

Transcript of Proceedings

PRESIDENT'S COMMISSION ON THREE MILE ISLAND

INTERVIEW OF JOSEPH MALLAM HENDRIE

THIS DOCUMENT CONTAINS
POOR QUALITY PAGES

Washington, D. C.

Friday, 7 September 1979

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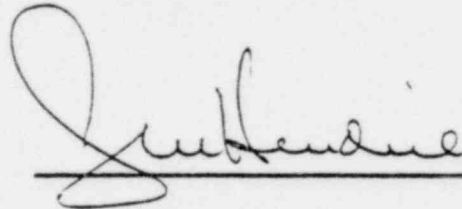
CHANGE

11	-	17	Delete "B" Insert "A"
45	-	5	Delete "noticeable" Insert "noteable"
47	-	16	Insert "a" Between "using" And "more"
48	-	14	Delete "deregulate" Insert "regulate"
84	-	1	Insert "or" After Comma
85	-	25	Delete "That" Insert "What"
96	-	16	Delete "sufficient" Insert "fission"
97	-	12	Delete "program" Insert "parameters"
97	-	13	Delete "meters"
105	-	15	Delete "that" Insert "but what"
188	-	10	Delete "retrieval" Insert "relief"
191	-	19	Delete "medium" Insert "immediate"
191	-	24	Delete comma
198	-	2	Delete "CCF" Insert "CC of"
198	-	16	Delete "year" Insert "years"
200	-	13	Insert "the" after "had"
202	-	14	Delete "Budnetz, B-u-d-n-e-t-z" Insert "Budnitz, B-u-d-n-i-t-z"
228	-	10	Insert "we" between "as" and "were"
231	-	10	Delete "normal" Insert "formal"
241	-	3	Delete "or" Insert "are"
244	-	9	Delete "hearts" Insert "hats"
244	-	10	Delete "hearts" Insert "hats"

CERTIFICATE

I certify that I have read this transcript and corrected any errors in the transcription that I have been able to identify, except for unimportant punctuation errors.

Date: 9-15-79

A handwritten signature in cursive script, appearing to read "J. Hendrie", written over a horizontal line.

Joseph M. Hendrie

PRESIDENT'S COMMISSION ON THREE MILE ISLAND

INTERVIEW OF JOSEPH MALLAM HENDRIE

Office of the Chairman
1717 H Street, N. W.
Washington, D. C.

Friday, 7 September 1979

The Interview of Chairman Joseph Mallam Hendrie was
convened at 10:10 a.m.

PRESENT:

KEVIN P. KANE, ESQ.
Deputy Chief Counsel, President's Commission on
Three Mile Island

MARK E. CHOPKO, ESQ.
Attorney for NRC; for Chairman Hendrie

JAMES A. FITZGERALD, ESQ.
Attorney for NRC

DONALD HASSELL
Legal Assistant to Chairman Hendrie

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WITNESS:

EXAMINATION:

Dr. Joseph Mallam Hendrie

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E X H I B I T S

HENDRIE EXHIBIT NO.:

IDENTIFIED

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P R O C E E D I N G S

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Whereupon,

JOSEPH MALLAM HENDRIE

was called as a witness and, having been first duly sworn,
was examined and testified as follows:

EXAMINATION

BY MR. KANE:

Q Would you state your full name for the record,
please?

A Joseph Mallam Hendrie.

Q Mr. Hendrie, have you had your deposition taken
before?

A Couldn't say for sure. Not recently at any rate.

Q Let me just refresh your recollection then as to
what we are doing here today.

You have been placed under oath and although we are
sitting here in the relative informality of this conference
room you should be aware that the testimony you will give
here has the same force and solemnity as if you were
testifying in a court of law.

My questions and your answers are being taken down by the
reporter here. They will be later reduced to a booklet form
and you will be presented with a copy of that booklet, given
the opportunity to read it and to make any changes you deem
necessary.

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1 However, it's important to avoid the necessity for
2 changes as much as possible by being as accurate and as precise
3 as we can right now.

4 For that reason, I would ask you at any point if you
5 don't understand a question or you feel some response needs
6 some clarification or amendment, please indicate that and we
7 will stop at that point and put that matter on the record.

8 Let me also remind you of the two basic ground rules in
9 any deposition. The first is that you respond audibly to my
10 questions since the reporter cannot take down a nod of the
11 head or a gesture and secondly, that you permit me to finish
12 my questions even if you know what the question is going to
13 be, which may often be the case.

14 The reason for that is that ~~the reporter~~ cannot take down
15 both of us at the same time and it makes for a confused
16 record if I am attempting to finish the question and you are
17 attempting to respond.

18 Do you understand all that?

19 A I do, indeed.

20 Q All right. Chairman Hendrie, I have here a
21 biography which I believe you have previously provided to
22 the presidential commission.

23 Let me just show you that and ask you if that is an
24 accurate summary of your educational and employment
25 background.

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1 A It is in part. If you would like a supplementary
2 document, why, that is also — the document I have just
3 given you is an entry listing sort of biography, and that may
4 be somewhat more complete than the press release.

5 Q Excellent. This bears the date of yesterday,
6 September 6, 1979.

7 A Yes, I went over it with my secretary a day or two
8 ago to check it out.

9 Q Let's have these documents marked collectively as
10 Exhibit 1 to the deposition.

11 (Deposition Exhibit 1 identified.)

12 BY MR. KANE:

13 Q Mr. Hendrie, you assumed the position of chairman
14 of the NRC on August 9th, 1977. Of course, you have had
15 previous involvement in nuclear regulation, as well as in
16 the private industry.

17 Could you please describe your duties in the position as
18 chairman of the NRC?

19 A I think you will have to delete private industry
20 from that.

21 Q I am sorry. That was with the Brookhaven National
22 Laboratory previously. All right, excuse me for that
23 inaccuracy.

24 Could you please, however, describe your duties as the
25 chairman of the Nuclear Regulatory Commission?

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1 A I can certainly try. First of all, the chairman
2 is one of a group of five presidential appointees who
3 collectively hold the responsibilities and authorities under
4 the Atomic Energy Act for the agency.

5 I act as presiding officer of that collegial body. I am
6 also nominally the chief executive officer of the agency, and
7 therefore, responsible for -- in effect, for the whole
8 operation of the agency, and deal as they occur with all of
9 the assorted questions of all natures that may come up
10 through the organization and fail to be dealt with
11 adequately at a lower level in the command chain.

12 That is, those things which rise to the top of the
13 agency, rise nominally to me for decision or mediating
14 between warring factions, or whatever the circumstances may
15 require.

16 Contacts outside the agency with the heads of other
17 government agencies. I am also nominally the spokesman for
18 the agency in appearances outside the agency, notably before
19 the Congress.

20 Why don't I quit there and let you go on with the
21 questions.

22 Q All right, yes. My next question was, I notice
23 that once or twice you mentioned that nominally you are the
24 chief executive officer of the Nuclear Regulatory
25 Commission.

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1 As those words are normally used, do you think you are
2 the chief executive officer of the Nuclear Regulatory
3 Commission?

4 A In this agency, we don't really have a chief
5 executive officer in the sense that cabinet departments have
6 a head, and that, for instance, the Environmental Protection
7 Agency has a head.

8 We don't even have a chief executive officer in the sense
9 that a number of other agencies that are headed by
10 commissions have a head where the founding statutes for
11 those other agencies in fact give pretty full administrative
12 powers to the chairman.

13 Here, we operated under — very much under a collegial
14 system which is derived from the Atomic Energy Act, the
15 original provisions, which provide that the Commission is a
16 body of five equal members and that the authorities and
17 power of the head of agency reside in the collegial action, and not
18 the chairman.

19 Now, there was a later amendment to the — to those
20 circumstances that came, I think a year after the Energy
21 Reorganization Act was passed and the NRC was formed.

22 Bill Anders got a provision passed which said that the
23 chairman is the chief executive officer and would deal with
24 administrative, personnel and budget matters.

25 However, it retains for the collegial commission an equal

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1 voice in the appointment of senior officers of the agency
2 and in budgetary matters, significant budgetary matters and
3 so on.

4 And that, coupled with the original "five equals"
5 language, and what I read as the inclinations, by and large,
6 of my colleagues, leads us to conduct a collegial operation.

7 So there is in — not a single head of the agency in the
8 sense that there is in most other sections.

9 Q The reason I raise that particular question,
10 Chairman Hendrie, is that several of the presidential
11 Commissioners have voiced an interest in precisely how the
12 NRC Commission interfaces with the daily operations of the
13 NRC staff in terms of licensing, in terms of regulating
14 currently operating nuclear power plants and all the other
15 matters in which the staff engages on a daily basis.

16 My impression is that the five Commissioners themselves,
17 including yourself, are relatively removed from the
18 day-to-day operations of the NRC staff.

19 Do you think that is a fair assessment?

20 A Well, in the sense that there are five of us and
21 2500 of them. And at 500 apiece, even if we divide up the
22 agency, there is still inevitably going to have to be a
23 certain distance from the day-to-day workings of everybody.

24 Now, there are some other considerations that enter that
25 also affect the situation. The notable one of those is that

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1 on all of the applications in review for construction
2 permits, those are all by law to go through the Commission's
3 adjudicatory chain, starting before a licensing board, to
4 talk to the staff about the merits of any of those cases is
5 a violation of the ex parte provisions of the Administrative
6 Procedures Act.

7 Q If I could interrupt you at that point just so I
8 can understand.

9 A Yes.

10 Q Am I correct in my understanding that the reason
11 for that is that the matter may well at some point reach the
12 Commission for final adjudication on appeal?

13 A Well, in the case of construction permit
14 applications, why, that's a -- those cases are required by
15 law to go before board.

16 So that in those cases, all of them, there will be board
17 decisions and a review by the Appeals Board. Whether or not
18 there are actually appeals from the Appeals Board to the
19 Commission, the Commission always has the right to reach
20 down into the case and say, "We want to look at this or
21 that," or the whole thing.

22 And eventually, at a minimum, we will sign off on a case
23 that's been through that adjudicatory procedure by saying --
24 well, typically, the counsel office will take a look at the
25 Appeals Board's conclusion, and so on. Then if there seems

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1 nothing untoward, recommend to the Commission that we not
2 review on our own motion.

3 And so typically, I think, Don, isn't that right? Don't
4 we always end up signing a sheet that says we agree there is
5 no review, as a minimum?

6 In some cases, obviously, we do. So at least for all
7 construction permit cases, that is, the front-end licensing
8 process, those are all from the day they are docketed,
9 formally in the adjudicatory process, and we know that the
10 Commission has the engagement that I have described.

11 For operating license cases, it's not quite so
12 automatic. There is then an adjudicatory procedure only if
13 there is a petition for hearing, so that on operating
14 license cases where there has been no filing for a hearing,
15 then we can talk to the staff.

16 But it's always a little difficult to keep sorted out
17 which case is and which case is not in the adjudicatory
18 chain. And I think most Commissioners recognize that if
19 they start to talk about the merits of any particular case
20 with staff members, that they are very likely to be getting
21 into an improper ground.

22 And so they will tend to either ask, or sheer back and
23 talk about it in a general fashion.

24 Q That tends to be somewhat frustrating on occasion,
25 I would think, isn't it?

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1 A It's enormously frustrating on occasion. It means
2 that Commissioners who are occasionally prodded by
3 congressmen, members of the public, learned counsel for
4 presidential commissions as to why they are not more down in
5 the bowels of ^{the} safety machine here, one of the answers is
6 that for certain of those getting down in the bowels of the
7 machine activities, it would be a violation of the United
8 States Code.

9 Q Does that —

10 A Which is a fairly compelling argument to me.
11 Now, I was talking about why aren't Commissioners closer
12 to the process, and that is one reason.

13 But it is by no means all of the reasons. It's simply
14 one in the array, because, indeed, on a safety problem, we
15 certainly discuss with the staff the generic aspects.

16 I don't have to discuss a problem of undersized
17 core-cooling pumps on Plant A in the context of Plant ^A B. I _R
18 can talk about it in the general case.

19 In the general case, that is certainly a permissible
20 discussion with the staff. So there are ways in dealing
21 with that, in part at any rate. Other reasons that
22 Commissioners are not all that close to the day-to-day
23 workings of the staff have to do with the fact that there is
24 a steady stream of papers that rise to the Commission level,
25 papers from the staff, incoming papers from outside,

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1 congressional correspondence and an assortment of other
2 things.

3 If you will, the incoming array of papers, queries,
4 condemnations, even occasionally praise, almost forms a
5 screen which you have to fight your way through in order to
6 get on out and talk to the staff, to begin to dig in detail
7 into what is going on.

8 Sometimes, pursuit of one or another of the issues in the
9 incoming paper in your office will lead you out into that —
10 into one of those expeditions.

11 But for the most part, if you want to know what the
12 staff's doing in some detail, you have to go out and talk to
13 them.

14 They are 40-odd minutes to an hour away, 40 minutes to an
15 hour back, or more at rush hour. So it is hardly worth
16 doing unless you can put a half day into it.

17 One of the things I tried to do when I came down here was
18 to get a day or a half day a week out in the staff offices,
19 and we went through that intermittently.

20 I go back into that program. I am not sure I have worked
21 my way all the way through the staff even yet. Certainly
22 all the major offices. Go and meet with groups of 10 to 20
23 at a time.

24 So an hour and a half, two hours at a shot in order to
25 have a reasonable chance to have a rd or two from

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1 everybody in the room and a good many words from the more
2 vocal ones.

3 But that's a time-consuming process. Commissioners find
4 their time heavily encumbered by the things that they have
5 to do in their offices, that is, try to deal with the
6 incoming decision papers and information papers and consent
7 papers, the correspondence from outside, and appearing on
8 the Hill.

9 I spend an awful lot of time in preparation for
10 congressional hearings, and even at congressional hearings.
11 It's not a, in fact, trivial amount of time.
12 actually, the hours spent on the Hill with the Congress.
13 So that Commissioners find their time very heavily used.
14 And I think most of us who do keep up with the paper work do
15 so by dint of a lot of late-hour work at home.

16 And I guess some of us don't quite keep up with the paper
17 work.

18

19

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1 Q Having seen over the course of the last three
2 months the volume of what some of that paper work is like, I
3 can understand that. I am curious about certain of your
4 remarks, Chairman Hendrie.

5 The first point that you made about the adjudicatory
6 process in which the Commission has confined themselves, on
7 occasion as posing a problem for Commissioners who may wish
8 to be involved in specific aspects of a matter which is in
9 the adjudicatory process.

10 Do you think that it would be a significant improvement
11 in the way the NRC goes about its business to separate the
12 adjudicatory function from the regulatory function for those
13 who are in charge? For example, to take the adjudicatory
14 function away from the Commissioners, or to leave the
15 Commissioners with that, but then to put the day-to-day
16 regulatory responsibility somewhere else in a single
17 individual, perhaps.

18 Do you think that would be an improvement over the
19 current situation, where you have got adjudicatory
20 functions and to some sense regulatory functions combined?

21 A I am not convinced that it would be an
22 improvement, in fact.

23 Q When you are faced with a situation as a
24 Commissioner where there is some question about how, for
25 example, the design review process is being applied in a

bwCk 1 specific case, to the extent that that matter is an
2 adjudication, I take it that as a Commissioner you are
3 precluded from addressing it on that specific basis?

4 A You can't address the merits of a case. That is,
5 I could not go down and talk to a Staff member about whether
6 and why Plant A met Appendix K and argue with him about it,
7 or tell him my views on it or something like that. But
8 there are a number of things I can do. First of all, I can
9 go and ask the Staff where that case is in the process.
10 That is, I can ask questions about where it is in the
11 procedure. If I find it's off track in a procedural sense,
12 I can certainly raise that issue and discuss it with the
13 staff managers who have allowed it to get into that shape.
14 I can also ask "What is the progress of your review of the
15 conformance with Appendix K?" Always be informed.

16 Q I see.

17 A But what I have to be careful to do is not then
18 start giving my opinion of things and attempt to influence
19 what is, after all, one of the parties in adjudication,
20 without the other parties being around and having
21 opportunity to get their point of view.

22 Q I take it -- I am sorry.

23 A So I am not completely helpless, and I don't want
24 to leave you with the impression from my remarks about the
25 ex parte rules that it is by any manner or means a total

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1 disablement. It is one of the circumstances that we live
2 with, however, and once in a while we find ourselves
3 gritting our teeth because we can't quite get down and argue
4 at an early stage about some of the particulars that we
5 might want to argue about.

6 Q I take it the tenor of your remarks in part to
7 this subject are to the effect that the Commissioners are
8 not on top of the day-to-day operations of the NRC on a
9 daily basis, necessarily. Who is, in the NRC?

10 A Well, I'd agree with the comment "not
11 necessarily." I am not sure that I would agree that the
12 Commission is — and the Commissioners generally are as
13 unaware of all of things that are going on as the question
14 might be read to imply. But it's certainly true that the
15 Commissioners, and I guess I would have to include myself
16 too, are not in what I would regard as an immediate total
17 control and cognizant situation with regard to all the
18 things that are going on out in the Staff.

19 I think I am probably rather closer to that than any of
20 the other Commissioners. Both because a good deal more
21 Staff contacts comes through my office, a wide variety of
22 administrative, procedural, budgetary, personnel matters,
23 get flagged into me for checking. Matters that I consider
24 minor enough so that I don't have to invoke the collegial
25 Commission. And also because, having been a member of the

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1 Staff myself for a while some years ago, and having been
2 around it for, I don't know, 20 years, off and on, I know it
3 a lot better than any of the other Commissioners.

4 Q However, again, what I think you have said is that
5 there is no one of the five Commissioners, including
6 yourself, who is in total, immediate control of the
7 day-to-day operations of the NRC?

8 A I think that is right. On the other hand, I
9 suspect that it may also be true of a number of other
10 government agencies.

11 Q Who, if anyone in the NRC is in total immediate
12 control of the day-to-day operator ?

13 A The Executive Director.

14 Q You would identify the Executive Director for
15 Operations --

16 A Yes.

17 Q -- Mr. Gossick, as being the one who is really in
18 total, immediate control?

19 A Yes.

20 Q I am curious about that because the Senate-House
21 Conference Report on the Reorganization Act of 1974 does
22 make the comment that the Executive Director for Operations
23 will be the coordinating and directive agent below the
24 Commission for the effective performance of the Commission's
25 day-to-day operational and administrative activities. And

1 you would say, then, that the Executive Director for
2 Operations is in charge of the day-to-day operational
3 activities of the Staff?

4 A Just so.

5 Q All right. The reason I make a point of that is
6 because in discussing the matter with Commissioner Ahearne,
7 I did come across a statement that he made in a speech just
8 recently. I believe it was in June of 1979 before the
9 National Energy Resources Organization. The comment he made
10 was that to cite a study which was prepared in 1976 by the
11 Joint Committee for Atomic Energy which concluded that the
12 Chairman of the Commission would not appear to have the time
13 to administer the Commission on a daily basis. Even if he
14 did, he is much too removed and isolated from the day-to-day
15 problems by the layer upon layer of management in the
16 organizational structure. The Executive Director for
17 Operations could not perform as an effective manager of the
18 Commission's offices, because the major offices can bypass
19 him and go directly to the Commission. No one is in a
20 position to manage effectively the Commission's
21 organization, and no one is so doing.

22 The statement made by Commissioner Ahearne in the speech
23 was, that statement was made in 1976, which would have been
24 before your time as Chairman. Commissioner Ahearne also
25 stated that he did not think the matter has changed.

1 Do you think that is an accurate description of the
2 current managerial structure of the NRC?

3 A I think it's a trifle starker than the reality.
4 But there is certainly no doubt that they have touched upon
5 some of our management problems. These are imposed upon us
6 by the laws under which we operate, and there is not much we
7 can do about them until we can get the law changed.

8 The situation with the Executive Director is as follows:
9 I have always regarded the Executive Director as the
10 day-to-day manager on behalf of the Commission of that large
11 Staff out there. The Commissioners and the Chairman
12 inevitably have a certain amount of turning outward from the
13 agency type of duties, Congress, and so on. We need an
14 on-the-job inside chief who manages the Staff on a
15 day-to-day basis. I regard the Executive Director as being
16 that person. And I regard the other office directors as
17 reporting to the Commission through him for normal purposes,
18 but with, as the statute reads, the right to come directly
19 to the Commission should they feel they are not getting
20 reasonable treatment from the Executive Director. That is a
21 view which is currently reflected in a manual chapter which
22 was adopted by NRC finally some months before I came here,
23 April or May of 1977, as I recall.

24 The Commissioners, however, themselves, I think you will
25 find a mixed view amongst the five sitting Commissioners,

bwCK 1 and it's quite clear that not all of us agree with that
2 definition. So those who do not agree, or who, for one
3 reason or another, are not fond of the present incumbent,
4 find it convenient to operate as though that were not the
5 case. In a — and since the Agency head is, in fact, five
6 people, that makes for a somewhat confused situation at
7 times. It leaves the Executive Director in some doubt as to
8 whether, in fact, he has the authorities that he ought to
9 have to run the Staff on a day-to-day basis. And, again,
10 that sort of indistinctness is reflected in some of our
11 management problems.

12 But it's also — it also ought to be noted that where
13 these problems appeared to me, and please note I said
14 "appeared," appeared to me to be acute during the first
15 couple of years of the NRC's existence, while I was not here
16 then, you see, my view of that is that of an outsider and
17 may not be totally accurate. But at least it appeared to me
18 that those problems were acute in the first couple of years,
19 because there were very strong and independent personalities
20 as heads of the major offices with that statutory authority
21 to go to the Commission. They were people from, for the
22 most part, outside the organization, and they felt they had
23 a statutory mandate to deal directly with the Commission,
24 and that the Executive Director was, well, maybe some sort
25 of chief of administration.

bwck 1 When they needed new office space, why he was the logical
2 person to go and deal with GSA to get it for them —

3 Q I see.

4 A — but was not in any sense directing and
5 coordinating their efforts.

6 Q Sort of an administrative manager.

7 A Yes.

8 Q As opposed to an operational manager?

9 A Just so. Now, what I want to note is that for
10 however correct or incorrect that view of mine from outside
11 the agency is, as to the first couple of years, I think I
12 ought to note for you that at the present time I think the
13 level of cooperation amongst major office heads between —
14 between them and with the Executive Director, is very
15 considerably better. There are also strong personalities
16 out there at the heads of those offices now, but they are
17 also people who have been on the Staff long enough to
18 recognize, to have known each other a long time, to
19 recognize that working together is an essential thing. And
20 I think there is much less of the kind of difficulty that —
21 than there was a couple of years ago. But it still is —
22 out the whole system continues to have these flaws in it in
23 a management sense, which leads to certain weaknesses.

24 Q Yes. I was curious about that, because we have
25 taken Mr. Gossick's deposition prior to today. And I spent

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1 some hours with him going over the functions of his office
2 as Executive Director for Operations and the types of
3 matters he becomes involved with. My impression was that
4 Mr. Gossick does not become too intimately involved with the
5 technical details of the ongoing daily work of the Staff.

6 A I think that's correct and is a function both of
7 the level of his job and the fact that he has to deal with
8 the whole large group of the Staff. And also Mr. Gossick is
9 an aeronautical engineer, a pilot, a military officer and
10 not a —

11 Q — nuclear person?

12 A — reactor engineer. So his personal expertise in
13 nuclear matters is acquired over the last five, six years
14 that he's been in the business and is not a fundamental
15 professional specialty.

16 Q As a result of that deposition, Chairman Hendrie,
17 and other things that I have heard and picked up over the
18 course of the last few months of this investigation, my
19 impression is that except as to very major matters which
20 might go to the Commission itself for a decision on a policy
21 basis, focusing instead on day-to-day matters in nuclear
22 reactor regulation, for example, decisions would be made by
23 Harold Denton, the head of that division, and not by
24 Mr. Gossick, the Executive Director for Operations; isn't
25 that an accurate statement?

bwc.

1 A Certainly.

2 Q The same would apply for Nuclear Reactor Research
3 and for Inspection Enforcement?

4 A Sure.

5 Q And for the other major offices?

6 A Absolutely.

7 Q Okay.

8 Chairman Hendrie, something which has come up several
9 times in the course of this investigation, and I believe
10 there was a comment made by Commissioner Trunk of the
11 Presidential Commission last week in the course of the
12 public hearings, when Harold Denton was being questioned
13 about how his proposal for the resumption of licensing
14 relates to trust, confidence in the way the NRC is going
15 about its business and, specifically, going about the
16 licensing of plants. In May of 1979, Congressman Ertel of
17 Pennsylvania testified before the Commission. He brought to
18 the Commission's attention at that time a letter which he
19 had written to you in conjunction with Congressman Goodling
20 in February of 1979, relating to concerns that both of these
21 Congressmen had over the current state of licensing of
22 nuclear power plants. I have a copy of that letter here.

23 I know you receive a lot of correspondence, but I wanted
24 to ask you if you recall receiving that letter?

25 A I don't recall the specific letter, but I am sure

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1 that it would have come across my desk. All incoming
2 correspondence makes at least one pass on the way in and one
3 pass on the way out. There was a fair flurry of
4 Congressional correspondence over the publication in about
5 mid-January, I think, of the Commission's conclusions
6 following the study by Hal Lewis and his group on the -- on
7 WASH-1400. So this would be one of those. I don't remember
8 it particularly.

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1 Q All right. Congressman Ertel explained to the
2 Commission in some written testimony that he submitted that
3 he had written this letter to express his concerns over the
4 safety systems of TMI-1 and TMI-2 which were among some 16
5 plants whose continued operation had been supported by low
6 accident probabilities of the Commission report.

7 He explained to the Commission that he received in
8 response a letter from you, dated March 15, 1979. And he
9 provided the Commission with a copy of that letter.

10 I would like to show a copy of that letter to you and ask
11 you if you recall having sent that letter in response? I
12 might note there are some marks on the copy of that letter
13 which are my own, and not yours.

14 MR. KANE: While you are reading that, if I can
15 have this letter, dated February 9, 1979, addressed to the
16 Honorable Joseph Hendrie from Congressmen Ertel and
17 Goodling, marked Exhibit 2 to the deposition, please.

18 (Exhibit 2 identified.)

19 THE WITNESS: Yes.

20 BY MR. KANE:

21 Q Do you recall sending this letter in response,
22 Chairman Hendrie?

23 A Well, not specifically. But it reads well and has
24 my signature at the end of it. Pretty clear that I read it
25 and approved and signed it.

rc CK 1 Q Good. All right. The letter is dated March 15,
2 1979, approximately 13 days before the accident at TMI-2.

3 On page 2 of this letter -- towards the top of the page,
4 you make the statement: "The designers, builders and
5 operators of these plants are required to have effective
6 quality assurance programs and their work is subjected to a
7 continuing licensing and inspection process by the NRC."

8 As of March 28, 1979, did TMI-2 have an effective quality
9 assurance program?

10 A I guess I would have to say I don't know, in the
11 sense that I don't recall recently enough, at any rate, to
12 have it in mind having read reports on inspections of the
13 quality assurance programs there.

14 Q All right.

15 A I think it is fair to say that, in a sense, you
16 hope that operators of nuclear power plants, like those of
17 us on the regulatory side, ought to be bright enough with
18 all the operating experience to anticipate problems, that it
19 wasn't up to that level.

20 Q As of March 28, 1979, was the work of TMI-1 and at
21 TMI-2 subject to continuous licensing and inspection process
22 by the NRC?

23 A Continuing in the sense that we don't stop looking
24 at a plant once it has an operating license. That is, there
25 is an inspection process which has gone on in the past.

rc CK 1 visitations from the regional office and once in a while, I
2 guess, from the headquarters I&E office for these plants.
3 And that continues throughout the life of the plant. So,
4 certainly continuing in that sense.

5 Q All right. I take it that, knowing what you know
6 today, you would not say that as of March 28, 1979, TMI-2
7 had an effective quality assurance program?

8 A Well, as I commented a moment ago, if one stands
9 back from the details, which would be — the details would
10 be looking at things that they do to keep their maintenance
11 in shape, their operators up to snuff, the plant records in
12 good shape.

13 You can go through and check this and check that, see
14 whether the log for a certain day was properly kept, see
15 whether the maintenance records show all of the maintenance
16 checkoffs that are required, and so on.

17 If you step back from that detail and say, look, the
18 reason you have quality assurance programs is not to be sure
19 that paper number 22 got laid in the right bin, although
20 that is part of it. The reason you have quality assurance
21 programs is to try to have the highest quality operation
22 that you can have.

23 And since we have had a major accident at Three Mile
24 Island, the process for whatever — for however good it may
25 have been wasn't good enough to catch that. So, in that

rc CK 1 overall sense, there's been a failure.

2 Q I take it you would agree, then, that although
3 there was this continuing license and inspection process by
4 the NRC as of March 28, 1979, that process was not
5 sufficient to detect these deficiencies in the quality
6 assurance programs at TMI-2?

7 A That's correct.

8 Q All right.

9 A little further down on the same page, in the third
10 paragraph down, you make —

11 MR. CHOPKO: Before we leave this, let me
12 interject. You are not asking the Chairman for his
13 conclusions as to the adequacy of the quality assurance
14 program under the NRC regulations which might be a subject
15 of some enforcement proceeding at NRC; is that correct?

16 MR. KANE: That's correct.

17 MR. CHOPKO: You are asking him for his general
18 impression and opinions?

19 MR. KANE: Based on what he knows.

20 MR. CHOPKO: Just general observations?

21 MR. KANE: General observations based on what the
22 Commissioner knows today about the situation at TMI-2. I
23 want to know what he thinks about the quality assurance
24 programs at TMI-2 as they existed on March 28, 1979.

25 MR. CHOPKO: You are not asking him about his

rc QK 1 conclusions?

2 MR. KANE: As to the violations of NRC
3 regulations, no.

4 MR. CHOPKO: As to the effectiveness?

5 MR. KANE: I am keeping in mind Chairman Hendrie
6 is not an attorney, so I am not asking for his legal opinion
7 on whether or not a violation of the regulations has taken
8 place.

9 I am asking, however, about the efficiency or
10 effectiveness of the continuing licensing and inspection
11 process that he refers to as being carried out by the NRC.

12 MR. CHOPKO: That was clear. I just wanted to
13 make sure that the record is clear that we are not speaking
14 to final matters which may come before the Commission at
15 some point.

16 MR. KANE: All right, fine. Yes, we are not.

17 BY MR. KANE:

18 Q A little further down on the same page, Chairman
19 Hendrie, you make the statement: "We believe this
20 regulatory system has served us well. It is an
21 exceptionally rigorous system and appropriate so in view of
22 the technology we regulate."

23 In the case of TMI-2, as of March 28, 1979, do you think
24 that the regulatory system administered and implemented by
25 the NRC had served the NRC well and was an exceptionally

rc CK 1 rigorous system?

2 A The fact that we had Three Mile Island, the
3 accident at Three Mile Island, means that there were
4 failures in the regulatory system. I have no hesitation
5 about saying that and I have said it on a number of
6 occasions.

7 The regulatory system should have picked up the precursor
8 events, the design characteristics which would lead into
9 this situation. The operator tendencies and inclinations
10 which were also a leading into the accident, and the
11 regulatory system did not do that.

12 There was clearly a failure in a number of ways at Three
13 Mile Island, and needs to be repaired forthwith, as I
14 believe we are doing.

15 I would also note, however, that this regulatory system
16 has produced upwards of, oh, now between 4-, we must getting
17 on now closer to 500 plant, large unit, that is, years --

18 Q Yes.

19 A -- of commercial operation. And Three Mile Island
20 is the significant -- is the accident that's occurred. Even
21 at Three Mile, it is also fair to note that, as best we
22 know, the public health and safety consequences from Three
23 Mile Island are probably a good deal less than many -- than
24 that of many other accidents that occur every year in our
25 society.

rc CK 1 So I would have to say at this point that that regulatory
2 system couldn't have been all wrong, or can't be all wrong.
3 And I do not believe, in fact, that it is all wrong. It did
4 fail at Three Mile, and in some rather significant ways.
5 And, as I say, we have to cure those.

6 But I think to regard the occurrence at Three Mile Island
7 as a demonstration that all of the aspects of regulation that
8 this agency's undertaken are wrong, either not done well or
9 are misdirected, simply won't stand against the facts.

10 Q Well, let me say at this point that was not the
11 question.

12 A No, no.

13 Q That was not my implication.

14 A No, I didn't mean to imply that it was.

15 Q But I did want to ask you whether or not, knowing
16 what you know today, whether or not as of March 28, 1979,
17 you feel that TMI-2 had been subjected to an exceptionally
18 rigorous system which had served the NRC's regulatory
19 purpose well?

20 And I take it from what you have just said, the answer to
21 that question would be no, today.

22 A Well, we had the accident, and there is no getting
23 away from that. So, it didn't prevent that accident, and
24 that's bad.

25 On the other hand, precisely the same system that had

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1 worked on Three Mile Island 2 has produced that overall
2 commercial plant record.

3 Q Yes. Now, I note from the letter you did go on to
4 state that, "While one must acknowledge strongly held views
5 to the contrary, over 400 reactor years of experience to
6 date give us reason to believe that we are on the right
7 track."

8 Now, again, knowing what you know today about the
9 situation at Three Mile Island Unit 2, what occurred during
10 the accident and what the general state of quality assurance
11 and training and other matters is or was at that facility as
12 of March 28, 1979, do you think that as to Three Mile Island
13 2, the NRC, as of March 28, 1979, was on the right track in
14 terms of its regulatory approach?

15 A I don't think the question can be answered yes or
16 no.

17 Q Okay.

18 A Because the two-valued answer applies either zero
19 or 100 percent. And I don't think it is a zero or 100
20 percent situation.

21 I am unprepared and unwilling to say yes, the regulatory
22 system on March 28, at TMI-2, was just dandy, because it
23 didn't prevent the accident and it certainly is flawed on
24 that account.

25 Q Okay.

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1 A I am unwilling, on the other hand, to say that on
2 March 28, we know the regulatory system at TMI-2 was no
3 good. That clearly isn't true.

4 Q All right.

5 A So, I think, in this case, a better question is,
6 was it good enough on March 28? And the answer is, while we
7 thought it was better than it turned out to be, it wasn't
8 good enough.

9 Q Okay. Maybe we can take a look at some ways in
10 which it might not have been good enough. Are you aware
11 that the NRC staff has now identified the Three Mile Island
12 Unit 2 accident as a class 9 accident in connection with
13 Atomic Safety and Licensing Board question propounded in a
14 proceeding relating to Salem Unit 1?

15 A Yes, I understand that's the case.

16 Q All right. I have taken a look at the proposed
17 annex to Appendix D of 10 CFR part 50, which addresses that
18 situation and which is discussed in the staff position, or
19 response to that question relating to whether or not TMI-2
20 is a class 9 accident.

21 As I read that proposed annex to Appendix D, class 9
22 accident is described as sequences of postulated successive
23 failures more severe than those postulated for the design
24 basis, for protective systems and engineered safety
25 features.

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1 The same annex goes on to comment that accidents in this
2 class are deemed to be sufficiently remote in probability,
3 that the environmental risk is extremely low, and for those
4 reasons, it is not necessary to discuss such events in
5 applicants' environmental reports.

6 Now the fact that TMI-2 happened, the fact that it has
7 now been identified by the staff as a class 9 accident,
8 would suggest that class 9 accidents are now going to have
9 to be considered in some fashion in connection with the
10 licensing of nuclear power plants. At least speaking as a
11 layman, that is what it seems to me to be.

12 I wanted to get your reaction to that, however.

13 A I think it is a question which is open.

14 MR. CHOPKO: Can we go off the record for a
15 moment?

16 MR. KANE: Sure.

17 (Discussion off the record.)

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THE WITNESS: I think I can make some what might be from your standpoint useful or at least interesting general remarks of a preliminary nature without tying myself into a situation where I would be foreclosed subsequently from dealing on the Commission level.

MR. KANE: For the record, let me see if I can capsule what I understand to be the difficulty here.

That is that insofar as this question has been raised in a Salem unit 1 proceeding, insofar as it may be the subject of rulemaking, it may reach the full commission at some point for some type of adjudicatory redetermination, is that an accurate statement? And for that reason, it's difficult or problematic for you to take any ultimate positions on that question.

Is that a fair statement, because it may compromise your ability to participate effectively in the adjudication?

MR. FITZGERALD: And all the information, isn't it?

BY MR. KANE:

Q However, you can make some general comments about the situation, the impact of this position that, as I understand it, for the first time we have had a nuclear incident which has been identified as a Class 9 accident, the impact of that upon the licensing process, I think the presidential commission would be very interested

ltCK 1 in that.

2 A Let me try my comment, then, with the
3 understanding that it is a preliminary view.

4 And also, the comment I have in mind is a rather general
5 one, and doesn't deal specifically with whether the staff's
6 conclusion that Three Mile 2 is a Class 9, what that means
7 for the process.

8 And the general comment is as follows. In establishing
9 regulations both for safety purposes and for environmental
10 purposes, one deals with a very wide spectrum of possible
11 events which could either affect public safety, or have
12 environmental, perhaps other environmental consequences.

13 The Atomic Energy Act says that we shall regulate so as
14 to provide adequate protection for the health and safety of
15 the public and the National Environmental Policy Act says we
16 will take environmental consequences of our actions, i.e.,
17 the allowing to be built and operated, plants, into account
18 in our decisions.

