WITNESS KEATEN) Let me answer that in part, at he least. My comments -- and I believe I am the one that addressed the human factors aspect of it or certainly the general principle of human factors -- that we do not want our operators presented with useless information, even if it is correct useless information, because it tends to overflow them with information and may divert them away from the other things.

23

25

10,922

Q I understand that. Okay.

1

A (WITNESS KEATEN) That is the only comment I
3 remember making about the human factors aspect of it.
4 Q I am going to go back and read the transcript on
5 it.

6 A (WITNESS JONES) I think I know part .. the basis 7 for your confusion. Yesterday a lot of my testimony --8 actually, it was in the rebuttal part I believe you will 9 find most of these statements -- were looking at -- we were 10 answering questions on some of the specific usages that Mr. 11 Phillips either identified in his testimony or in responses 12 to some of our interrogatories, showing how level would not 13 be useful and in fact could be damaging becaue of that.

I think the other point of doubt in a lot of people's mind that I know about at B&W is if you have a water level indicator that is perfect and does show the core to be covered throughout some long term time in a transient, and let's say the break was in a pressurizer which would give him a full pressurizer similar to what has occurred at the Three Mile Island, the operator may, under those circumstances, take an incorrect action and throttle HPI, and then it may be too late to restore it.

I think it is difficult -Were there other examples like that, too?
A (WITNESS JONES) Just in general, not even looking

1 at the pressurizer. If he had a water solid vessel or 2 generally a full vessel, he might choose to do that.

A lot of the questions I answered yesterday were a also based on existing instrument capabilities like DP measurements where he would show core uncovery, and when in a fact the core would be covered because of the two-phase 7 mixture, and that could lead him to take the wrong actions.

8 With some displays, with some good operator 9 training and somehow minimizing the information he gets even 10 from this information, too, like I said, couple it, say, 11 with a CRT to know the core is uncovered, say, with a DF so 12 the in-cores say you are saturated, hot leg temperatures say 13 you are saturated, therefore you have almost a conclusion at 14 the end of this display which says do not throttle HPI or 15 assure HPI or something like that. If you make it a bigger 16 system and feed the information into it, you could possibly 17 eliminate some of the unsafe operator actions, but in light 18 of even the technology today --

19 Q Skip technology, skip technology. I understand. 20 I listened to the testimony yesterday and I understand that, 21 but the thread came through to me which I have had a great 22 deal of difficulty accepting, and that is a clear, reliable 23 indication of a plant condition, important plant condition 24 would cause mischief in a plant, and I would request that 25 you go back to the transcript, and I understand the point

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 that generally speaking you do not want unnecessary

2 information. You made that point very well, Mr. Keaten, but 3 I am having difficulty accepting the idea that you have a 4 group of operators that are going to run that plant that do 5 not know how to take accurate information and be trained to 6 handle it. That is what I want addressed.

7 A (WITNESS KEATEN) Let me address that for just a 8 minute. I do not think certainly in anything that I said --9 and I will let dr. Jones speak for himself -- but certainly 10 I did not ever intend to imply that you cannot train 11 operators to correctly use, or as the case may be, correctly 12 ignore information that is presented to them.

13 C Correct information, that is my premise. 14 A (WITNESS KEATEN) That's right, and in fact, with 15 the knowledge that we have today, I believe it is true that 16 the training we would provide the operators if we had a 17 level gauge is that they should not take any action based 18 upon that level gauge. They could look at it if they wanted 19 to, but their actions should be taken based upon the 20 saturation conditions in the hot legs and the readings of 21 the in-core thermocouples, and certainly with the right kind 22 of training and re-emphasis, the operators could be trained 23 not to take wrong actions.

24 Q My question is with that understanding and your 25 explanation and everything, would you review the transcript

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 where that issue was raised and report back to the Board if 2 you think that the proper emphasis has been given to that 3 problem. (WITNESS JONES) Yes. A 4 A (WITNESS KEATEN) Yes, sir. 5 (Board conferring.) 6 CHAIRMAN SMITH: Okay, we are going to proceed on 7 g the quorum rule. Dr. Little is going to leave. But before we --9 (Board conferring.) 10 CHAIRMAN SMITH: So then you gentlemen are excused. 11 We will ask Mr. Phillips to come back for a couple 12 13 of questions that Dr. Jordan --DR. JORDAN: You can stay where you are if you 14 15 Wish to. MR. CUTCHIN: Will I get a chance to pose a 16 17 question or two when they come back rather than now? CHAIRMAN SMITH: That is always the case. 18 19 Whereupon, LAURENCE E. PHILLIPS, 20 21 recalled as a witness by counsel for NEC Staff, having 22 previously been duly sworn by the Chairman, was further 23 examined and testified as follows: BOARD EXAMINATION 24 BY DR. JORDAN: 25

10,925

AL ERSON REPORTING COMPANY, INC.

