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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

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In the Matter of:
IE TMI INVESTIGATION INTERVIEW
of Mr. E. Allen Womack
Manager Plant Design

Trailer #203
NRC Investigation Site
TMI Nuclear Power Plant
Middletown, Pennsylvania

May 9, 1979
(Date of Interview)
June 28, 1979
(Date Transcript Typed)
188
(Tape Number(s))

NRC PERSONNEL:

Mr. James S. Creswell
Mr. Owen C. Shackleton

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1 SHACKLETON: This is an interview of Mr. E. Allen, Womack. Mr. Womack
2 is presently the Manager Plant Design, Babcock and Wilcox Nuclear
3 Power Generation Division in Lynchburgh, Virginia. This time of this
4 interview is 9:50 a.m., Eastern Daylight Time, May 9, 1979. The place
5 of the interview is in an office of Babcock and Wilcox Facility for
6 their Nuclear Power Generation Division in Lynchburgh, Virginia.
7 Present to conduct this interview from the U.S. Nuclear Regulatory
8 Commission is Mr. James S. Creswell. Mr. Creswell is a Reactor Inspector
9 presently assigned to Region III. My name is Owen C Shackleton. I'm
10 an investigator presently assigned to Region V. Just prior to beginning
11 this interview on tape, I presented to Mr. Womack a two page document
12 from the U.S. Nuclear Regulatory Commission which outlines the scope
13 and purpose of this investigation. It identifies the authority by
14 which the U.S. Nuclear Regulatory Commission is conducting this investi-
15 gation and advises Mr. Womack of his rights to refuse to be interviewed
16 and to refuse to submit any form of a statement. It also identifies
17 to Mr. Womack that he has the right to have present someone of his
18 choice. Mr. Womack has present for this interview Mr. Byron D Nelson.
19 Mr. Nelson is the Assistant Council for Babcock and Wilcox for their
20 Nuclear Power Generation Division in Lynchburgh, Virginia. On this
21 two page document on the second page are listed three questions all of
22 which Mr. Womack answered in the affirmative. At this time to make it
23 a matter of record, I'm going to repeat these questions and ask Mr.
24 Womack to please respond orally. Mr. Womack did you understand the
25 text of the two page document that I am discussing?

1 WOMACK: Yes.

2

3 SHACKLETON: And do we of the U.S. Nuclear Regulatory Commission have
4 your permission to tape this interview?

5

6 WOMACK: Yes.

7

8 SHACKLETON: Would you like a copy of the tape?

9

10 WOMACK: Yes.

11

12 SHACKLETON: Alright sir, we will provide that to you or sent it to
13 you by mail to your facility here where you are employed. And now Mr.
14 Womack for the benefit of the many people who will be listening to
15 your testimony as you attempt to help us here to reconstruct what
16 transpired from the beginning of the incident on March 28, 1979 at the
17 Three Mile Island Nuclear Power Station operated by Metropolitan
18 Edison, would you please give us your background regarding your
19 education and work experience in the Nuclear field?

20

21 WOMACK: Alright Mr. Shackleton, I was educated in physics at the
22 Massachusetts Institute of Technology, the highest degree I hold is a
23 Doctor of Philosophy which I received in 1969. My experience in the
24 nuclear field began with the U.S. Atomic Energy Commission in 1968
25 from 1968 until 1975 I was employed in a division of Reactor Develop-

1 ment and Technology and in various capacities. In 1975 I joined the
2 Babcock and Wilcox Company. From 1975 until 1978 I was employed in
3 association with the International Program Support of the B&W company.
4 In August of 1978 I became a Manager of Plant Design coming from the
5 position of Program Manager for Amuillheim Kerlig Plant in West Germany.
6 Since August of 1978 I have been Manager of Plant Design.

7
8 SHACKLETON: Thank you very much sir and now I'll turn the interview
9 over to Mr. Creswell.

10
11 CRESWELL: Mr. Womack who do you report to in the Nuclear Power Genera-
12 tion Division Organization?

13
14 WOMACK: I report to Dr. Donald Roy who's Manager of Engineering.

15
16 CRESWELL: Okay. As Manager of Plant Design what are your responsi-
17 bilities in the Nuclear Power Generation Division?