19 Now, neither the adequate protection language of the
20 Atomic Energy Act, or the sort of rule of reason with regard
21 to NEPA that's grown up that says take account of things
22 that are — may reasonably be expected to occur.

23 But you don't have to account for every possible
24 eventuality in the universe. The thrust of both of those
25 statutes is that, indeed, not every conceivable

1 physically possible event that anybody can devise need be
2 included in either the safety standards and regulations, or
3 the environmental protection standards and regulations.

4 You will also have, then, no matter how far out you go in
5 trying to take account, either in the safety review or the
6 environmental reivew, you are always going to have to come
7 to a point where you say, okay, we have now taken account
8 in a safety sense, for instance, of a sufficiently wide
9 range of the possible events, and we are going to regard
10 protection against those as the safety basis and write our
11 regulations on those grounds.

12 But there is always going to be a residual tail to the
13 distribution of events which you have not included in the
14 safety design basis.

15 And the same is true on the environmental side. Those
16 are what we call, in a general way, Class 9 accidents or
17 events. And what I suggest to you is that in the real world
18 of real people on the real Earth, there will always be for
19 every technology and every action of man a set of Class 9
20 events.

21 Q However, I take it the idea behind the Class 9
22 event, from the language which I just read from the annex,
23 proposed and next to Appendix D, was that the reason those
24 events are described and designated as Class 9 events is
25 because the probability of their occurrence is deemed

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1 sufficiently low —

2 A Just so.

3 Q — that they are so remote in possibility that it
4 is not realistic or practical to design against those
5 accidents or to consider them in approving the design of a
6 plant.

7 A Just so. When I talk about a residual tail on the
8 spectrum of events which are not covered, the implication is
9 that those things are, indeed, pretty unlikely to occur, and
10 that even though if they occurred the consequences might be
11 severe, you are prepared to say that because of their — the
12 unlikelihood of it, that you have indeed produced adequate
13 protection, or whatever the words in the particular case may
14 be, if we go to airplanes or so on.

15 It's clear that whether it's explicit or implicit, all of
16 our regulatory activities, and indeed, all kinds of
17 activities, have a Class 9 analogue to them.

18 And, as you say, there is the implication that the
19 Class — that it's okay in the real world not to worry about
20 and design against or have fixes for the Class 9 events
21 because they are sufficiently unlikely that we are willing
22 to just accept that risk.

23 Q Now — I am sorry.

24 A Well, go ahead. I was going to anticipate where
25 you were going and that is not a very good thing to do. I

1tCK 1 suspect, in these circumstances.

2 Q What I was going to say is that that leads me at
3 least to one of the crucial questions on this subject matter
4 which is, doesn't the fact of the occurrence of the Three
5 Mile Island unit 2 accident place that entire procedure that
6 you just described into a state of doubt at the present
7 time?

8 A No.

9 Q It does not?

10 A What I was just describing to you is a fundamental
11 human condition which goes well beyond nuclear technology,
12 but extends in fact to certainly all of the technological
13 aspects of our civilization and lives, but goes on into
14 other areas as well.

15 What I am just saying is that in all human activities, we
16 protect ourselves against a certain range of possibilities
17 and don't protect ourselves against everything in that
18 general sphere that's possible.

19 Q Doesn't the fact of the occurrence of the Three
20 Mile Island unit 2 accident prove that events placed in the
21 Class 9 category can, in fact, happen?

22 A That was understood on day 1.

23 Q But not proved until we had a Three Mile unit 2
24 accident?

25 A That's, I am afraid -- perhaps it's the difference

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1 between us as lawyer and engineer that leads me to find that
2 a peculiar statement.

3 Q Perhaps it is --

4 A When I have said to you that there is, under the
5 way in which we regulate, and, as I have said, under the way
6 in which a good deal of modern society operates, there is a
7 residual tail to the spectrum of events which we are not
8 taking into account in our designs.

9 Q Yes. Well, let's see if --

10 A What I understand is that, indeed, those events
11 can happen. If an event is physically possible, it can
12 happen.

13 Q Yes.

14 A Now, let me go on. For me, events are not divided
15 into those that we are familiar with on a more or less
16 daily, or general experience basis, that can happen, and
17 those events that we don't experience on a general
18 experience -- in our general experience, or on a daily
19 basis, can't happen, and are regarded as can't happen.

20 That is, I would judge, perhaps the kind of view of the
21 world that, I don't know, you might have, or at least people
22 who have not thought much about risk in a quantitative sense
23 would have.

24 I don't think of it that way. Activities have a risk
25 spectrum associated with it, with them. And some activities

ltCr 1 have low-probability occurrence, and others have
2 high-probability occurrence.

3 And then with each of these, there is a consequence,
4 which again may be high or low. So the fact that there is a
5 set of Class 9 accidents out here which we have decided not
6 to take into account certainly and explicitly doesn't mean
7 they can't happen.

8 All it means is that we have some reason to believe that
9 the probability of these events is low enough so that we are
10 willing not to take specific measures to deal with them.

11 Now, what does TMI-2 mean with regard to our drawing of
12 that line?

13 Does it now mean that all events out here in Class 9
14 have to be taken into account? That is the implication of
15 your question, and that is clearly not sensible.

16 Does TMI-2 mean that the probability of large meteorites
17 landing on nuclear power plants is now increased? No.
18 Clearly not.

19 What do I say now with regard to the Class 9 event which
20 is a large meteorite landing on a nuclear power plant? I
21 say TMI-2 hasn't got a damn thing to do with that.

22 And that will continue to be a Class 9 event, I have
23 quite high confidence, okay?

24 Q Will multiple failures continue to be Class 9
25 events?

1tCK 1 A Good, now we can talk about some more sensible
2 things.

3 Q Because I really, you know.

4 A Yes.

5 Q You took an implication from my question which was
6 not there.

7 Let me say that a favorite expression among lawyers,
8 Chairman Hendrie, is that anything is possible. It's a
9 standard objection made in the deposition when a witness is
10 called upon to speculate upon the unreal world.

11 Obviously, anything is possible. Were we talking in a
12 pre-TMI-2 context about the nature of the Class 9 accidents,
13 I think your point about the fact that it doesn't mean it
14 can't happen is well taken.

15 Once it has happened, however, I think we have to focus
16 on what that does to the approach previously taken. And
17 specifically in the context of single-failure analysis
18 versus multiple-failure analysis.

19 A Yes. Well, let me talk about several points that
20 flow from that, and are connected with that.

21 First of all, I should note that the fact that TMI-2 has
22 happened makes that event or other multiple-failure events
23 neither more nor less probably than they were on the 27th of
24 March, okay?

25 What we can say in a statistical sense is that we have

1 one more data point than we had before, and to that extent,
2 perhaps, the range of our uncertainties is narrowed a little
3 bit.

4 But one event is not -- that is not very good statistics.
5 But that's a sort of parenthetical remark and is not really
6 to the point of where you are going.

7 What do we do about multiple failures is the question,
8 and is the single-failure approach that we have used so
9 long, what does it mean for that?

10 The single-failure approach, you must understand, is a
11 poor man's way of doing reliability engineering and risk
12 analysis in the sort of detailed way that was done in
13 WASH-1400, the reactor safety study.

14 It's a technique which has the merit of great simplicity
15 and easy understanding by all the practitioners, on our
16 side, the industry's side and wherever, whereas, reliability
17 engineering and good practitioners of the sort of risk
18 assessment that was done in WASH-1400, that is a high art.

19 If one looks at systems which have been analyzed on a
20 single-failure requirement basis, that is, the requirement
21 that, for the whole range of transients and accidents
22 considered, that the system, there be a clear path to no
23 consequences, taking into account not only the initial event
24 and anything that flows directly from it in a causal
25 fashion, but also an arbitrary single-active failure.

ltCK 1 If one looks at systems that are designed and analyzed on
2 that basis and looks at them with the more sophisticated
3 techniques of risk analysis, and that was precisely what the
4 WASH-1400 exercise was all about, to do that, one finds that
5 the single-failure criteria, in fact, does go quite a long
6 way in giving you a reliable and failure-resistant system.

7 But because it is a very simplified first cut at detailed
8 reliability engineering, or risk assessment, it does come up
9 short of where we would like to be.

10 A comment which I must characterize with an asterisk,
11 post-TMI view of J. M. Hendrie, okay.

12 I am not sure I would have said that before Three Mile
13 Island, although I think it's been clear for several years
14 that, over the long term, the regulatory system ought, as we
15 develop the practitioners and the techniques, ought to turn
16 more and more to the use of the more sophisticated
17 risk-assessment techniques, rather than that single-failure
18 determinative sort of thing.

19 Now, all right, let me go on and then say about multiple
20 failures. One of the characteristics of the growth of
21 safety philosophy in reactors over the past 25 years has
22 been a tendency to concentrate on large-, and then, for the
23 most part, low-probability sorts of accidents.

24 There has been less emphasis on plant transients where I
25 characterize a transient as something you reasonably expect

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1 to see in the operating life of the plant, at least once or
2 twice, whereas an accident is something you hope you don't
3 see, the analysis of transients and small accidents has
4 tended to be regarded historically in the practice of
5 nuclear safety as less ~~noticeable~~^{noticable} than the analysis of grand
6 catastrophes, if I can characterize it that way.

7 So there has been, until rather recently, less emphasis
8 than is clearly warranted by the fact that these transient
9 events are guaranteed to occur.

10 That is sort of the way we define them. And small
11 accidents are much more likely to occur than big ones,
12 because there are so many more ways that small accidents can
13 occur.

14 And one of the conclusions in fact of WASH-1400 in the
15 '73 to '75 time frame was that that was the case.

16 And the reading of that group was that the major risk,
17 the major piece of the overall risk of nuclear power in fact
18 lay within this area of transients and small accidents,
19 coupled with the assorted things that can go wrong when
20 things begin to go wrong.

21 The regulatory staff did not move very rapidly to
22 assimilate that lesson. There was a recognition in the
23 staff that, indeed, that was probably true, but back in
24 those days, we were all so pretty heavily hung up with
25 trying to upgrade the whole system and deal with a lot of

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1 what seemed at the time to be larger problems, and there
2 always seemed to be a shortage of resources to put into
3 transient and small accident analysis.

4 At the present time, the staff is in, I think, rather
5 better shape to do that work than it was in '72, '3, '4,
6 when I was down here, and clearly, we haven't done well
7 enough.

8 And it seems to me that what we will have to do is to
9 come as rapidly as we are able to develop the expertise in
10 the licensing staff, and the regulatory framework in which
11 -- which to anchor it, we will have to come toward a
12 reliability engineering, that is, a risk assessment sort of
13 analysis, because that's a technique in which you can, in
14 fact, take account of multiple failures, and it
15 gives mechanism and a discipline in your thinking and in
16 your logic to sort out which are the multiple failures you
17 ought to worry about and which are the ones which again fall
18 down into that class of really very unlikely events.

19 Possible, but very unlikely, for which you can reasonably
20 say that you will accept that risk.

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sonCK 1 Q I take it in the meantime, the 70, some 70
2 operating plants that we currently have in the United States
3 have been licensed pursuant to the older --

4 A Just so.

5 Q -- single analysis type of system.

6 A That's exactly right.

7 Q I take it also that the plants which are coming up
8 for operating license issuance before the end of this year,
9 1979, have been reviewed, at least in the past, and will
10 continue to be reviewed up until the time of their OL
11 issuance under essentially the same kind of system, single
12 failure analysis approach; is that right?

13 A In large part. But I should add a couple of
14 things to the answer. The first is that, oh, since about I
15 guess maybe '72, '73, or thereabouts, the licensing staff
16 has been using ^amore ^{of}sophisticated sort of analysis, failure
17 mode and effect analysis, one of the aspects of reliability
18 engineering, in parts of the review.

19 So that there are some elements of that kind of look
20 being taken at this.

21 The second thing is that I think one of the early things
22 that we want to do, and that I have been encouraging the
23 staff to do, is to go through the operating plants on a --
24 at least a rough cut event tree analysis basis and see if we
25 can -- and see if we identify some places, some additional

1 things we ought to fix. I think if we had done that before
2 Three Mile Island, we might have well have caught the
3 difficulty, because to a fully-experienced practitioner of
4 the event tree art, the Three Mile Island accident stood out
5 like a sore thumb.

6 Q Why was not that done before Three Mile Island?

7 A I guess because the staff, the licensing staff,
8 was reluctant to change, and also found it difficult to
9 change from the, what I will call the classical review
10 system and approach to this new system, because it was —
11 because it was new, because it required extensive additional
12 learning, I guess, because there is a considerable inertia
13 built into any regulatory scheme.

14 With the agonies of trying to ~~re~~regulate some things in
15 other areas at the present time, and because the licensing
16 staff has generally been in a pretty hard-worked condition,
17 and I know when I was running the engineering staff, why,
18 the — and the Rasmussen Study was going on at that time,
19 and I had some contact with the people in it. And the tack
20 they were taking was very attractive intellectually. It
21 provided ways to deal with some things which, clearly, in
22 the system we had going, we couldn't deal with them easily.
23 But the difficulties of getting all of the regulations
24 rewritten, doing all of the preparatory work that would have
25 to go into that, and then getting everybody trained up and

sbnCK 1 so on, seemed like a practically insurmountable workload to
2 add on to what was already a condition in trying each day to
3 get through the day's work.

4 It left everybody staggering around late in the evening
5 and a little dazed. So it just seemed like, my God, not
6 this year. Maybe next year we will be in better shape and
7 we can think about it and do it then. And I wouldn't be
8 surprised but what that has sort of continued to be the
9 feeling even down to the present.

10 Q Is that bothersome to the staff, that in the
11 meantime they were being called upon to license more plants
12 with the thought in mind that they would really like to make
13 some changes, that they just weren't finding the time to be
14 able to implement.

15 A I guess you will have asked a number of staff
16 people that and they obviously are entitled to answer for
17 themselves. As an ex-staff member, I would answer for
18 myself.

19 Q Well, I would also -- excuse me. I would also
20 like to ask you on the basis of your observation of the
21 staff in the time that you have been with the NRC as a
22 chairman of the Commission.

23 A Well, I think it comes out the same way.

24 Q All right.

25 A I don't think the licensing staff, by and large,

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1 felt that the approach that they were using was a faulty
2 one. I think that there has been a general recognition
3 in the licensing staff that the risk assessment sort of
4 approach, by virtue of giving you a way of attacking all of
5 the higher risk, that is, higher probability sequences in an
6 orderly way, and figuring out which they are in a number of
7 events, I think that has been recognized but I think people
8 have looked and sort of felt as I do that we ought to get
9 more and more over on to that system as the methodology
10 develops further and as we are able to train more people.

11 But in the meantime, the system we have got is an
12 adequate one, and the basis that we are using is an adequate
13 one.

14 Q Do you think that consensus prevails today among
15 the NRC staff?

16 A I think there is a much greater feeling of urgency
17 about improving the ability to treat transient and small
18 accident sorts of events, and to treat them in a way that
19 does take into account, you know, multiple events. And
20 try to sort out what are, if any, are the high probability
21 multiple event sequences that could lead to trouble.

22 Q But in the meantime, as I take it, the staff is
23 proceeding with the -- at least in terms of the plant
24 licensing, the basic document is the standard review plan,
25 which I understand you are a principal architect.

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1 A Yes, I invented it.

2 Q I take it one of the tenets of the standard review
3 plan is single failure analysis, is it not?

4 A Yes.

5 Q Okay.

6 A I think there is some talk in some of the standard
7 -- I remember some -- building in some failure modes and
8 effects language over in the auxiliary branch, parts of the
9 standard review plan. In part that was to create a toe in
10 the door.

11 Q Yes, I am curious about that. You have referenced
12 twice now the failure modes and effects analysis being used
13 in some fashion in connection with plant review. A document
14 that's been provided to the Presidential Commission by
15 Mr. Basdekas, who is a reactor safety engineer with the NRC,
16 makes reference to that situation.

17 This is a document we have already marked as Exhibit 3 to
18 the deposition of Commissioner Kennedy. In looking it over,
19 the left-hand side of the page refers to safety concerns
20 expressed by Mr. Basdekas in 1976, specifically relating to
21 the necessity to subject control system failures to a
22 failure modes and effects analysis for normal operation.

23 And the left-hand side of the page references the
24 determination by the NRC staff in 1976 that, although
25 analyses have not been performed for these postulated

sbnCK 1 sequences of events, the staff believes that the
2 consequences would be acceptable and much less severe than
3 those calculated for postulated accidents.

4 On the right-hand side of the page references that in
5 April of 1979, in the post-TMI-2 era, B&W has now committed
6 to the NRC to conduct a failure modes and effects analysis
7 on its integrated control system and, in May of 1979, the
8 staff, in new regulation 0560, the Tedesco Report, has made
9 the recommendation that all classes of operating plants
10 should be reanalyzed using failure modes and effects
11 analysis.

12 Again, reading it as a layman, the purport of the
13 comparison here seems to be that in 1976, failure modes and
14 effects analysis in this regard was proposed and was
15 rejected by the NRC at that time, or not followed-up on.
16 And now in post-TMI-2 era, in 1979, it is being followed-up
17 on.

18 Again, just as a layman, that suggests that there were
19 certain approaches in the design process which were not
20 deemed necessary by the NRC. They now do appear to be
21 deemed necessary and advisable.

22 MR. CHOPKO: I will object to a line of
23 questioning based on this document. Not without voir dire,
24 have you undertaken any independent assessment to ensure --

25 MR. KANE: That the quotations are accurate? Yes.

sbnCK 1 MR. CHOPKO: Have you undertaken any review to
2 ensure that those quotations are in proper context?

3 MR. KANE: Yes, and I have with me here today, if
4 you would like to examine them off the record we can take a
5 break, Mr. Chopko, new regulation 0153 excerpts and new
6 regulation 0560 excerpts, in order to satisfy you in that
7 regard, because I know you raised that question the other
8 day.

9 Do you want to take a break off the record for ten
10 minutes?

11 Let's have marked as Exhibit 3 the letter dated March 15,
12 1979, to Congressman Ertel from Chairman Hendrie, which we
13 have been discussing previously in the testimony as being in
14 response to a prior letter, dated February 9th, 1979, which
15 we have already marked as Exhibit 2.

16 (Hendrie Exhibit 3 identified.)

17 (Recess.)
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1 MR. KANE: Back on the record.

2 BY MR. KANE:

3 Q Chairman Hendrie, I have had a discussion off the
4 record with your counsel, Mr. Chopko, here concerning this
5 document that has been marked previously as Exhibit 3 to the
6 deposition of Commissioner Kennedy, and specifically as to
7 the foundation for some of the statements which appear on
8 this document, in discussions with Mr. Chopko, I think we
9 have managed to nail down that some of the statements on
10 this document do appear in NUREG 0153.

11 Some of the statements on this document on the right-hand
12 side do appear in NUREG 0560. And some of the quotations
13 which appear, particularly on the left-hand side of the
14 document, do not appear to be in NUREG 0153, and there
15 appears to be a miscitation to a portion of NUREG 0153,
16 specifically the following language: "Although analyses
17 have not been performed for these postulated sequences of
18 events, the staff believes that the consequences could be
19 acceptable and much less severe than those calculated for
20 postulated accidents."

21 That language does appear in attachment 1 to NUREG 0153.
22 It references a paragraph in NUREG 0153 itself which does
23 not contain that language.

24 MR. CHOPKO: Moreover, the language, the portion
25 of NUREG 0153 where that particular sentence appears was

1 prepared by Mr. Basdekas.

2 MR. KANE: Yes.

3 MR. CHOPKO: And the quotation which he refers to
4 in this Kennedy Exhibit Number 3 does not appear on my
5 examination in the text of NUREG 0153.

6 Moreover, the document that Mr. Basdekas prepared and
7 provided to the Kennedy Exhibit Number 3 contains a title
8 which is different than the title given in NUREG 0153.

9 It also appears that —

10 MR. KANE: Which title is that?

11 MR. CHOPKO: The title in Exhibit 3 says safety
12 implications have control system failures and plant
13 dynamics. The title in NUREG 0513 is "Systematic Review of
14 Normal Plant Operations and Control System Failures."

15 MR. KANE: The title in attachment 1 to NUREG
16 0513?

17 MR. CHOPKO: Is also "Systematic Review."
18 Mr. Basdekas suggests it should be changed to read as he
19 would want it to read, the title which appears on this
20 document.

21 My trouble with the document is its foundation, as you
22 point out. We will stipulate that the first two paragraphs
23 in particular which contain the recommendation of
24 Mr. Basdekas are quoted verbatim in NUREG 0513.

25 MR. KANE: All right.

rc CK 1 MR. CHOPKO: We will not stipulate as to the
2 context since we do not have the memoranda prepared by
3 Mr. Basdekas. We cannot stipulate and refuse to stipulate
4 to any discussions that Mr. Basdekas may have had with
5 Mr. Rusche who is mentioned in this document or any other
6 members of the staff or senior staff.

7 MR. KANE: Do you also stipulate that the
8 statement which appears on right-hand side of the document
9 as a quotation from NUREG 0560 in fact appears in that
10 publication?

11 MR. CHOPKO: I have no objection to your
12 representation of that, about NUREG 0560, the Tedesco
13 report. My trouble is with the context of the document, the
14 various underlying documents not being there, the trouble
15 with miscitation in the documents and the trouble with
16 self-serving characterizations in this exhibit.

17 You are free to ask your hypothetical questions about the
18 recommendations and ask the Chairman his impression of that.

19 MR. KANE: So we can have the record entirely
20 clear on this matter, let's have marked at Exhibit 4 to this
21 deposition collectively the following documents: excerpts
22 from NUREG 0153 in which the handwriting on the document
23 is — has been added by my staff.

24 But otherwise, this is an excerpt from NUREG 0153,
25 composed of some seven pages. Also another excerpt from

15 06 04

rc CK 1 NUREG 0153 which is attachment 1 in that publication
2 composed of two pages.

3 MR. CHOPKO: Which was evidently prepared by
4 Mr. Basdekas.

5 MR. KANE: Right, we don't know that one way or
6 the other.

7 MR. CHOPKO: But the context indicates it was more
8 likely than that?

9 MR. KANE: We just don't know.

10 The last is an excerpt from NUREG 0560, which is five
11 pages in length.

12 Let's have that marked collectively as Hendrie Deposition
13 Exhibit 4.

14 MR. CHOPKO: Can we have the testimony of
15 Mr. Basdekas also included in that exhibit?

16 MR. KANE: All right, fine. We will be, in
17 effect, combining an exhibit from another deposition into a
18 current exhibit. No problem.

19 Let's include then as this packet of documents we are
20 marking as Exhibit Number 4 the actual document that I am
21 now questioning Mr. Hendrie about. It is entitled "A
22 Comparative Listing of Safety Concerns Before an Action
23 After the TMI Accident."

24 It, as far as I know, was prepared by Mr. Basdekas and
25 supplied to the Presidential Commission. It has previously

c CK 1 been marked as Exhibit Number 3 to the deposition of
2 Commissioner Kennedy.

3 (Exhibit 4 identified.)

4 BY MR. KANE:

5 Q Chairman Hendrie, before we went off the record,
6 and before I had this conversation with your counsel
7 concerning this document, I was about to state that it does
8 appear to be from the nature of two recommendations which
9 are juxtaposed, one on either side of the page, that in
10 1976, Mr. Basdekas did recommend that failure modes and
11 effects analyses be utilized in connection with integrated
12 systems controls.

13 And that pursuant to the recommendation on the right-hand
14 side of the page, excerpted from NUREG 0560, in May of 1979,
15 in fact, the NRC did recommend that its licensees, that all
16 classes of operating plants be reanalyzed pursuant to
17 failure modes and affect analysis.

18 Now, assuming that is the case, and I note, I am asking
19 you to make that assumption for purposes of this question,
20 why does it take so long for the NRC to act on that kind of
21 recommendation?

22 A Well, I judge from the comments that are on this
23 single sheet that I am looking at which Mr. Basdekas has
24 listed as a countering argument of the regulatory staff, he
25 cites a sentence which reflects their view that —

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1 MR. CHOPKO: Off the record.

2 (Discussion off the record.)

3 THE WITNESS: Back on the record then.

4 Assuming the correctness of the assignment here, the
5 staff believed that the — apparently believed that the
6 accident sequences that were taken into account in the
7 safety analysis adequately covered failure — control system
8 failures.

9 And that there was no need, then, to make a full analysis
10 of control system failures and modes. So that would be the
11 reason that staff concluded that they need not implement
12 Mr. Basedekas' recommendation.

13 BY MR. KANE:

14 Q In light of the fact that the recommendation to in
15 fact conduct that type of analysis is now being made on
16 NUREG 0560, as reflected on the right hand side of the page,
17 I take it that would indicate that the staff of the NRC now
18 feels that those analyses should be performed?

19 A At least for the B&W, the Babcock & Wilcox
20 integrated control system.

21 Q All right. Your counsel, Mr. Chopko, so we can
22 complete our record on this, has pointed out to me a
23 statement which appears at page 22-3 of the excerpt from
24 NUREG 0133, which forms a portion of the documents we have
25 marked collectively as Exhibit 4, the following statements

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rc CK 1 appear: Failure modes — failure mode and effects analyses
2 have been initiated under a technical assistance contract to
3 better identify design requirements for systems needed to
4 mitigate the consequences of transients and accidents.

5 In addition, a separate contractor study of control
6 system failure is being performed for the staff to determine
7 the immediate and cumulative effects on the reactor coolant
8 pressure boundary and challenges to the reactor protection
9 system resulting from control system failures.

10 The results of these analyses would provide a basis for
11 any needed new review and safety requirements related to
12 control system malfunctions.

13 Are you familiar with those studies having been conducted
14 since 1976, Chairman Hendrie?

15 A No, I am not.

16 Q In any event, from the fact that the
17 recommendation is being made in May of 1979, that B&W
18 licensees, that is, licensees with B&W plants, conduct this
19 analysis, it apparently was not done in connection with
20 integrated control systems: is that right?

21 A I would judge so.

22 Q All right. Chairman Hendrie, you made a comment
23 before which I have heard several times before, that the
24 effects of the Three Mile Island accident were not severe in
25 terms of the environmental impact, as far as we know, in

rc CK 1 terms of the health impact and things of that nature.

2 That relates to a question which you were asked by the
3 Congressman — I take that back. That you were asked in
4 June of 1979 by a congressional committee. I believe it was
5 Mr. Udall's committee. And that was, how close do you
6 believe we came to having a core meltdown?

7 On June 6th, 1979, you submitted written responses to the
8 Udall committee. And you answered that particular question
9 as to how close do you believe we came to having a core
10 meltdown at TMI-2 with the response that, "I cannot tell at
11 this point. It was a possibility. But I think considerable
12 analysis will have to be done to make a reasonable estimate
13 as to how close it was."

14 Now, that was in June of 1979. Do you have any further
15 response you could make to that question now?

16 A No, I think that continues to be the case.

17 Q So you really feel that even now, you cannot tell
18 how close we came to having a core meltdown at TMI-2?

19 A Not in any detail.
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1 Q Can you express that in any further detail than
2 you did to the Udall Committee on June 6th, 1979?

3 A I am not sure that I could do more than make some
4 general comments, which I am willing to do.

5 One of the things I expect we are going to learn over the
6 long term out of the Three Mile 2 postmortems is going to be
7 a good deal more about how likely meltdowns are.

8 You must remember that in regulatory staff practice in
9 safety analysis, we have generally assumed that where the
10 core, where a core might be uncovered and cooling is not
11 rapidly supplied in copious amounts, that the uncertainty of
12 that situation then has led the safety analysis people to
13 assume, well, that's an indeterminate situation.

14 We are not sure. We will conclude that it might lead to
15 a core meltdown. Judging from what we know at the present
16 time, I would say that the Three Mile damaged core has
17 revealed a remarkable resistance to melting in circumstances
18 in which the heat transfer and transport phenomena were at
19 much lower levels than we would have expected possible and
20 still have a core that, even though damaged, remains without
21 significant melting and at least more or less in the same
22 general volume within the vessel.

23 I think we may find out of the long-term detailed
24 analyses of the core and the conditions and so on, that
25 these machines are rather more resistant to core -- core

ItCK 1 melting than we had thought before.

2 But the more specific answer, how close were we to a
3 meltdown, I think it will still be a long time before we are
4 able to feel that we have a sound analysis there.

5 Q Chairman Hendrie, yesterday morning there was a
6 meeting of the Commission and I take it there was a briefing
7 by Harold Denton on a number of matters, including the
8 subject of the resumption of licensing of nuclear power
9 plants, is that correct?

10 A True.

11 Q As a matter of fact, I had a transcript delivered
12 to me last night and I have spent some time going through
13 that transcript.

14 I would like to establish for you on the record some of
15 the elements of the presentation that was made at that time
16 in terms of the broad subject matters. In addition to a
17 transcript of the briefing session, I was also provided by
18 the NRC with copies of a, what I believe are a number of
19 different slides that were presented during that briefing
20 session.

21 I would like to go through some of them with you just to
22 establish that this was, in fact, your understanding of what
23 was being presented to the Commission.

24 One of the slides was apparently entitled "Elements of
25 Proposed Plan."

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1 Do you recall seeing those elements presented to the
2 Commission during that briefing session yesterday?

3 A Yes.

4 Q I believe this reflects, then, that the changes
5 that are to be made would be implemented on operating plants
6 by January 1, 1981, and then as to other plants there are,
7 the category A, items by January 1, 1980 on or prior to oral
8 issuance.

9 The intent is to obtain Commission approval of the
10 staff's first completed OL review which I understand would
11 probably be Salem Unit 2, is that right?

12 A Possibly. I am not quite sure which one is likely
13 to get here first, but I think Salem Unit 2 is a strong
14 possibility as the lead.

15 Q What about the North Anna plant, is that another
16 one, Unit 2, that may come up approximately at the same
17 time?

18 A I guess on North Anna, there is a board proceeding
19 in being, which means that the board has to complete its
20 deliberations before it could come on.

21 Q All right. The last item on this elements of
22 proposed plan is that it's assumed that proposed short-term
23 actions would not prejudice the implementation of
24 recommendations for -- from ongoing investigations.

25 I take it that language would include the investigation

ItCK 1 by the presidential commission?

2 A Absolutely.

3 Q Was it your conclusion at the meeting that these
4 proposed short-term actions would not prejudice
5 implementation of recommendations from ongoing
6 investigations such as the President's Commission?

7 A Yes.

8 Q What knowledge do you have about what
9 recommendations are or are likely to be made by the
10 presidential commission?

11 A Since any comment of mine about what the
12 President's Commission might recommend would be sheer
13 speculation, why, I just wouldn't propose to — wouldn't
14 propose to guess.

15 Q Fine.

16 A I think in a general way, one can anticipate a
17 number of items which I am sure the President's Commission,
18 as well as the staff and practically everyone else who has
19 studied the subject would think appropriate.

20 But I am not going to speculate on details.

21 Q I think that is what I was after.

22 For you to comment in any direct way on the
23 recommendations to be made by the presidential commission,
24 you feel you would have to speculate, is that right?

25 A Clearly.

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1 Q All right. Another copy of a slide that I was
2 provided with is entitled, "Near-term Licensing Decisions."
3 And as far as I understand this, this refers to facilities
4 for which operating license or construction permit or
5 limited work authorization will be coming up for final
6 decision within the near future.

7 Do you recall seeing that particular slide?

8 A Yes.

9 Q Does that accurately categorize or characterize
10 the information that is being imparted there? These are
11 plants that are going to come up for some final action in
12 the near future?

13 A Yes.

14 Q I see Salem 2, North Anna 2, Diablo Canyon and
15 Sequoyah, coming up for operating licenses in October of
16 1979 and November of 1979.

17 Does that characterize correctly the information?

18 A That's what the slide says.

19 Q Okay. That is what you understood it to mean.
20 Diablo Canyon, then, I take it, is among these plants for
21 which Mr. Denton proposes to resume licensing.

22 Are you aware that Jesse Ebersole of the ACRS has raised
23 a generic safety issue concerning interference with natural
24 circulation cooling by either condensable or noncondensable
25 gasses in all pressurized water reactors?

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1 A I know that Jesse has. I don't recall the details
2 of his comment, but I think he's raised questions about
3 natural circulation. And I know that other people of the
4 staff, the ACRS, have raised questions and are thinking
5 about natural circulation.

6 Q It's — it was Mr. Ebersole's contention before
7 the presidential commission in hearings last week that the
8 phenomenon which he is discussing is one in which under
9 certain conditions natural circulation could be blocked by
10 condensable or noncondensable gasses and that the matter
11 could be handled in connection with the B&W design by
12 placing an event in an appropriate location on the
13 candycanes as they are called.

14 But that the matter could not be very readily addressed
15 in the Westinghouse design of the steam generator because of
16 the large number of U tubes which appear in that design.

17 Are you familiar with those details of Mr. Ebersole's
18 contentions?

19 A Yes. That's, as a matter of fact, in discussions
20 of the B&W steam generators versus the steam generators of
21 the other PWR vendors.

22 There is normally a good deal of discussion about the
23 dry-out times which are then connected with the normal
24 operating secondary water inventories in the steam
25 generators.

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1 And there is considerably less discussion of the possible
2 meanings of these two different configurations for such
3 things as venting of noncondensables or steam.

4 Q Right.

5 A And I think Jesse, among others, has pointed out
6 that one of the features of the once-through steam
7 generators is that it is ventable. The systems are not at
8 present equipped with such vents, and those vents are one of
9 the measures that Harold Denton felt personally were very
10 desirable. And is planning to go ahead with.

11 Q Yes, I have seen some reference to high-point
12 venting. Is that what you understand to be Mr. Denton's
13 addressing of Mr. Ebersole's concerns?

14 A Well, I think the answer is yes, that is what
15 Harold means.

16 And I think he has in mind a number of things. Not only
17 the clearing of gasses that might impede natural circulation
18 in the primary system, wherever the high point may be, but
19 also, Harold, I am sure, has very keenly in mind the
20 concerns we had about being able to get the hydrogen bubble
21 out of Three Mile Unit 2 for several days there before it
22 became clear that the natural processes of solution and
23 dissolution of hydrogen were going to take care of it for
24 us.

25 So he also wants a vent on the top of the reactor vessel

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1 which could be controlled from the control room.

2 Then you would have a straightforward way of dealing with
3 that situation, should it ever arise again.

4 Q Yes. I am interested in that point because
5 Professor Taylor, of the presidential commission, did have a
6 conversation with Mr. Ebersole at the last set of public
7 hearings concerning whether or not his concern in this
8 regard is addressed by this recommendation by the NRC, that
9 this high-point venting capability be addressed.

10 And as I recall, Mr. Ebersole's suggestion was that that
11 does not address his concern because in most designs,
12 including the B&W design, the high point which presumably
13 would be chosen for the installation of the venting would be
14 the top of the pressurizer and that would be just fine, but
15 that that would not address the steam generator.

16 And the loops within the steam generator with which he is
17 most concerned. Specifically, the candycane in the B&W
18 design, and the U tubes in the Westinghouse design.

19 Are you familiar with that distinction between the two,
20 or does that distinction exist?

21 A Yes, I think you have got several things mixed up
22 together here. First of all, Jesse's comment about possible
23 difficulties with natural circulation in the U tube steam
24 generator designs would be only addressed in part by
25 high-point vents, because there is no reasonable way to get

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1 in and put vents on each of the the, I don't know, it must
2 run to 10,000-odd tubes in one of these steam generators at
3 the top of the U tubes.

4 The vents that are going to be required by Harold would
5 be not just on the pressurizer. There is, after all,
6 already on all plants a venting system on the pressurizer,
7 controllable relief valves are a vent on the pressurizer
8 space.

9 Harold's requirement would be for a controllable vent,
10 remotely controllable vent on the top of the reactor vessel,
11 and at other high points as available in the primary system.

12 Now, that doesn't — it deals partly with Mr. Ebersole's
13 concern in that if you have high-point vents and
14 top-of-the-vessel vents, you have increased your ability to
15 remove from the system, when needed, noncondensable gasses
16 or steam.

17 But it indeed doesn't do anything for those U tubes in
18 the steam generator. And you have to depend there on the
19 ability to, for steam, to condense the steam, which is a
20 perfectly feasible way of dealing with the steam in a steam
21 generator, and for the noncondensables, with the ability
22 just to have enough thermal driving force to move them on
23 through and entrain the bubbles in the liquid and carry them
24 on out of the steam generator.

25 Q When you say thermal driving force, do you mean

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ltCK 1 natural circulation?

2 A Yes.

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1 Q But Mr. Ebersole's concern, I take it, is that
2 these noncondensable gases lodging in the U tubes would
3 interrupt or prevent natural circulation?

4 A Well, it depends upon the balance of pressures
5 that are present in the system. For natural circulation you
6 have a thermal driving head which derives from the
7 difference in density between cold fluid on one side in the
8 downcomer, in the downcoming parts of the system, and the
9 lighter and, hence, relatively rising or floating hot fluid
10 elements in the upwardgoing parts of the system. If that
11 thermal driving head, creates natural circulation, is
12 stronger than the tendency of the noncondensable gases
13 to stay up at the top of the U tubes, then you get natural
14 circulation.

15 And if it's not, you don't. In an actual situation
16 the -- you are probably somewhere in between and will clear
17 some tubes and circulate through some tubes, but perhaps not
18 all tubes.

19 It depends very much on how much noncondensable gas there
20 is, and whether it's all gotten over into the steam
21 generator.