400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 Q I have one or two questions for Mr. Fhillips. 2 Has the staff really decided, for example, that 3 level is better than inventory? Would they rather have 4 inventory but don't know how to get it? Do you know? 5 A I think we regard level measurement system as 6 really an inventory measurement system. We would rather 7 have -- inventory would be perfectly fine. I think level is

g the way to get there, essentially.

g Q I see.

Now, you have heard the objections of the Licensee 11 in the last day and today. You said that you have had 12 conferences with Net Ed on this I believe on several 13 occasions.

Have all of these concerns come up to you before is such as, for example, that you really cannot measure level if -- it is not a good indication of the situation? Have these if concerns been brought to the attention of your group, and have you considered them all and in spite of it all said is still you want level information at B&W plants.

A Yes, we have. They were identified at a rather early stage, I think, for the most part. They were really identified in that early document which we reviewed and wrote the SER on, and we have heard further arguments in meetings with BEW owners' groups, and those were rather searly, too.

We proceeded with our clarification meetings
 starting back about last September in which I do not believe
 we had any real direct interaction with Met Ed alone after
 that, but we had interaction with all of the Licensees as a
 group, and we have taken those arguments into consideration.

We feel that -- well, for instance, if you have a 8 7 low level or low inventory or indication of void signal in a conjunction with something like high radiation in g containment, high pressure in containment, or other 10 indicators which would indicate clearly to you that 11 something is wrong, that level or inventory information is 12 something that does belong in procedures, whether actions 13 are keyed off of that or not, and that in the larger 14 perspective, if you are in a condition where you have 15 something of a TMI 2 nature and you are recovering or are 16 attempting to recover, you still have superheat on those 17 thermocouples because your core is so badly mangled, it 18 certainly is going to make you feel awfully good if you -ig or a lot better if you now where your level is, that you do 20 have water sitting over the core. And it could enter into 2; such things as not an immediate plant operator decisions but 22 even evacuation decisions. Can you get water into the 23 system, can you get it on the core?

24 Q Are you saying -- well, if you were to restrict 25 your attention only to design basis accidents that have been

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

1 described in the PSAR, would you say that for design basis 2 accidents, a level indicator would not be necessary?

3 A I would say it would not be necessary. I think it 4 is -- it can be used as an additional piece of information, 5 even in those events, but it is not necessary.

6 Q So is it your position that as far as those 7 accidents beyond the design basis, that it has the greatest 8 potential for payoff?

9 A Yes.

10 CHAIRMAN SHITH: Okay. Anything further?

11 DR. JORDAN: One other question.

12 BY DR. JORDAN: (Resuming)

13 Q You said something about a risk-benefit analysis, 14 you did not plan one. I believe there was a risk-benefit 15 analysis made for the ATWS, and that this situation is not 16 entirely different from the ATWS, where the Licensees are 17 dragging their feet. Only, in that case, I believe they are 18 almost unanimous in dragging their feet, but in that case I 19 believe Volume 4 of the ATWS does have a risk-benefit 20 evaluation.

Now, is it your considered opinion that it is not necessary or you just don't know whether we would have to have one for this or not?

24 A Well, I think we have already done what evaluation 25 we would intend to do on that as far as benefit. I do not believe Mr. Baxter mentioned benefit, but we have taken the
 position the Licensee should proceed now to procure the
 systems, even where there may be some degree of uncertainty
 as to some very, very small degree as to ultimate
 acceptability of the systems.

So we would plan no further, certainly from a
7 benefit standpoint, or cost, I should say.