18
19 WOMACK: The Plant Design section of the Engineering Department encompasses
20 groups which have responsibility for Reactor System and NSS Analyses.
21 We have a unit which does emergency cooling system analyses and a unit
22 which does safety analyses a unit which does what we call control
23 analyses and a unit which does analyses of the mechanical response of
24 the reactor systems in addition two other units are part of the section
25 this units have respectively the integration responsibility for the
plant design for the B&W domestic NSS and for international projects.

1 CRESWELL: I see. Mr. Womack as part of your responsibilities would
2 you make decisions related to safety related problems that are identified
3 at your facilities in regard as to whether they should...changes
4 should be implemented in other plants?

5
6 WOMACK: Yes or the members of my staff would.

7
8 CRESWELL: Would the ultimate decision be yours?

9
10 WOMACK: Not in every case but I would frequently contribute to the
11 ultimate decision.

12
13 CRESWELL: Okay. I'd like if we could to go back to the time of March
14 28, 1979, and if you could relate to us when you first found out about
15 the event that had occurred at Three Mile Island Unit 2?

16
17 WOMACK: I was first notified that an incident had occurred at TMI 2
18 shortly before 8:00 a.m. when I arrived in the office on the 28th of
19 March.

20
21 CRESWELL: Who did you hear about the event from?

22
23 WOMACK: Dr. Roy came to my office and gave me the information.
24
25

1 CRESWELL: Did Dr. Roy indicate where he had obtained the information?

2
3 WOMACK: My recollection is that he mentioned that Bill Spangler had
4 passed it to him.

5
6 CRESWELL: Did Dr. Roy elaborate on the status of the plant as he
7 understood it at that time?

8
9 WOMACK: Yes, he gave me certain information, I believe that he charac-
10 terized that he thought this had been a loss of feedwater event and
11 that the only thing right at that moment that I recall that appeared
12 to be particularly unusual with respect to this event was an indicated
13 high radiation reading in the upper portion of the containment reactor
14 building.

15
16 CRESWELL: What did that indicate to you?

17
18 WOMACK: Well either one of two things either that there had been some
19 release of radioactivity within the building or that a particular
20 instrument might be reading incorrectly.

21
22 CRESWELL: So at that time as far as radiation levels were concerned
23 your information was based on one instrument?
24
25

1 WOMACK: Based on indirect knowledge one instrument is...of what I
2 understood to be one instrument, yes.

3
4 CRESWELL: Okay. Upon receiving this information what discisions did
5 you...did you make?

6
7 WOMACK: Well I was asked by Dr. Roy to establish responsibility, to
8 followup this incident, to make those analyses which might be necessary
9 to help the licensee, help Met Ed recover in the longer term since...from
10 the event and reestablish reliable safe operation at TMI 2 as promptly
11 as possible.

12
13 CRESWELL: Was there any discussion of...between you and Dr. Roy of
14 providing recommendations to the plant in a short...in the short term?

15
16 WOMACK: It certainly wasn't an immediate...it certainly wasn't my
17 immediate thought at that point in time and for most of the morning
18 following we were primarily in a data gathering mode and our immediate
19 thought was to gather those kinds of data which we knew we would need
20 to assist Met Ed in a recovery operation, in particular data which
21 might be related to the exposure of the components to thermal, out of
22 the ordinary thermo conditions.

23
24 CRESWELL: But the subject of providing recommendation to the plant at
25 that point in time wasn't discussed?

1 WOMACK: My recollection was that we certainly were not in the immediate
2 mode of trying to provide recommendations to Met Ed. The onsite
3 operators were handling the event to our knowledge, and indeed were.
4

5 CRESWELL: Okay, it's my understanding at this point that Dr. Roy gave
6 you responsibility for the data collection, analysis.....
7

8 WOMACK: Right, he ask me...he ask me to take...he ask me actually to
9 delegate that responsibility and when he did call in other people and
10 made the various assignments.
11

12 CRESWELL: How did you go about implementing that responsibility?
13

14 WOMACK: Well one of the things we did was recognize that we would
15 need additional detailed information to followup the engineering
16 evaluation of the event and we asked immediately we selected three
17 people whom I believe you've interview to make a trip to the site near
18 Harrisburg and those three people were Mr. Robert Winks and Mr. Joe
19 Kelly and Mr. R. C. Twilley. We did make transportation arrangements
20 for them to go to Harrisburg to collect information.
21