22 I think the Staff has concluded that you would get
23 natural circulation in the U tube steam generators. They
24 are set up with the appropriate elevation differences. And
25 because in the steam generators you have this very large

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1 multiplicity of parallel flow path, each one not large in
2 diameter, but a great number of them, there is a much
3 smaller likelihood that you will block the whole system,
4 because it means you somehow have to find a magical way to
5 get the noncondensable gas, a) have a lot of it, and b) get
6 it distributed so that it's blocking all of the tubes.

7 You see, the heat transfer capacity in a steam generator,
8 because it, after all, is rated for whatever the full power
9 rating of the plant is, is enormously larger than is
10 required to remove afterheat in the natural circulation
11 system.

12 So you don't need nearly all of those tubes, but only a
13 few percent of them.

14 Q As I understand the implementation table which was
15 attached to Mr. Denton's memorandum of August 20 to the
16 various NRC Commissioners, the reactor coolant system
17 venting that you have been referring to is set up such that
18 designs shall be submitted pursuant to implementation
19 category A, which is by January 1, 1980, or prior to
20 operating license, whichever is later, and installation is
21 to be completed under Category B, that is, complete by
22 January 1, 1981.

23 Does that mean, then, that until January 1, 1981, the NRC
24 is not going to require that the reactor coolant system
25 venting changes that Mr. Denton has recommended be

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1 implemented?

2 A True.

3 Q All right. And if I understand again this
4 document that is entitled "Near-Term Licensing Decisions,"
5 the decision on the operating license for Salem 2 and for
6 the North Anna 2 is projected to come up sometime in October
7 of '79 and the decision on Diablo Canyon and Sequoyah,
8 November 1979. That means then that the Commission will be
9 called upon to decide about the issuance of operating
10 licenses for these plants before there is any requirement
11 that this reactor coolant system venting be completed; is
12 that right?

13 A The answer is yes. I would just note that the
14 projected dates at which time the Staff might be prepared to
15 come forward and recommend issuance of an operating license
16 to the Commission, those dates are inevitably very
17 speculative. There are a number of steps that would have to
18 be taken in the Staff's view on those plants, and whether or
19 not one or another of them might come up in October is a
20 question.

21 If you read the transcript and managed to stay with it all
22 the way through to the end of it, you will note some
23 discussion in there where it's pointing out that, from what
24 I have been hearing, I concluded that it was rather unlikely
25 that they would see any of those propositions much before,

1 oh, around the first of November.

2 Q Yes. So we can be clear on the record about that,
3 I have read the transcript and I think I understand it. But
4 let me see if I can't paraphrase it. That is that the
5 Commission determined that it would permit Mr. Denton to
6 resume the licensing activities, but that at least for the
7 first operating license to be issued pursuant to that
8 resumed procedure, the matter would go to the entire NRC
9 Commission for a determination, and it was guesstimated that
10 that would not happen until something like the first part of
11 November of 1979; is that right?

12 A In general; but let me make a couple of comments.
13 First of all, when you say "resume licensing," what
14 Mr. Denton is doing is, as some of the Staff groups under
15 his command finish some of their short-term Three Mile
16 Island associated studies and get them published, he's
17 beginning to turn some of those people back to the
18 processing of applications. So that what you characterize
19 as "resume licensing," is, in fact, simply to resume work in
20 preparation for recommendation to the Commission that a
21 license could be considered.

22 Q All right.

23 A Secondly, I would note that I believe my reading
24 of the Commission and my own inclination is that rather more
25 than just the first OL would be seen by the Commission, I

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1 think it is going to be appropriate for the Commission to
2 retain an immediate control on the issuance of all licenses
3 for some time.

4 Maybe we will make that permanent, as a matter of fact.
5 But it clearly is more than just saying, "Well, bring the
6 first one up, and after that, never mind."

7 Q Another copy of an apparent slide which was
8 discussed in the transcript that I read of the briefing
9 session, and I would like to show you, appears to set forth
10 a resolution of the Presidential Commission on August 23,
11 1979, concerning its request to the NRC to consider the
12 viewpoints of the Presidential Commission and the testimony
13 at the previous hearings of the Commission in connection
14 with any plans to resume licensing activities.

15 Was that slide presented at the briefing session?

16 A I assume it was. I must say, I don't remember it
17 explicitly, because I had a copy of the Resolution that had
18 been forwarded to us from the Presidential Commission.

19 Q Do you understand --

20 A So I was reading what I will call the "original,"
21 rather than Harold's slide. But it looks like it, and I
22 assume he, barring typos and mishaps in the transcript, that
23 he's correctly --

24 Q This was generally your understanding of the
25 resolution of the Presidential Commission?

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1 A Yes. I read the transcripts of those meetings on
2 wednesday and Thursday of, what, three weeks ago or two
3 weeks ago.

4 Q Yes. You did read the transcripts themselves from
5 August 22 and August 23?

6 A Yes, they were forwarded to us, as you will
7 recall, at the order of your Commission with a request that
8 we take a look at those so we would have an opportunity to
9 read for ourselves the comments of the Presidential
10 Commissioners about the matter.

11 Q I also have here another slide which Mr. Denton
12 apparently presented, a copy of the slide Mr. Denton
13 apparently presented at the briefing session, entitled
14 again, "Presidential Commission on the Accident at
15 Three Mile Island." It has five phrases or statements with
16 question marks at the end of them, and it appears to be an
17 attempted summary of the points raised by the Presidential
18 Commission during the hearings.

19 Do you recall that slide being presented at the briefing
20 session? And do you understand that to be a summary of the
21 points raised by the Presidential Commission?

22 A Yes, I recall the slide. And I recall that
23 Mr. Denton's characterization of it was that he didn't
24 propose to be making an authoritative or necessarily full
25 reflection of the sort of collective views of the

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1 President's Commission, but rather was trying to
2 characterize in a limited number of items for the NRC
3 Commissioners what he sensed were the — some of the basic
4 points that seemed to be being raised with him at the
5 meeting with the President's Commission.

6 Q Do you think this document, after having read the
7 transcript, does adequately state in summary form the
8 concerns raised by the Presidential Commission concerning
9 the resumption of licensing activities?

10 A Yes, I think it's a not unreasonable shorthand
11 version of at least most of the central concerns, as I
12 recall them from reading the transcript.

13 Q Did any of the other NRC Commissioners read the
14 transcripts of the August 22 and 23 hearings of the
15 Presidential Commission?

16 A I really couldn't say.

17 Q All right. In your reading of those transcripts,
18 did you get the impression that members of the Presidential
19 Commission are concerned that there are outstanding
20 substantial safety questions concerning operating nuclear
21 power plants in this country? And let me just end it there
22 at that point. Did you get that impression from reading the
23 transcripts?

24 A I think, yes. I don't recall from the transcripts
25 whether or not there was much, or any, discussion of

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1 specific items. But there certainly was the thrust that,
2 from members of the President's Commission, that these
3 plants have been renewed and licensed to operate under a
4 system about which they have some doubts. Perhaps in
5 general, but if not in general, at least in specific areas.
6 And I judge that there would probably be recommendations
7 forthcoming from the President's Commission about that.

8 Q Do you recall any concern about the nature of the
9 once-through steam generator utilized in the B&W design
10 posing safety issues in terms of being less forgiving when
11 an error is made by an operator?

12 A I don't remember specifically. I think that could
13 very well be the case.

14 Q All right.

15 A But I -- it's been almost two weeks, since I read
16 the transcripts. And I have also in the same time frame
17 read, I would shudder to estimate how many thousands of
18 pages of other material in which that matter's come up.

19 We will now -- wait a minute. Let's see. Ebersole was
20 one of the people testifying there. And I remember
21 specifically in Ebersole's testimony these comments about
22 the once-through steam generator with regard to the venting
23 possibilities. So I do remember that clearly. And I would
24 have expected, in fact, that it would have appeared in other
25 places, as well.

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Q Do you recall the Presidential Commissioners
expressing any concern about the state of operator training
at existing nuclear power plants in this country?

Handwritten marks:
A
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rc CK 1 A I am sure they must have.

2 Q All right. Do you recall the Presidential
3 commissioners expressing any concern about the use of a
4 single failure analysis in connection with approving the
5 plant designs of existing nuclear power plants in this
6 country?

7 A I think my answer here has to parallel with the
8 previous answer. That is, I have been reading a lot of
9 stuff in which all of these things are cited in one way or
10 another, and it is hard to sort out exactly where particular
11 things appeared and in which of these documents certain ones
12 appeared.

13 I would certainly have expected that to be part of the
14 discussion with Denton, Stello, other NRC witnesses,
15 certainly germane to the discussion they were having.

16 Q Lastly, do you recall there being any concern
17 expressed by the Presidential commissioners in connection
18 with the safety related concept by which the NRC determines
19 what it will examine in connection with a plant design and
20 what it will not examine?

21 A Yes, I think I remember some discussion about, in
22 particular, the pressure relief valve and why wasn't that
23 safety related in the array of safety related items in a
24 plant versus nonsafety related.

25 Q Yes. Commissioner Kennedy commented yesterday in

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rc CK 1 his deposition that the -- described that particular point
2 as being a Catch-22 in connection with Mr. Mattson's
3 explanation to the Presidential Commission that the PORV was
4 not safety related because it had a block valve behind it
5 and the block valve is not considered safety related because
6 it had a PORV in front of it.

7 Do you think that is a Catch-22? I don't know how to
8 define Catch-22. Do you know what I mean?

9 A Yes. Sure.

10 Q Do you think it is a Catch-22? In the safety
11 related system as used by the NRC in approving plant
12 designs?

13 A Yes, I do.

14 Well, let me put it a little different way because I
15 don't know exactly what you have got in mind when you say a
16 Catch-22.

17 Q I meant something that doesn't make sense, and the
18 reason it doesn't make sense is because it is justified on
19 the basis of something else that doesn't make sense, and it
20 is a circular situation.

21 A Well, let me comment generally about the matter of
22 safety related items and nonsafety related items here. The
23 classification of an item as safety related in a plant
24 design means that attached to that item and its supporting
25 equipment, there must, in the array of design procurement

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1 and so on, be a whole train of much increased quality
2 assurance measures. It means that a higher grade of
3 specification will have to be made for it.

4 The equipment will have to be qualified for its service
5 by prototype testing or other means. So that when the plant
6 designer attempts to set down his list of safety related
7 equipment, he's really dividing all of the gear in the plant
8 into classes with regard to the standards that apply to them
9 and the specifications and testing backup that must apply to
10 them.

11 I suspect, I don't know for sure, but I will speculate
12 that the pressure relief valve and the safety valves, but at
13 least the pressure relief valve, was not classed as safety
14 related in the same -- for the same sorts of reasons that
15 the control systems we discussed earlier were not classified
16 as safety related systems.

17 And that is on the basis that the safety related parts of
18 a plant had to be set up in such a way that they could
19 accommodate failures of the nonsafety related equipment.

20 And it is that sort of a -- that's sort of the basis for
21 the judgment.

22 Now, the plants are set up to deal with loss of coolant
23 accidents, and the equipment which is provided to deal with
24 loss of coolant accidents is classed as safety related. A
25 failure of the pressure relief valve, either in an

rc CK 1 inadvertent opening, ^{or} having properly opened in some
2 circumstance, a failure to reclose when it should have,
3 leaves the plant with a, what is called a small break, that
4 is, just a small opening in the primary system, a small
5 break loss of coolant accident configuration.

6 And I think the judgment about relief valves was probably
7 based on the proposition that the plants are required to
8 have full spectrum loss of coolant accident protection by
9 safety related equipment.

10 Now, that provides what I would guess to have been the
11 rationale for not including relief valves in the category of
12 safety related equipment.

13 I will further remark that my own judgment, obviously
14 extensively enforced by the Three Mile Island accident, but
15 also because there has been a lot of experience with
16 inadvertent opening and some failures to reclose of both
17 relief and safety valves, that I have concluded that these
18 items ought to be classed as safety related, and that we
19 ought to regard the inadvertent opening, or the failure to
20 reclose of a relief valve as a thing that is likely to
21 happen.

22 That is, to put it in the plant transient category and
23 require that the design be such that that is accommodatable
24 with the safety related systems without any untoward effects
25 even affecting operability of the plant, let alone more

rc CK 1 serious effects in terms of plant worker or public health
2 and safety.

3 Q All right. If I can come back to where we began
4 in this discussion, in your reading of the transcripts, in
5 your appreciation of some of these concerns of the
6 Commission as I have raised, others of which you do not
7 specifically recall from the reading, did you at all get the
8 impression that the Presidential commissioners do not wish
9 to see an increase in the number of operating plants in the
10 United States until these outstanding safety issues have
11 been resolved?

12 A Yes.

13 Q Is there anything on this piece of paper,
14 entitled "President's Commission on the Accident at Three
15 Mile Island," that has these five statements underneath with
16 question marks which, to your understanding, embodies or
17 paraphrases that concern of the Presidential commissioners?

18 A Well, I think the first one about sufficiency
19 includes it.

20 Q You would understand that to mean sufficiency of
21 recommendations for increasing the number of operating
22 plants; is that how you understand that?

23 A Let's see. Let's go back and recap a little bit.
24 I understood the question to be which of these things seems
25 to me to cover the concern of the commissioners. ^{what}~~first~~
^

rc CK 1 outstanding safety matters ought to be dealt with before
2 further licensing.

3 And one of them I would still count is the sufficiency.
4 That is, are the measures proposed by the staff at this
5 time, which go not only to operating plants, but also to
6 plants in the licensing chain, sufficient to deal with those
7 concerns?

8 It seems to me that it also arises under the adequacy of
9 technical fixes item, and the adequacy of present licensing.

10 Q What is your understanding from reading the
11 transcript that the Presidential commissioners were
12 concerned about having these problems addressed and resolved
13 before the number of operating nuclear plants in this
14 country is increased?

15 A Yes.

16 Q All right. Is it your understanding that the
17 recommendations made by Mr. Denton and discussed at this
18 briefing session yesterday will resolve those problems about
19 which the Presidential Commission is concerned before the
20 number of operating nuclear reactors in this country is
21 increased?

22 MR. CHOPKO: Objection. I think what the
23 President's Commission had in mind was that the Commission
24 consider their views.

25 MR. KANE: I didn't suggest anything different.

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(The reporter read the record as requested.)

2

MR. KANE: I didn't say anything about what the Commission expects, what the Presidential Commission expects of the NRC.

3

I am just asking for Mr. Hendrie's understanding of the recommendations made by Mr. Denton, and whether or not they will resolve those problems about which the Presidential Commission is concerned before the number of operating plants in this country is increased.

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THE WITNESS: Let's see. Now, after all of that, let's see if I can keep the question sufficiently in mind to answer it.

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I am not sure I can make a yes or no answer. Let me elaborate a little bit. I can't tell, and I know Harold recognizes that he cannot tell what all of the concerns of the Presidential Commission are. I think we will have to await the formal report to have those enunciated in a clear and unambiguous fashion.

What Harold has said is that he believes that the staff has identified those items which the staff believes ought to be upgraded or changed or fixed in some fashion before the staff would find, in its judgment, that an adequate protection level has been established for any plant proposed for operation, at least.

I think it is Harold's conclusion, he said it pretty

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1 clearly, that he believes that other recommendations as may
2 flow from the Presidential Commission, or indeed from other
3 investigations, our own, for instance, that none of these
4 are -- would be foreclosed by going ahead with licensing.

5 And he has commented that, in his view, if one is willing
6 to accept the continued operation of the 70 licensed or 68
7 nominally operating units, that with regard to the
8 relatively small number of plants which are now essentially
9 completed, that those don't constitute an addition which is
10 an unacceptable burden to the public good.

11 Q Let me ask you, in that regard, I have heard
12 Mr. Denton make that statement before and I believe he's
13 suggested that he does not see any rational way to say that
14 it is okay to leave the 70 plants that exist operating, and
15 yet refuses, at this time, at least, to license the few that
16 are still coming up.

17 And I have difficulty understanding that because I know
18 that the Presidential commissioners are concerned about
19 existing safety issues in connection with the existing
20 plants. And it seems to me that with every plant in
21 addition that is permitted to go into operation, to the
22 extent that those safety issues apply, they apply to that
23 plant as well and that is simply increasing the risk that
24 some of these safety issues, before they are resolved, will
25 result in another accident.

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Now, I take it you do not understand it that way.

A I don't find, for myself, I don't find a particularly significant increase in risk to add Salem 2 to the operating list with Salem 1 operating.

Q Okay.

A If we did not believe that the risk in fact is rather small with Salem 1, it would be our responsibility to shut Salem 1 down.

Q Let me ask you this: Knowing what you know today, did the opening and going critical and going into commercial operation of TMI Unit 2 substantially increase the risk of an accident at TMI Unit 2?

A Well, plants that don't operate don't have any fission products in them, don't constitute any risk.

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1 Q So they can't have the kind of accident that
2 occurred at TMI-2.

3 A Every time you put a plant in operation there is
4 some increment which is required under the law to be
5 acceptably small. And that judgment is one which we must
6 make here.

7 Q We spent some time talking about single failure
8 analysis and how that may have to be modified or changed in
9 some ways in light of the recognition of TMI-2 as a Class 9
10 accident. Do any of the recommendations discussed by
11 Mr. Denton at the briefing session yesterday with the NRC
12 address the changes to be made in single failure analysis in
13 the approval of plant designs?

14 A No.

15 Q Let's come specifically to the implementation of
16 the recommendations made by Mr. Denton and considered
17 yesterday in the briefing session.

18 MR. CHOPKO: Let's be clear that the President's
19 Commission on the record through its chairman states that it
20 has no objection to making changes and implementing these
21 recommendations on already operating plants.

22 MR. KANE: Indeed. I think, yes, that falls right
23 in line with the point that I -- that we were discussing
24 before. As to existing plants in this country, the feeling
25 I have, and I can't speak for the Presidential

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1 Commissioners, but the feeling I have is that the attitude
2 is that, well, they are there. We will do the best we can.
3 The question becomes, should the number of those with which
4 the NRC has to deal, with which the Presidential Commission,
5 as long as it is in existence, has to deal, should that be
6 increased?

7 Now, specifically coming to the implementation of
8 Mr. Denton's recommendations, I have here —

9 MR. CHOPKO: Pending applications?

10 MR. KANE: Yes, on pending applications. I have
11 here a copy of Enclosure Number 6 to the August 20, 1979
12 memorandum that was submitted by Mr. Denton to the
13 Presidential — to the Nuclear Regulatory Commission and
14 also a document entitled, "Implementation Requirements Prior
15 to OL Issue."

16 I just want to be sure I understand this correctly.
17 Mr. Denton at the briefing yesterday, as I understand it,
18 represented to the NRC Commission that, although Enclosure
19 Number 6 sets a number of items to be completed according to
20 designated schedule, he has since the preparation of this
21 Enclosure Number 6 determined that some of the items on that
22 list should actually be implemented before any operating
23 license is issued for pending applications.

24 So that the document we have here, "Implementation
25 Requirements Prior to OL Issue," is in effect an amendment

sbnCK 1 and a change to the schedule set up in Enclosure Number 6
2 for some of the recommendations referenced in that
3 enclosure.

4 BY MR. KANE:

5 Q Is my understanding correct on that?

6 A Well, Enclosure 6 lists a number of items, and
7 then gives an implementation category for them. A's and B's.
8 And the footnote says for Category A, implementation
9 complete by January 1, 1980, or prior to operating license,
10 whichever is later.

11 Q If I understand it, what Mr. Denton has decided is
12 that certain of those items in Enclosure 6 should instead be
13 implemented before the operating license is actually issued,
14 regardless of its designation according to a different
15 schedule under Enclosure 6 itself?

16 A Well, certainly for the Category A items, the
17 footnote says do it before an OL where an OL has not
18 issued. So that any of the items on this list entitled
19 "Implementation Requirements Prior to OL Issue," which are
20 also listed as Category A in Enclosure 6, then that is the
21 same conclusion.

22 Now, there may be some other things on the Implementation
23 Requirements Prior to OL Issue Sheet, which have some other
24 category designation in Enclosure 6. I wouldn't say that
25 that was not the case. I haven't compared them in detail.

sbhCK 1 Q I really don't want to address the items that have
2 been identified as requirements prior to operating license
3 issuance. I think that does not address my concern, which
4 is putting operating plants into -- or granting operating
5 licenses to nuclear power plants at which some of the
6 requirements have not been implemented yet.

7 So what I have done in my own handwriting in going
8 through Enclosure 6 is to circle the items that have been
9 designated under implementation requirements prior to OL
10 issue. I don't want to address those. But I do want to
11 look with you at the other uncircled items which appear to
12 be subject to the schedule designated in Enclosure 6.

13 Emergency power supply requirement and relief and safety
14 valve testing is subject to category A which, as you say, is
15 a category which states that the items shall be complete by
16 January 1, 1980, or prior to the operating license,
17 whichever is later.

18 I take it then that it is theoretically possible for
19 facilities to receive operating licenses, and as to
20 requirements that are in Category A, if they have gotten
21 their operating license before January 1, 1980, they may
22 well have not implemented that requirement yet, such as
23 emergency power supply requirement, and relief and safety
24 valve testing.

25 Am I reading that schedule correctly?

sbnCK 1 A I don't seem to come out the same place you do.
2 And I don't know whether —

3 Q Okay, let me see if I can come back on it.

4 A I don't know whether I am being dense here or
5 what. Look.

6 Q Let me see if I can understand it.

7 A Let's talk —

8 Q Category A requires completion by January 1, 1980
9 or prior to the OL, whichever is later. That means if a
10 plant gets its OL in June of 1981, it could take up to June
11 of 1981 before implementing a requirement in category A?

12 A Yes.

13 Q However, if it's gotten its OL before January 1,
14 1980 —

15 A It will have to have implemented that
16 requirement.

17 Q By January 1, 1980. The phrase is, January 1,
18 1980 or OL, or prior to OL, whichever is later in time.

19 A Oh, I detect the difference. I detect the
20 difference. Yes.

21 Q So, in other words, if you got your OL in November
22 of '79, you would not have to implement this requirement
23 until by January 1, 1980?

24 A Yes.

25 Q That comes later.

sdnCK 1 A Yes, I see. Yes.

2 Q For example, let's take the Salem-2 plant.

3 A Yes.

4 Q The projection in the document we have looked at
5 was October 1979. I realize that may well not happen then
6 or November or December or whenever.

7 A To be sure.

8 Q But if it did happen in November 1979, it would
9 not have to meet Category A requirements at that time. It
10 would have until January 1, 1980 to in fact implement the
11 requirements in Category A?

12 A Yes, that would be apparently true with regard to
13 those Category A items in Enclosure 6, which are not on the
14 other list.

15 Q That would include emergency power supply
16 requirement, relief and safety valve testing, page 2,
17 recombiners, systems integrity for high radioactivity.
18 Plant shielding review, improved iodine instrumentation.
19 All those are in Category A.

20 On-site technical support center and on-site operational
21 support center; those are all in Category A. Now there are
22 also some in Category B.

23 B is implementation complete by January 1, 1981. So, for
24 example, many plants getting their operating licenses either
25 this year or sometime next year would not have to comply

sbnCK 1 with these Category B requirements until the end of 1980, or
2 January 1, 1981. Some of those Category B requirements are
3 complete — I take that back; are implementing plant
4 modifications for plant shielding review. Implementing
5 plant modifications for post-accident sampling. Completing
6 installation of containment pressure monitors. Completing
7 installation of containment water level monitor and
8 containment hydrogen monitors, and completing installation
9 of the reactor coolant system venting we mentioned before.

10 Mr. Hendrie, do you think it is prudent and wise to
11 license further plants that do not yet have these
12 recommendations implemented in this fashion?

13 A I don't have a difficulty with it for the
14 following reason; the Category A items are items which
15 relate to safety protection in the event of plant
16 accidents. What we are concerned about is ^{fission}~~sufficient~~
17 product inventory in the plant.

18 Now, the aperture which this schedule presents for a
19 possible, and I emphasize possible, only, OL before January
20 1, 1980, the time frame is such that a plant, a hypothetical
21 plant which might fall into that category, would not have
22 enough fission products in it by January 1, 1980, to matter
23 much one way or the other.

24 When he made this schedule up, Harold and his licensing
25 staff had in mind that we are now late in 1979, that when

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1 you issue an operating license finally for a plant, it is
2 only at that time that the operators of the plant are
3 allowed to put the fresh fuel, begin to load the core.

4 It takes from six months to a year to work a plant up to
5 substantial power operation. There are some instances where
6 that's been done at a brisker pace, but in no case do you
7 have anything other than the initial core loading, which
8 takes some weeks because it must be done carefully and the
9 critical positions observed.

10 After that, there are required to be a long series of
11 zero power, that is, just barely detectable nuclear
12 reaction, physics tests, to establish the physics ~~program~~^{parameters}
13 ~~parameters~~ of the machine by specific testing.

14 And then an extended period in which operation at a few
15 percent goes on, further tests are made, a few more percent,
16 and more tests. So that even if we licensed, for instance,
17 and it is just as a hypothetical case and not that I have
18 concluded one way or another how I am going to come down on
19 Salem-2, even if we licensed Salem-2 for an operating
20 license, it would not be at any perceptible power before
21 January first.

22 And it was for that reason, I suspect, that the
23 implementation schedule on the A items was laid out in this
24 fashion.

25 Now, as long as there is no perceptible level of activity

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1 in the machine, then even though it has nominally an
2 operating license, it is a long way from having joined that
3 group of plants that are up in the neighborhood of
4 equilibrium fission product content and for which the full
5 range of concerns applies.

6 With regard to the B items on the list for which an
7 additional year for implementation is required, the staff in
8 the course of working these things out, analyzing the
9 systems and seeing what they thought needed, have come to
10 the conclusion in each case that the extended implementation
11 schedule for a particular B item is an acceptable one, and
12 that the incremental risk, if any, that attaches to not
13 having completed implementation for the additional year, is
14 an acceptably small one.

15 So I think that the implementation schedule proposed here
16 for this array of items is indeed a rational one that takes
17 account of the practicalities in what will actually happen
18 and what the actual risk levels are.

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1 Q Let's come to a few of those points because I have
2 some difficulty with some of them.

3 Wasn't an inability to vent noncondensable gas from the
4 pressure vessel a significant problem in the Three Mile
5 Island accident?

6 A It certainly prevented the system from going to a
7 cold shutdown for an extended period.

8 Q Which was a bad thing, wasn't it?

9 A Well, we would have all been happier if it could
10 have gone down, let me put it that way.

11 Q Well, I see that reactor coolant system venting is
12 a B item, installation complete by January 1, 1981. So, for
13 example, at the Salem 2 plant, if we have a situation, the
14 middle of next year, let's say, where they get a big bubble
15 of noncondensable gas in the reactor pressure vessel, if
16 they haven't been early birds in following the
17 implementation table we have here, they won't have the
18 capability to vent that gas directly from the pressure
19 vessel, will they?

20 A They will not. And as I say, the likelihood of
21 that occurring and the incremental risk that would attach
22 thereto I judge to be, I agree with the staff, I judge that
23 to be pretty small and an acceptable one.

24 Q That is an acceptable risk? That they won't have
25 it and that they may need it, all right?

ltCK 1 Do you regard that as an acceptable risk?

2 A Yes.

3 Q All right. I also see that plant shielding review
4 is a B item in terms of implementing plant modifications for
5 plant shielding.

6 wasn't plant shielding in terms of deploying hydrogen
7 recombiners a problem at the TMI-2 accident?

8 A Yes. Not a very serious one, I don't think. But
9 it had to be done after the accident, and indeed the
10 attachment of the recombiners themselves have to be done
11 after the accident.

12 I will note that the plant shielding requirement here is
13 considerably more extensive than hydrogen recombiner
14 situations. And, in fact, is focused a good deal less on
15 that specific sort of thing than on the general proposition
16 that we want to go back and look very carefully at things
17 like the arrangement of the residual heat removal systems in
18 plants to make sure that, indeed, if one has to circulate
19 contaminated primary coolant water through them, that that
20 can be done, and that the occupational exposures that would
21 be involved to plant personnel would be as low as you can
22 reasonably get in the circumstances.

23 Also, sampling provisions and so on are set up so that
24 the occupational exposure is low. But let me point out that
25 we went through Three Mile and did things like sampling and

ltCK 1 kept the heat removal going, and the worker exposures even
2 in that case without these provisions has been, on balance,
3 acceptable.

4 There have only been a couple of cases of exceeding the
5 normal operating occupational exposure annual limits,
6 something like three people went a shade over three rem.

7 Q One of the other aspects of the accident which I
8 think has been stressed several times was the absence during
9 the accident of a device whereby the operator could directly
10 measure the level of inventory in the core.

11 And instrumentation for inadequate core cooling including
12 a level instrument being installed is part of the
13 recommendations that have been made by Mr. Denton.

14 Looking at 2.1.3-B here. And I am also looking at the
15 fact that 2.1.3-B is designated in the document
16 implementation requirements prior to OL issue. •

17 I see the actual requirement in that regard, listed in
18 the right-hand column under requirement is, develop
19 procedures and describe existing instrumentation and new
20 level instrument design submitted.

21 Other than that, is the instrumentation for inadequate
22 core cooling requirement to be implemented pursuant to the
23 schedule set in Enclosure 6, specifically, I am looking at
24 the actual installation of the new level instrument.

25 A Yes.

1tCK 1 Q Now, that is a B. Does that mean then that that
2 does not have to be done until January 1, 1981?

3 A Yes.

4 Q Once again, we have a situation where if there
5 is a TMI-2 accident, type of accident at Salem 2, in the
6 middle of next year, assuming it's gotten its OL and has
7 come up to that point by that time, we are going to have a
8 situation where the operator could conceivably not have this
9 new level instrument installed for him, is that right?

10 A Yes. But I would also have to point out with
11 regard to that item that the instrumentation which exists at
12 plants provides a lot of information, and that if you use it
13 properly and take account of it properly, you can be very
14 well aware of the kind of circumstances that existed at
15 Three Mile Island.

16 That is, it's not a great mystery which requires some
17 brand new sort of device before you have any information on
18 it.

19 Q Yes, I think the point was made that the TMI-2
20 operator on March 28 had the instrumentation necessary to be
21 able to make that determination. Didn't he?

22 A Yes, he did.

23 Q Okay. I am looking at Item 2.1.5-A, dedicted,
24 what is H-2, hydrogen?

25 A Hydrogen.

ltCK

1 Q Hydrogen control penetrations.

2 A Yes.

3 Q What's the necessity for dedicated hydrogen
4 control penetrations?

5 A The present regulatory requirements on hydrogen
6 control require that the — that there be — that the plant
7 owner have or know where he can get on short order,
8 recombiners.

9 And that there be penetrations to which he can affix
10 these recombiners through the containment wall.

11 One of the things which the staff has concluded ought to
12 be done is to go beyond that level of preparation for
13 dealing with hydrogen in a containment and to have a
14 particular set of penetrations which are just for the
15 purpose of hydrogen — well, containment atmosphere
16 recirculation to recombiners, and then return to the
17 containment, penetrations which would be the right pipe
18 size, would have the appropriate fittings, be appropriately
19 located outside the containment so that there wouldn't be a
20 need to look around, scratch your head and say, "Well, now,
21 where are we going to hang this thing on," and perhaps have
22 to use a penetration in which the line size and the
23 throttle, the control valve, the stop valve sizes perhaps
24 were larger than you would need and hence, you would have
25 less control of the valve than would be desirable in the

ltCK 1 circumstances and so on.

2 Q Okay.

3 A But all of the plants in conforming to the present
4 requirements have the capability to attach recombiners and
5 have the equipment someplace reasonably close at hand.

6 Q But, again, what I see in this item of dedicated
7 hydrogen control penetrations, number 2.1.5-A, is that
8 description and implementation schedule is subject to the
9 implementation requirements prior to OL issue.

10 However, complete installation is again a B item. Only
11 be completed or required to be completed by January 1, 1981,
12 is that right?

13 A Yes.

14 Q Okay. Another item is 2.1.7-A, automatic
15 initiation of auxiliary feed. I see that the
16 recommendation is complete implementation of control grade,
17 which is an A item, that is reflected in the requirements
18 prior to OL issue, complete implementation of safety grade,
19 however, is left as an item B and will not be completed
20 until required to be completed until the end of 1980.

21 Is that right?

22 A Yes.

23 Q And the same situation exists for 2.1.8-A,
24 post-accident sampling. The implementation of plant
25 modifications, actually doing the modifications necessary to

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ltCK 1 carry this recommendation out is left to a B item.

2 In other words, by the end of 1980, is that right?

3 A Yes.

4 Q And, again, an item which has been mentioned
5 several times in connection with some of the concerns of
6 some of the presidential commissioners, high-radiation
7 monitors, 2.1.8-3, again, installation complete is a
8 category B item to be done by the end of 1980 and the
9 further requirement being implemented prior to OL issuance
10 is not the installation of those items, but simply the
11 preparation of procedures to correlate radiation
12 measurements to active level.

13 The procedures but not the installation itself, is that
14 right?

15 A I think — this one is — well, I don't know ^{but what} ~~that~~
16 it's different in kind from some of the others. The
17 preparation and procedures to correlate direct radiation
18 measurements means, and I guess it's similar to things like
19 the instrumentation for inadequate core cooling, those
20 procedures require that the plant operator look at what he
21 has got in place now, and figure out how he can use what he
22 has got now to supply the information which, on a more
23 extended implementation schedule, would be supplied more
24 directly, and perhaps more accurately, by the new equipment.

25 So that that arrangement for implementing some of these

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1 things, as, for instance, in the high-radiation monitor
 2 area, says, we want new instruments that will directly read
 3 these things as soon as you can get them.

4 And in the meantime, look at what you have already got
 5 and figure out what sort of conversion factors and \bar{F} tables
 6 and such things ready, so that you can use now, or
 7 immediately use what you have got to get that information.

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bwCK 1 Q But you are not going to require the licensee to
2 have the actual instrumentation until the end of 1980?

3 A That's right.

4 Q All right. Another feature or remedy which has
5 been discussed quite a bit is the shift technical adviser,
6 2.2.1.B. And again, there are two phases to that. Shift
7 technical adviser being on duty was originally designated as
8 a Category A item. It's now been designated as a
9 requirement prior to OL issue. However, the completion of
10 the training of that individual is a Category B item, so
11 once again that is not to be completed as a requirement
12 until the end of 1980. Again, this creates the situation
13 where we can have an accident at a plant that will be
14 licensed this year or early next year, and the shift
15 technical adviser's training will not have been completed by
16 the time of that accident, if it occurs before the end of
17 1980.

18 That is possible under these requirements, isn't it?

19 A Yes.

20 Q Your answer was yes?

21 A Yes.

22 Once again, one notes that the implementation schedule takes
23 reasonable account of the practicalities. The provision of
24 a shift technical professional person immediately provides a
25 substantial increment in terms of the quality of plant

bwCK 1 staffing to deal with such events. That's to be done
2 immediately. But rather than stop there and say, "Okay,
3 that's good enough," we clearly are going to want some
4 special training for these people. That is going to take
5 some time. And that is the extended implementation
6 schedule. But the configuration still leaves you with a
7 substantial increment starting for new plants with the OL.

8 Q Why don't you want to forego increasing the number
9 of plants at which these recommendations have to be
10 implemented, until such time as they are, in fact,
11 implemented? Why give a plant an operating license under a
12 shift technical adviser whose training has not been
13 completed?

14 A I can answer that as soon as you tell me why you
15 think it's permissible to continue the operation of the 68
16 presently licensed plants --

17 Q Well --

18 A -- under precisely the same circumstances.

19 Q I suppose the answer in part has to be that those
20 plants are already there, and shutting down the existing
21 plants will obviously have a substantial negative impact
22 upon existing power needs in this country. Whereas plants
23 to be licensed presumably are addressing future needs.

24 A I am sorry. The plants that we are talking about,
25 since these implementation schedules are close in, are

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1 plants which also exist. They are not imaginary
2 propositions which are only to come into being in the
3 future. They exist. They are there. I was in Sequoyah two
4 weeks ago. It's in pre-op testing and it's ready to go.
5 The construction has been completed. It is an integral and
6 important part of the supply, power supply plans for the
7 utility system which has built it. They are counting on
8 it. The argument you have just made that they exist, they
9 are there, they are part of the power supply, is as true of
10 Salem 2 and Sequoyah, et cetera, as it is of Salem 1 and
11 other operating plants.

12 Q Let me get your view on another possible
13 distinction. Salem 1 is operating, it is putting out
14 electrical power that is being consumed by persons wherever
15 that power goes to. Salem 2 is not operating yet. It is
16 not putting out the power yet. No one is actually utilizing
17 that power plant. If Salem 2 never goes into operation, no
18 one who is currently utilizing power from that plant will be
19 deprived of it, whereas if Salem 1 is closed down, there
20 will be, in fact, that situation. Someone who got that
21 power no longer will be getting; is that right?

22 A Are you prepared to mandate that every citizen of
23 the United States will be allowed next year to have no more
24 electricity than he used this year? And are you further
25 prepared to mandate that older plants, more expensive

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1 plants that are scheduled to be phased down in operation, or
2 phased out in operation, either because they are getting so old
3 that they can't be operated, or are so expensive that their
4 cost to the consumer is exorbitant, are you willing to
5 mandate that the power supply situation, both on the
6 consumer side and the production side is to be frozen for
7 several years? I doubt it very much. And if you are not,
8 then you have to be prepared to take into account the
9 already built increments which are planned for the near term
10 as part of that power supply situation.