8 Q I believe they actually did --

9 A Did you use the adjective -- could I hear that the 10 way you described that again?

11 · Q It seems to me that there were cost figures 12 involved in the ATWS --

A Oh, yes, that's right. I say the staff has
 14 considered the cost of these systems --

15 Q They have.

16 A Yes. In objections that have been raised by 17 Licensees about costs that will be incurred to install 18 systems which ultimately may not be acceptable. We have 19 considered that and have reached a judgment that they still 20 should proceed.

21 MR. BAXTER: My question, Dr. Jordan, however, was 22 on incremental risk and benefit to the safe operation of the 23 plant.

24 DR. JORDAN: That was a little different than your 25 position.





## IMAGE EVALUATION TEST TARGET (MT-3)



6"









## IMAGE EVALUATION TEST TARGET (MT-3)



6"





10,930

I see. All right.

1

2

9

BY DR. JORDAN: (Resuming)

3 Q Do you remember a figure for cost?

A Well, something like on the order of a million
5 dollars for the Delta P systems.

6 CHAIRMAN SMITH: Mr. Cutchin, it just occurred to 7 me that I did not really catch your entire statement about 8 an opportunity to examine on the Board's questions.

Would you repeat that?

MP. CUTCHIN: I said if when these two witnesses return with their response to your question as to what they said about necessary versus confusion, that if I was unhappy at that time, would I have an opportunity to question them further.

15 CHAIRMAN SMITH: Okay. It was coing to be my 16 thought that for my purposes -- I am the sole Board member 17 raising this -- that it would not be necessary for the 18 entire panel to return, that Mr. Keaten, sometime when he is 19 here otherwise, could present this information after 20 consulting with the other panel member, although it was 21 partly Mr. Boss's testimony that caught our attention on 22 that.

23 MP. BAXTER: I should be clear that Mr. Keaten is 24 going to be coming back to testify in the future on Board 25 Question No. 6. We have no present plans to recall Mr.
1 Jones.

2	Now, depending upon what they report, it may be
3	necessary, but I would think if the staff has questions, I
4	cannot guarantee they are going to come back.
5	CHAIRMAN SMITH: I would accept Mr. Keaten
6	representing Mr. Jones' views, if there are no objections."
7	MR. CUTCHIN: So would I.
8	CHAIRMAN SMITH: Except for Mr. Keaten.
9	(General laughter.)
10	CHAIRMAN SMITH: I just want to make sure that I
11	have a clear and unequivocal statement of their position on
12	that particular question and I, like you, have a similar
13	recollection of the record yesterday, but I am waiting to
14	see.
15	MR. BAXTER: And the other side of the coin, of
16	course, is that if the staff is going to respond to the
17	Board's interest in clarification of their position, we are
18	going to have perhaps the right to interrogate that.
19	DR. JORDAN: By the way, that letter to the
20	Commission, is there any objection to having that?
21	MR. CUTCHIN: The document which Mr. Phillips
22	referred to?
23	DR. JOPDAN: Yes.
24	MR. CUTCHIN: I was going to identify that.
25	What it is is a SECY, SECY-80-529, dated December

1 4, 1980.

2 Am I incorrect in presuming that the Board 3 coutinely sees SECY papers?

4 DR. JORDAN: No, we do not see SECY papers. 5 MR. CUTCHIN: Then I will undertake to provide 6 copies of tht to the Board and the parties. I have no 7 objection to its being circulated. Its purpose is stated to 8 be to provide the Commission with an information paper on 9 the status of the technology for measuring reactor vessel 10 water level.

Having glanced at it, I still do not think it will resting answer the Chairman's question, but it will resting provide some information on status.

14 DR. JORDAN: Good.

15 CHAIRMAN SMITH: All right.

16 Mr. Dornsife?

MB. DORNSIFE: I have a couple of short questions 18 for Mr. Phillips if I may.

19 BY MR. DORNSIFE:

20 G Mr. Phillips, in your professional opinion, would 21 you agree that providing a system, a more reliable system 22 for recovering from inadequate core cooling would provide a 23 larger margin to safety than providing another means of 24 determining whether you have inaiequate core cooling? 25 A Let me think about that for a second.

> ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

It is difficult for me to understand what you mean
 2 by your question.

3

Can you give me an example?

4 Q If you were to do a risk, WASH-1400 type of study, 5 and if you made a system that was available more reliable to 6 recover from inadequate core cooling, would you feel that 7 would decrease the risk of that plant more than just 8 providing another instrument that told you you had 9 inadequate core cooling?