22 CRESWELL: Did you communicate any of the information that you were
23 giving to anyone higher in the organization say than Dr. Roy in...in
24 the Management structure?
25

1 WOMACK: I did not directly at that point in time we then wished as
2 the morning developed we all wanted know more about what was happening
3 at TMI and our source of information is usually as it was in this case
4 through our Nuclear Service Department later in the morning we asked...we
5 joined Mr. Spangler of Nuclear Service in a general meeting and which
6 involved a number of us and I believe did involve well among others
7 Mr. Davis, the Senior Manager of the Division at that...on that day
8 and we received a report of information from Mr. Spangler.

9
10 CRESWELL: So your source of information concerning site conditions
11 basically came from Mr. Spangler?

12
13 WOMACK: Mr. Spangler, yes.

14
15 CRESWELL: And that was...was that true throughout the day of March
16 28, 1979?

17
18 WOMACK: Generally yes, Mr. Spangler communicated throughout the day
19 with... the in...with Pennsylvania. I did have one additional conver-
20 sation following our morning meeting, Mr. Jim Floyd who is a member of
21 the operating staff at Met Ed was here for simulator requalification
22 and I talked briefly with him he indicated to me that he had been in
23 touch with someone at the site and passed on additional information
24 that there had been delay in the auxiliary feedwater initiation or
25 thought that there had been delay and this is second hand information

1 of course and we used that information in an attempt to get started on
2 simulating the transient that might have occurred at TMI 2.

3
4 CRESWELL: Okay, what sort of information...what was the nature of
5 discussion with Mr. Floyd beyond say the delay of the emergency feedwaters
6 is that a fair characterization of what he would relate to you?

7
8 WOMACK: That's my recollection that...I don't recall, you know,
9 extensively what else we might've discussed I think we probably discussed...you
10 know ... how might've that happened and that kind of thing.

11
12 CRESWELL: Did you discuss with Mr. Floyd what activities...what the
13 nature of the activities that B&W would be engaged in at that point?

14
15 WOMACK: I think what I mentioned to Mr. Floyd that we would be trying
16 to simulate the event, probably did, but what he had passed on to us
17 would be helpful and I believe in fact that later on in the morning
18 he...as he was at the simulator he was a part of our efforts to do
19 some simulation.

20
21 CRESWELL: During the day of March 28, 1979, did you personally
22 contact any officers of Metropolitan Edison Company or their parent
23 company and GPU?
24
25

1 WOMACK: No. To the best of my recollection I did not.

2
3 CRESWELL: Okay, are you aware of any such conversations that did take
4 place?

5
6 WOMACK: I believe that conversations...conversation did take place
7 during the course of the day between Mr. Denton and Mr. Arnold.

8
9 CRESWELL: Okay. Do you know anything of the nature of that conversa-
10 tion?

11
12 WOMACK: The only thing that I know directly...well it's all indirect
13 of course... the indirect knowledge that I have of that conversation
14 was that in the middle of the afternoon Mr. Denton did pass on a
15 recommendation to Mr. Arnold that if high pressure injection flow was
16 not...had not been established or was not being maintained at at least
17 400 gallons a minute that we'd die.

18
19 CRESWELL: Was someone responsible to you for yourself the one that
20 determined the quantity of flow that was necessary?

21
22 WOMACK: Yes.

23
24 CRESWELL: Who would that've been?
25

1 WOMACK: That was my manager of ECCS and he simply recommended the...that
2 we make sure that high pressure injection flow was being maintained
3 and he gave me a quantitative recommendation which I asked him to
4 check before we passed on and he did check that and we passed it on.

5
6 CRESWELL: Your manager of ECS...ECCS is who?

7
8 WOMACK: Burt Dunn.

9
10 CRESWELL: Burt Dunn. Are you aware of how Mr. Dunn arrived at that
11 particular flow value?

12
13 WOMACK: Yes, I believe he arrived at by looking at the...at the
14 expected decay level at that time.

15
16 CRESWELL: Okay. Were any other recommendations made to officials of
17 Metropolitan Edison Company or its parent company that you're aware
18 of?