11 Q Okay.

12 Let me ask you just one or two more questions and then I
13 really would like to break for lunch. Just to round this
14 off on the implementation matters. I also have here a copy
15 of a document entitled "Analysis and Training Schedule,"
16 which I gather is the proposed schedule for implementing
17 changes in the training of operators. Do you understand
18 that to be the case?

19 A Yes. Well, it's -- let's see. It's a Staff --
20 tell me where this came from? I don't recognize it from
21 yesterday.

22 Q Yes. This is a --

23 A It may have been in the pack.

24 Q This is attached as part of a -- I don't know if
25 it's part of Enclosure 6, but it makes reference to it in

bwCK 1 Enclosure 6 which was part of the August 20, 1979
2 memorandum sent by Harold Denton to all of the NRC
3 Commissioners.

4 A This would fall under Paul Collins'
5 recommendations for operator training updating, I take it.

6 Q Yes.

7 A Was it part of his handout yesterday at the
8 Commission meeting, do you know? Is that where it came
9 from?

10 Q That I am not certain of.

11 I guess all I want to ask you, obviously the document
12 will speak for itself. Does this generally reflect how you
13 understand these things are going to be implemented, the
14 kind of schedule that is going to be utilized?

15 A You know, without, I think, having to agree in
16 full measure, why, it certainly has that thrust to it.

17 Q Okay.

18 A And looks about like what I would expect.

19 Q There is nothing on the document that contradicts
20 your understanding of how the training changes ought to be
21 implemented?

22 A Or to put it another way, how the training changes
23 are proposed to be implemented by the Staff. I think it --
24 we ought to understand that the Commission, while it has
25 indicated concurrence with Harold Denton on the sorts of

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1 things he's derived from the Lessons Learned report, from
 2 the work of that group, that with regard both to operator
 3 training and emergency planning, which are important
 4 elements in the upgrading, that I think the Commission has
 5 clearly indicated that it wants to review the operator
 6 training and emergency planning, what I will call the
 7 immediate measures proposed by the Staff in considerably
 8 more detail than we have been through them. So I think we
 9 should understand that, whatever the Staff has proposed on
 10 the operator training, both the extent and schedule, and so
 11 on, is still a matter to be considered by the Commission.

12 Q Fine.

13 A So with that background, please go ahead.

14 Q All right.

15 MR. KANE: Let's have this collection of documents
 16 we have been discussing, the following titles as appear at
 17 the tops of each of the pages: "Elements of Proposed Plan,"
 18 "Near-Term Licensing Decisions," "President's Commission on
 19 the Accident at Three Mile Island, August 23, 1979."
 20 Another page entitled "President's Commission on the
 21 Accident at Three Mile Island." Page entitled "Enclosure 6,
 22 Implementation of Requirements for Operating plants and
 23 Plants in OL Review." It's composed of four separate
 24 pages. Another page entitled "Implementation Requirements
 25 prior to OL issue. Lastly, a page entitled "Analysis and

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1 Training Schedule," collectively marked as Exhibit 5.

2 (Hendrie Exhibit 5 identified.)

3 MR. KANE: In view of the fact that it's now
4 1:30, perhaps —

5 THE WITNESS: Would you like to take a break for
6 lunch?

7 MR. KANE: Yes, I think that might be a good idea.

8 (Whereupon at 1:30 p.m., the deposition was
9 recessed, to reconvene at 2:15 this same day.)

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AFTERNOON SESSION

(2:20 p.m.)

Whereupon,

JOSEPH MALLAM HENDRIE

resumed the stand and, having been previously duly sworn,
was examined further and testified as follows:

EXAMINATION (Continued)

BY MR. KANE:

Q Mr. Hendrie, before we took the lunch break, we
were talking about a number of different schedules for
implementation of recommendations for improvements in the
regulatory process of the NRC.

I also have here a document that is entitled, "Emergency
Preparedness, Improvements and Commitments Required for
Operating Plants and Near-term OLS."

I believe this was part of the package that was presented
to the Commission during the briefing session with
Mr. Denton yesterday, September 6.

I wanted to ask you if you understand that to be the
schedule for implementation of improvements in emergency
preparedness as recommended by Mr. Denton's task force?

A Certainly looks like it. Looks like a printout of
the book, and looks like the handout that came out yesterday
from which Brian Grimes briefed the Commission on
these things.

ltCK 1 Q Again, this appears to be the same situation of A,
2 Arabic numeral 1 and Category B for various implementation
3 dates, Category A being implementation prior to
4 operating license or by January 1, 1980.

5 Category A-1 being implementation prior to OL or by
6 mid-1980 and B being implementation by January 1, 1981.

7 Do the categories that are set out next to the items
8 designate, then, pursuant to that description when those
9 features will be required to be implemented?

10 A Presumably.

11 MR. KANE: Let's mark this as Exhibit 6 to the
12 deposition.

13 (Deposition Exhibit 6 identified.)

14 BY MR. KANE:

15 Q On August 23, 1979, and before the presidential
16 commission and its public hearings, Roger Mattson, excuse
17 me, Dr. Kemeny recalled Roger Mattson's testimony of the
18 prior day, August 22, to the effect that the Lessons Learned
19 Group fully recognizes that the complete engineering
20 understanding of the accident is not yet available.

21 Harold Denton, on August 23, when that statement was
22 recalled to him, responded as follows: I guess we won't
23 have a complete engineering understanding until many, many
24 years down the road when the containment is open, the core
25 is taken out and analyzed.

1 Do you agree with those statements?

2 A Sure, with the qualification that we will have to
3 discuss after a while what we mean by engineering analysis.

4 Q I take it in light of the decision made yesterday
5 morning, however, the Commissioners, as a body, and you
6 specifically, do not feel that the absence of this complete
7 understanding of the TMI-2 accident should pose a bar to the
8 resumption of licensing activities.

9 A Let me answer what I think is the thrust of your
10 question in a moment. First, let me ask, do you understand
11 we resumed licensing yesterday morning?

12 Q No, but I would like to confirm my understanding
13 of what occurred. I have read the entire transcript of the
14 briefing session but I got in rather late last night and I
15 would like to confirm.

16 My understanding is that as of the decision made
17 yesterday by the NRC Commission, the staff of the NRC is
18 going to resume the work that is goes on pending license
19 applications, up to the point, in the case of Salem 2 and
20 North Anna 2, of OL issuance.

21 At that time, the matter will be presented to the NRC
22 Commission.

23 A Correct.

24 Q The Commissioners will determine whether or not
25 those OLs will issue?

ltCK 1 A True.

2 Q That is what I understand was the effect of
3 yesterday's decision.

4 A So in particular, the point I want to make sure
5 that we both understand is that with regard to whether or
6 not -- with regard to this question of license issuance, the
7 Commission hasn't reached the question yet.

8 What I recognized was that it was going to be
9 sometime, a couple of months probably, before the first one
10 could come up in any case.

11 The Commission still has to chew on operating licensing
12 and emergency preparedness, short-term matters, and we
13 simply didn't reach the question.

14 Q My specific question --

15 A Now, then, with that understanding, the answer to
16 your question is that -- I will have to answer for myself.

17 Did you phrase it for the Commission, or for me? You
18 better phrase it for me, because the Commission hasn't
19 reached the question and my colleagues always take exception
20 when I attempt to speak in advance for them.

21 They prefer to have their own, speak their own views.
22 For myself, when we talk about an engineering analysis, we
23 understand that we mean as complete an understanding as it
24 is possible to get about the whole thing and in considerable
25 detail.

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1 Is that — question: Is that necessary before we — to
2 allow continued operation of any plant? No. Is it
3 necessary to have in hand before we would consider licensing
4 any new plant?

5 My view is, no. We don't have to know those details. As
6 I pointed out earlier, what is clear, fairly clear already,
7 is that the core seems to have been a good deal tougher, or
8 more resistant to even more extreme damage than occurred
9 than we might have guessed.

10 We have no reason to doubt from TMI that our previous
11 assumption that keeping the core covered, and the core
12 cooled, is the key to reactor safety.

13 We have no reason to doubt that that is true. There is
14 nothing in TMI that suggests that is not true. If you keep
15 the fission products in the core, why, that's fine.

16 That is what you want to do. And we don't need to know
17 in detail all of the things that we will eventually learn
18 from postmortem examination of the TMI core in order to
19 prosecute that safety objective effectively.

20 Q Do you feel the NRC, today, knows enough to resume
21 the safe licensing of plants?

22 MR. CHOPKO: Are you asking about the issuance of
23 a license, per se, or the whole process, from reading the
24 mail to analyzing what the applicant says and things like
25 that?

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1 MR. KANE: I am not talking about the whole
2 process, but let's talk about the licensing process whereby
3 a PSAR is submitted, it's analyzed, a SER is prepared, an
4 environmental impact --

5 MR. CHOPKO: More than just the simple issuance of
6 a CP.

7 MR. KANE: More than just the bureaucratic act of
8 signing a license. I am talking about the process of
9 evaluating whether or not a license should be issued.

10 BY MR. KANE:

11 Q Do you think the NRC today knows enough to safely
12 resume that process?

13 A Yes.

14 Q Do you feel that the NRC today knows enough to
15 instruct operators how to safely handle the type of accident
16 that occurred at TMI-2?

17 A Yes.

18 Q Are you aware of NUREG 0600, the NRC's analysis
19 of the causes of the TMI-2 accident? It's a thick orange
20 book.

21 A Yes.

22 Q Are you aware that that study states as a possible
23 item of noncompliance the operators failing to stop the
24 reactor coolant pumps during the accident at TMI-2?

25 A Yes, I am, rather an anomalous item in the

1 listing, but the I&E people were trying to be — to include
2 everything, including clearly some items that one wouldn't
3 care to cite the utility for, or the operators for, and
4 because the tech specs said in certain events, why, you trip
5 the pumps, or — if they haven't been tripped. Why, they
6 listed it.

7 But, after all, we had a bulletin out before, well before
8 that report came out which said leave the pumps running.

9 Q Yes, that is 7905-A in which the NRC told
10 operators to leave on the reactor coolant pumps during the
11 accident.

12 A For some period of time at any rate. Then we
13 subsequently on further examination issued a bulletin
14 saying, no, turn them off.

15 Q Before we come to that, however, after 7905-A went
16 out, are you aware that the NRC required B&W operators to
17 retrain pursuant to that procedure?

18 A Sure, absolutely.

19 Q So there was a bulletin, then there was
20 retraining?

21 A Yes.

22 Q That they should leave on the reactor coolant
23 pumps during the accident. Now, recently as discussed at
24 the briefing session yesterday, there is an order, 7905-C in
25 which the NRC is now telling operators to turn off the

ltCK 1 reactor coolant pumps during this type of accident.

2 A Yes.

3 Q All right. Are you aware from Mr. Denton in his
4 briefing of the NRC yesterday that the NRC came to this last
5 order, the 7905-C, after new industry studies had been
6 performed on small-break LOCA conditions?

7 A Yes.

8 Q So what it seems to come down to then is that the
9 NRC has said stop the pumps. Then it said don't stop the
10 pumps.

11 Now it says stop the pumps after new studies. How can
12 one not think that some further study may not indicate a
13 further 180-degree change?

14 A Possible.

15 Q In your opinion, is that a safe environment in
16 which to license further nuclear power plants?

17 A Yes, because we take account of what we know, as
18 we know it. I will point out that the TMI situation ran
19 along both with and without pumps at various stages in the
20 first 12 hours.

21 And that although we got a level of core damage that we
22 hope never to see again, that the results certainly weren't
23 catastrophic.

24 The instruction currently to leave the pumps running, or
25 to turn them off, I am sorry, relates to some particular

1tCK 1 circumstance, and is sort of a balancing judgment on whether
2 it's -- comes out, the conclusion is that it's on balance,
3 you cover -- you cover the spectrum of small breaks more
4 completely and better if they are tripped.

5 But the results, if they are left running for a period of
6 time, are unlikely to be extreme. Let me characterize it a
7 little differently and try to let you see what's behind my
8 remark here.

9 It is not one of those situations in which one walks
10 along a very sharp dividing line between disaster and
11 success.

12 Q Do you think that before the NRC resumes licensing
13 plants, it should thoroughly understand this phenomenon of
14 whether or not to turn off the pumps?

15 A I think we understand it tolerably well at the
16 moment. It is --

17 Q The reason I ask that, if I may interrupt.

18 A Yes.

19 Q In reading the transcript last night of the
20 briefing on September 6th, there was an exchange between
21 Commissioner Gilinsky and Denwood Rusche about the matter.

22 Commissioner Gilinsky commented you indicated earlier we
23 are still in the process of coming to grips with this
24 phenomenon and trying to understand it.

25 This was in the context of discussing 7905-C. Mr. Rusch

ltCK 1 responded, yes, sir. I think the thing we are trying to
2 sort out right now is, since we did get different answers,
3 the combustion concern was for the hotleg break and the
4 other for coldleg break, we are trying to sort out is this
5 due to plant or model differences?

6 Shouldn't the things Mr. Rusche is trying to sort out be
7 sorted out before more plants are licensed and operators may
8 be called upon to determine whether or not they should turn
9 off the reactor coolant pumps during a small-break LOCA?

10 A In principle, one would like all things perfect in
11 the most perfect of worlds. We live, Mr. Kane, in an
12 imperfect world. One then has to decide with things like
13 reactor pump trips in the event of a small LOCA, how
14 critical the matter is.

15 And if it's critical, then it becomes something that has
16 to be completely worked out before one goes ahead. And if
17 it's not absolutely critical, if it's a matter, rather, of
18 choosing on balance the best course between, as in this case,
19 either on or off, and in either case, the accident can be
20 worked out with the safety equipment, then it's not
21 necessary to have perfection and have all things completed.

22 It depends very much on the nature of the particular item
23 you are talking about. One of the things that the staff has
24 worked hard to do is to try to separate out for themselves,
25 taking all things into account, where the really cutting

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1 points are that have to be totally fixed before we go
2 ahead.

3 Q What is the NRC doing to insure that operators at
4 B&W plants, the next time they have a small-break LOCA type
5 of situation, do not follow the instructions in 7905-A, and
6 instead follow the instructions in 7905-C?

7 A There will have to be a retraining and review of
8 the results, sort of enterprise of much the same sort that
9 went on after the initial bulletin retraining, in which
10 teams went around and discussed with all of the B&W
11 operators these matters to confirm that the results of the
12 utility instructions and training were understood, and make
13 sure that the operator's understanding runs beyond just
14 getting the right -- writing the right answer on a test
15 paper, but really understands what he's looking for on the
16 board and the reasons behind what he's doing and so forth.

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rc CK 1 Q Yes. I see a reference in one of the documents we
2 have attached as part of Exhibit 5, entitled "Analysis and
3 Training Schedule." Number 2 is implementation of small
4 break LOCA emergency procedures and retraining of operators
5 to be accomplished December 31, 1979.

6 Is that where that retraining under 7905-C would be
7 accomplished, Mr. Hendrie?

8 A It has already been done under 05.

9 Q 7905-C?

10 A Well, let's see, what is C?

11 Q C is the newest one, which has directed, as I
12 understand it, from -- I don't have the bulletin --

13 A Is it C that they reversed the pump trip?

14 Q 7905-C says turn off the reactor coolant pumps
15 during this type of accident.

16 A Yes. In that case, yes.

17 Q So that is where this retraining would be done?

18 A Yes.

19 Q Is that going to be some retraining on a
20 simulator, something like that? That is what was done
21 pursuant to 7905-A, as far as I know.

22 A I am not sure whether they will go back on the
23 simulator for that, or whether they will want to see the
24 results of -- see what the utility's done or taught their
25 operators, then interview operators and make sure they

rc CK 1 understand what is going on.

2 Q Will those be selective interviews or will every
3 B&W operator be interviewed?

4 A I can't say. I just don't know. The number of
5 B&W plants is not that large.

6 Q I think there are only eight.

7 A In operation. So that it is -- and they went
8 through the complete group, I believe, for the O5-A, or A
9 and B sequence.

10 Q Do you know how many B&W operators would be
11 involved?

12 A There would be something upwards of 30 licensed
13 operators at the plant.

14 Q At each plant, approximately?

15 A Well, you need five shifts, for decent, around-the-
16 clock, seven-day-a-week staffing, you need five shifts, and
17 you need three, let's see, I think it is three licensed
18 operators per shift. So there is about half of them.

19 And then, generally, there are a number of other people
20 in the plant, engineering and management structure, who try
21 to maintain -- who have had licenses and try to maintain
22 them. It may, on average, turn out to be less than 30,
23 but --

24 Q We could take that as a guesstimate. I am not
25 trying to pin you down to a figure. But if I am correct in

rc Ck 1 my recollection that there are eight B&W plants, that gives
2 us something between 2- to 300 operators?

3 A Yes, at most, I would say. And, I guess, maybe a
4 little less than that.

5 Q It is entirely practical for all of those
6 operators to be tested by the NRC, is it not, on these new
7 procedures?

8 A I think probably it is, but I don't know -- I must
9 say, I don't know the specifics of what the operator
10 training group and I&E have in mind on it. So, I can't
11 represent to you authoritatively what the staff intentions
12 at this point are.

13 Q So you don't know whether or not the OLB, for
14 example, Operator Licensing Branch, you don't know whether
15 or not they intend to reexamine each B&W operator on this
16 new training?

17 A No, I don't.

18 Q Do you think they should reexamine each B&W
19 operator on this new training?

20 A I am inclined to think they should make every
21 effort to do that.

22 Q Why do you think that is necessary?

23 A It is particularly unfortunate when you have to
24 reverse signals. And we have now made two 180-degree shifts
25 starting from pre-TMI, first, to leave the pumps running;

rc CK 1 and second, to turn the pumps off.

2 Operators are just like you and me. They resent anything
3 they perceive as sort of arbitrary directions. And it is
4 very important, then, that they understand the background.
5 That won't make them any happier about the reversals, you
6 understand.

7 But, again, like you and me, if we understand how that
8 sequence came into place, then their understanding of the
9 whole situation is improved and their state of mind is
10 improved and it sticks.

11 Q Do you think they should also be retested because
12 this is a significant aspect of handling the TMI-2 type of
13 accident, knowing whether or not to turn off the reactor
14 coolant pumps? Is this important training?

15 A It is important training. But if we are going to
16 talk about expending limited resources of the Operator
17 Licensing Branch on trying to reach all of these people,
18 each one personally, I think the former reason is a stronger
19 one, to make sure that the operators fully understand both
20 reasons, and the reasons why the reversals went on.

21 So that their background on the whole subject is as
22 complete and satisfactory as one can make it, and they
23 understand why now it is better, thought better on balance
24 to turn them off than to leave them on.

25 Q Certainly this is significant training from a

rc CK 1 safety related point of view, isn't it?

2 A Sure, it is part of the response to a transient
3 that has occurred and --

4 Q And in that same connection, is my recollection
5 correct that it is the NRC's intention to individually
6 reexamine each of the operators who will be cross-licensed
7 at Salem Unit 2?

8 What I am referring to --

9 A I should know the answer to that because Collins
10 talked to us about it yesterday and I don't remember.

11 Q It is my understanding from the transcript of the
12 briefing sessions that the idea is that the operators for
13 Salem Unit 2 will probably be cross-licensed from Salem Unit
14 1. And they will be subjected to a difference course
15 between the two units by the utility and they will be tested
16 by the utility.

17 But they will also be, then, individually retested, each
18 and every one of them, by the NRC. Does that refresh your
19 recollection on that?

20 A Well, I am glad to hear it, but, you know, if I
21 couldn't remember it before, I am not sure that I can
22 remember it now.

23 Q I thought perhaps if I expounded on it a little.
24 That is my understanding.

25 The reason I ask these questions is it is also by

rc Ck 1 understanding that after 7905-A came out, and after the B&W
2 operators were subjected to a week of training on the B&W
3 simulator and had then been tested by the utility, that the
4 NRC elected to spot-check individuals who had gone through
5 that training, rather than retesting each and every one of
6 those individuals, even though, as he set forth in his
7 testimony before the Presidential Commission last week,
8 Mr. Paul Collins of the Operating Licensing Branch initially
9 recommended that all of those B&W operators be tested by the
10 NRC directly.

11 Now were you aware of that situation, that they were only
12 spot-checked?

13 A I surely must have been, because there was a very
14 considerable discussion about that process. As a matter of
15 fact, Harold Denton went personally with his staff to the
16 first one, and not just the operator licensing people, but a
17 number of the senior members Lessons Learned and Bulletins
18 Group, in order to see for himself, talk to operators and
19 see for himself whether he thought that their understanding
20 of the TMI sequence was as good as he wanted it.

21 And, in fact, he found that -- he felt there were some
22 deficiencies, and there was a sort of a recycling of some of
23 the training and retalking to them. And then there were
24 again visitation teams from, I think from Ross' group, that
25 went around to the other B&W plants to make the same direct

rc CK 1 check.

2 Q But it is my understanding from Mr. Collins that
3 it was a selective check, not every B&W operator who went
4 through that retraining was directly examined by the NRC.

5 The reason I stress that point, it may seem to be a
6 rather minor point, but I have spent some time deposing
7 Mr. Collins and going over the operating training with him.
8 It is my understanding that there is every reason to think
9 that the testing procedures utilized in the past by the
10 utilities have left something to be desired, at least in
11 terms of some of the stresses that they put on some of the
12 understandings that the operators came away from those
13 examinations with.

14 I am, therefore, concerned that, given the testing
15 procedures already utilized by the NRC with regard to this
16 retraining, that there may well be B&W operators at plants
17 around the country who still do not understand how to deal
18 with the TMI-2 accident. That wouldn't be known to the NRC
19 because they didn't retest each individual.

20 The reason I bring this up in this context is because I
21 understand what you said, you do feel that the re-retraining
22 now for the B&W operators, the second time around, they
23 should be retested individually by the NRC. Why didn't
24 you think so the first time?

25 A Well, I am not sure that I would quite

rc CK 1 characterize it as a retesting.

2 What I would look for is discussion with operators,
3 taking them in groups, because some will be on shift and
4 some will be sleeping, and so on, but cycling through each
5 plant, to make sure that they all understand the bases, why
6 these things changed and why it is now thought better this
7 way, because as I say, the business of reversing directions
8 this way is -- people, if they have to go through that sort
9 of a thing, want to understand why.

10 Q Surely.

11 A If you don't go and explain why and are quite
12 candid about it and answer questions and so on, you leave
13 them with a feeling that, you know, there is all kinds of
14 funny business going on that they don't understand.

15 And that is a feeling of lack of confidence in the system
16 that you don't want in the operators. So I think that is
17 important.

18 Now, on the original business, there was a fairly careful
19 audit on the testing done by the utilites.

20 Q Let me interrupt. Before we come to that, because
21 sometimes some of the statements you make are directly
22 relevant to what we were talking about, let me be sure I
23 understand.

24 Do you think that each and every one of the B&W
25 operators, after they have undergone this new training

rc CK 1 pursuant to 7905-C, should be individually evaluated by the
2 NRC as to their understanding of that training?

3 A I think if they -- if the retraining procedures,
4 of course, and examinations which the utilities will have to
5 put in place, are carefully audited by the training branch,
6 and are satisfactory, that that is, in terms of direct
7 testing, adequate.

8 My concern is with the understanding of the operators as
9 to why these things came about this way.

10 Q You said audited. That suggests to me something
11 less than individually evaluating each one of the
12 operators. Is that what you mean by auditing?

13 A Yes.

14 Q Something less than that. A selective process?

15 A Well, by auditing, I mean that you review the
16 training program with some care, and the results of the
17 examination. You know, you take a look at the exam and see
18 if you think it was a competent one and covered the right
19 things. Then you look at all of the results.

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sbnCK 1 Q How do you determine —

2 A But I don't know that I see a need for the
3 NRC, after that, to come in and then sit everybody down and
4 administer a new exam. It is a way of going, and one that
5 we could do and may end up doing for all I know, because, as
6 I would caution once again with regard to the area of
7 operator training, it is still one in which we have
8 considerable discussion.

9 The Commission has considerable discussion that it wants
10 to have with the staff about the details of this. And it is
11 quite possible that we will end up wanting substantial
12 changes in what is proposed. And I wouldn't in the least
13 foreclose my own judgment coming out of those discussions
14 will be, yes, let's get in and have the NRC test all those
15 people.

16 Q But as a historical fact we do know that that
17 decision was not made in connection with the first
18 retraining after 7905-A. I am curious to know why you
19 did not feel that was necessary then. We had had an
20 accident which clearly demonstrated that the operator did
21 not understand, at least at Met Ed, TMI-2; they were given
22 the retraining and tested by the utilities.

23 You have just described how Harold Denton in doing an
24 investigation determined that at least one of the training
25 programs, and I believe the reference he made was to the

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1 Oconee plant, was not up to snuff as far as the NRC was
2 concerned and they had to redesign it.

3 Again, just as a layman, that would give me even more
4 pause about not individually ensuring, guaranteeing that
5 each one of those operators in fact knew how to handle a
6 TMI-2 accident after that training. Now you obviously
7 didn't feel that way, and I would like to know why.

8 A Well, because in terms of the formal training and
9 testing program, I am not sure that it requires that the
10 piece of paper on which the test is written be an
11 NRC piece of paper, and that the questions be one — ones
12 which NRC people have written down, and that the grading
13 marks afterwards are made by NRC hands.

14 I think what you want to look at is the content of the
15 course and the results of the example, and what the example
16 covered. And if it is a good course, which you can
17 determine, and if it is a good example, which you can
18 determine, and if the grading has been done fairly and the
19 results come out all right, I am not sure that I see why it
20 is that having NRC people do precisely that has some magical
21 element.

22 Q I was not suggesting there was anything magical
23 about it. Let me give you a for instance.

24 How do you determine that during the course given by the
25 utilities, the utility did not simply teach the test to the

sbnCK 1 students? In other words, simply teach them how to pass the
2 examination, rather than to stress a substantive
3 understanding of the subject matter?

4 A Well, that's part of the process of auditing the
5 training program and the examination. And there is that
6 peril, I think. But it is also --

7 Q The reason I ask that question is because
8 Mr. Collins has previously testified that the utilities, it
9 was widely known, did maintain what he referred to as
10 fraternity files, that is, copies of NRC examinations in the
11 past which were then utilized in the course.

12 And he admitted that there was the possibility that they
13 might well be teaching the test, and he felt that the way
14 that was counteracted and mitigated was the fact that the
15 NRC not only requires a written examination, but also an
16 oral examination.

17 A Yes.

18 Q Where, one on one, an examiner comes in and speaks
19 to the individual and asks him questions to find out if he
20 really does understand what he's supposed to understand.

21 A I think there is no question but what that is an
22 important element in the overall evaluation.

23 Q Why didn't you feel that should have been done
24 with regard to the training under 7905-A?

25 A Well, it was done on an audited basis.

sbnCK 1 Q Okay. Not each and every one?

2 A Not so far as I understand.

3 Q That is what I want to come back to. If that is a
4 valuable thing to do, why didn't you feel it should be done
5 for each individual?

6 A I don't know. I don't remember specifically
7 focusing on it, as a matter of fact. It seemed to me that
8 the auditing, talking to the people as the groups did, the
9 NRC groups did when they went out and talked to people,
10 would reveal that kind of difficulty.

11 And Harold felt that he had — that he was not satisfied
12 with some of the discussions he had with the operators, that
13 they fully understood the meaning of saturation in the
14 machine, and what followed from that and in turn what that
15 meant with regard to pressurizer level and so on. So that
16 was refurbished there.

17 Q Lastly, just so we can leave this subject matter,
18 so I can understand fully your testimony as to your current
19 attitude about the new training that will be done under
20 7905-C, I take it you simply are not certain in your own
21 mind as to whether or not the NRC should require each one of
22 the individuals going through that training to be
23 individually evaluated by the NRC after being tested by the
24 utility. You simply haven't made up your mind on that?

25 A I think that is fair.

sbnCK

1 Q I saw a reference in the transcript last night,
2 and it has come up before. I just wanted to be clear on
3 this. Is it true that there was no licensing board
4 proceeding in the Salem-2 licensing proceeding?

5 A I think either that is correct — no, I guess that
6 would have to be correct, otherwise it would be still going
7 on.

8 Q How did that come about?

9 A No one, no party asked for a hearing.

10 Q There was no intervenor coming in and asking for a
11 hearing?

12 A That is correct, yes.

13 MR. CHOPKO: Off the record.

14 (Discussion off the record.)

15 BY MR. KANE:

16 Q There was no qualified person requesting a
17 hearing, qualified under the NRC regulations, requesting a
18 hearing?

19 MR. CHOPKO: That is true.

20 (Discussion off the record.)

21 MR. CHOPKO: That is true in the sense that no
22 party met the requisite interest to demonstrate that he had
23 standing to intervene in a legal sense.

24 BY MR. KANE:

25 Q As I have made reference to several times,

sbnCK 1 Chairman Hendrie, we have had quite a bit of testimony
2 relating to the NRC role in operator training and have spent
3 some time with Paul Collins in that regard.

4 There were several points that came out of the
5 examination that I -- some of which I would like to go over
6 with you.

7 Mr. Collins testified that in the operating license
8 branch there is no examination of the design of the
9 equipment for which the operator is licensed. Is there any
10 thought that that should be changed?

11 A Yes, there certainly is. The question of operator
12 training is only one element of what I will call the
13 operational aspect of the machine and the people who run
14 it. The operator training is obviously a subject which
15 needs considerable upgrading.

16 But, also, we need to look, as we have not looked before,
17 at the control rooms, the layout, the kind of information
18 that is presented and the way it is presented. And to work
19 into our requirements some improvements there. The control
20 rooms are, well, they are not all that bad. But they aren't
21 all that good, either.

22 Q Do you know when those changes would likely be
23 made in the operating licensing branch to address this
24 problem?

25 A I am not sure the operator licensing branch

sbnCK 1 itself is exactly the right place to begin to build this
2 into the regulatory scheme, because when you talk about
3 these aspects, you have to keep in mind channel separation
4 requirements and electrical code requirements on the
5 circuitry, as well as the operational aspects.

6 I think looking back at this area over the years, we have
7 been probably much too interested in the electrical
8 circuitry isolation aspects. And I have a notion that some
9 of the -- that a part of the reason that there are clearly
10 some awkward places on the control boards in the layouts has
11 to do with NRC requirements about separation and so on.

12 You come to a point where you need to bring into the
13 consideration of where this is laid out on that board, not
14 only those isolation and separation considerations, but also
15 the consideration of, in doing that, are you impeding the
16 operators from a speedy and intuitive feeling for the board
17 and the switches and the arrays of matters and so on.

18 Q Without going into all of the details on that, is
19 it fair to say that this is a subject which the NRC is
20 looking at?

21 A Yes.

22 Q Is it fair to say that this is a subject, a
23 problem area which is not likely to be resolved within the
24 next couple of months?

25 A I think that is clear and even perhaps the

sbnCK 1 next couple of years.

2 Q All right.

3 A This is clearly a long, long-term thing.

4 Q All right.

5 A I would hope that in this area, some of the
6 current nuclear industry efforts that are centralizing now,
7 some of these things, would have a major input to this,
8 because we in the NRC have focused in our safety reviews and
9 our regulations much more on safety in an equipment sense
10 than upon the integrated plant and its operability aspects.

11 And so we tend to be understaffed in terms of making
12 sweeping judgments on operability aspects. And I would hope
13 we would get sound input from people that are good at it.

14 Q Mr. Collins also testified that the operating
15 licensing branch has only eight full-time examiners, or had
16 only eight full-time examiners.

17 A Yes.

18 Q For the entire country as of March 28, 1979 and 22
19 part-time examiners, most of whom had no commercial reactor
20 experience. Are there any changes that are contemplated in
21 that regard?

22 A Well, we are going to improve the staffing
23 situation very substantially as soon as we can get our hands
24 on the people.

25 Q When is that going to happen?

sbnCK 1 A That ought to be in the process now. We have been
2 authorized to hire another 100 staff members into NRR. And
3 that recruiting is going forward now.

4 Q Is that a long-term project, or is that going to
5 be done by the close of 19

6 A Well, when you are talking about trying to recruit
7 highly experienced people here —

8 Q It is not easy.

9 A It inevitably turns out to be a longer-term
10 proposition. That is right. I would comment, I found
11 another resource that I hadn't really realized we had until
12 recently.

13 In the inspection and enforcement office there is a
14 training section, who have been put in place over the last
15 couple of years to carry out the training NRC does for our
16 inspectors, particularly the resident program inspectors.
17 And we have there in that branch, not a large number, but a
18 number of people who have good experience in plant
19 operation. And they are a resource that I think we need to
20 use.

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1 Q Mr. Collins mentioned that there no periodic
2 evaluation of training programs offered to utilities by
3 vendors such as B&W. The last formal evaluation of the B&W
4 program according to Mr. Collins was conducted in 1968. Is
5 there any thought of changing that situation now?

6 A This is with regard to --

7 Q Periodic evaluations of training programs offered
8 by vendors to licensees.

9 A Typically to new customers.
Q Yes.

10 A Or an offer of retraining for old customers, I
11 guess.

12 Q Yes.

13 A I think those training programs -- well. that's a
14 good question. One is inclined to say, yes, we ought to
15 look at those. On the other hand, the proof of the pudding,
16 so to speak, is the operators out at the plant. And it's
17 sort of a policy question how far back up the line we go.
18 For instance, if Utility A is hiring new staff and they have
19 a local college in the area, and they hire a lot of people
20 from the college, you know, how far back up the line should
21 we go? It may be that we will decide that we ought to stick
22 a little closer to the plant itself and the specific
23 operators and improve the testing and examination there,
24 rather than go clear back to the vendors.

25 Q I was not asking you what you think should be
26 done.

bwCK 1 done.

2 A Yes.

3 Q I was asking you, is anything specific proposed at
4 this time to be done.

5 A So far as I know — Well, I just don't know. I
6 just don't know, is a better way to —

7 Q All right. Utility training programs which teach
8 the test given by the NRC, I made reference to that before.
9 Mr. Collins feels that the oral evaluations done by the NRC
10 as part of the cold and hot licensing programs are
11 sufficient to counter that factor. Without saying on that
12 one way or another, I would like to know if there is anything
13 specific that has been proposed to change that situation.

14 A The business of teaching against examinations?

15 Q Yes.

16 A I suspect that that is too deeply inbred in human
17 beings to ever stamp out.

18 Q Okay.

19 A I will bet you a cookie that when you went to the
20 bar examination, you weren't unaware of the kinds of
21 questions that had been asked in previous years on that bar
22 examination.

23 Q Indeed. But thank goodness I don't run a reactor.

24 A And if the, you know, if the bar association had
25 some magical way of going through and grabbing all of those

bwCK 1 old copies, why, the next generation of bar examinees after
2 you would have found some way to learn whatever they could
3 about previous exams.

4 Q Indeed.

5 A So I think that is in any field, whether
6 qualifying examinations, universities, reactor operator
7 training, airline pilots, lawyers, professional engineers,
8 who when I went for my New York exams, there was an
9 extensive literature of professional engineering
10 examinations from all around the country, you could buy
11 books of it, and I did.

12 Q Sure.

13 A It's not -- I must say, it's not a proposition
14 that is totally evil, either.

15 Q I wasn't --

16 A Because among other things it helps the student --
17 tends to concentrate him on some of the things which, at
18 least to the extent they are revealed in the examinations
19 that have been given, his peers have thought were important
20 and should be tested on. So I think as a part of the
21 educational process, it's probably inevitable and then what
22 we need to do, as Collins has pointed out, is to improve the
23 ways in which we get on beyond that and get inside the
24 individual head and find out just how well all of that has
25 penetrated, and is it all just some sort of learn by rote

bwCK 1 and when he's confronted by a control board, he goes cold,
2 or is it a deeper understanding that is what you need?

3 Q Once again, I wasn't asking you if you thought it
4 was a good idea to change it, but just whether or not there
5 was anything specific proposed to change it.

6 A Well, I don't know. I don't think there is. And
7 as I say, I think the reason for that is that it's probably
8 more a futile effort and your efforts would be better put to
9 other things.

10 Q Mr. Collins also told us that there is no
11 requirement that significant transients at other operating
12 nuclear power plants ought to be incorporated into either
13 classroom or simulator training. Is there any specific
14 proposal to change that situation?

15 A Not in the form which you seem to state it. So
16 far as I know. Although as a general proposition, it's
17 quite clear that the training of operators on off-normal
18 conditions, all the way from just the sort of minor upsets
19 that can expected every few shifts and don't amount to much,
20 all the way up to the extreme -- well, all the way through
21 at least the small accident range. That that area has had
22 considerably less emphasis in operator training and
23 requalification than was clearly merited. And it's
24 certainly clear that in amplifying that training, one of the
25 things that you will be looking for are prototypical

bwCK 1 sequences, off-normal sequences. And the operational
2 experience certainly gives you a very strong set of
3 guidelines about lots of the things that ought to be in
4 there. Not necessarily all of the things, but numbers of
5 them. So I would expect in the future that that portion of
6 the training, the off-normal condition training,
7 requalification, would have built into it the whole gamut of
8 things that have happened in operating plants.

9 Q But I was talking about an ongoing situation of
10 incorporating transients that may occur at operating plants
11 as they occur.

12 A We get September, the Davis-Besse and, good, in a
13 couple of months that is part of the retraining -- of the
14 training program for new operators and requalification
15 training for other operators.