10 A Well, if I may, let me maybe not give quite so 11 direct an answer. I think one of the key objectives was 12 always to prevent getting into the condition and having 13 early information on the status of level I feel will 14 increase the potential of preventing cetting into the 15 condition to begin with. An ounce of prevention is worth a 16 pound of cure or whatever.

17 If we get into the condition, certainly, I think 18 that we need something to help tell us whether we are 19 adequately recovering from the sit uation. That is 20 important, too.

I guess I have not directly answered your question.
 I think sufficiently enough.

23 But let me ask another related question. Most of 24 your testimony concerning the use of the water level meter 25 was involved mainly with recovering. You said -- you

> ALDERSON REPORTING COMPANY, INC. 4CJ VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

10,933

1 implied numerous times, at least my impression was you
2 implied numerous times that the core level meter -- the only
3 thing that would give you unambiguous indications upon -4 after core damage occurred.

A Yes. I think the reason that perhaps I stressed 5 6 that in my testimony was I thought that point had not been 7 touched yesteriay, and the point in my prepared testimony, I g think a great deal of emphasis was placed on the advent to g inadequate core cooling, the fact that the level meter or 10 void meter or whatever you want to call it with the pumps 11 running will give you an early pretty definite indication 12 that I have all my HPI on, or at least I think it is on. I 13 am not sure if it is getting to the core. My void fraction 14 in the primary system -- I have gone saturated already. I 15 know that. My void fraction in the primary system is 16 increasing and if I have shut off the pumps, it is obvicus 17 that my inventory is decreasing, either slow or whatever. 18 Gee, I am in this situation. Maybe it is a very slow 19 situation. Myabe I ought to go to that step now to where I 20 want to rapidly depressurize the secondary system. I wanted 21 to get the system down into a cold shutdown condition. I do 22 not want to get into a position where after my level is 23 already into the core I am going to have to open the PORV 24 and further decrease inventory in order to get onto my low 25 pressure injection systems.

10,934

I just think it provides you with a much earlier
 indication and a great deal more flexibility to prevent
 getting into the situation.

4 Q In other words, would you agree that it maybe 5 provides a bridge between the t-sat meter and the in-core 6 thermocouples?

7 A Exactly, exactly.

8 Q I have one more, if I could, a very short one.
9 If the staff's position on the reactor -- if the
10 staff's position were to change -- it is up in the air right
11 now, isn't it?

12 A Well, I guess it is always somewhat up in the air,
13 but I am not aware of any intent to change it at this point.

14 Q If some new information were to arise, or some of 15 the information is further evaluated and it is decided to 16 change that position, allowing the option of letting the 17 pumps run, would that make any of the current systems that 18 are being proposed not appropriate?

19 A No, because the current systems that are being 20 proposed will function with the pumps running. I think that 21 a more relevant position might be that if this position 22 stays the same and if the pumps are tripped, do we really 23 need the requirement that the system measure with the pumps 24 running?

25

I guess that that position could -- we could

ALDERSON REPORTING COMPANY, INC. 400 VIRGINIA AVE., S.W., WASHINGTON, D.C. 20024 (202) 554-2345

10,936 + reconsider whether that position micht be modified. Q You are saying that the Westinghouse Delta P 2 3 system would work with the pumps running. 4 A Yes. It measures the void fraction with the pumps 5 running. This is based on the two-phase pressure drop e across the core, an increase in pressure drop as a function 7 of void fraction. MR. DORNSIFE: Thank you. I have nothing further. 8 CHAIRMAN SMITH: Anything further? 9 (No response.) 10 CHAIRMAN SMITH: Okay, we will adjourn, and meet 11 12 Tuesday at 10:00. (Whereupon, at 12:37 o'clock c.m., the hearing in 13 14 the above-entitled matter recessed, to reconvene at 10:00 15 O'clock a.m., Tuesday, January 27, 1981.) 16 17 18 19 20 21 22 23 24 25

## NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

in the matter of: METROPOLITAN EDISON COMPANY (TMI UNIT 1)

· Date of Proceeding: January 22, 1981

Docket Number: 50-289(Restart)

Place of Proceeding: Harrisburg, Pa.

were held as herein appears, and that this is the original transcript thereof for the file of the Commission.

David S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)