19
20 WOMACK: Well late during the day we discussed and recommended the
21 initiation of operation of one of the reactor coolant pumps in order
22 to establish...to reestablish force flow. That was...I don't remember
23 the exact time but it was very light in the day, 6 or 5:30 or 6.

24
25

1 CRESWELL: Going back earlier in the morning we may have already
2 discussed this it's my understanding there's a meeting conducted
3 around 10:00 in the morning in one of the training rooms.

4
5 WOMACK: Yes.

6
7 CRESWELL: Did you attend that meeting?

8
9 WOMACK: Yes that was the meeting with the...in which Mr. Spangler
10 gave us the information again.

11
12 CRESWELL: Okay and it's also my understanding that during the course
13 of that meeting the decision was made to send the three individuals we
14 discussed earlier to the...to the site.

15
16 WOMACK: Yes I would say the decision was confirmed because we had
17 already made a decision to send the...those three individuals earlier
18 and arrange transportation earlier. We just confirmed the...that
19 these people should proceed and I think the final decision was made at
20 that point as to who the third individual would be, Mr. Twilley.

21
22 CRESWELL: How was the decision made to send these three individuals?
23 By that I mean these individuals appear to have certain areas of
24 expertise. Could you describe to me why these three individuals were
25 selected?

1 WOMACK: Well I can describe to you in particular how the two individuals
2 who are part of the plant design section were selected. Mr. Winks is
3 especially knowledgeable of plant performance...excuse me...and he is
4 a control analyst and especially qualified in collection of data and
5 the analysis of...and the analyses of plant transients and it was
6 recognized that he would need assistance and I made the decision to
7 send with him Mr. Kelly who has a broad knowledge of plant systems
8 generally in having participated in startup programs of other plants.

9
10 CRESWELL: Um Um. Did you personally give these gentlemen instructions
11 before they left?

12
13 WOMACK: Yes, I ask them to go as quickly as they could, gather information
14 and telecopy it back to us so that we could begin...begin evaluations.

15
16 CRESWELL: Could you recollect when you first received telecopied data
17 of any nature from the site and what the nature of the material was?

18
19 WOMACK: It was the next day, it was the 29th I believe these gentlemen
20 didn't really get to the site until the 29th and we began to receive
21 telecopy plots of temperature pressure in the reactor coolant system.

22
23 CRESWELL: Would you characterize the information that you had the
24 first day as..as being minimal of nature or was it sufficient enough
25 to become....begin some sort of analyses that would either be hand

1 typed calculations, computer typed calculations. You already mentioned
2 that there was some work done on the simulator.

3
4 WOMACK: Yeah, I think I would certainly say that we went ahead and
5 did some work based on the feeling that we had had a delayed feedwater
6 event and we used the simulator because it was immediately and readily
7 available to us rather than other design codes which would have taken
8 a bit longer to set up.

9
10 CRESWELL: Then perhaps it required more input data...

11
12 WOMACK: Oh absolutely, yes.

13
14 CRESWELL: Were there any model changes made on the simulator that
15 day?

16
17 WOMACK: I can't really say for sure, I doubt it, in the sense of
18 model changes as we would understand model changes the way the set of
19 equations which the simulator solves certainly changes appropriate to
20 assumption had to be made to delay feedwater for example which would
21 not be the normal mode of response.

22
23 CRESWELL: Were you at anytime in the simulator room observing?
24
25

1 WOMACK: I don't believe that on the 28th I was.

2
3 CRESWELL: Did you receive any information from anyone as to how the
4 simulator was performing in mock modeling this particular event?

5
6 WOMACK: Yes it was relayed back to me that...that the simulator
7 had...was running and they were running various cases and they were
8 seeing various things and more or less as we expected.

9
10 CRESWELL: Do...Do you think that the simulation was successful or
11 unsuccessful?

12
13 WOMACK: Well, that's...success in terms of being able to say that,
14 you know, we ran...we ran simulation of certain...of what we knew at
15 that particular point in time the simulation ran and produced results
16 of more or less in accord with our...with our expectations that was
17 successful. I would say at that point in time we did not have sufficient
18 information to successfully simulate what had actually had happened and
19 was happening at TMI 2 and that did not come until later when we
20 fouled up with the information that we had to get on the 29th from Mr.
21 Winks and Mr. Kelly.

22
23 CRESWELL: Okay, that is from retrospect?...