16 Q That is what I meant, an NRC requirement that
17 that be carried out is not currently contemplated; is that
18 right?

19 A Not directly in that form. But I would think more
20 in the form that I put it, that that general area of
21 training needs substantial improvement and work and that part
22 of that will be -- in the course of that you will certainly
23 build in numbers of these things that have happened.

24 Q In any event, that is another long term item that
25 is not going to be accomplished by the end of this year, is

bwCK 1 it?

2 A I think inevitably that is a long-term item.

3 MR. HASSELL: Why don't we go off the record?

4 (Discussion off the record.)

5 THE WITNESS: Back on the record. Mr. Hassell
6 asked what about the new Operations Evaluation Group which
7 the Commission has directed be set up. Their task is to
8 sort out of the couple of thousand event reports and other
9 operating incidents that are noted each year from the full
10 array of operating plants, to sort out the significant
11 elements and to follow up on them, to understand them fully,
12 to go beyond the sort of bare-bones statement of the event
13 from the plant where it happened, to understand the
14 background significance of it, its general connotations for
15 the type of plant that it occurred on, and what might have
16 happened if somebody had made the wrong step in the middle
17 of it. And then to bring that lesson back and make sure it
18 gets out to all the operating plants.

19 Now in that sense, it is — it does have a retraining
20 aspect to it. But the Operations Evaluation Group, I would
21 think would not then follow through and then see that that
22 transient is included in the off-normal training. I would
23 think that would be over in the training review branches.

24 BY MR. KANE:

25 Q Again so we can be clear, that is a long term

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1 It's not going to be done in the next few months?

2 A Well, the group is in the process of formation
3 now. We are recruiting for a director. But it's -- looking
4 forward to the earliest time that it might be in full and
5 effective operation, that is clearly some months away.

6 Q No requirements for instructor or training
7 supervisor qualifications, no auditing of similar
8 training, no evaluation of similar performance in the
9 utilities requalification programs, and permitting an
10 operator who flunks a written requalification examination to
11 continue work as a licensed operator, while he takes
12 accelerated training, are all aspects of the training
13 programs that were described for us by Mr. Collins. If I
14 understand the briefing transcript from yesterday, September
15 6, Mr. Collins has explained to the Commission that NRC
16 administration has requalification examinations and
17 developing industry instructor qualifications must go
18 through rulemaking procedures, and that will be a fairly
19 lengthy process; is that right?

20 A Eventually, if those requirements are to be
21 reflected in the Commission's regulations in specific ways,
22 why, then -- well, to be reflected in the regulations, why,
23 there will certainly have to be a rulemaking, which will
24 take some time or other. As a minimum, we after all have to
25 go out and get public comment, as a minimum. The items

bwCK 1 which you mention I will note are clearly ones which need to
2 be changed and upgraded. Now it isn't necessary, I don't
3 think, to wait for the effective date of final rules on all
4 of that, that is, there are all sorts of things we can do
5 prior to the implementation to the effective dates of rules.

6 Q Requirements for instructors of training
7 supervisor qualifications, can that be addressed on a
8 short-term basis by the NRC?

9 A Sure.

10 Q The NRC can simply promulgate requirements?

11 A We would say we issue an order.

12 Q Has anyone proposed that that be done?

13 A We don't have, that I know of, we don't have such
14 an order before us at the moment.

15 Q Do you think the NRC should make such an order?

16 A Well, I think we need to get ourselves organized
17 and know what these steps are. And then I think that we can
18 move ahead and begin to implement without having to wait for
19 a year's rulemaking or something like that.

20 Q To implement requirements for instructor or
21 supervisor qualifications?

22 A Yes, if that is judged to be finally something we
23 need to put requirements on.

24 Q That is where I am curious. Do you think that the
25 NRC should prescribe requirements for instructor or training

bwCK

1 training supervisor qualifications?

2 A I think some of the training supervisors need to
3 be very experienced people in the operation of a plant — of
4 plants. Whether the fellow that gives the nuclear physics
5 part of the operator prep course has to be licensed by NRC
6 is not nearly so clear to me.

7 Q That is not what I asked you. Should the NRC
8 prescribe requirements, without getting into what they are,
9 should the NRC prescribe requirements for instructor or
10 training supervisor qualifications?

11 A Well, I think a more general answer — I have
12 been giving you more specific ones, what they add to in sum
13 is that this is very much an area before the Commission at
14 the moment and the details of this really remain to be
15 sorted out. I haven't settled down and prescribed for
16 myself here," here are my final conclusions on all of the
17 things that ought to be done." And the one you cite is one
18 of these possibles, and I haven't focused —

19 Q You haven't made up your mind on that?

20 A I haven't focused on whether you check yes, or no,
21 or in part, and then specify. But it's clearly — I
22 recognize it as one of the elements that certainly has to be
23 treated.

24 Q Your response still isn't quite clear to me. Are
25 you unclear as to whether or not any requirements for

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1 instructor or training supervisor qualifications should be
2 prescribed by the NRC? Without getting into what
3 requirements.

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1 A You mean say yes or no now whether I will ever vote
2 in favor of requirements or not requirements? Too early to
3 say.

4 Q Okay.

5 A Let me see if it helps you to say the following.
6 I am certainly unwilling to say that I can foresee no need for
7 any requirements on any training personnel.

8 Q You are unwilling to say that?

9 A I am unwilling to say that. I think that would not
10 reflect my feeling.

11 Q Okay.

12 A I think that some requirements are appropriate in
13 particular cases, and we need to sort out who and what.

14 Q You think, then, that those requirements in some
15 particular cases should be required by the NRC?

16 A Yes.

17 Q All right. Do you think there should be an auditing
18 of simulator training in the requalification program by the
19 NRC?

20 A Yes, I do.

21 Q Do you think there should be an evaluation of
22 simulator performance in the requalification programs by the
23 NRC?

24 A Yes.

25 Q Do you --

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1

A I think it is one of the more important elements in

CRAIG

2

the upgrading of operator training. It is the place where

3

you bring it all together and get your best measure, in my

4

view, of whether you have on your hands an individual who is

5

capable, not only of carrying out effectively the normal

6

routines of the plant and observing all of the license

7

conditions, but who also has a sufficient understanding of the

8

machine and its possible behavior to give you a good and

9

proper response in off-normal conditions.

10

Q Do you think an operator who scores less than 70

11

percent on his written requalification examination should be

12

permitted by the utility to continue to work as a licensed

13

operator while he takes accelerated training?

14

A Oh, I think that is too much detail for me to

15

answer, too much of a detailed question for me to answer a

16

yes or no. I think it depends on where did he downgrade.

17

Did he do fine on fairly trivial things and blow all the

18

questions that have to do with limiting conditions for

19

operation? Oh, boy.

20

Q Well, of course that is another matter which has

21

come up previously about the eight subparts on the exam.

22

A Yes.

23

Q And how an overall score is all that was required

24

even if you did poorly in one or two of them.

25

A Yes.

amn 1 Q I understand that has now been changed.

CRAIG 2 A Yes.

3 Q It is my understanding that the NRC is now going to
4 require a minimum grade in each part.

5 A Yes.

6 Q As well as an overall grade, which makes sense.

7 A Yes.

8 Q But what I was specifically looking to was the
9 situation where the utility determines, okay, you have got
10 less than 70 percent. He does have to take accelerated
11 training but we will continue to allow him to work as a
12 licensed operator in the meantime.

13 I take it your response is you would have to look at the
14 situation further before you would indicate whether or not
15 that would be acceptable?

16 A Yes.

17 Q Has that specific subject matter been addressed in
18 any proposal to the NRC for changes?

19 A In terms of something formally before the
20 Commission?

21 Q Or discussed in any Commission meeting that you are
22 aware of.

23 A Well, you have already heard the operator training
24 branch changes with regard to the parts of the exam and so on.
25 So to that extent, yes. In a more general sense, no.

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Q There is to my judgment and observation a fairly

CRAIG

2

substantial list of items that are wrong in the operator

3

training program, that need to be corrected.

4

How did the operator training program reach this point where it had this many deficiencies in it?

5

6

A Well, I am not sure I can give you an answer that's

7

very authoritative. I haven't until recently paid a great

8

deal of attention to the operator training side of the NRC

9

activities, and in my previous work down here, and with the

10

ACRS, while there were some aspects of operation obviously

11

which were important, and we dealt with -- and I dealt with

12

personally -- in general, the operator training aspects I

13

didn't have a great deal to do with.

14

We didn't pay a great deal of attention to it. So I am

15

not sure I am much of an authority on how it got here. I

16

think I'd just speculate that the feeling was that, having

17

provided requirements that the plants have assorted safety

18

systems to cover the full range of design-basis events,

19

and having looked at those transient and accident sequences,

20

with regard to automatic detection, and initiation of the

21

safety features, and having avoided places where operator had

22

to respond in very short times to off-normal conditions, where

23

the times were at least 10 minutes, in some cases 15 or 20,

24

the feeling was that the -- that there didn't need to be,

25

then, as much emphasis on operator training as we now all

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1 amn 1 perceive to be the case.

2 CRAIG 2 I noted at page 100 of the briefing transcript for
3 Mr. Denton's briefing of September 6, 1979, that Mr. Denton
4 was requested to prepare a paper on the advisability of
5 halting construction on all B&W reactors in progress. That
6 was done at the request of Commissioner Ahearne. I just want
7 to inquire on the record as to whether or not there would be
8 a problem with the Presidential Commission obtaining a copy of
9 that paper once it is available.

10 A I shouldn't think so. I expect it will be a public
11 paper.

12 Q Fine.

13 A It will come up you know, and be the subject of a
14 Commission discussion. It would be public the day of that
15 briefing. And I am sure the Presidential Commission could
16 have access to it probably before that.

17 MR. KANE: I would like to formally request then
18 that we be given access to it as soon as that is feasible.

19 THE WITNESS: All right. Can I relay that and
20 make Mr. Fitzgerald my agent for carrying that out. So if you
21 call me up and ask me where it is, why, I can refer you to
22 him.

23 MR. KANE: I will call Mr. Fitzgerald.

24 BY MR. KANE:

25 Q Chairman Hendrie, again, referring back to some

amn 1 written answers to written questions that you provided to the
CRAIG 2 Udall Committee on June 6, 1979, one of the questions was,
3 could you explain to us what was done to make sure that the
4 Three Mile Island management was informed fully of the
5 incidents at other B&W plants.

6 And your answer was, TMI management, like all licensees,
7 receive copies of licensee event report summaries and regular
8 current events reports prepared by the NRC staff. The
9 pertinent B&W reactor events, notably the Davis-Besse and
10 Rancho Seco events, would have been covered in these reports.

11 Now do you feel these documents you have referred to fully
12 informed the licensees of the Davis-Besse transient, for
13 example, of September 24, 1977?

14 MR. CHOPKO: Off the record.

15 (Discussion off the record.)

16 THE WITNESS: Well, the current events reports,
17 the summaries are simply computer listings in which you get a
18 three or four line summary of the event and any interested
19 licensees are then expected to request the full reports or
20 so on.

21 MR. KANE: The summary doesn't give the details of
22 the transient, does it?

23 THE WITNESS: Yes. The Current Events of Power
24 Reactors and its predecessor publication make an attempt to be
25 a more, a fuller description of the events, and so on.

55.17.07

BY MR. KANE:

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1

Q A significant feature of the Davis-Besse transient

CRAIG

2

of September 24, 1977, was the operator's interruption of high

3

pressure injection based on pressurizer level, was it not?

4

Post TMI-2 we can certainly see that, can't we?

5

A Our hindsight gives us every reason to say that.

6

Q I have spent some time going through the various

7

documentation that relates to that transient. I don't expect

8

you to read all of this, but I can represent to you that I

9

have here the preliminary notification that was prepared on

10

that transient dated September 26, 1977. It makes no

11

reference to operator error in any sense in terminating

12

high-pressure injection based on a misleading pressurizer

13

level reading — makes no reference to any HPI interruption

14

at all.

15

I also have the LER that was submitted on October 7, 1977,

16

which makes no mention of operator error concerning any

17

interruption of HPI. The LER was followed by a supplement

18

of some 59 pages dated November 14, 1977.

19

Again there is no mention of operator error concerning

20

HPI termination. The document states at page 4 that at six

21

minutes into the event, the operator stopped the HPI pumps,

22

so it states the fact.

23

But it also states at page 2 that operator was timely and

24

proper throughout the sequence of events. These documents

25

were followed up by an I&E report prepared by the NRC which is

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1

accompanied by a cover letter dated November 22, 1977. Again

CRAIG

2

there is no mention of error by the operator concerning HPI

3

termination. The only reference appears on page 5 as part of

4

a detailed chronology and the reference is that HPI pumps were

5

shut down at this time as pressurizer level was normal. That

6

is it.

7

The LER monthly summaries as you have indicated are put out

8

and as you have indicated do not contain any setting forth of

9

the events of the transient. It is simply a summary. The

10

summary makes no reference to any operator error concerning

11

termination of HPI.

12

Lastly, the current event power reactors that I think you

13

referred to in your response to the Udall Committee question

14

was put out concerning Davis-Besse. The particular issue

15

involved has a section called operator error, but there is no

16

reference to Davis-Besse in that section.

17

The section in which the Davis-Besse transient is described

18

appears under valve malfunctions and does not in any way

19

mention anything about operator error in doing anything with

20

regard to the high-pressure injection.

21

My question is having gone through all of that

22

documentation, if I were approaching it as someone who knew

23

nothing about the Davis-Besse transient whatsoever, there

24

doesn't seem to be any way in which I could have concluded

25

any operator error based upon interrupting or terminating

amr 1 high-pressure injection.

CRAIG 2 How then are the licensees to be fully informed about the
3 important events of that Davis-Besse transient via this
4 documentation?

5 A Oh, because the important items about Davis-Besse
6 are considerably more than the fact that the operator turned
7 the high-pressure injection off early in the transient. The
8 important elements in the Davis-Besse transient that should
9 have been noticed, and that were in fact picked up by Jim
10 Creswell, and never succeeded in getting through the NRC mill,
11 and that were picked up by Dunn & Kelley at B&W and never
12 succeeded in getting through their mill, and that should have
13 been picked up by an operations evaluation function in the
14 NRC and on the industry side, for pity's sake, were that here
15 is a transient which occurred frequently, a secondary side
16 trip, that every time you had a secondary side trip in the
17 B&W plants you pop the relief valve.

18

19

20

21

22

23

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1 We all know what the statistics are on relief valve
2 closing, so that you know every hundred or so times that you
3 pop the relief valve, you are going to have a failure to
4 reclose.

5 Every hundred times you are going to have one or two
6 failures to reclose, I mean. And that the plant is then
7 left in a small-break LOCA situation with the break up in
8 the pressurizer vapor space.

9 Now, the significant thing that should have caught more
10 people's attention in that Davis-Besse writeup were that in
11 spite of the fact that the relief valve was open, the system
12 pressure was falling, fell rapidly, fell enough to trigger
13 high-pressure injection, that the pressurizer level didn't
14 go down.

15 In fact, I think the backup reports mention in a rather
16 mild way that there were saturation conditions in the
17 primary system. An appreciation should have flowed from
18 that event that on a small-break LOCA like that, whether
19 it's a relief valve or something else, the pressure falling,
20 that if you drop the pressure below the saturation pressure,
21 that you are going to get voiding in some portions, in the
22 hot portions of the system.

23 The voiding in turn is going to keep your pressurizer
24 level up, and you stop looking at the pressurizer level.

25 Davis-Besse should have keyed us to that aspect on all

ltCK 1 PWRs.

2 Q Yes, but the —

3 A Then, once you understand all of that, and look at
4 what was done at Davis-Besse, you say, hey, he shouldn't have
5 turned off the HPI.

6 Q But how can you come to that conclusion if nowhere
7 in the documentation is it indicated that he turned off the
8 HPI in reliance upon that pressurizer level?

9 A Oh, because that — it's clear that's why he
10 turned it off. All you have to do is to have any sort of
11 elemental understanding of the operation of PWRs and you
12 know that.

13 Q The preliminary —

14 A There isn't a PWR operator in the United States
15 who wouldn't tell you why he turned off the HPI.

16 Q The preliminary —

17 A That I can tell you that.

18 Q The preliminary notification on this transient
19 doesn't say anything about HPI being turned off, period,
20 nothing.

21 A We are talking about the current events in power
22 reactors.

23 Q All right, let's come to that particular document.

24 That is this newsletter that is put out.

25 A And the backup report.

1tCK 1 Q The backup report?

2 A The 90-day report.

3 Q You mean the I&E report? Oh, you mean the LER.

4 A The licensee's 90-day report. Once you get
5 started on one of these things, inevitably you find in that
6 limited writeup summarized by NRC people considerably less
7 than you would really like to know about the whole thing.

8 So then you call up and say, "Hey, give me a copy of the
9 90-day report where the licensee has to deal with it in some
10 detail, and other pertinent documents."

11 So you now end up with this thing and —

12 Q And this LER, you mean?

13 A No.

14 Q The supplement.

15 A And you end up with that. Now, you know what
16 people have written down about it.

17 Q Let's come to the supplement. This is dated
18 November 14, 1977.

19 On the second page of that document, it makes the
20 statement that operator action was timely and proper
21 throughout the sequence of events.

22 Does that sound like a recognition of the fact that the
23 operator should not have terminated the HPI?

24 A No, but what I am saying is that a careful look at
25 this event has revealed here, here and maybe in the I&E

ltCK 1 report, but this is -- these generally are pretty good.

2 A careful look at this then leads you to some quite
3 different conclusions than that.

4 Q This was prepared by the licensee, provided to the
5 NRC. The NRC didn't see that, did it, what you are talking
6 about, the significance of the operator having turned off --

7 A He didn't understand the significance except for
8 Mr. Creswell.

9 Q Mr. Creswell didn't get it from this. My
10 understanding from Mr. Creswell, he went back to the utility
11 and checked their records and interviewed some of the people
12 at Davis-Besse and found out at that point that the operator
13 had turned off the HPI based on the pressurizer level.

14 He did not get it from the documentation. He found the
15 documentation confusing.

16 A He had access directly to the plant, so he got it
17 there. If he hadn't gotten it there, why --

18 Q How would the utilities get this information, that
19 at some other plant somebody had erroneously turned off the
20 HPI based on pressurizer level?

21 A Well, I would hope that the utility operating
22 organizations are trying to keep pretty good track of sister
23 plants and what is going on.

24 And if they are not, the vendor who supplied the plant
25 certainly ought to be keeping pretty good track of the

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ltCK 1 events that go on. And beyond that, the NRC ought to be.

2 Q To answer my question, should the utility or
3 vendor be keeping better track than the NRC? Should they be
4 really on top of this, more so than the NRC?

5 A You bet.

6 Q But they are clearly not?

7 A There certainly weren't here.

8 Q All right. You also made reference to the fact
9 that the NRC did not appreciate the fact that there had been
10 operator error here in terminating the HPI.

11 That is not entirely correct from what I understand to be
12 the case. Roger Mattson has described for us, as well as a
13 fellow in his office, Gerald Mazetis , the fact that
14 Mr. Mazetis , soon after the transient within a few days was
15 sent to the site for evaluation.

16 A That's right. I had forgotten that there was an
17 enterprise from NRR that almost got there and then somehow
18 again fizzled out.

19 Q You say almost. Almost in Mr. Mattson's view is
20 not the case. There was a meeting in Mr. Mattson's office
21 soon after the transient at which Mr. Mazetis described his
22 trip to the site and his evaluation of the event.

23 That was followed up by a memorandum from Denny Ross to
24 Mr. Carl Seyfrit of I&E in which he confirmed that one of the
25 subjects discussed at the meeting and to be followed up on

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1 by I&E was the operator's termination of the high-pressure
2 injection and the best we are able to construct is that it
3 simply did not go any further than I&E.

4 We deposed Mr. Seyfrit. Although he has no specific
5 recollection, he confirms that where that evaluation by I&E
6 would have wound up is in this November 22, 1977 inspection
7 and enforcement report.

8 That is the document that I said makes no mention of
9 error concerning HPI termination and simply says HPI pumps
10 were shut down at this time as pressurizer level was normal.

11 My intention in going through all of this with you,
12 Chairman Hendrie, is to simply try to ascertain and nail
13 down the fact that the NRC did not do a very good job of
14 putting the word out to the licensees in this event, did it?

15 A I couldn't agree with you more. I think I have
16 been saying that.

17 Q So it's not a question of the licensee being fully
18 informed by reading these documents because
19 these documents do not spell out operator error in
20 terminating HPI.

21 A No. But that is quite correct. But let me
22 reiterate in shorter form, I hope, what I said before.

23 I think it's incumbent upon the operators of these
24 plants, either individually or on an industry basis, or a
25 vendor basis, if they like, to get a better grip on this

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1 kind of thing. And this precursor event should have keyed
2 both sides of the house, both the regulatory side and the
3 industry side that there was trouble from this source.

4 Most particularly in the B&W plants because they are
5 set up to challenge the relief valve every time you get a
6 secondary transient.

7 But in a more general sense, the possibility of any time
8 you get a small break or relief lifting in any PWR, if the
9 pressure drops to saturation, you are going to get some
10 voiding in the hot parts of the system and that is going to
11 drive your pressurizer level back up.

12 And if you have gone into an off-normal situation in
13 which the system pressure has gone to saturation, then by
14 God, you better be very careful what you make of pressurizer
15 level from then on out.

16 Q You should certainly instruct the operators not to
17 rely on it under those circumstances?

18 A That's right.

19 Q Are you aware that in fact, that implication of
20 the Davis-Besse transient was recognized by the involved
21 utility and they did give their people training against that
22 particular occurrence?

23 A At Davis-Besse?

24 Q Yes.

25 A No, actually, I hadn't realized that.

1tCK 1 Q Oh. Well, we have a document dated —

2 A I am glad to hear it.

3 Q Well, I am glad and I am not so glad in a way,
4 because I guess it's ironic, in light of all this
5 documentation, it does not reflect that recognition. In
6 fact, at that utility on a plant-specific basis, they did
7 recognize it.

8 In a letter dated May 18, 1979, from Mr. Lowell Roe, of
9 Toledo Edison to Robert Reid, of the — as director of
10 nuclear reactor regulation, there is a —

11 A Reid? Wait a minute.

12 Q Excuse me, through director of nuclear reactor
13 regulation, he was chief of branch number 4. This is a
14 letter dated May 18, 1979, from Toledo Edison to Mr. Reid,
15 in which he encloses an evaluation or event review of the
16 September 24, 1977 transient.

17 The enclosure was also dated May 18, 1979. And it does
18 state that as a result of that incident, all licensed
19 operators —

20 A The dates are '79?

21 Q May 18, 1979 is when the document is dated. What
22 it refers to, however —

23 A Okay, it's a previous action by the utility to
24 get its, tell its operators what all that saturation
25 business meant.

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1 Q Yes. Specifically referencing that as a result of
2 the incident at Davis-Besse 1, all licensed operators were
3 given detailed training on the event with special attention
4 to the hazards of relying on pressurizer level
5 instrumentation as an indication of primary system inventory
6 when a leak in the top of the pressurizer exists.

7 That is what you are talking about, isn't it?

8 A That's exactly right. That piece of information
9 should have been immediately forwarded to all the other
10 B&W -- all the sister plants, and everybody, they on the
11 industry and operating side, and we in reg, should have
12 recognized its further broader significance for PWRs in
13 general.

14 And I must say now that you have informed me of that,
15 my level of frustration over this particular set of failures
16 is increased.

17 MR. CHOPKO: Can we go off the record for a
18 second?

19 (Discussion off the record.)

20

21

22

23

24

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1 BY MR. KANE:

2 Q It is clear to me, at least, Mr. Hendrie, from all
3 this documentation, that there were some things left out of
4 the description of the Davis-Besse transient that probably
5 should have been put in.

6 I am more interested in what that occurs. And I
7 understand it can be simply human oversight. Perhaps that
8 is something we can never eliminate.

9 But isn't it true that a standard feature of utility
10 vendor contracts is that the vendor pays for any changes
11 that are ordered by the NRC and the utility pays for any
12 other changes?

13 A I think, well, let me try to answer as fully as I
14 understand. But let me preface it by saying that I am not
15 an expert on the contractual arrangements between utilities
16 and their nuclear steam supply vendor or their architect
17 engineers, and so on.

18 With that caveat before you, it is my understanding that
19 the contracts are, as you would expect, not by any manner or
20 means uniform. But that it is often the practice for the
21 utility to ask for, ask the nuclear steam supply guy to make
22 him a bid to supply a licensible nuclear steam supply of a
23 certain size.

24 The vendor then, and the contract then says that the
25 vendor, for a certain price agreed upon, will supply a

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1 licensible machine. His part of the supply will be
2 licensible.

3 Now, both sides, particularly in more recent years, have
4 recognized that there are almost certain to be on every
5 project further things the reg staff will find that they
6 want before they can find the system acceptable, and new
7 requirements come along.

8 And some of the contracts, the more recent ones, then,
9 will have clauses in them which say, now with regard to any
10 new regulatory requirements and the equipment that would be
11 required to fulfill them, we will have some procedure for
12 deciding who pays or an arbitration procedure to divide the
13 cost, or something like that.

14 But the general proposition that you enunciated
15 initially, I think we can take that as a general starting
16 point for what I see is coming discussion, and say that if
17 it is not true in all contracts, it is at least true in
18 enough contracts, so it is worth talking about.

19 Q The reason I bring it up is because, and I can't
20 confess to this being an original idea with me, but it was
21 the subject of an exchange between Commissioner Pickford and
22 Jesse Ebersole during the last set of public hearings that
23 the Presidential Commission held.

24 The subject matter they were discussing in that regard or
25 the question was, where that is the case, that the vendor is

rc CK 1 going to have to pay for changes ordered by the NRC, doesn't
2 that create a substantial disincentive, economic
3 disincentive for the vendor to conclude that any transient
4 or problem poses a generic safety problem?

5 A It sure does.

6 Q Doesn't it also create a substantial disincentive
7 for the utility to identify safety problems which may not
8 be considered generic and for which the utility alone may be
9 responsible?

10 A You bet. I wouldn't mind amplifying a little on
11 that, actually.

12 Q Please do.

13 A Because it is a subject that I have worried about
14 off and on for a good many years. Not only is it a
15 disincentive in a given project for the vendor to propose an
16 improved safety system which might cost more, because he's
17 then going to have to pay for it, but the vendors are scared
18 to death if they propose it on plant 12, the current
19 project, that the NRC will love it and mandate that it be
20 supplied on his units 1 through 11 that he's already
21 supplied to somebody. And he will then have 11 other
22 utilities saying, okay, smart guy, you pay for it.

23 Q So, we are looking at millions of dollars
24 potentially, substantial money?

25 A It could be many millions in some cases. That is

rc CK 1 a very uncomfortable aspect.

2 I have discussed it a number of times with various
3 people, our intervenor groups and others, about how we might
4 find a way to free the system up so that you wouldn't
5 necessarily find yourself in a situation of having to
6 back-fit every previous plant in order to encourage people
7 to be ingenious and to go forward and improve the technology
8 on new projects.

9 Obviously, if it was something that we made a
10 determination was simply essential on all the plants, why,
11 everybody agrees in principle that in that case, there is no
12 question. It is done, and who pays for it, well, that will
13 get worked out between the individual parties.

14 But this area of here's a better way to configure the
15 ECCS, maybe, and it costs a little bit more, and the
16 vendor's engineers think it is a very substantial
17 improvement. And, by God, they're really reluctant to mention
18 it, lest, as I say, the NRC engineers say, hey, that's a
19 great idea. Let's do that all over the place.

20 Q That leads me to a comment made by Robert Minogue,
21 M-i-n-o-g-u-e, in a deposition I took a few weeks ago, in
22 which I was not focusing specifically in the context of the
23 utility-vendor financial arrangements, but just generally
24 about the regulatory approach taken in the past by the NRC.
25 And its relationships with the industry.

55 19 05

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1 Mr. Minogue commented that: Our regulatory approach is
2 based on a presumption of good faith compliance. It is
3 inherent. There is a presumption that there is a real
4 dedicated commitment to achieving those requirements that
5 doesn't require an inspector behind every worker.

6 He went on to say: My faith in that presumption was
7 sadly shaken by TMI.

8 So, the remark I made to Mrs. Omang, O-m-a-n-g, a
9 Washington Post reporter, about heavy regulation was based
10 also on the perception, not just the things we have been
11 talking about, but a perception that maybe this industry
12 shouldn't be presumed to be in good faith compliance.

13 Given that financial mode we talked about, given the way
14 the Davis-Besse incident was reported and analyzed by the
15 industry, do you agree with that statement, that we can no
16 longer place — engage in a presumption of good faith
17 compliance by the industry?

18 A I guess I wouldn't go that far.

19 Q Does the current situation give you pause on that
20 subject?

21 A Sure.

22 Q Do you think that is something the NRC Commission
23 needs to address?

24 A Yes. And it has been a subject that we — that
25 should have been addressed at the Commission long since,

rc CK 1 going back prior to the NRC. I must say that, in the
2 contacts that I have had with industry people over the
3 years, it is certainly true of all of the senior figures
4 that I know, that there is a very strong dedication to
5 safety.

6 I couldn't, and wouldn't, affirm that that is uniformly
7 true all the way down the ranks. But I don't know of any
8 principal on the vendors' or utilities' sides that has
9 had -- that I regard as a real nuclear professional that
10 doesn't have a strong dedication to safety.

11 Now, that doesn't mean that there aren't very strong
12 differences of opinion between -- on specific measures and
13 specific items. And the problem that we have discussed
14 here, the financial incentives for better safety measures
15 proposed from the industry's side, is one which is very
16 keenly felt by senior engineers of the vendors and some of
17 the senior nuclear professionals on the utilities' side.

18 So, I guess, I am not prepared to make the blanket
19 assumption that we are dealing with a bunch of crooks here.

20 Q I -- Let me say, I was not suggesting that.

21 A No. Let me not put words in your mouth, and let
22 us understand that language is a shorthand exaggeration of
23 the thing. I am not prepared to regard them as a bunch of
24 crooks.

25 But there clearly are differences in the points of view.

55 19 07

rc CK 1 And we have always had that adversary relationship. And I
2 think we always will.

3 Q Do you think it is accurate to say that, where it
4 is a close call on a safety question, the inclination of the
5 industry would be to let it fall on the side of it not being
6 a safety question?

7 A I think that probably is the case and I think
8 probably ours is to call it on the side of the safety
9 question.

10 Q Which is why it is so important for the NRC to be
11 advised of these problems as they arise.

12 A You bet.

13 Q Chairman Hendrie, are you familiar with Stephen
14 Hanauer?

15 A Oh, very well. I have known Steve since I joined
16 the ACRS in 1966.

17 Q Do you feel that he is a competent person, from a
18 technical point of view?

19 A Extremely. One of the best.

20 Q I have a memorandum here which Mr. Hanauer
21 apparently wrote to Commissioner Gilinsky, dated March 13,
22 1975. It states that --

23 A Thank goodness it is before my term.

24 Q It states that attached, Commissioner Gilinsky
25 will find, in accordance with his oral request, a discussion

55 19 08

rc CK 1 of some technical issues that Mr. Hanauer believes to be
2 important subjects for Commission consideration.

3 In going through this document, I was struck by the
4 similarities between some of the things Mr. Hanauer
5 identified here and some of the things we have been talking
6 about today.

7 For example, on the third page of the document towards
8 the top, Mr. Hanauer, at the very top, Mr. Hanauer notes the
9 operating plants are one our chief sources of information,
10 but we don't know whether the rate of abnormal occurrences
11 now being experienced is a satisfactory one or not.

12 A Wait a minute. Where are you?

13 Q I am sorry. On the third page towards the top.
14 At the top.

15 A On, okay.

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1 Q What Mr. Manauer appears to be referring to is
2 exactly what were just discussing. The passage through
3 to the NRC of operating experience at nuclear power plants
4 for the purpose of assessing safety questions.

5 A Yes.

6 Q This is 1975 he noted this problem. I take it
7 since TMI-2, certainly that problem's gotten a lot more
8 attention. The question inevitably arises, why wasn't this
9 problem adequately handled between 1975 and March 28, 1979?

10 A I guess two reasons. One of them is that it is a
11 difficult problem. Steve notes the operating plants are one
12 of our chief sources of information but we do not know
13 whether the rate of abnormal occurrences now being
14 experienced is a satisfactory one or not. The industry, in
15 spite of having been nominally around for 30 years, is
16 really an operating industry only, oh, since the late '60s.
17 Ten years.

18 And so Steve's quite right. It is hard to say whether it
19 is -- whether the abnormal occurrence rate is
20 extraordinarily high or extraordinarily low, or what. The
21 feeling is that it is high. Because I think all of us who
22 are professionals in the business have a feeling that we
23 ought to be able to build and operate these plants so we
24 don't have a great many abnormal occurrences at all.

25 Q In fact, as you commented, it is now emerging that

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1 the incidence of PORV failures, or PORV challenges in at
2 least the B&W design is at a disturbingly high rate.

3 A Yes, that is right. It goes on to note, we do
4 know that nuclear unit availabilities and capacities are not
5 satisfactory. And he says then we need to find out whether
6 safety system availability is satisfactory and to improve
7 whatever aspects of reliability need improving. There has
8 been a drive on the industry side to deal with some of the
9 system availability problems, and I think in part at least,
10 that has had some success.

11 I think in general the unit availabilities have shown a
12 useful increase, say, in the period through, oh, maybe, I
13 don't know, '73-'74, and, say, '78. But it is a hard
14 problem. And the other reason why isn't all of that cured
15 and in good shape, the other part of the answer is that it
16 in part was a failure on our side to make sure that we had
17 an adequate system set up for shaking out what all of these
18 LERs meant in full detail.

19 In getting the information fed back in a forceful way,
20 and as I have already said, in part, failure on the
21 industry's side to appreciate how important that was from
22 their side and for them to do it.

23 Q Another point that Mr. Hanauer makes on the same
24 page, just below that paragraph I cited, the paragraph that
25 is numbered 4, Mr. Hanauer says present designs do not

sbnCK 1 make adequate provision for the limitation of people. Means
2 must be found to improve the performance of the people on
3 whom we depend and to improve the design of equipment so
4 that it is less independent, I assume he means dependent.

5 A I think so.

6 Q On human performance. Again it seems here he is
7 addressing that man-machine interface.

8 A Yes.

9 Q Which has come up so many times in connection with
10 the TMI-2 accident. In questioning other members of the NRC
11 as to why the man-machine interface was not previously
12 addressed, the way it has been now, I have gotten responses
13 along the lines that it simply was not addressed because the
14 thought was that the automatic systems that could be
15 installed could adequately protect the public and could
16 adequately lead to a cold shutdown if necessary under
17 even the worst accident conditions.

18 For that reason, then, there was simply less emphasis
19 within the NRC on how the human beings in the control room
20 would relate to these devices. I think I understand that
21 explanation but it just strikes me as anomalous that here is
22 a situation in 1975 where a highly competent and respected
23 technical advisor is bringing this matter directly to the
24 attention of a NRC commissioner, and, yet, if we are to
25 judge by the TMI-2 post-accident situation, nothing really

sbnCK 1 was done in that four-year period.

2 Again, why wasn't something done after this matter was
3 directly brought up?

4 A I guess that is a question that you will probably
5 be discussing with Vic Gilinsky tomorrow, isn't it?

6 Q Yes, I was hoping you might have some information
7 on that.

8 A I wouldn't be surprised with regard to the
9 man-machine interface, I daresay that some more searching
10 around in the assorted documents, both here and on the
11 industry side, that you could find criticisms that predate
12 1975 about the way the interface is treated in control
13 rooms.

14 Q Could you turn to the last page of that document?
15 There is another comment there by Mr. Hanauer under the
16 heading of "Too Many Surprises." He refers there that in
17 the past couple of years surprises have come both from
18 operating experience and from improved understanding by both
19 reg, and the industry, of safety problems we thought were
20 put to bed.

21 An obvious example is all the trouble we had with ECCS
22 evaluation models. Innovation by applicants will continue
23 to generate surprises. We must develop methods for dealing
24 with these surprises in cases and generically without having
25 a fire drill each time.

sbnCK 1 Now there are obviously a number of surprises in
2 connection with the TMI-2 accident, the most significant I
3 guess being the one you have referred to before of
4 pressurizer levels staying high while pressure went low.
5 There was another matter, however, that came up which I take
6 it was a surprise to the NRC because it hadn't previously
7 been addressed.

8 As far as I know, that was coincident logic for ECCS
9 actuation. The Presidential Commission has had testimony
10 concerning a transient which occurred in Beznau,
11 Switzerland, in which this problem with coincident logic of
12 ECCS actuation during the course of this phenomenon of
13 levels staying high and pressure going low occurs.

14 I think I understand why the NRC didn't do anything about
15 that, because apparently it was not reported. But here is
16 Mr. Hanauer in 1975 saying we have got to look at these
17 matters and we have got to figure out what is going on. And
18 I have had many people, including Mr. Lefleur of the
19 international program, suggest to me that with 20-20
20 hindsight, it is obvious that under the kind of small break
21 LOCA conditions you would have, levels would stay high,
22 pressure would stay low.

23 This is not a major revision to the basic theory of
24 physics or steam hydraulics or anything else.

25 A It is a perfectly straightforward conclusion

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1 that every junior and senior in a power, heat power course
2 in the country will tell you about.

3 Q Under those circumstances, then, how could the NRC
4 have carefully evaluated and licensed plant design which had
5 ECCS actuated only when both level and pressure dropped to a
6 requisite point?

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ltCK 1 A I think the answer about the coincident level runs
2 as follows. In considering loss of coolant accidents which
3 were a primary focus obviously for a design basis
4 for emergency core cooling systems, we started out with big
5 pipe breaks, and work out what happens there and what you
6 do.

7 And then carry that analysis down to smaller and smaller
8 breaks. Some years ago when these requirements were being
9 worked out and implemented on plants, and the various
10 actuation schemes being reviewed, we had in a sense stopped
11 the small break analysis at -- before it went all the way
12 down.

13 That is, you carried the break analysis down through
14 smaller and smaller breaks. And you got down to a size of
15 break where the mass flow through the break was clearly less
16 than the capability of your high-pressure injection systems.

17 And it was thought, it seemed reasonable enough at the
18 time, that when you reached that point, what would happen
19 down at the point of a break size, what would happen is, you
20 would get -- the pressure would drop, and the pressurizer
21 level would drop as fluid was being lost from the system.

22 That you would reach the trip point in pressure and in
23 pressurizer level, the high-pressure injection system would
24 come on, and hold the system pressure at about that point.
25 And that would still be above saturation because the trip

ltCK 1 points on the low pressure trips are all set above the
2 saturation pressure in the hot leg. And that you would not,
3 then, not form steam voids in the system because you
4 would be above saturation pressure.

5 And the machine would sit there, then, pouring water out
6 of the small break but with water being pumped in from the
7 high-pressure injection systems at a sufficient rate to
8 equal that and keep the system liquid full and in
9 equilibrium.

10 So it was felt that the dual actuation on the
11 Westinghouse, and I guess, Combustion, I believe Combustion
12 uses the same system.

13 Q Yes.

14 A Was a consistent one.

15 Q Used to use the same system.

16 A Used to use the same system. And that the
17 coincident, the one out of two twice, or whatever the
18 arrangement was, the coincident-logic system, was a
19 reasonable way of making sure that you got actuation when
20 you needed it, but didn't get the high-pressure injection
21 pumps attempting to fire into the system on spurious, you
22 know, a transient in an instrument channel that would say
23 trip one of the level channels, and give you a signal to
24 start, that you need both.

25 Now, both in the Davis-Besse and Three Mile Island cases,

ltCK 1 I don't remember from the subsequent analyses of small
2 breaks, in particular, the relief valve, I don't remember
3 whether if they had left the high-pressure injection on, it
4 would have kept the system pressure up.

5 You remember in both cases, the level in the pressurizer
6 did indeed fall. Here we are talking about a B&W system
7 where there was a low pressure trip on it that fired the
8 thing, but in both cases, the level did fall, the pressure
9 fell and you got the trip.

10 But then they cut the blasted HPI off, which allowed the
11 system to depressurize on down further and go below
12 saturation pressure.

13 Q Wasn't the system already at saturation though,
14 because you had enough voiding in the primary system to hold
15 the pressurizer level up?

16 A No. Let's go back and trace from the beginning
17 and do it sort of generically so we can be thinking about
18 either -- about any PWR.

19 You get a small break, and let's take the relief valve
20 inadvertantly opening as a prototypical case, because that
21 is probably more likely than a small pipe break or a crack
22 in a pipe, actually.

23 The first thing that happens is that the pressure begins
24 to fall in the system as fluid moves out of the primary
25 system. The loss of fluid will be also reflected in a drop

ltCK 1 in the pressurizer level. The pressure will be slower than
2 would be the case in a liquid solid system.

3 In a liquid solid system, if you vent the least little
4 bit, why, you have dropped the pressure enormously because
5 the compressibility of water is so small.

6 But in a system with a steam bubble in it, and that is
7 why it's in there, the steam bubble will expand and tend to
8 hold the pressure up a little bit so the pressure will drop
9 more slowly.

10 With a ~~retrieval~~^{relief} valve open now we have initially the
11 pressure falling somewhat, we have the liquid level falling
12 in the pressurizer. The high-pressure injection is supposed
13 to come on and catch you before you go below saturation.

14 If it does and if the makeup of water into the system at
15 the pressure, 16, 1700 pounds, wherever the trip points are,
16 equals the amount coming out the break, you never drop the
17 pressure below saturation in the rest of the system and you
18 wouldn't get any steam voiding and you wouldn't see that
19 spurious —

20 Q Is the leak through the PORV large enough such
21 that the HPI cannot equal or exceed the loss?

22 A No, it's smaller.

23 Q At TMI-2, why did the pressurizer level come back
24 up again, wasn't it the formation of voids?

25 A Sure.

ltCK 1 Q That happened before they terminated HPI?

2 A No, after.

3 Q I thought they terminated HPI because of the
4 pressurizer level rising. As a matter of fact, it went off
5 scale and the operator went over and turned it off, or
6 throttled it.

7 A There are liquid expansion phenomena going on
8 here, too, that complicate the situation, because if you cut
9 the power generation, and then there is still heat removal
10 going on out on the steam generators, why, you cool, a few
11 degrees cooling in the primary system causes a little
12 contraction in the liquid volume.

13 Just the temperature coefficient of expansion.

14 Q Which would tend to make the level drop still
15 lower.

16 A Which drops the level in the -- in the B&W
17 machines, what happens when the pressure, when the pressure
18 relief valve opens, you -- the reason it's opened is you
19 have had a system heat up.

20 The heat removal on the secondary side has dropped a
21 little bit. You are in an imbalance. The system heats a
22 little bit. The pressure goes up.

23 You get the venting. Pressure then relieves. You are
24 supposed to drop back and get the relief valve closing, and
25 so on.

ltCK

1 But in the more general PWR case, as I say, the thought
2 was in terms of the small break analysis, and the coincident
3 logic was that you would get HPI injection and it didn't
4 occur to anybody the operator would go around turning it
5 off.

6 And that you would then hold the pressure up. You
7 wouldn't get — nobody thought much about voiding. We
8 assumed pressure would stay up for a while.

9 Q Nothing in that explanation you have mentioned or
10 that prior analysis seems to address what you have described
11 and what's been previously described to me as an obviously
12 known phenomenon, that if the break occurs at the top of the
13 pressurizer, you will have pressure in the coolant system
14 decreasing, and you will have level in the pressurizer after
15 an initial drop going back up.

16 Thereby, potentially deceiving the operator into thinking
17 that he had more inventory in his primary system than he in
18 fact did.

19 A It wouldn't go back up because of voiding
20 someplace else in the system and pushing some of the liquid
21 up in the pressurizer until you have dropped below the
22 saturation pressure.

23 Q Right.

24 A If you can, if you drive the high-pressure
25 injection system hard, and in most of the B&W plants, you

ltCK 1 can actually drive against the relief valve.

2 And I think against the safeties, too, in some of those
3 systems, and you have got enough flow rate at that pressure
4 to keep the pressure up there.

5 If you do that, you wouldn't get the saturation
6 conditions and voiding.

7 Q I am curious about that because it's my definite
8 recollection that the TMI-2 scenario was one in which the
9 operator did not throttle or terminate the HPI until he saw
10 his pressurizer level go off-scale high.

11 In other words, for whatever reason, if it was voiding in
12 the core or anything else, I don't know, you know far more
13 about it than I do, but it's my understanding that for
14 whatever reason, that level went up and went off-scale high
15 before he touched the HPI.

16 And the HPI had come on.

17 A Yes. This was a phenomenon that he had
18 seen before. That is, in previous secondary side trips
19 where in the B&W system, you don't get the ^{immediate} ~~medium~~ scram but
20 you see if the system wouldn't work its problems out and
21 keep online, he had seen before the relief valve opening.
22 And pressure drop, high-pressure injection. And one of the
23 things that he was keyed to do was to go and to keep the
24 system from going liquid, ^c solid by going and tripping his
25 HPI, clearly an inappropriate procedure under the

ltCK 1 circumstances.

2 But, nevertheless, one that they had been through a
3 couple of times before. At least a couple of times before.

4 And that that initial surge in the pressurizer was not
5 due to saturation conditions but rather to the fact that he
6 was getting high-pressure injection at some hundreds of
7 gallons per minute into the system and hadn't lost all that
8 much yet out the relief valve.

9 Now, so he tripped his HPI and then, by virtue of not
10 realizing that the valve was open and he had a small-break
11 LOCA going on, he kept the darn things tripped off and then
12 the pressure went down to saturation.

13 Once that happened, then the pressurizer level no longer
14 is a valid indication.

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amn 1 Q Let's come back to coincident logic because that is
CRAIG 2 where the mechanical problem comes in, and you eliminate the
3 question of human error, at least human operator error. It is
4 more human design error, I guess. That is a situation where
5 the ECCS will not automatically actuate until both level and
6 pressure reach a certain low set point.

7 A Yes.

8 Q Again. If it was obviously known that under certain
9 circumstances certain types of small breaks towards the top of
10 the pressurizer, level would not drop low enough to actuate
11 that HPI and would instead stay on, while pressure did
12 continue to drop to the point where you would want ECCS to
13 come on, that design wouldn't have been approved, would it?

14 A I don't think so.

15 Q It would clearly pose a danger.

16 A Or would have had other provisions in it to deal
17 with the circumstances. I think the problem was that we had
18 not carried the small break analysis out far enough, down far
19 enough in terms of break size and in detail and on out in
20 time. And that we were making the kind of assumption that I
21 outlined to you initially, that in the event of a break which
22 was small enough so that you were within the capacity of the
23 high-pressure injection pumps, they would simply come on
24 before you had saturation in the system, and keep you at that
25 point.

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And people just didn't think about the void formation in that context. If we had gone ahead and, as we should have done, clearly, and carried those analyses out in full detail and for extended times, then I think the kinds of problems that we got into at TMI would have been clear enough and there would have been fixes all around.

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Now the subsequent actions of course have been to recognize that condition and to take out the coincident feature.

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Q Right.

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A On that trip. I must say, it is also pretty frustrating, I have read the Westinghouse report from Beznau, which turned up here quite recently, the first we had seen it. It is very straight; it is a very straightforward report. They had voiding in that system. They were at saturation conditions. They had voiding in that system. Pressurizer level stayed up. Tell me why Westinghouse wasn't bright enough to figure out what all of that meant.

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Q See, to be honest, that is one of the central things --

A That is your question to me. I am glad I asked first.

Q That is one of the central things that really bothers me because I see an organization like Westinghouse give a careful study of that question and not perceive the

amn 1 generic safety issues. I see the NRC taking a look at that
CRAIG 2 design and presumably approving it at some point in
3 connection with Westinghouse plants, and I hear people now
4 including yourself telling me that this phenomenon of level
5 high and pressure low is by no means a startling or new
6 phenomenon whatsoever.

7 It just seems that an awful lot of very fine minds turned
8 on the problem at one point or another and didn't come to the
9 solution. Now again, perhaps the best explanation for that is
10 simply human fallibility.

11 You can't be perfect, no one, no matter how long they
12 study these problems can come up with a perfect solution for
13 every one. That raises the problem then.

14 A I think we can be a hell of a lot better than we have
15 been in this case.

16 Q Okay. But take Westinghouse for example. As you
17 say, the Westinghouse Beznau report is thorough. They have
18 charts, graphs, diagrams in that thing. Speaking just as a
19 layman I look at it and it appears to be a highly competent
20 job of technical evaluation.

21 A Somehow they came out of that thinking, well, the
22 operators here recognized —

23 (Recess.)

24 (The reporter read the record as requested.)

25 THE WITNESS: Apparently they thought that the

amn 1 operators recognized the problem and dealt with it all right,
CRAIG 2 and that other operators would, and they didn't see it as a
3 difficulty. But I have troubles with their having stopped at
4 that point --

5 MR. FITZGERALD: Excuse me.

6 (Discussion off the record.)

7 BY MR. KANE:

8 Q Before we leave this subject, Chairman Hendrie,
9 Westinghouse has made a statement which had appeared in the
10 newspapers to the effect that in investigating and evaluating
11 the Beznau transient, Westinghouse did not perceive any
12 generic safety problem to be involved in that transient. It
13 is clear now that that was erroneous in light of the action
14 that the NRC has taken since the Three Mile Island accident.
15 Doesn't that fact, if it is a fact, assuming that Westinghouse
16 is correct in that statement, doesn't that indicate that this
17 whole reporting system for operational experience is subject
18 to human failings and that those human failings can well
19 result in missing important things on occasion?

20 A They have. It has. The answer is yes. And it has.

21 MR. KANE: Let's have this letter from, or
22 memorandum from Mr. Haneuer to Commissioner Gilinsky with the
23 attachment that we have been discussing --

24 MR. CHOPKO: Already marked in the Kennedy
25 deposition.

amn 1 MR.KANE: I wasn't sure about that. Let's have this
CRAIG 2 marked as the next exhibit in order to the deposition today.

3 (Exhibit 7 identified.)

4 BY MR. KANE:

5 Q Chairman Hendrie, on Sunday, April 1, 1979, were you
6 involved in the process of President Carter arranging to go
7 to the Three Mile Island unit 2 site?

8 A I was not -- no, I was not engaged with the
9 arrangements for the President going to Three Mile Island.

10 Q On that day, Sunday, April 1, were you concerned
11 about the explosibility of the hydrogen bubble?

12 A The possibility that there had been oxygen evolving
13 up into that bubble, and the possibility that the mixture
14 might be approaching a flammable limit, had been a subject of
15 rising and falling concern ever since Friday morning for me.

16 One of the first things that occurred to me in the course
17 of a series of very rapid and, sometimes hurried conversations
18 with staff members as soon as I got in on Friday morning, when
19 I learned about their belief that the core was extensively
20 damaged and the determination that there was a noncondensable
21 gas volume in the primary system, it obviously had to be
22 hydrogen, and I began to wonder how soon, if ever, we would
23 have problems with oxygen evolution.

24 I could remember that PWRs in fact operate with a hydrogen
25 overpressure on the volume control tank, or in a Westinghouse

amn

CRAIG

1 system, or whatever corresponds to it on the others. You get
2 something like, I don't know, 20, 25 CCF² ^{of} hydrogen dissolved
3 per liter of water or something like that. And it suppresses
4 radiolytic decomposition, or rather, what it does is to cause
5 the back reaction to go fast enough so you get no net
6 evolution of oxygen.

7 And I kind of thought that ought to be holding things down,
8 but it was something that I asked the staff and I think my
9 earliest request to them, as best I can remember, were —
10 would have been Friday morning at sometime. To get somebody
11 started calculating what the net evolution rate might be, and
12 what — and also somebody to look into what high-pressure
13 flammability limits were.

14 I could remember very well what the approximate limits were
15 down around atmospheric pressure, because I had done a lot of
16 work on hydrogen in containments year^s before. And I couldn't,
17 I didn't remember any strong pressure dependence to the
18 flammability limit, but obviously wanted it checked.

19 So over Friday, Saturday and Sunday, there were a series,
20 sort of an iterating series of calculations and an ever
21 expanding circle of experts throughout the country who were
22 sucked into trying to estimate what the evolution rate, if
23 any, might be. And it went through, and what the flammability
24 limits were and what the pressure surges would be and so on.

25 And these things went through cycles. And the cycles

amn 1 seemed to approximate the following. Late every afternoon,
CRAIG 2 why, it would look as though if there were any, it was some
3 days away to a flammable condition. And that position would
4 sort of hold more or less through the evening. And that would
5 be pretty good.

6 And I'd come in the next morning and the first set of
7 reports that had come in is that overnight calculations had
8 changed that and it now looked worse. Then we would go
9 through a cycle of, you know, are we on the edge of having a
10 flammable mixture in the vessel, in which case the ballgame
11 sort of changed leads.

12 Q Was that the situation on Sunday?

13 A It was that way on Friday. Mid-afternoon on Friday I
14 got the first oxygen numbers back up and I didn't like the
15 looks of them. Then they seemed to say, well, no, that's
16 probably very conservative calculation, so there are more
17 days. Then Saturday morning, no no. It looks much closer in.

18 By Saturday night, why, it had gone down again. And
19 Sunday morning it had gone up again.

20 So, and in fact I think, judging by what I have read of
21 the transcripts on Sunday, why, while I was down on the Three
22 Mile site, why, the Commissioners up here were having a
23 session about it.

24 We were very concerned about it down at Three Mile.

25 Q Did you think on Sunday that the President was going

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1 into a potentially dangerous situation in visiting the site?
2 A No, but I thought — but there was a time Sunday
3 morning when it looked like we were getting — might be
4 getting awfully close on the basis of some calculation as to
5 the flammability limit.

6 Q Did you issue any warning to the White House or
7 anything like that? It just doesn't sound like the kind of
8 place where you want the United States President to be.

9 A Or anybody else's president for that matter. No,
10 because by the time we got those results — let's see. When I
11 went down in the morning I picked up Roger Mattsen out at
12 Bethesda and some communications gear, and we headed then
13 down, or ~~headed~~ up toward the Three Mile site. And Roger had ^{the}
14 status.

15 I had asked him to get the latest on the overnight status
16 and he'd gone out early to the response center to collect
17 that. And it looked, let's see, I don't remember what the
18 numbers were. But it looked as though we were still away
19 away. The President came in. I got there, must have gotten
20 there in the neighborhood of 11:30. Went immediately, after
21 checking in at the NRC trailer there at the visitors center,
22 where the emergency operations command post was, I then went
23 immediately down to the airport to see if I ought to stand by
24 for the President or not.

25 And turned out that the President wanted to meet with

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Harold, and in a very closed meeting.

So he and Roger Mattsen did that. And I then went back to the trailers. And it was sort of after the President was in and out that these series of further phone calls from Bethesda came through and said, you know, we have got — we have enlarged the circle of experts by one more increment on the radius and gathered in another group. And this makes it look bad.

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Q So, up to that point, you weren't that concerned on Sunday?

A No.

Q You did not feel that the President was going into a highly dangerous situation?

A No.

Q Okay.

A And furthermore, even in the control room, you are a long way away from the vessel, and if you are going to have hydrogen-oxygen mixture, my feeling was that a good place to keep it away from ignition sources is in a, you know, in a wet vessel.

Now, later in the afternoon, there were some things that came through that Bob Budn¹atz, B-u-d-n-¹a-t-z, who is in the research office, had gotten called into him that there was the possibility of ignition even from just slopping of the water at the interface. But that was later on.

So I wasn't concerned about a pressure surge while the President was there. But later that afternoon, why, these concerns began to come through again from Bethesda and looked worse.

Stello, backed by Matt Taylor at the site, was strongly of the belief that the overpressure was keeping down the decomposition, and had calls out to the Naval Reactors Laboratory in Bettis, who come close to knowing what there

rc CK 1 is to know about the subject and Cappel and GE and maybe
2 some other places and I had a couple other places out.

3 By latish afternoon, why, it was clear that we had been
4 chasing a myth. That, in fact, with the overpressure, you
5 weren't getting any net oxygen and never had.

6 Q On Friday and Saturday, how seriously did you take
7 Roger Mattson's warnings about the bubble?

8 A With regard to the oxygen problem or more general?

9 Q I guess more general. Both the possibility of an
10 explosion and also the possibility of the bubble expanding
11 and uncovering the core?

12 A Let me talk first about the oxygen problem, since
13 I may very well have been the generator of that ghost that
14 haunted us for three hard days there.

15 I had the feeling from the time the first results came
16 in, which surprised me at the size of the oxygen evolution
17 rate they were reporting, I had the feeling that there were
18 either errors there in the units, or in the calculations
19 that had been done or something, because it sounded to me
20 much too high.

21 And I told them to go on and, you know, expand their work
22 on it and try to firm it up. And I pretty well felt through
23 the three days, although it was clearly a substantial
24 concern and subject of a lot of conversations with the
25 commissioners because I told them about it, I think about

rc CK 1 midday, my concern about midday or thereabouts on Friday.
2 So, it was the subject of discussion before the
3 Commission very extensively.

4 My feeling kept being that we still hadn't gotten our
5 hands on an authoritative result and that it just smelled
6 like one of those scary preliminary results that you don't
7 want to go off and take actions without knowing a little
8 better. Okay. Now that is about oxygen.

9 On the more general subjects, Roger's concern about the
10 bubble and what it meant for cooling in the core and how we
11 were going to get down, get the bubble out and get the
12 system down to cold shutdown sooner or later, that was a
13 matter obviously of concern to me and subject of keeping
14 pretty close contact with the staff, including the people at
15 the site.

16 But the machine, after all, had gone through its violent
17 evolutions in about the first 15, 16 hours on Wednesday, and
18 had been stable in the condition with bubble at 1000 pounds
19 at about 280 Fahrenheit for, well, ever since Wednesday,
20 sundown Wednesday.

21 Here we were on Friday, the afterheat was now
22 substantially down, so that if something untoward happened,
23 we would have longer times before we began to get
24 substantial core melting. The heat rates are down.

25 And my feeling Friday when Roger was talking about the

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rc CK 1 unsettling aspects of the whole thing was one of, steady
2 now. Let's not panic ourselves into unfortunate and
3 precipitous actions.

4 The machine had been on an even keel after its first
5 transients and the core damage has occurred. We sort of
6 hour by hour are improving our ability to keep the pump
7 running and improving the status of the plant in that
8 regard. Let's keep it right there and nobody make any moves
9 until we know exactly where we are going.

10 And the concern, then, was, okay, you have got a power
11 failure, or the pumps trip out on you. The running pump
12 trips out and you can't get another one started, and you
13 have to start an evolution on to another cooling mode.

14 My feeling was that, if that happened, we would have a
15 number of hours before any fission products could come out
16 if it went sour, and would have time to evacuate people
17 around the site.

18 Q If I could —

19 A And that the situation, while very serious, and I
20 did a lot of sweating and not much sleeping for three or
21 four days.

22 Q I can well imagine.

23 A Nevertheless, was not one in which I felt we ought
24 to start taking, oh, moving people out or start some
25 evolution with the machine. In particular, I was rather

rc CK 1 concerned that Met Ed not get ahead of us and start
2 anything.

3 And talked to — I talked to Bob Arnold up there Friday
4 morning, both to check on what in hell he thought he was
5 doing with the waste gas releases and what the nature of
6 those was. And also to make sure that he understood that
7 there wasn't to be any fooling around with the machine
8 configurations, change of mode or anything without our
9 concurrence.

10 Unless, of course, you know, the machine went sour and it
11 got to be an emergency, in which case they would have to do
12 what they could do.

13 Q Two things on that before you go any further,
14 Chairman, because in these responses you gave, all kinds of
15 questions come up.

16 With regard to that waste gas release, there had been
17 some question about whether or not that release was
18 authorized in advance, or at least was disclosed in advance
19 to the NRC, to someone within the NRC.

20 As far as you know today, was that release approved in
21 advance by the NRC?

22 A I don't know.

23 Q Was it disclosed in advance to the NRC?

24 A I don't know.

25 Q Okay.

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1 A What is clear is that I didn't know it was coming,
2 and I didn't know it was deliberate on their part until I
3 talked to Arnold.

4 Q He told you it was deliberate? Because there was
5 some question about that, too.

6 A Let me not say that. Let me think about that a
7 minute. But let me come back to that, about what Arnold
8 told me. I didn't know about it and I didn't know it was
9 deliberate until later on.

10 Harold Denton didn't know that it was deliberate, I know,
11 because he told me when Floyd testified before you people
12 and said he had ordered it, that he was pretty darned
13 surprised.

14 When I say I don't know whether we were notified or
15 agreed to it, there were NRC people down there in the —

16 Q Control room.

17 A In the control room and around the site. And
18 since there are all these investigations going on, I have
19 not gone in for myself to try to find out. I thought this
20 would all work out in your investigation and ours.

21 And I can't be sure, but what the shift supervisor didn't
22 say to an NRC person who was there, look, we are going to
23 have to do a little venting here, and the NRC person, I am
24 not sure that that didn't happen, and I am not sure
25 personally that the NRC person didn't say, well, you know,

rc CK 1 if there is no other way out, I guess we have to.

2 So, I have to say I don't know.

3 Q Under those kind of emergency conditions, in your
4 role as Chairman of the NRC, should you be notified of that
5 kind of thing in advance and be called upon to approve it or
6 disapprove it before anything is done?

7 A I am inclined to think that that may be getting a
8 trifle too fine an operational — even though it is raised a
9 hell of a lot of flap, may be getting to be too fine an
10 operational point, to have the system inoperable, that is,
11 not allowing anything, anybody to do anything until the
12 Chairman of the NRC makes up his mind.

13 I expect that is too far away to go to get clearance.

14 Q But that is not what I was talking about. We are
15 talking about a specific item, that is, a significant
16 release of radioactivity to the outside environment, the
17 1200 millirem cloud or plume that resulted here was one
18 which was a cause of some alarm.

19 A Yes.

20 Q Before that kind of release is permitted to take
21 place, assuming it was done deliberately during the course
22 of an accident, shouldn't someone of your stature within the
23 NRC be called upon to pass on that?

24 A It depends upon the circumstances. My
25 understanding is that Floyd also claimed that he either had
26 to do that, or there would be worse things.

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bwCK 1 Q I see.

2 A And he had to do it when he did it. Now I can't
3 tell you that I know that is what he said. But I seem to
4 recall that. The general proposition of who ought to be
5 authorized to order what in one of these emergency
6 situations, in my view, depends very strongly on the
7 circumstances and the available time. If, for instance,
8 the machine is running along stable and that one main pump
9 goes off, they immediately try to start another pump. They
10 can't get it started. We are now on a track that may lead
11 to a lot of trouble. They can't be calling Washington,
12 D.C., to find out if the Chairman of the NRC — and
13 explaining everything to the Chairman and see what the great
14 Chairman thinks. They have got to do everything they can do
15 and do it as fast as they can. So emergency situations
16 which require urgent action, the decisions will have to be
17 taken by the most knowledgeable people immediately in
18 command of the situation. And I think that is going to be
19 true also, and always be a feature of these things. So
20 depending on whether this waste gas release was something
21 that could very well have been delayed and discussed, or
22 whether it was, in fact, an urgent operational situation,
23 the answer to that kind of consideration would determine my
24 answer to whether it was right or wrong.

25 Q All right.

bwCK

1 A Let me go back for a minute and repair the
2 suggestion that Bob Arnold told me it was deliberate. I am
3 not sure that he did. He told me that there had been
4 releases between something like, oh, 7 and 8 o'clock to
5 relieve the building pressure in the waste gas system, to
6 avoid any possibility that ruptured discs might go and then
7 have a much more serious release. And I don't recall
8 whether he said those were deliberate or not.

9 Q Let me jump to something else. Did you tell
10 Governor Thornburg, on Saturday night, March 31st, that the
11 Associated Press story concerning the hydrogen bubble was
12 erroneous?

13 A I think I probably did. I spent Saturday —
14 for a period there on Saturday, I can remember calling one
15 of the civil defense directors in the area a couple of
16 times. And I daresay I called the Governor's office. But
17 I don't remember specifically.

18 Q Was there something erroneous about the Associated
19 Press story on Saturday concerning the bubble?

20 A Yes.

21 Q What was wrong there?

22 A What had happened was that, in spite of our
23 resolution to let Harold Denton speak for us at the site,
24 there had got to be such a crowd of press people, media
25 people at the response center in Bethesda that Frank

bwCK 1 Ingram said you have to say something. We were out there
2 on Saturday. You have got to go out there and somebody's
3 got to say something — and it seemed — or they will tear
4 the building down, and I can't afford to have the building
5 torn down. And so I volunteered to go and do the duty.

6 Q So did you conduct a press briefing?

7 A I had a press briefing.

8 Q That was on Saturday?

9 A It would have been, I think, early Saturday
10 afternoon, as I remember.

11 MR. DORIE: About 4 Saturday afternoon.

12 THE WITNESS: Was it that late?

13 MR. DORIE: I thought it was fairly late
14 afternoon.

15 THE WITNESS: The days ran fairly long, so 4
16 p.m. was — now at that press briefing, I attempted to
17 answer questions in a pretty straightforward way and not,
18 you know, shilly-shally about the possibilities. There
19 was a line of questioning. I have got a transcript of that
20 thing. There were questions along the line: "What about the
21 hydrogen bubble? What are you going to do with it?" The
22 answer was, "Well, we are not sure at the moment. The thing
23 is to stay where we are, not make any false moves until we
24 determine the best way to get it out of there."

25

bwck

BY MR. KANE:

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2 Q While we are on that, you did make some remarks
3 that afternoon about the explosibility of the bubble?

4 A Yes, there were sort of two lines of questions
5 that I recall in particular. One of them had to do with,
6 well, would — "If you decided to take certain steps with
7 the machine, would you consider that, would that be risky
8 enough so you would consider evacuation," and the answer was
9 clearly. "Yes." There was some discussion then that went
10 off on that train. There was also discussion about, "Is
11 there any chance that it could explode?"

12 There was also some discussion about how many bubbles
13 there were, because there had been a previous — that
14 morning, I think from Harold Denton's press conference,
15 there had been confusion over how many bubbles and which
16 bubble who was talking about. And I attempted to make clear
17 that there were, in fact, two bubbles in the primary
18 system. The one in the pressurizer being maintained by the
19 pressurizer heaters and into which some hydrogen was
20 coming, and also we thought then at least one bubble in the
21 reactor vessel. And the hydrogen might also be in some
22 other places in the system.

23 Q What do you think now of your remark during that
24 press conference that an evacuation out to 20 miles might be
25 considered?

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1 Do you recall making that remark?

2 A Yes, that was in connection with, "Well, if things
3 begin to look bad, would you consider an evacuation?" And
4 the answer was obviously, "Yes, evacuation — that the
5 possibility of a precautionary evacuation in the event that
6 we find we have to make an evolution, and we are not dead
7 sure how it will come out, is certainly something we would
8 consider recommending to the Governor."

9 Then the question was, "Well, if you had to evacuate, can
10 you give us some idea how far out you might go?" And I
11 probably reached a little far, but said, "Well, it might be
12 as far as 20 miles."

13 Then people wanted to know what about Baltimore? What
14 about Washington? And I told them not to worry about
15 Baltimore and Washington.

16 Q For the benefit of the people on the Presidential
17 Commission Staff, who are working on the public information
18 aspects of this matter, do you feel today that those
19 comments you made on evacuation and on explosibility of the
20 bubble on Saturday, March 31st, was an effective way of
21 dealing with the public information obligations you had at
22 that time?

23 A I don't know. It's a very serious and difficult
24 question. On the one hand, you have the urgent need to
25 speak factually. People have a right to know what we think

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1 we know. On the other hand, those reports, the comments
2 that I made, which I think in their entirety, had they been
3 presented to any member of the public, wouldn't have excited
4 undue unrest, began to appear very soon after that in the
5 form that the Chairman has said the machine's going to
6 explode. And that everybody within 20 miles is in peril.

7 And there was a hell of a flap up there that night.

8 Now, if things that you think are factual statement of
9 circumstance are going to get treated that way in the media
10 and are going to cause public panic, as was the case in some
11 parts of Pennsylvania that night, then it's a very serious
12 public interest question whether you ought to be as
13 forthcoming as I was trying to be. And I think that is a
14 subject that is worth some thought.

15 I don't know how to deal with it. I would welcome
16 suggestions.

17 For the benefit of your public information people, let me
18 add, there were a number of times during that first week
19 when I desperately wished that I had a group, small group of
20 accredited correspondents who knew what a reactor was, UPI
21 people, AP people, television people, press people, who knew
22 what a reactor was, who knew what the NRC was, who knew a
23 little bit about the outlines of reactor safety, had a
24 little bit of technical background and could understand some
25 of the technical language, to whom one could sit down and

bwCK 1 talk, either in a background session or even on the record,
2 and who could then be counted upon to present to the public
3 straightforward factual accounts, not leaving out the
4 caveats and the necessary supporting details that help provide
5 a reasonable background.

6 But, I don't know. It is a problem. We try here to say
7 it minute by minute like we think it is. We try to be open,
8 and to say, let everybody speak up. And — but clearly when
9 you get situations like Three Mile Island, then that kind of
10 openness by the agency and its people has the potential, by
11 virtue of misunderstood reports or reporters, sort of
12 misdirected summary of what's been said, has the
13 potential for severe, bad effects on the public. You know,
14 I think a large part of the human damage from Three Mile
15 Island 2 in that area of Pennsylvania is a psychological
16 stress damage.

17 And that in turn flows in part from the nature of the
18 reporting which in some places and some stories and on the
19 part of some news organizations was, I think, about as good
20 as you could have hoped for, because we weren't, you know,
21 we didn't — weren't in a position to tell everybody
22 everything they wanted to know either.

23 As I say, we didn't know. But on the part of some other
24 organizations, was really wild. Some of the small radio
25 stations would take these things off the press wires which

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1 were in themselves incomplete and not see summaries of what
 2 a NRC person had said, be it Dudley Thompson the day before,
 3 Ed Case later, the day after I had my press conference. And
 4 some of these little radio stations would pull those things
 5 out and just go on the air with just flagrant
 6 misrepresentations. Not deliberately, obviously, but
 7 they just didn't understand and they were playing the
 8 sensational side.

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1 Q Did the White House force you into closing down
2 the East-West Press Center on Saturday night, March 31st?

3 A No. I had some discussions on Friday afternoon
4 with Mr. Powell, the President's press secretary, in which
5 he pointed out the perils as a public information sort of
6 operation of trying to run briefing centers at several
7 places, geographically separated and inevitably with the
8 people not able to hear each what the other was saying and
9 so on.

10 And he recommended that we consider deciding
11 whether Bethesda, or Denton, at the site, was the best
12 place.

13 I recall we discussed it a little bit and agreed that
14 Denton was in a better position than we were up here because
15 of some of the communications difficulties, and we agreed
16 that indeed, it would be desirable to try to concentrate the
17 point of supply of public information down there at the site
18 with Harold Denton.

19 I also, either, I guess it was Friday night or Saturday
20 morning, I talked to the Met Ed chiefs several times during
21 the day. And in one of those discussions, probably Friday
22 night, suggested that in the circumstances, they might want
23 to give up ~~their~~ press briefing and let Harold speak for the
24 situation.

25 But it was a discussion, Mr. Powell was concerned

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ltCK 1 precisely about the panic side of it creating an unnecessary
2 unease, and perhaps even panic down there. And our
3 discussion was in the nature of recommendation, you know, of
4 his view of a reasonable way to run it, and discussion of
5 that back and forth.

6 And I concluded that that was indeed a good idea. Then,
7 of course, the next afternoon, in response to the press
8 crowd at Bethesda, I went and breached my own determination
9 and regretted it the rest of Saturday evening.

10 Q Was Ed Case opposed to shutting down the East-West
11 Press Center?

12 A I really don't know.

13 Q Why did you not meet the press before Saturday
14 afternoon in connection with TMI-2?

15 A I think because I spent most of Friday with a
16 telephone stuck in my ear. Either that or sprinting — I
17 had to go up to the White House, the situation room there,
18 in the early afternoon.

19 But mostly because I was just stuck in here with a
20 telephone in my ear.

21 Q So you were just too committed to other things.

22 A Yes. It was too much, much too much a matter of
23 trying to catch up with the operation, let alone stay on top
24 of it. And I had just too much to do.

25 Q I wanted to ask you a few questions about some of

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ltCK 1 the evacuation recommendations that were made by you, or the
2 discussions about evacuations that you had with Governor
3 Thornburg. The transcripts and tapes we have show that at
4 10:07 on Friday morning, March 30, you recommended to
5 Governor Thornburg that people stay indoors.

6 A Yes.

7 Q By that time, as I understand it, Harold Denton
8 had recommended a formal evacuation.

9 A Yes.

10 Q And I am curious as to why you did not deem it
11 advisable to follow that advice, instead were talking about
12 simply having people stay indoors at that point.

13 A Well, my discussions with the staff that morning,
14 I guess some of which are recorded in the Commission's
15 transcripts because they would have been on the speaker
16 phone, but there were others that were direct to people out
17 at Bethesda, seemed to make it clear to me that, with regard
18 to the machine situation, the reactor configuration was as
19 it had been for some time, since sundown, Wednesday, that it
20 hadn't changed.

21 That if anything, the machine situation was more
22 favorable, because the afterheat was dying out all the time
23 and because the — sort of the maintenance work on making
24 sure that another pump could be started and so on had gone
25 ahead.

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1 They'd gotten a lube oil pump, were working on it to get
2 it in shape to start. So the machine configuration was
3 better. And barring an abrupt change in that mode of the
4 machine, the reactor, that is, the stuff inside containment,
5 looked in the circumstance in decent enough shape.

6 There had been these bursts earlier that morning from the
7 waste gas header. There was the report of the 1200 MR per
8 hour dose rate in the plume immediately over the plant vent.

9 But in part, that was inferred by ratioing an alleged
10 release rate, curie per second release rate, with a previous
11 day's alleged release rate, and dose above. And, in fact,
12 when I talked to Arnold a little later that morning, why
13 his helicopter had been measuring, oh, something in the 3-,
14 400 MR range.

15 Even at 1200 alleged, the off-site doses were going to be
16 down in the few tens at the most of the MR range, by the
17 time it got down to surface level and off-site.

18 Furthermore, by the time I got anold of the situation, a
19 little after 9:00 o'clock, the releases had apparently, at
20 least temporarily been stopped.

21 So that what we had had was an emission of a limited
22 amount of material which would not lead to substantial doses
23 off-site, i.e., substantial in an accident sense, and not
24 certainly up to the EPA evacuation protection action
25 guidelines.