24
25

1 WOMACK: Yes, from retrospect.

2

3 CRESWELL: ...that you would evaluate that? At that point in time was
4 any data or any information that was obtained from the simulator runs
5 used as a based for making recommendations?

6

7 WOMACK: I don't believe so, no, my recollection is that it was not.

8

9 CRESWELL: You had mention that there had been a certain recommendation
10 made to Mr. Arnold regarding high pressure injection flow. Upon what
11 information was that...that recommendation made other than I believe
12 you stated that decay heat in the core...

13

14 WOMACK: Right.

15

16 CRESWELL: ...was the question at that time.

17

18 WOMACK: Well I think that they also had indirect information of high
19 readings in the reactor hot leg thermocouples and we were concerned
20 that adequate cooling be maintained.

21

22 CRESWELL: Was it assumed to your knowledge that the 4...400 gpm high
23 pressure injection flow would all be directed through the core area?

24

25

1 WOMACK: No, I'm sure that it was assumed that there could be some
2 diversion of this flow and some factor or conservatism and was added
3 that is our standard practice.

4
5 CRESWELL: What would be the path of diversion regarding the...the
6 layout of the reactor coolant system?

7
8 WOMACK: Well when we performed ECCS analysis we typically take the
9 assumption that a break might have occurred in one of the paths for
10 high pressure injection flow. There's one in each cold leg and so we
11 assumed that some of the high pressure injection flow might have
12 been...might be diverted out the break and we have instructions regarding
13 balancing those flows to assure that that diversion of flow out the
14 break is not...does not deprive the core of necessary cooling.

15
16 CRESWELL: You assume then for the purpose of the 400 gpm figure that
17 there was a break?

18
19 WOMACK: No, I'm just...I'm just telling you generically how we do
20 ECCS analysis and with respect to the assumption of 400 gpm figure I
21 don't know much conservatism specifically was added, I'm just telling
22 you generally that we do add conservatism in the chance that there is
23 some diversion.
24
25

1 CRESWELL: I guess what I'm trying to get to though is was there any
2 discussion of flow pass which could bypass the core area?

3
4 WOMACK: No. Not with me and I don't believe it was...or if it was
5 really being considered at that point in time.

6
7 CRESWELL: At this point in time did you and your personnel believe
8 that the hot leg temperatures were within some band of accuracy telling
9 you that there was a bubble in that area of the reactor coolant system?

10
11 WOMACK: Well yes during the early to mid afternoon we became aware at
12 that time it was...at least the indirect information we were getting
13 was indicating that.

14
15 CRESWELL: Did you or individuals responsible to you make recommenda-
16 tions that a reactor coolant pump be started?

17
18 WOMACK: Yes we did.

19
20 CRESWELL: Did you or any of response...people responsible to you
21 provide to either your people at the site, that's B&W people at the
22 site or to the licensee a correlation between reactor coolant pump
23 currents and possible conditions in the reactor coolant system?

24

25

1 WOMACK: Yes I believe late in the day when we were communicating
2 particularly communicating these recommendations we did...I wouldn't
3 so much call it a correlation but we did pass along the information as
4 to what current which you might expect to see if the pump were not
5 pumping...if the pump were unloaded there were significant voids in
6 the pump bowl.

7
8 CRESWELL: Were there any other things to be considered as a function
9 of pump current other than just the condition of voids in the area of
10 the impeller or void or voiding in the area of the impeller?

11
12 WOMACK: At that point in time my recollection is that there were not.

13
14 CRESWELL: Okay. Owen, at this point I'd like to turn it over to you
15 see if you have questions.

16
17 SHACKLETON: Thank you, no, at this inasmuch as Mr. Womack did not go
18 to Three Mile Island, I don't have any...any questions. Mr. Womack
19 would you have any further comments that you would like to make at
20 this time?

21
22 WOMACK: No, I don't think so, thank you very much.

23
24 SHACKLETON: We thank you very much in behalf of the Commission for
25 your time and we'll end this interview at this time. The time is now
10:20 a.m. Eastern Daylight Time, May 9, 1979.

RECEIVED

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1973-1975, Assistant Director, Division
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1975-1976, Senior Technical Consultant,
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1976-1978, Program Manager, International
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August 1978-present, Manager of Plant
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