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1 That the release had at least temporarily been stopped
2 and there was some prospect of holding it, although there
3 was worry that they would have to vent again in some hours.

4 Or that it would vent itself again in some hours. So
5 here's this cloud which has been lofted an hour or two
6 before. Is now cut off. Is moving gently northward.

7 And if there was one thing I didn't want to do, it was to
8 have exposed people in that quadrant to the whatever dose
9 derived from it, as I say, the measurements and projections
10 were not at very large levels, and then move them on out so
11 they could get it again.

12 So that it seemed to me to make --

13 Q Better to stay indoors?

14 A Yes, it seemed to me that much the best thing to
15 do, particularly in view of the very erratic nature of the
16 reporting and what was going on and so on, it was really
17 very harum-scarum sorts of limited bits and pieces of
18 information that didn't tie together.

19 Nobody seemed to have a consistent story and so on. It
20 seemed to me best to say, wait a minute. The best thing to
21 do is the people off-site and in the area, why don't they
22 stay indoors this morning and in a little bit, we will get a
23 better handle on thing.

24 Then we can see where we go from there. So that was the
25 initial reaction. I recognized that the staff had gone

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ltCK 1 ahead and recommended a recommendation but it seemed to me
2 that their reasons for doing so were less a valid set of
3 good information that would support that than just general
4 concern over what was going on.

5 And I was worried about beginning to move people around,
6 both with regard to the thing I had mentioned, that is,
7 moving them into a place where here comes the cloud again.

8 You know, they'd just — it's just gone over them and now
9 we evacuate them and they drive away from the site and get
10 back under the cloud.

11 And, also, the risks that are inevitable when you try to
12 make a rapid evacuation. You are bound to get some mishaps
13 and there is always a human cost involved in evacuations, so
14 it seemed to me very prudent to just hang on there a minute.

15 It didn't sound all that bad to me and it didn't sound
16 like the prudent thing to do to evacuate. And the
17 Governor's information, when I talked to him at that first
18 time around, his people were saying, you know, what
19 evacuation? You know, what are those nuts up to in
20 Washington?

21 I had a better tie to the site at that point than I did.

22 Q On the other hand, by that time, Harold Denton was
23 on-site, wasn't he?

24 A No, no, this was 10:00 o'clock in the morning.
25 Harold didn't get there until about 1:00 o'clock or a little

ltCK 1 out after.

2 Q All right.

3 A I talked to the Governor again, it must have been
4 what, about 11:30 or something like that?

5 MR. HASSELL: About 11:30?

6 BY MR. KANE:

7 Q That is the second one we found on the tapes, at
8 11:40, on Friday morning, March 30, you again talked to
9 Governor Thornburg and at that time recommended a five-mile
10 evacuation of pregnant women and pre-school children.

11 A Yes.

12 Q Did you come to the decision that you should make
13 that evacuation when you received a note from William Dorie
14 concerning the fact that Harold Denton had again recommended
15 evacuation?

16 A No.

17 Q No?

18 A That recommendation sort of -- not a compelled --
19 the recommendation was that the Governor suggest, not order,
20 but suggest that pregnant women and pre-school children who
21 could reasonably leave the area might be well-advised to do
22 so, out to a range of five miles.

23 That was the nature of the recommendation. And that
24 derived from some discussion that I had had with the
25 Commission, in which that sort of limited action with regard

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1 to the most sensitive component of the population, most
2 sensitive to radiation, was something that I can recall was
3 discussed, Commissioner Bradford recommended and said it
4 sounded like -- I can remember him saying, well, you know,
5 what would we do if we had a good friend and his pregnant
6 wife and small children, you know, in Middletown and we
7 weren't Commissioners?

8 And it was made, the recommendation was made to the
9 Governor. I think the Governor's own people weren't very
10 fond of it. But the recommendation was made to the Governor
11 in part because we couldn't discount the possibility that
12 there would be more of these waste gas releases.

13 And that people who could, pregnant women and pre-school
14 kids who could reasonably leave the area, had transportation
15 and didn't have a strong reason to stay, it might be just as
16 well to just avoid the -- even the small incremental
17 exposure to those people.

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1 Q Did you have any significantly new knowledge at
2 11:40 that you didn't have at 10:07 on Friday that led to
3 this recommendation?

4 A By that time I'd talked to Arnold, had a little
5 better handle on how it looked from his standpoint. Had
6 talked a number of times with staff people, the information
7 on the morning releases was firming up a little bit, and the
8 data that was coming back on off-site dose rates was indeed,
9 you know, down. Oh, there were a couple of places close-in
10 that got around 20, 20 MR per hour or a little bit above
11 that.

12 But for the most part, the levels were down and there
13 hadn't — I don't think by that time there had been any more
14 puff releases. And I had a chance to get a little better
15 handle on the situation. There was also a conversation in
16 which I tried, I think, to outline a little more for the
17 Governor what we thought the machine situation was and what
18 the possibilities were. He wanted to know, you know, well,
19 what can happen from here? What do we need to be prepared
20 for?

21 One of the things I wanted to tell him was that, although
22 we were not recommending that he consider at that time any
23 general evacuation, that surely Civil Defense people ought
24 to be on alert.

25 Q Were you informed by William Dorie before you

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sonCK 1 made that recommendation to Governor Thornburg at 11:40 on
2 Friday that Harold Denton had again recommended evacuation?

3 A I just don't remember.

4 Q All right, fine.

5 A And I don't recall that being a factor in my —

6 Q I see Mr. Dorie shaking his head behind you, so he
7 obviously agrees with your recollection.

8 THE WITNESS: Do you remember giving me a note?

9 MR. DORIE: No. What you have, what we turned
10 over to the commission was a scratched note that Tom Gibbon
11 had written. I don't know where he got that information. I
12 would not have, and be in a position to, make a
13 recommendation of that kind to the chairman.

14 MR. KANE: It was my understanding it was a note
15 that simply recited the fact that Harold Denton had again
16 recommended evacuation, something to that effect.

17 THE WITNESS: If I would have gotten it, I would
18 have disregarded it because I had been talking with Harold
19 Denton off and on since 9:00 o'clock in the morning, and
20 would have regarded my conversations with him as a more
21 authoritative source of information than a note. And I
22 couldn't — If I had had a note, it might have related to
23 the earlier one which I had already dealt with.

24 BY MR. KANE:

25 Q Fine. At 3:41 in the afternoon on Friday,

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sonCK 1 March 30, you again had a conversation —

2 A Yes, called the Governor again.

3 Q At that time you stated to him that it would be

4 prudent to be ready for something like a 20-mile

5 evacuation. At that time in the afternoon, did you have any

6 significantly new knowledge that you didn't have in either

7 of the prior conversations with Governor Thornburg?

8 A Only to the extent I'd had that much more time to

9 talk to an assortment of staff members and had a better view

10 of the machine. The reason I called him in mid-afternoon,

11 as I recall it, was a feeling on the part of the

12 Commissioners, and that includes me, that we ought to try to

13 fill the Governor in as best we could on everything we knew

14 about the machine condition.

15 And I hadn't, there hadn't been an extensive discussion,

16 all that extensive a discussion before. So as I remember

17 it, a good part of the reason for that call was to try to

18 make sure that he understood the various aspects of the

19 machine condition, particularly the -- with regard to

20 the possibilities that, A, something in the stable cooling

21 mode we were in could go bad, in which case you would be

22 precipitated into an action situation, and might want to

23 make a precautionary evacuation; and, B, that it was

24 possible that, down the line when we figured out how best to

25 get the bubble out, that we might conclude that our bubble

sbnCK 1 removing procedure had some questions about it, and we might
2 want to do a precautionary evacuation while — and have
3 people out of the area while that was going on.

4 And the Commission, as I recall it, felt that he ought to
5 understand those various conditions. And as I recall, we
6 got on a speaker phone and he had a number of his staff
7 people there with him. And I can remember answering as best
8 I could questions that a number of his staff people had. It
9 apparently was a group around the speaker phone there, just
10 as ^{1, 2} were here on that occasion.

11 Q At the time you were making these recommendations
12 to Governor Thornburg, did you know how many people were
13 residing in Middletown?

14 A I think not very accurately, if at all. I know it
15 is not — you know, knew that it was not a large — not a
16 large city. But I don't recall — I guess the transcripts
17 would reflect whatever I thought I knew or people told me at
18 the time.

19 Q Did you have any specific knowledge as to how many
20 people would be involved in a five-mile radius, ten-mile
21 radius, 20-mile radius, something like that?

22 A You know, I don't recall at this time. Again, I
23 think whatever the transcripts of that sort of period in the
24 afternoon indicate, are much better than my recollection.

25 Q At the time you had these conversations, did you

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sonCK 1 have any familiarity with the terrain over which the persons
2 would have to move in the event of an evacuation, at various
3 radii around —

4 A Not in detail but in general. I have been to the
5 Three Mile site. I was on the Three Mile site before even
6 one, back when Unit 1 was up for construction permit
7 review. And you know, I'd driven through the Harrisburg
8 area a few times.

9 Q Were you familiar with access routes and times for
10 evacuations of varying distances when you were having those
11 conversations?

12 A No.

13 Q Were you familiar with the provisions of the TMI
14 emergency plan at that point?

15 A No, other than knowing that it must have had in it
16 at least the required provisions under Appendix E and the
17 staff review at the time that it went through, which would
18 have covered contact with local authorities in the low
19 population zone and that sort of thing.

20 Q Were you familiar at the time of these
21 conversations with the provisions of the Pennsylvania
22 Emergency Management Administration emergency plan, or the
23 Pennsylvania Bureau of Radiological Protection emergency
24 plan?

25 A No. I had some discussion with those, about

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1 those, with the Governor. But that was not until Sunday
2 night when I was in the area and went up to see him.

3 Q On Friday, March 30, you spoke to President
4 Carter. Did you have any discussion of evacuation with
5 President Carter at that time?

6 A I reported the situation of the machine, the
7 releases, what seemed to be the dose rates and what my best
8 assessment of the situation was as of that time. That would
9 have been about 10:30, I guess, about.

10 And I told him that I had talked to the Governor and had
11 recommended that, for the moment, people stay indoors, that
12 there did not seem to me to be a need for a general
13 evacuation. We then discussed some of the problems we were
14 having. I told him particularly, he wanted to know what
15 could he do to help. And I told him we were having savage
16 communication problems and that we were trying to improve
17 them and get a hold of the phone company and one thing or
18 another.

19 And he said "Never mind that; I'll put you in business
20 with my White House communications people," which was an
21 enormously helpful step. He also said that he felt that we
22 should have a senior federal officer on the site who would
23 speak for the Federal Government and for him, and wanted to
24 know whom I recommended.

25 And I told him I already had a man packing his bag who

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sbnCK 1 was the best person in the U.S. for it. His name was Harold
2 Denton.

3 Q Okay. I wanted to ask you about that. Why did
4 you assume the responsibility for recommending evacuation
5 rather than leaving the matter to Harold Denton?

6 A I guess primarily because after the staff people,
7 Harold and Lee and the others at the response center, had
8 asked state programs to forward that word to the Governor,
9 the Governor had kind of said, wait a minute. My people
10 don't seem to be in accord with that. And is this a normal
11 recommendation of the Commission or what?

12 And I guess they were bucking it upstairs.

13 Q So that is how you wound up with it. Okay.

14 Let me ask you just two very general questions to round
15 out this subject matter. In your opinion, did the NRC
16 Commission act effectively in this emergency, and what
17 should be the role of the NRC Commissioners under these
18 kinds of circumstances?

19 A With regard to the first question, since I am one
20 of the Commissioners, my view is strongly colored by that
21 personal interest. I think the Commission behaved
22 responsibly and did its best in the circumstances. There
23 had not, in the agency's emergency planning, been any
24 particular thought that, or provision for commissioner
25 involvement in the emergency team actions. The emergency

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1 response plan as established by the agency and refurbished
2 after the Browns Ferry fire with the response center being
3 put in place there in Bethesda, had contemplated that the
4 executive director, director of NRR and of I&E would gather
5 and form a key emergency management team that they would
6 man, they and their deputies would man that function around
7 the clock, that there would be support forces there around
8 them. And that they would do what had to be done in terms
9 of informing other federal agencies, communication with the
10 sites and so on.

11 I think that in that planning there was a feeling, there
12 was a sense that accidents were likely to happen in such a
13 way, either that they were big accidents and events would
14 move very fast at the site, and the licensee's emergency plan
15 would have to be the effective one, that is, is supervised
16 — shift supervisors, plant superintendent, operations
17 superintendent and so on, would be the people on the site
18 close-in, available immediately, who would have to deal
19 immediately with it, and that NRC involvement would be more
20 a catch-up aftermath phase; or that accidents would be more
21 — of a more minor nature and the ones that would last
22 longer would be a more minor nature.

23 At any rate, and for whatever reason, whether my
24 speculation is right or wrong, there was not anything
25 specific mapped out for commissioners in this role. And I

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1 think clearly that was a bad oversight.

2 It is quite clear that in any serious nuclear incident,
3 people are going to want to know that the appointed heads of
4 the agency are active in the matter. And inevitably,
5 commissioners are going to get pulled in.

6 Now, without any preparation for the event, why, I think
7 the Commission did — didn't do badly.

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1 The commissioners are not nuclear experts. Of all the
2 commissioners, so far as I know and can remember, in fact,
3 all the way back through AEC days, I am the only nuclear
4 reactor professional who has ever served here.

5 So my presence on the Commission, in a sense, is
6 anomalous, and I am not sure in the general sense where
7 commissioners are more likely than not to be people without
8 experience in the specifics of reactors and what may happen
9 and what to do about that, how deeply you can involve them
10 in sort of minute-to-minute command of an emergency
11 situation that requires an extensive technical background.

12 Friday, Saturday, I was down there on Sunday, Monday,
13 Tuesday, for about the first six or seven days, starting
14 Friday morning when the Commission involvement became acute,
15 the Commission meetings were, to a considerable extent,
16 educational sessions. What does this mean? What does that
17 mean? What is the significance of the other thing? What
18 could happen here?

19 And I spent a lot of time explaining what this meant and
20 what that meant and what the other things meant. The
21 commissioners said what we thought, you know, as far as they
22 could form opinions from what they heard from me and the
23 staff and other sources, would offer recommendations.

24 But there seemed to be a kind of unspoken but general
25 agreement that, of the commissioners, I had the background

rc CK 1 to have some better understanding of what was going on. And
2 there was considerable deference to my views which I would
3 enjoy in quieter times, if it were accorded.

4 Q In that regard, when you are dealing with an
5 unquiet time, do you think it is clear from TMI-2 that
6 someone within the NRC of your technical background and
7 scientific stature should be designated as the person who
8 will be in charge during this type of a crisis situation?

9 A Yes, I think so. If we ever have another one, I
10 am going to go immediately to the response center and I will
11 then go immediately to the site or stay at the response
12 center, depending on what appears best from a command,
13 overall command situation.

14 It was a mistake for me to have stayed here all of Friday
15 and part of Saturday. I did what I could on the telephone
16 with the staff, both when I could break through to the
17 site. I don't think I got through to the site until, well,
18 Friday afternoon. And the White House communication links,
19 after they went in.

20 And I couldn't seem to move because I couldn't get more
21 than the length of the telephone cord away from where the
22 set plugs in, between that and the commissioners and people
23 coming and going and four phones at once, and so on.

24 But I would have had a better control on things if I had
25 been in Bethesda in the Emergency Management Center. So, if

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rc CK 1 one, if anything like that pops again, I will go to Bethesda
2 and then on to the site, if that is -- seems best.

3 And I think -- I attempted in the Three Mile case to
4 maintain a semblance of operational control by my steady and
5 frequent contacts with the staff. Discussion of technical
6 problems, what courses of action to take, what the thorny
7 points were and what to watch out for and so on. That was
8 almost -- it was almost a sort of dual, but completely
9 separate role from the one of meeting with commissioners and
10 discussing things with them.

11 Q Chairman Hendrie, has the NRC ever denied an
12 operating license to an applicant who gets its construction
13 permit, built their plant and then went through the
14 licensing process for the OL?

15 A No.

16 Q All right. Has the NRC ever denied an application
17 for a construction permit?

18 A In very -- the answer is yes. But I have to point
19 out, not in the sense that, after a case had gone all the
20 way through the review process, and the board adjudication
21 come to -- the commissioners have never reached down and
22 squelched one.

23 Or, indeed, one has never gone through the whole
24 adjudication process and then had the board recommend in its
25 initial decision, recommend against issuance.

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1 But there have been a number of cases where the staff has
2 made it clear to the applicant that it just was not going to
3 fly as a viable project, and applicants are not dumb. They
4 are not going to come into a hearing with the regulatory
5 staff prepared to stand up and say this thing doesn't meet
6 minimum standards of adequate protection for the public
7 health and safety. There is no board in the world that is
8 going to ride that down and say, never mind that.

9 Q Last topic. It has come to our attention,
10 Chairman Hendrie, that there is an current dispute between
11 the NRC as to the manner in which waste, radioactive waste
12 from Three Mile Island Unit 2 should be transported once it
13 has been processed.

14 As I understand it, the essential dispute is between NRR
15 within the NRC, that feels that the waste can be shipped in
16 the form of dewatered resins, and the Division of Waste
17 Management within the NRC, which feels that the waste, the
18 dewatered resins should be cast into some solid matrix like
19 concrete before being transported.

20 Have I succinctly described the controversy?

21 A Yes, I think you have got the essence of it, yes.

22 Q Why not cast it into concrete matrix form before
23 shipping?

24 A The pros and cons of that argument go about as
25 follows: The argument, since you have phrased the question

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rc CK 1 that way, let me start out with the arguments against a
2 further solidification process.

3 The stuff, you understand, is not all that liquid. Do
4 you want to give me the brown bottle? Give me the two
5 bottles.

6 Q You have an example?

7 A Yes, I will let you have some dewatered resin.

8 Q Has anybody figured out how many millirems it is
9 putting out right now?

10 A Nonsense. Clear your sinuses. It is good for
11 you.

12 (Discussion off the record.)

13 BY MR. KANE:

14 Q That is dewatered resins?

15 A I don't know how we will show this to the record,
16 out that, you can just open that up. It is clean stuff. Is
17 the pre — that is the way the resin comes from the
18 manufacturer before it goes into the resin tanks. It is an
19 organic bead and makes a sort of like finely ground grits.

20 Q Wet sand, maybe?

21 MR. CHOPKO: Would you care to make any other
22 description of it for the record?

23 MR. KANE: I would say for the record that it
24 looks to me like slightly damp sand.

25 THE WITNESS: And here is a sample of dewatered

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rc CK 1 resin removed from one of the vessels after a prototypical
2 run there on the Epicore II system.

3 Now, the argument against a further solidification
4 process goes as follows: That solidification process will,
5 first of all, require a fair amount of design and
6 construction work to get the equipment in place, and that
7 has a time penalty associated with it.

8 That is, one would then not be able to begin processing
9 the auxiliary building water that this system was built to
10 process as soon as would otherwise be the case, and the time
11 increments are variously estimated at six months to maybe a
12 little longer, nine months.

13 That has a down side, because as long as the radioactive
14 material is in solution, in liquids in the tanks in the
15 auxiliary building, or, and this is also true of the water
16 in the containment building, the longer that stuff is in
17 loose liquid form in those tanks, free liquid form, the
18 longer you continue to have a small but finite possibility
19 that somebody will open valves or a tank will fail or a leak
20 will develop someplace and that stuff will get out into the
21 environment.

22 There is another down side to going over now to a
23 solidification process, and that has to do with the fact
24 that that additional processing step of radioactive resins
25 will certainly involve, even with the best provisions, an

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1 additional increment of exposure to the work force that has
2 to deal with it. And that is again a cost that has to be
3 reckoned in.

4 The proponents of not solidifying cite these negative
5 aspects of solidification.

6 Then they turn to the question of whether it is safe, as
7 safe to transport the material in the dewatered form you see
8 here as it would be if it were in the cement.

9 This stuff, the process that leads to this dewatered
10 resin is to, after the processing of a bed is — bed is used
11 up and you are ready to cycle it out, the free water is
12 drained down out of the resin bed vessel, which is a welded
13 steel vessel. And then a vacuum hose is attached, and the
14 stuff is vacuum dewatered. So that it really comes out
15 pretty dry.

16 And at least in this bottle, you can see there isn't any
17 free water standing.

18 Now that is not a compelling proof of the principle, you
19 understand, because I doubt, since they were going to give
20 me a specimen of dewatered resins that they would have
21 selected a bottle with a lot of free water in it. But let's
22 not make too much of the specimen before us.

23 But the vacuum dewatering does indeed remove a lot of the
24 water which otherwise would be trapped in the interstices
25 between these little organic beads.

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The resin vessels are to be shipped in type B shipping containers. Now that is a category of shipping casks for radioactive material and the type Bs ^{are} ~~or~~ the big tough ones which are built and tested to not leak, let alone breach, in all manner of transportation accidents.

Spent fuel is also shipped in type B casks and there have been extensive sets of tests over the years, running these things into concrete walls and exposing them to fires and dropping them and so on.

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1 So the proponents of no solidification argue that they
2 believe that, first of all, the dewatering, the resins being
3 in good quality, welded steel vessels, which are in turn
4 encased in tight and accident-proof Type B casks, and with
5 careful attention to the transportation provisions, that
6 indeed, the transportation risk is really just minimal.

7 So the proponents of no solidification say that you do
8 not gain all that much in public safety in the
9 transportation phase from solidification, and you do suffer
10 the downsides, the additional time and the occupational
11 exposure.

12 Okay, the proponents of solidification feel that, even
13 though the casks are good and the steel vessels are good and
14 the stuff is carefully dewatered, that further incorporating
15 the material trapped on these beads in something like a
16 concrete matrix really adds an additional substantial
17 additional barrier, and if anything should happen, you
18 would have that additional protection.

19 And they point out that our long-range aim with regard to
20 this kind of material is, in fact, to solidify it on reactor
21 sites before it's shipped, so that all the shipment can be
22 in complete solid form.

23 And they say, not unreasonably, here in a case where we
24 have to process substantial quantities of radioactive
25 material from an accident like Three Mile with all of the

1 sensitivity to it and so on, why shouldn't we use here the
2 very best technology that we know about. So those are the
3 points of view and you can choose which way you would like
4 to come down.

5 Q In fact —

6 A Accordingly.

7 Q There have been some incidents in which shipments
8 of dewatered resins have been found to be leaking when they
9 have arrived at the burial site, is that right?

10 A Yes. I will note that the last set, such set,
11 were in a so-called — from a so-called solidified resin
12 wastes.

13 Q Even the solidified was leaking?

14 A Well, there is a urea-solidification process which
15 has its fits and starts, is one of several possible
16 processes. And those resins from Pallsades that were
17 leaking at the site had been solidified, I put the word in
18 quotes, by the urea process.

19 It apparently wasn't tightly enough controlled. It does
20 leave the possibility of an acidic liquid residue which ate
21 through the drums.

22 But it's fair to note that the shipping provisions for
23 the Three Mile resin bed materials, the higher-level
24 radioactive materials are a good deal more rigorous than
25 those provisions.

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1 That is, those were in 55-gallon steel drums and were
2 being treated as low-level activity in Type A shipping
3 containers.

4 This would be done on a much more rigorous basis. So I
5 think the argument is a fair one. That is, I think there
6 are good points to be made on both sides, and the Commission
7 has yet to come down one way or the other.

8 But, it's not -- it's not a case in which all the white
9 ^{hats}~~hearts~~ are on one side of the room and all of the black
10 ^{hats}~~hearts~~ are on the other side of the room.

11 Q We have been informed that depending upon the
12 routing that is used for the actual transportation overland
13 of the waste from TMI-2 to the burial site in Hanford,
14 Washington, that anywhere from 11 to 17 states will have to
15 be passed through depending on the routing.

16 Does the NRC intend to permit the states that will
17 probably be involved in having this material pass through
18 their borders to -- afford those states an opportunity to
19 participate in the deliberations on how it shall be
20 packaged?

21 When I say that, I mean in the broadest sense. Being
22 solidified versus being shipped in dewatered resin form --

23 A Well, to the extent that any state, or for that
24 matter, any citizen wants to get his two cents' worth in,
25 this will not be a formal adjudication, I would think.

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1 It will be -- the Staff will finally come to the Commission.
2 And there will probably still be a disagreement between the
3 offices. And each office will present its proposition. We have
4 already had some discussion along this line, but not to a
5 decision point. And other people can either write -- well, I
6 would prefer actually that they would write in and tell us what
7 their views are, because it gets to be kind of a tumult if we
8 have to hear great numbers of people in open meetings.

9 Q But I'm focusing specifically on the State Governments
10 that might be involved.

11 Is there a procedure whereby the NRC notifies?

12 For example, if it's anticipated that the wastes are going
13 to be shipped across the State of Michigan, does the NRC have
14 a procedure whereby it notifies the State of Michigan and the
15 state is invited to comment?

16 A In terms of deciding on something like solidification?

17 Q Yes, insofar as it's going to pass through their
18 state.

19 A I don't think there -- certainly -- well, I don't
20 know that there is anything explicit and formal along that line.

21 We do certainly notify the states when there is going to be
22 a shipment so they know all about it ahead of time.

23 Q But not necessarily about a dispute as to how the
24 shipment should be packaged or how it should be processed before
25 shipment?

1 A No.

2 Q I note by my watch it's 6:00 o'clock. There are many
3 more things I could ask you, Chairman Hendrie.

4 A Well, I can spend some more time if you can. I don't
5 know how the rest of these people spend their Friday nights, but
6 I always plan to stay in the office and give a deposition. It
7 saves money. It's good for the health.

8 Q Were I not facing another Commissioner's deposition
9 tomorrow morning at 10:00 a.m., I might take you up on that,
10 Chairman, but I think I would rather close by asking you one
11 very general question, which I'm posing to each of the NRC
12 Commissioners. Because the Presidential Commissioners
13 certainly want the input from the heads of this agency in com-
14 piling their own recommendations as to the NRC, and so my final
15 question then is: if you were given all the resources you wanted
16 and all the discretion you wanted, aside from the immediate
17 things that have been identified by the NRC Lessons Learned Task
18 Force, what changes, if any, would you make in the way the NRC
19 is currently set up?

20 A Well, that covers a wide range of possibilities.

21 Q Yes; that's the problem the Presidential Commissioners
22 have.

23 A Let me -- since we would like to close in some finite
24 time -- you said this was the last question?

25 Q Yes, and I would prefer a relatively brief response,

1 if you can manage that.

2 A Let me touch on some areas without -- with the
3 understanding that that probably wouldn't exhaust my thoughts.

4 Let me start on the organizational side. If I were equipped
5 for some period of time with my druthers in the matter, in trying
6 to make a better system out of it, I would clear up some of
7 the organizational indistinctness which has been created for us
8 by existing statute, to allow the duly appointed managers of
9 the agency to run it in a more effective fashion.

10 I would want some more staffing.

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EX 3

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Q Where would you like to see that staffing?

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A I was just going to say that the Congress recently

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has been — gotten rather generous, and awarded us 100

4

people in the licensing, reactor licensing area. And another

5

146, apparently, in the inspection department.

6

I would like enough staffing increases to go on in the

7

inspection and enforcement area, and go get both a site

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resident and a unit resident on each operating unit and on

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each unit — and a construction resident on construction sites

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soon after they start.

11

I think the present force level in I&E with the recent

12

increment begins to come close to that, but doesn't get there

13

quite, and we will be back I am sure in due time, a year or

14

two out, for some more people there. I would also want funds

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and staff for a — to establish a NRC — what should I call

16

it — operational center.

17

I am beginning to think that we ought to have a

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multicontrol room large simulator facility, driven by

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sophisticated computer array as we can command with the

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technology department, to allow us to track and work out on as

21

good a real machine simulation as the technology allows, an

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assortment of the kind of things we have been talking about

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here.

24

For instance, we are putting in place an operations

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evaluation group which is a start on some things that have

amn 1 been deficient. How valuable would it be if a group like
CRAIG 2 that were able, when they get the LER, had been able to get
3 the LER on Davis-Besse to go into the B&W site with the NRC
4 simulator and start to run that transient.

5 And the first thing they will find is that it doesn't
6 make sense the way it is written down here in the first
7 report. Then they go back to the operators and say wait
8 a minute. This couldn't, you know, this couldn't be right.

9 Then they get that straight. Then they go back on the NRC
10 B&W simulator again and run it and say, okay, well, that
11 seems to be the way it worked out in this case. Now let's
12 try it at full power. Now let's try it if we do some other
13 things. Let's try it if this happens; let's try it if that
14 happens.

15 I expect that's likely to be — my intuition is that that
16 would be a very effective way of working through and
17 understanding the ramifications of numbers of these
18 off-normal situations which are really very difficult to
19 analyze if you are just sitting there with paper and pencil
20 and a set of drawings of a plant, because you now allow all
21 your human intuitions to come into play, and to come into a
22 play in much the same way that the operators at the plant
23 exercise them.

24 It is not coincidence and just a matter of happenstance
25 that the Navy experience is good. They train those people

amn

1 on off-normal situations and they start them out on the
2 prototypes, on-shore prototypes and train them on real plants.
3 And they take them to sea, and train them against casualty
4 exercises all the time. They develop a real intuition for
5 their machines and that is the kind of human interaction that
6 can be very effective.

CRAIG

7 There are some pieces of the safety design basis that need
8 improvement. I tend, because I am a professional in the
9 field, to turn to some of these details which are apt to seem
10 down in the -- sort of down in the grudging detail of the
11 trade, perhaps, to nonprofessionals.

12 But I think we have neglected this operability aspect,
13 to our woe. And we need to work hard on it. I think if we
14 ever get back into a situation where we are beginning to think
15 about having a new generation, another generation, if you
16 will, of nuclear plants, if I regard what is in the mill now
17 and operating as maybe an A generation, if we ever conclude
18 that we need a B generation, I don't think I would care to
19 build it on precisely the same basis that the A generation is
20 built.

21 What I have in mind are a number of detailed aspects of
22 plant design and safety bases, residual heat removal systems
23 rated at full system pressure with dedicated and fully
24 protected and redundant power supplies, so that if anything
25 happens on the secondary side of the plant, for instance, in

55.29.04

amn

1 PWRs, you don't have to sit there and try to diddle with your
2 steam generators and see if you can get energy out that way
3 but you can cut the whole thing loose and all you ask of the
4 secondary side is that the steam generator tubes not totally
5 blow out on you.

6 You have got the reactor protection, and afterheat
7 removal is over here in the containment. That is separate.
8 It is safety grade; it is dedicated. It comes on automatically
9 and when something happens on the secondary side of the plant
10 the operators keep their hands off the reactor.

11 Well, to avoid extending on into the evening, those —

12 Q I think that is satisfactory for my purposes.

13 A That at least touches on a couple of areas and
14 indicates some —

15 Q Let me say this also, Chairman Hendrie, if after
16 receiving the copy of the transcript, and having an
17 opportunity to think about what suggestions you have made here
18 today, you feel that there are some further major items that
19 you would like to bring to the attention of the Presidential
20 Commission as a — as your thoughts on what could be done to
21 change the NRC, please feel free to submit those in written
22 form and they will be given due note in the Commission's
23 work.

24 A Okay.

25 MR. KANE: Other than that let me say that for the

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CRAIG
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time being I have exhausted my questions, or at least I have determined that I do not need to proceed any further with any remaining questions I may have at this time. However, this is an ongoing investigation, and it may be necessary at some point in the future to bring you back for a further deposition.

We will make every effort to avoid having to do that. For that reason I will elect to adjourn the deposition rather than terminate it, though, in the thought that it might be necessary to resume it. I should ask your respective counsel here at this point if they have any questions?

MR. CHOPKO: No questions.

MR. KANE: Fine. Then I thank you for your time, Commissioner Hendrie, and it has certainly been educational and a pleasure to be here with you today.

THE WITNESS: Well, you have kept me -- heaven knows what mischief you have kept me out of. It may be one of your more useful exercises of public duty.

(Whereupon, at 6:15 p.m., the taking of the deposition was adjourned.)

e. 29

Hendrie Depo Ex 1 CLK



UNITED STATES NUCLEAR REGULATORY COMMISSION

OFFICE OF PUBLIC AFFAIRS
WASHINGTON, D.C. 20555

BIOGRAPHY

DR. JOSEPH M. HENDRIE

Dr. Joseph M. Hendrie, who has spent more than 20 years working in the field of nuclear reactor safety, was sworn in as Chairman of the Nuclear Regulatory Commission on August 9, 1977. He was named to a four-year term on the Commission and designated as its Chairman by President Carter.

He came to the NRC from the Brookhaven National Laboratory in Upton, New York, where he had been Chairman of the Department of Applied Science since 1975. He previously had worked at Brookhaven from 1955-72, beginning as an assistant physicist performing research on nuclear power reactors. He later directed the design and construction of the High Flux Beam Reactor and the Pulsed Fast Reactor at Brookhaven, and from 1971-72 was Head of the Engineering Division of the laboratory's Department of Applied Science.

From 1972-74 Dr. Hendrie was Deputy Director for Technical Review of the Atomic Energy Commission's Directorate of Licensing. He also served for six years (1966-72) on the Advisory Committee on Reactor Safeguards, an independent group of experts who advised the former AEC and now the NRC on reactor safety matters. He was Chairman of the committee in 1970. Dr. Hendrie also has been the U.S. representative on the International Atomic Energy Agency's Senior Advisory Group on Reactor Safety Codes and Guides. In 1970 he received the Atomic Energy Commission's Ernest O. Lawrence Memorial Award.

He received the B.S. degree in physics from Case Institute of Technology in 1950, and the Ph.D. degree in physics from Columbia University in 1957. He was a research assistant at Columbia from 1950-55.

Dr. Hendrie has served on the Risk-Impact Panel, Committee on Nuclear and Alternative Energy Systems of the National Research Council. He also is a member of the National Academy of Engineering, the American Physical Society, the American Society of Mechanical Engineers, the American Nuclear Society, the National Society of Professional Engineers, the American Concrete Institute, the Institute of Electrical and Electric Engineers, and the New York Society of Professional Engineers. Dr. Hendrie is a registered professional engineer in the States of New York and California. He has had numerous articles published in professional journals, and is a member of Sigma Xi and Tau Beta Pi honorary societies.

Born March 18, 1925, in Janesville, Wisconsin, he served in the U.S. Army from 1943-46. Dr. Hendrie is married to the former Elaine Kostell. They have two daughters.

#

September 6, 1979

Biographical Data

JOSEPH MALLAM HENDRIE

Business Address:

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Tel: 202-634-1459

Born:

Janesville, Wisconsin; March 18, 1925

Education:

Case Institute of Technology 1946-50; B.S. 1950; physics major
Columbia University 1950-55; Ph.D. 1957; physics major

Employment:

Research Assistant, Columbia University 1950-55

Brookhaven National Laboratory:

Assistant Physicist, Reactor Physics Division 1955-57

Associate Physicist 1957, Physicist 1960, Physicist with Tenure 1962,
Senior Physicist 1971

Project Engineer and Chairman of the Steering Committee,
High Flux Beam Reactor Project 1958-65

Acting Head, Experimental Reactor Physics Division 1965-66

Project Manager, Pulsed Fast Reactor Project 1967-70

Associate Head, Engineering Division, Department of Applied Science 1967-7
Head, Engineering Division, Department of Applied Science 1971-72

Deputy Director for Technical Review, Directorate of Licensing,
US Atomic Energy Commission 1972-74

Chairman, Department of Applied Science, Brookhaven National Laboratory 1975-77

Other Professional Activities:

Consultant, Columbia University Radiation Safety Committee 1964-72

Advisor, US Delegation, Third United National International Conference on the
Peaceful Uses of Atomic Energy 1964

Member, Editorial Advisory Board, "Nuclear Technology" 1967-77

Member, Advisory Committee on Reactor Safeguards, USAEC 1966-72;
Vice Chairman 1969; Chairman 1970

Lecturer on nuclear power plant safety and licensing in special sessions at
Massachusetts Institute of Technology 1970-77; Northwestern University 19

US Representative, International Atomic Energy Agency's Senior Advisory Group
on Reactor Safety Codes and Guides 1974-79

Consultant, US Nuclear Regulatory Commission 1974-75

Consultant, US General Accounting Office 1975-77

Consultant, Rand Corporation 1975

Consultant, Argonne Universities Association 1976-77

Member, Board of Directors, American Nuclear Society 1976-77

Member, Risk-Impact Panel, Committee on Nuclear and Alternative Energy System
National Research Council 1976-77

Biographical Data

JOSEPH MALLAM HENDRIE

Membership in Professional Societies:

National Academy of Engineering
American Nuclear Society; elected Fellow in 1968
American Physical Society
American Society of Mechanical Engineers
American Concrete Institute
Institute of Electrical and Electronics Engineers
New York Society of Professional Engineers
National Society of Professional Engineers

Licenses:

Registered Professional Engineer: New York, California

Honors:

US Atomic Energy Commission's Ernest O. Lawrence Memorial Award, 1970

Patents:

"High Flux Beam Reactor," No. 3,143,478, 1964; with J. Chernick, K. Downes,
J. Hastings, and H. Kouts

Military Service:

US Army 1943-46; Ohio National Guard 1948-50

Fields of Professional Interest:

Advanced energy technologies and associated health and environmental effects;
fusion reactor design and engineering; nuclear power plant design and safety
analysis; design and utilization of research reactors and experimental facilities;
electrical power transmission by cryogenic cable systems; high-strength concrete
structures and vessels; reactor physics research; molecular physics.

COMMITTEE ON SELECTED CIVIL
LIBERTIES, AND THE ADMINISTRATION OF
JUSTICE
SUBCOMMITTEE ON CRIME
COMMITTEE ON PUBLIC WORKS
AND TRANSPORTATION
SUBCOMMITTEE ON AVIATION
SUBCOMMITTEE ON INVESTIGATIONS
AND REVIEW
SUBCOMMITTEE ON WATER RESOURCES

CONGRESS OF THE UNITED STATES

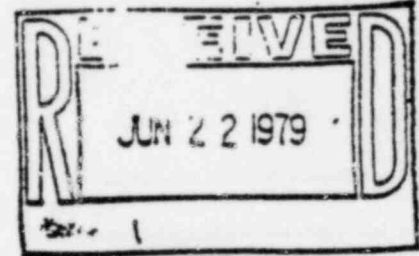
House of Representatives

Washington, D.C. 20515

February 9, 1979

Page 11407
House of Representatives
(217) 21-2143
Room 238
Federal Building
242 West Third Street
P.O. Box 488
Williamsport, Pennsylvania
(717) 255-2314

Honorable Joseph M. Hendrie
Chairman
U.S. Nuclear Regulatory Commission
1717 H Street NW
Washington, D.C. 20555



Dear Chairman Hendrie:

We are taking this opportunity to bring to your attention a matter of serious concern to us and to our constituents.

The controversy over nuclear power has escalated in recent weeks in the wake of the Commission's repudiation of major parts of the Rasmussen study. As we understand it, the Commission had relied on the accident probabilities contained in the study to support the continued operation of several power plants whose safety systems are possibly questionable.

Even though the study is no longer considered entirely authoritative by the Commission, the NRC has yet to indicate what the next step will be. Both the Congress and the public have received information from the Union of Concerned Scientists, who advocate not only the shutdown of the 16 plants in question, but also a moratorium on the licensing and construction of nuclear power plants.

Now, weeks after the release of the Lewis study, which raised the doubts about the Rasmussen report and opened a Pandora's box of questions about NRC's safety policies and procedures in general, the Commission has not offered any assessment of the risks of continued operation of these particular power plants, nor has it offered any specific indication of how it plans to proceed without the Rasmussen report.

There are several crucial questions which must be addressed now:

--What does the NRC plan with respect to the continued operation of the 16 power plants in question?

--What risks are we encountering that we did not know about prior to the Lewis study?

--What consequences would a shutdown of any of these plants have on the supply of energy to the affected area?

CHAIRMAN JOSEPH M. HENDRIE
February 9, 1979
page 2

--How will the NRC deal with the types of safety issues raised by the Lewis study and what, if any, improved safety precautions are needed in existing power plants?

Continued delay in confronting these matters can only further damage the cause of nuclear power development in the United States, at an all too critical point in the nation's energy future. The uncertainties of this future, characterized now by the crisis in Iran and the dwindling of our conventional fuel supplies, necessitate that these issues be resolved.

We appreciate your prompt attention to this matter.

Sincerely,

Allen E. Ertel
MEMBER OF CONGRESS

William Goodling
MEMBER OF CONGRESS

AEE/nb

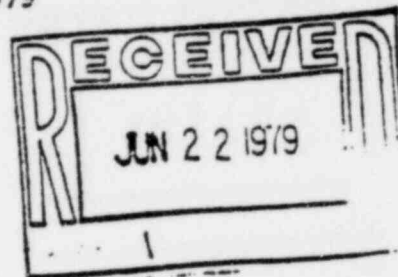


NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Hendrie Reps Ex 3

March 15, 1979

AK



The Honorable Allen Ertel
United States House of Representatives
Washington, D.C. 20515

Dear Congressman Ertel:

Thank you for your letter of February 9, 1979 raising questions concerning nuclear reactor safety in light of the recent critique of the Reactor Safety Study (WASH-1400) by a review group appointed by the Commission and the Commission's acceptance of the review group's findings.

The NRC established the Risk Assessment Review Group in July, 1977 under the leadership of Dr. Harold Lewis, Chairman of the American Physical Society's Study Group on Light Water Reactors. The review group's charter was to provide advice and information to the Commission regarding WASH-1400, advice and recommendations of risk assessment methodology and recommendations on future courses of action to improve the methodology and its application. The review group published its report last September. After consideration of the review group's findings, the Commission issued a policy statement on January 18, 1979 summarizing its response to those findings. Copies of this policy statement and the report of the review group are enclosed.

As you may know, subsequent to the transmittal of your letter, the Subcommittee on Energy and Environment of the House Committee on Interior and Insular Affairs held a hearing on February 26 concerning the use of the Reactor Safety Study, the effects of NRC's recent adoption of the findings of the Lewis Group, and the safety of licensed nuclear power plants. Some of the key points made in my testimony at that hearing are summarized below. I am also enclosing a copy of my testimony which provides further details.

In light of the questions raised by you and Mr. Goodling concerning reactor safety, I believe it is important to place in proper perspective the Reactor Safety Study (WASH-1400). A primary goal of the RSS, as established in 1972, was to obtain a "quantitative evaluation of the risk from the operation of a nuclear plant." The Safety Study was, in effect, a "measurement," made by analyzing two typical plant designs, of the effectiveness of an existing system of nuclear regulation.

The regulatory system depends on having nuclear plants sited, designed, constructed, and operated on the basis of conservative application of sound and accepted engineering principles, on requirements for multiple and redundant safety systems, and on a set of regulatory requirements that are updated to reflect operating experience. The designers, builders, and operators of these plants are required to have effective quality assurance programs and their work is subjected to a continuing licensing and inspection process by the NRC. The results of the licensing and inspection process are, in turn, subject to independent review by the Advisory Committee on Reactor Safeguards and often to examination in public hearings.

This health and safety regulatory system, much of which evolved long before the Reactor Safety Study was carried out, is unchanged in its basic principles today. It does not depend on the ability to make precise quantitative estimates of overall risk -- although that ability would be highly useful and should be developed.

We believe this regulatory system has served us well. It is an exceptionally rigorous system, and appropriately so in view of the technology we regulate. It is our job as regulators to make sure that there is no undue risk from licensed facilities and, while one must acknowledge strongly held views to the contrary, over 400 reactor-years of experience to date give us reason to believe that we are on the right track.

Your letter asks what actions the Commission has taken, particularly with regard to the continued operation of 16 nuclear power plants identified by the Union of Concerned Scientists (UCS), to assure the protection of the public in light of the findings of the Lewis Report and the Commission's January 18 policy statement.

Following publication of the review group's findings, the Commission asked Mr. Harold R. Denton, Director, Office of Nuclear Reactor Regulation to review the extent to which licensing or other regulatory actions relied upon WASH-1400. Mr. Denton recently reported the results of the NRC staff review to the Commission. A copy of his report is enclosed. In his report, Mr. Denton stated that he has "found no actions which, because of their reliance on RSS, should now be overturned." He noted "the record as a whole as showing an ancillary use of the RSS in licensing actions. Its principal application has been to supplement or confirm the mainstream of analyses and judgments reached by the staff."

Special attention was given to the issues raised by the UCS in its press release of January 26, 1979 and referenced in your letter. In his report Mr. Denton states the NRC staff conclusion that "the record has been mischaracterized by the UCS and that the UCS recommendations to require the shutdown of a number of operating facilities are not warranted. The staff's views are provided in an Appendix to Enclosure 1 of Mr. Denton's report. The Commission is currently reviewing the staff findings.

Your letter also asks what risks we are encountering that we did not know about prior to the Lewis study. The review group was established to study the present state of risk assessment methodology and to clarify the achievements and limitations of WASH-1400. It did not identify any new or previously unknown risks per se.

What the Lewis Group has told us is that the "measurement" of our regulatory system, as reflected in the overall risk estimates of the Reactor Safety Study, is much less precise than had been asserted. The Lewis Group did not conclude that the overall risk estimates were higher or lower than reported in WASH-1400, although they speculated on possible factors in both directions, but only that they thought the error bands on those estimates were substantially larger than had been reported. On that account, they recommended to us that the overall risk estimates of WASH-1400 should be used with great caution -- "should not be used uncritically" were their words -- in the regulatory process or for public policy purposes. We have accepted and are implementing with vigor that recommendation, as well as the other findings and recommendations of the Lewis Group.

With respect to your third question, concerning the consequences resulting from a shut down of any of the 16 plants for the supply of energy to the affected area, I have asked the NRC staff to review the most recent reserve margins for the utilities involved and will provide separately an answer as soon as it is available.

Finally, you ask how will the NRC deal with the types of safety issues raised by the Lewis study and what, if any, improved safety precautions are needed in existing power plants.

I have already mentioned the review of licensing and other regulatory actions that relied on WASH-1400 undertaken by the NRC staff. The staff findings and recommendations are contained in the Denton report now under consideration by the Commission. We will keep you advised of any actions that the Commission deems necessary as a result of this review.

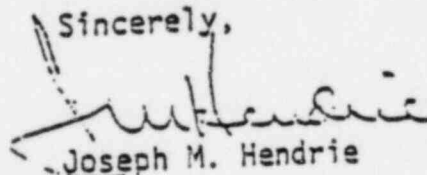
The Honorable Allen Ertel

-4-

In addition, the Commission has provided detailed instructions to the NRC staff concerning continued use of risk assessment techniques and results in response to the specific comments of the Risk Assessment Review Group and has asked the staff to submit by June 30, 1979, detailed procedures to ensure the proper and effective use of risk assessment theory, methods, data development, and statistical analyses.

In conclusion, I believe it is important to keep in mind what the Commission did and did not do in response to the Lewis report. It did reevaluate its reliance on, and relationship to, the Reactor Safety Study. However, it did not thereby take a new view of reactor safety. Nor did the Commission take a new view of past licensing decisions that each licensed plant will be so operated as to provide adequate protection to the health and safety of the public.

Sincerely,



Joseph M. Hendrie

Enclosures:
As stated

Hendrie Ripley
CRK
NUREG 0153

ISSUE 22
SYSTEMATIC REVIEW OF NORMAL PLANT OPERATION
AND CONTROL SYSTEM FAILURES

Statement of Issue

This issue was identified by D. Basdekas in a memorandum to Ben C. Rusche, dated November 19, 1976 in response to Mr. Rusche's memorandum dated November 3, 1976, requesting that staff members identify any significant safety issues they believe are presently being treated inadequately by the staff. In attachment 4, item 4 of his memorandum, Mr. Basdekas states:

"The effects of control system failure or, sometimes, non-faulted operation on safety are not being systematically reviewed. I believe that their effects on safety and plant availability should receive the proper attention. The first step would be to have the applicants perform a Failure Mode and Effects Analysis (FMEA) for normal operation, and in conjunction with postulated accidents and other off-normal events."

Based on a subsequent discussion between D. Basdekas and members of The Reactor Safety Branch, the issue was redefined as follows:

"In evaluating plant safety, the effects of control system malfunctions should be reviewed as initiating events for anticipated transients and also as failures that could occur concurrently or subsequent to postulated anticipated events (initiated by a different malfunction) or postulated accidents."

Summary Response

Postulated malfunctions in plant control systems are analyzed separately as initiating events for anticipated transients and

reported in Safety Analysis Reports. These transient analyses, identified in the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, Regulatory Guide 1.70, are reviewed for each plant application. When analyzing transients initiated by a single control system malfunction, all other control systems are considered to respond in a normal manner.

If additional single failures (including a random control system malfunction) were postulated to occur concurrent with or subsequent to anticipated transients, less stringent criteria would be used to evaluate the acceptability of the consequences because of the lower probability of such an assumed sequence of events. The staff believes that the consequences of an anticipated transient plus a control system malfunction would be acceptable and less severe than the 10 CFR Part 100 guidelines.

In analyzing postulated accidents, plant control systems are assumed to respond in their normal manner unless such a response would be beneficial to mitigating the consequences of the accident. In addition, the staff has evaluated the effects of some control system malfunctions on LOCA's and steamline break accidents. No significant effects on the consequences were observed. It is the staff's judgment that the consequences of these design basis accidents would not be significantly affected by malfunctions in plant control systems because of the rapid change in plant parameters during such accidents.

Failure mode and effects analyses have been initiated under a technical assistance contract to better identify design requirements for systems needed to mitigate the consequences of transients and accidents. In addition, a separate contractor study of control system failure is being performed for the staff to determine the immediate and cumulative effects on the reactor coolant pressure boundary and challenges to the reactor protection system resulting from control system failures. The results of these analyses would provide a basis for any needed new review and safety requirements related to control system malfunctions.

Detailed Discussion

The effects of malfunctions in normal plant control systems as initiating events of plant transients are analyzed by each applicant as specified in the Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (Regulatory Guide 1.70). When analyzing transients initiated by control system malfunctions, all other control systems are assumed to respond in a normal manner. Anticipated transients identified in this guide represent disturbances in system variables such as primary system pressure, pressure vessel liquid level, coolant temperature, coolant flow rate, and reactivity. In addition, disturbances in secondary system variables in PWR's are also considered such as pressure, steam generator level, and feedwater/steam flow ratio. The reactor protection system is designed to monitor combinations of these variables and to automatically shut down the

reactor if acceptable limits are exceeded. The analyses of the anticipated transients present in the Safety Analysis Reports demonstrate that the reactor protection system has been designed to avoid fuel damage or excessive primary system pressure as a result of these events.

The anticipated transients identified in Regulatory Guide 1.70 are considered to be bounding events for control system malfunctions. For instance, a reduction in primary system pressure could be caused by a pressurizer control system failure or a spurious opening of a relief valve. Since a blowdown through a relief valve is a more severe pressure transient, it is analyzed as a bounding anticipated transient.

In analyzing the consequences of such anticipated transients, only a single control system failure or malfunction is considered at one time and other control systems are assumed to respond in a normal fashion. Thus, the process variables monitored by the reactor protection system are perturbed by a single control system malfunction and the reactor is scrammed as necessary to prevent fuel damage. In over 250 reactor years of commercial operation, there has been no abnormal operational occurrence (a transient event with its attendant control system response) during any phase of normal operation which has resulted in a violation of fuel design criteria. On this basis alone, one could consider the present requirements for analyses of anticipated transients adequate for demonstrating the effectiveness of the reactor protection system.

Based on this reactor operating experience, the probability of an anticipated transient combined with a control system response which would reduce the reactor thermal performance to the point that fuel failure may occur has been shown to be low. For such a low probability event a less stringent criterion than no fuel damage would be used to evaluate the acceptability of the consequences. The staff believes that the consequences for such a combination of event would be less than the 10 CFR Part 100 guidelines.

Specific control system failures must also be considered in the design and safety evaluation of the reactor protection system. The reactor protection system is designed and evaluated for conformance to General Design Criterion 25 - Protection System Requirements for Reactivity Control Malfunctions, and General Design Criterion 24 - Separation of Protection and Control Systems. These criteria provide design requirements for the protection system resulting from control system failures.

In analyzing postulated accidents, plant control systems are assumed to respond in their normal manner unless such a response would be beneficial to mitigating the consequences of the accident. In addition, the staff has considered some control system failures in evaluating design basis accidents such as LOCA's and steamline breaks. For example,

venting of an intact steam generator due to inadvertent opening of a secondary relief valve concurrent with a steam line break has been analyzed. The impact of considering a malfunction in the relief valve control system on the calculated radiological consequences for the event was negligible. Similarly, malfunction of the recirculation flow control system concurrent with postulated LOCA's was considered for some of the BWR designs, and had no significant impact on the consequences. While the staff believes that control system malfunctions should be considered as single failures when evaluating postulated accidents, these events (such as LOCA, steamline break, rod ejection, and locked pump rotor) impose such rapid changes on plant parameters that normal control system actions or malfunctions would appear to have a negligible effect on the course of the event.

The staff has a technical assistance contract with INEL to conduct a failure mode and effects analysis to better identify design requirements of the equipment necessary to mitigate the consequences of anticipated transients and accidents postulated for light water reactors. The staff also has an active technical assistance contract with Oak Ridge National Laboratory for failure mode analyses of control systems. Currently, in this program a survey and tabulation of abnormal events is being conducted to determine sensitive areas of the plant control systems. The results of this program, in conjunction with the results of the failure mode and effects analyses for transients and accidents should provide a basis for any needed new review and safety requirements related to control system malfunctions.

The staff concludes that consideration of this issue does not warrant revisions to any existing license or any change in the current staff priority for continuing programs to pursue a more complete understanding of the effects of postulated control system malfunctions on plant transients or postulated accidents.

Attachment #1

DEC 20 1970

ISSUE 22

SYSTEMATIC REVIEW OF NORMAL PLANT OPERATION
AND CONTROL SYSTEM FAILURES

The title of this issue should be changed to read as follows:

SAFETY IMPLICATIONS OF CONTROL SYSTEM FAILURES AND
PLANT DYNAMICS

The present title does not accurately reflect the safety concern I expressed.

The subsequent discussion between me and members of the Reactor Safety Branch represents an inaccurate reference to a brief discussion between Dr. Ross, Mr. Novack, and me. Their understanding of my concern appeared to be correct during that meeting, but the way it is stated in the last two paragraphs of the "Statement of issue" conveys only part of it.

I do not agree with the statement of the concern and therefore with its discussion and conclusions. For example: On page 22-2, last sentence of second paragraph reads: "Although analyses have not been performed for these postulated sequences of events, the staff believes that the consequences would be acceptable, and much less severe than those calculated for postulated accidents." I do not see how such a statement can be made, when one has to consider that design features to mitigate the consequences of such events are not established, and therefore those provided for postulated and analysed accidents may not be sufficient, thus, in essence, having an unprotected series of events.

Another statement made on page 22-5, second paragraph reads: "Malfunction of normal plant controls is not considered when assessing the consequences of unlikely accidents such as LOCA and Steamline Break These postulated accidents impose such a rapid change on plant parameters that normal plant controls probably would not affect the course of the accident." The basic implicit assumption here, which is not correct, is that the time constant of nuclear and thermal-hydraulic processes involved in accidents, and the entire spectrum of each accident, are not comparable to the time constants of the control systems that may be involved. This is a sweeping and far ranging assumption which is not supported by the nature of most accident progression modes.

Attachment #1

-2-

DEC 20 1990

Because of the time constraints a complete discussion of all points of disagreement is not possible at this time. However, I will be happy to discuss this safety issue at an appropriate time and forum.

NUREG 0560

EXECUTIVE SUMMARY

On March 28, 1979, the Three Mile Island Unit 2 (TMI-2) nuclear power plant experienced a feedwater transient that, through an unusual sequence of failures, led to a small break loss-of-coolant accident and resulted in significant core damage. The failures that were experienced occurred in the general areas of design, equipment malfunction, and human error. In response to this event, a task group was formed to provide an early assessment of the generic aspects of the feedwater transient and the related ensuing events at TMI-2 to determine bases for continued safe operation of other reactor plants similar to TMI-2 that were designed by the Babcock & Wilcox Company (B&W). Consideration was given by the task group to initiating events other than loss of feedwater where it was determined that such events could lead to a similar transient. In addition, consideration was given to possible impact on other PWR plants designed by Westinghouse and Combustion Engineering.

A recent review by the staff on the frequency of feedwater transients occurring in B&W plants indicates that 27 transients have occurred in nine plants during the past year. This corresponds to a frequency of three per year per plant. The corresponding rate for the other PWR plants is about two per year per plant.

The results of this assessment are presented in this report by the task group in the form of a set of findings and recommendations in each of the principal review areas. Additional review of the accident is continuing and further information is being obtained and evaluated. Any new information will be reviewed and modifications to the results of the initial review will be made as appropriate.

Many actions have been taken since the TMI-2 event by the staff and industry to minimize the likelihood of recurrence, including the shutdown of the four operating B&W facilities for short-term corrective actions which will also be taken on the other B&W plants before they restart. As this response is being published, there are other ongoing activities, including discussions with Westinghouse, Combustion Engineering, and various utilities, to further improve the safety margins in these plants. Thus, this is a status report and is not considered to be a complete and final set of recommended actions. It is not a general critique of licensee and NRC response to the accident. Such review will follow while other ideas are being formulated, but that is beyond the scope of this report. It is likely that other actions, including long-term actions, will be required as the overall review of the TMI-2 accident progresses.

Prior to the TMI-2 accident, the general approach used for accident analyses was to ensure conservatism in the analysis models and results. Consideration has been given to the development of best-estimate codes, but licensing calculations were done on a conservative basis. It is recognized that shortcomings resulted from this approach. For example, the analysis of the September 24, 1977 transient at Davis-Besse did not include the phenomenon of voiding in the core and long-term natural circulation cooling. Other areas that need to be reevaluated include the use of safety and non-safety grade equipment for the termination of transients and mitigation of accidents.

On the basis of the results of this interim review, the task group concludes that certain design improvements and other actions already being implemented on B&W plants in accordance with Commission orders are necessary before plant operation can be resumed. These actions are being specified in the shutdown orders that resulted from this generic review; e.g., reactor trip on upsets in the secondary cooling system of the plant, additional operator training, improvements in auxiliary feedwater reliability, and further analyses of small break loss-of-coolant accidents. Other recommendations for longer term improvements are specified in the report.

The staff believes implementation of the recommendations stated in this report would further increase the safety margins in the B&W pressurized water reactor (PWR) plants. Certain of these recommendations also apply to the other PWR vendors (Westinghouse and Combustion Engineering) as well as to boiling water reactor (BWR) plants designed by the General Electric Company (GE).

The principal recommendations resulting from the initial review are given in Section 8.0 and are summarized below. In general these recommendations include the short-term actions taken in connection with IE Bulletins and the recent shutdown of the B&W plants and extend certain actions to longer term improvements.

- Plant design features unique to the B&W plants (e.g., OTSG and ICS) should be evaluated with regard to interactions in coping with transients. The mitigating systems (e.g., HPI) should also be included in the study.
- Plant instrumentation should be provided to give improved information on reactor coolant level and margin to bulk coolant saturation.
- A study should be made to see whether there are design deficiencies that may be corrected to reduce the frequency of feedwater transients. The reliability of auxiliary feedwater systems should be improved.
- Improved means for detecting a stuck-open power-operated relief valve (PORV) should be provided. In addition, consideration should be given to upgrading the PORV classification to safety grade and the associated controls and instruments to new standards for control systems; or, as an alternate,

consideration should be given to closing the relief valve and when during power operation if resetting of the set point is not effective in reducing actuation of the PORV.

Provisions should be made to assure that essential containment isolation will occur automatically when the safety injection system is actuated or a high containment radiation level is reached.

A study should be made by NRC, the licensees, and designers of the design basis for the residual heat removal (RHR) system with regard to its availability and operability as a low-pressure heat removal system when the reactor coolant system is contaminated.

An improved system, including reporting and data assembly, should be developed by the NRC to more effectively evaluate actual data from operating experience to assess whether the trend of data from the occurrence of equipment malfunctions or other events indicates excessive challenges to the plant safety systems.

Increased use of simulator training (and retraining) is needed, particularly in connection with emergency actions involving single failures, equipment malfunction, and operator actions, including extension to natural circulation cooling.

A study should be undertaken by NRC of actions that could make the operator a more effective recovery agent or incident/accident mitigator. Such actions would extend the defense-in-depth concept through the use of on-line diagnostic computer systems to seek ways to prevent (inhibit) inappropriate actions and promote productive intervention.

Operator training should be restructured to give more emphasis to protecting the reactor core under potentially degraded plant conditions.

Emergency procedures should be written in real time as an aid for operators to study and memorize those aspects that deal with the initial short-term response. The procedures should be written in conjunction with results available from analyses to promote proper understanding and proper identification of critical decision points.

Operators must have a better understanding of any limitations and must have a proper understanding of the plants. Each senior operator must direct activities and must not act simply as another operator.

More emphasis is needed on human engineering in control room design to improve operator comprehension and response.

All classes of operating plants should be reanalyzed using failure mode and effects analysis to identify realistic plant interactions resulting from failures in non-safety systems, safety systems and operator actions during transients and accidents. Associated analyses should be performed for a sufficient time duration to establish that a stable plant condition had been reached including natural circulation. Explicit consideration should be given to the effects of a loss of onsite or offsite power.

For all classes of operating plants, additional analyses should be performed of reactor coolant system breaks in the range of very small breaks (e.g., representative of a stuck PORV or small line rupture) and carried out until a stable, long-term cooling condition is established.

NRC should develop (and utilize for audit calculations) quick engineering types of analyses methods capable of both realistic and conservative application to operating transients and small break LOCAs from initiation through stable long-term cooling and of other events such as a small break in a main steam line or a steam generator tube rupture.

Standard Review Plans should be updated to ensure that the TMI-2 accident is taken into account during the normal course of licensing review for all future plants (OL and CP).

Regulatory guidance should be developed to give explicit interpretation of those General Design Criteria where variable interpretation in the past has led to inadequacies in instruments and associated requirements for control of anticipated transients and accident sequences.

Technical Specifications should be reviewed to ensure that (a) plant alignment and system operability requirements are clearly stated, (b) unplanned events are required to be reported to NRC whether or not technical specifications are violated, and (c) restrictive provisions do not inhibit operator improvisation under abnormal conditions.

Finding

The design requirements and criteria for plant process controls are not well defined in NRC regulations. Furthermore, the interaction of these features, especially in the B&W integrated control system and the auxiliary feedwater system, have not been thoroughly explored in previous NRC licensing reviews. The plant control systems play an essential part in plant operations and the control of transient situations that would otherwise introduce challenges to the plant safety system.

Failure of controls could initiate a transient or could inhibit the control of a transient otherwise mitigated.

Recommendation

1. The role of control systems in all plants, and their significance to safety, should be reevaluated by NRC and the vendors. The evaluations should be performed by the industry with guidelines developed by the NRC. Consideration should be given to establishing criteria regarding the rate at which transients challenge the plant safety systems. Such transients should include (a) those initiated by control failure plus (b) those initiated outside the control system that are not successfully mitigated by the control system. The plant monitoring instrumentation should be included in this evaluation. Failure mode and effects should be utilized to identify realistic plant interactions resulting from failures in non-safety systems, safety systems, and operator actions.
2. As a result of the TMI-2 accident, the evaluation of monitoring systems should focus extra attention on certain specific monitoring systems, such as the pressurizer level indication discussed in Section 2.2.9 of this report. The pressurizer level indicator has been used, sometimes incorrectly as at TMI-2, as a direct indicator of the adequacy of water inventory in the reactor vessel. A more direct and more easily interpreted indication of water inventory in the primary system would make operator inference and actions more reliable. Alternate monitoring methods for evaluating adequacy of reactor vessel water level, such as the primary inventory control system discussed in Section 2.2.9, should also be evaluated in the recommended study. Specifically, one approach can be characterized as instrumentation to measure and directly display to the operator such derived quantities as the subcooling in the reactor outlet, or the quantity of and energy content of cooling water in the core. Also, an assessment of the balance between additional automation versus improved operator response to maintain adequate plant conditions should be made.

A COMPARATIVE LISTING OF SAFETY CONCERNS BEFORE AND ACTIONS AFTER THE TMI ACCIDENT

May 17, 1979
REV. August 23, 1979

SAFETY CONCERNS EXPRESSED BY D. L. BASDEKAS, REACTOR SAFETY ENGINEER,
U. S. NUCLEAR REGULATORY COMMISSION ON NOVEMBER 19, 1976 AND
DECEMBER 20, 1976, SAFETY ISSUE NO. 22, NUREG-0153

SAFETY IMPLICATIONS OF CONTROL SYSTEM FAILURES AND
PLANT DYNAMICS *

"The effects of control system failures or, sometimes, non-faulted operation on safety are not being systematically reviewed. I believe that their effects on safety and plant availability should receive the proper attention. The first step would be to have the applicants perform a Failure Mode and Effects Analysis (FMEA) for normal operation, and in conjunction with postulated accidents and other off-normal events."

"In evaluating plant safety, the effects of control system malfunctions should be reviewed as initiating events for anticipated transients and also as failures that could occur concurrently or subsequent to postulated anticipated events (initiated by a different malfunction) or postulated accidents."

"... one has to consider that design features to mitigate the consequences of such events are not established, and therefore, those provided for postulated and analysed accidents may not be sufficient, thus, in essence, having an unprotected series of events."

On a related issue on reliability and risk assessment:

"... common mode failures and events that may result in such failures, along with human factors, are expected to contribute most significantly to the unavailability of the shutdown system. ..." (From Discussion of Issue No. 00, NUREG-0139)

* In countering Basdekas' arguments in December 1976 the NRC Regulatory Staff maintained:

"Although analyses have not been performed for these postulated sequences of events, the staff believes that the consequences would be acceptable, and much less severe than those calculated for postulated accidents."

In a Report to the Congress, NUREG-0430, April 12, 1978, The Office of Nuclear Regulatory Research of NRC, in justifying its position that no further research was needed on "Improved Plant Controls", reported:

"It is believed that only a small reduction in risk could result from

RECOMMENDATIONS BY THE NRC REGULATORY STAFF INCLUDING A COMMITMENT MADE BY BABCOCK AND WILCOX COMPANY, DESIGNER OF THREE HUE ISLAND UNIT 2 NUCLEAR POWER PLANT SUBSEQUENT TO THE ACCIDENT AT TMI

On April 26, 1979, almost a month after the TMI accident the Babcock and Wilcox Company, designer of the TMI Nuclear Power Plant, made the following commitment to NRC by letter from J. H. MacMillan, Vice President Nuclear Division to H. R. Denton, Director, Office of Nuclear Reactor Regulation U.S.N.R.C.:

"Subject: Integrated Control System

This letter documents the commitment of Babcock and Wilcox to undertake a reliability analysis of the Integrated Control System (ICS) which will include a failure mode and effects analysis.* This analysis will identify sources of transients, if any, initiated by the ICS and develop recommended design improvements which may be necessary to reduce the frequency of these transients.

In addition, means will be developed for decoupling of the auxiliary feedwater control of steam generator water level from the ICS. This modification will provide control of feedwater under emergency conditions independent of the ICS.

The scope of the reliability analysis and schedule for both the analysis and development of independent feedwater control will be provided within 48 hours."

On May 16, 1979 the NRC Regulatory Staff issued report NUREG-0560 entitled Staff Report on the Generic Assessment of Feedwater Transients in Pressurized Water Reactors Designed by the Babcock and Wilcox Company.

The report recommends that:

"All classes of operating plants should be reanalyzed using failure mode and effects analysis to identify realistic plant interactions resulting from failures in non-safety systems, safety systems and operator actions during transients and accidents."

"The role of control systems in all plants, and their significance to safety, should be reevaluated by NRC and the vendors. The evaluations should be performed by the industry with guidelines developed by the NRC. Consideration should be given to establishing criteria regarding the rate at which transients challenge the plant safety systems. Such transients should include (a) those initiated by control failure plus (b) those initiated outside the control system that are not successfully mitigated by the control system."

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ELEMENTS OF PROPOSED PLAN

• IMPLEMENT ON OPERATING PLANTS BY JANUARY 1, 1981

• IMPLEMENT ALL CATEGORY A ITEMS BY JANUARY 1, 1980
OR PRIOR TO OL ISSUE WHICHEVER IS LATER

• OBTAIN COMMISSION APPROVAL OF THE STAFF'S FIRST
COMPLETED OL REVIEW

• ASSUMED THAT PROPOSED SHORT TERM ACTIONS WOULD
NOT PREJUDICE IMPLEMENTATION OF RECOMMENDATIONS
FROM ON-GOING INVESTIGATIONS

NEAR TERM LICENSING DECISIONS

OPERATING LICENSE

SALEM 2
NORTH ANNA 2
DIABLO CANYON
SEQUOYAH

PROPOSED
PLAN

OCT 79
OCT 79
NOV 79
NOV 79

CONSTRUCTION PERMIT

BLACK FOX
PILGRIM

DEC 79
FEB 80

LIMITED WORK AUTHORIZATION

SKAGIT

DEC 79

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

AUGUST 23, 1979

WE REQUEST THE NUCLEAR REGULATORY COMMISSIONERS TO REVIEW ANY PLANS TO RESUME LICENSING ACTIVITIES, AND TO TAKE INTO EXPLICIT CONSIDERATION THE VIEWS EXPRESSED HERE THIS MORNING BY INDIVIDUAL MEMBERS OF THE COMMISSION, AS WELL AS TESTIMONY FROM PREVIOUS HEARINGS OF THIS COMMISSION WHICH GAVE RISE TO THOSE VIEWS.

PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND

- SUFFICIENCY OF RECOMMENDATIONS?

- FORECLOSURE OF COMMISSIONS OR TMI SPECIAL INQUIRY ACTIONS?

- FEASIBILITY OF SUBSEQUENT LICENSE MODIFICATION OR REVOCATION?

- ADEQUACY OF TECHNICAL FIXES?

- ADEQUACY OF PRESENT LICENSING

issue

IMPLEMENTATION OF REQUIREMENTS FOR
OPERATING PLANTS AND PLANTS IN OL REVIEW

Sect. No.	Position		Implementation Category
	Abbreviated Title	Position Description	
2.1.1	Emergency Power Supply Requirement	Complete implementation.	A
2.1.2	Relief and Safety Valve Testing	Submit program description and schedule.	A
		Complete test program.	By July 1981 ^b
2.1.3.a	Direct Indication of Valve Position	Complete implementation.	A
2.1.3.b	Instrumentation for Inadequate Core Cooling	Develop procedures and describe existing inst.	A
		New level instrument design submitted.	A
		Subcooling meter installed.	A
		New level instrument installed.	B
2.1.4	Diverse Containment Isolation	Complete implementation.	A
2.1.5.a	Dedicated H ₂ Control Penetrations	Description and implementation schedule.	A
		Complete installation.	B

^aCategory A: Implementation complete by January 1, 1980, or prior to OL, whichever is later
 Category B: Implementation complete by January 1, 1981

^bRelief and safety valve testing shall be satisfactorily completed for all plants prior to receiving an operating license after July 1, 1981.

IMPLEMENTATION TABLE (Continued)

<u>Sect. No.</u>	<u>Abbreviated Title</u>	<u>Position Description</u>	<u>Implementation Category^a</u>
2.1.5.c	Recombiners	Review procedures and bases for recombiner use.	A
2.1.6.a	Systems Integrity for High Radioactivity	Immediate leak reduction program.	A
		Preventive maintenance program.	A
2.1.6.b	Plant Shielding Review	Complete the design review.	A
		Implement plant modifications.	B

^aCategory A: Implementation complete by January 1, 1980, or prior to CL, whichever is later.

Category B: Implementation complete by January 1, 1981

IMPLEMENTATION TABLE (Continued)

Sect. No.	Position		Implementation Category ^a
	Abbreviated Title	Position Description	
2.1.7.a	Auto Initiation of Auxiliary Feed	Complete implementation of control grade.	A
		Complete implementation of safety grade	B
2.1.7.b	Auxiliary Feed Flow Indication	Complete implementation	A
2.1.8.a	Post Accident Sampling	Design review complete.	A
		Preparation of revised procedures.	A
		Implement plant modifications.	B
		Description of proposed modification.	A
2.1.8.b	High Range Radiation Monitors	Installation complete.	B
2.1.8.c	Improved Iodine Instrumentation	Complete implementation	A
2.1.9	Transient & Accident Analysis	Complete analyses, procedures and training	**
		Containment Pressure Monitor	B
		Containment Water Level Monitor	B
		Containment Hydrogen Monitor	B
		RCS Venting	Design submitted
		Installation complete	B

^aCategory A: Implementation complete by January 1, 1980, or prior to CL, whichever is later.

Category B: Implementation complete by January 1, 1981.

**Analyses, procedural changes, and operating training shall be provided by all operating plant licensees and applicants for operating licenses following the attached schedule.

IMPLEMENTATION TABLE (Continued)

Sect. No.	Position		Implementation Category ^a
	Abbreviated Title	Position Description	
2.2.1.a	Shift Supervisor Responsibilities	Complete implementation.	A
2.2.1.b	Shift Technical Advisor	Shift technical advisor on duty.	A
		Complete training.	B
2.2.1.c	Shift Turnover Procedures	Complete implementation.	A
2.2.2.a	Control Room Access Control	Complete implementation	A
2.2.2.b	Onsite Technical Support Center	Establish center.	A
2.2.2.c	Onsite Operational Support Center	Complete implementation	A

^aCategory A: Implementation complete by January 1, 1980, or prior to OL, whichever is later.

Category B: Implementation complete by January 1, 1981.

IMPLEMENTATION REQUIREMENTS PRIOR TO OL ISSUE

<u>SECTION NO.</u>	<u>ABBREVIATED TITLE</u>	<u>REQUIREMENT</u>
2.1.3.A	DIRECT INDICATION VALVE POSITION	COMPLETE IMPLEMENTATION
2.1.3.B	INSTRUMENTATION FOR INADEQUATE CORE COOLING	DEVELOP PROCEDURES AND DESCRIBE EXISTING INSTRUMENTATION NEW LEVEL INSTRUMENT DESIGN SUBMITTED
2.1.4	DIVERSE CONTAINMENT ISOLATION	COMPLETE IMPLEMENTATION
2.1.5.A	DEDICATED H ₂ CONTROL PENETRATIONS	DESCRIPTION AND IMPLEMENTATION SCHEDULE
2.1.7.A	AUTO INITIATION OF AUXILIARY FEED	COMPLETE IMPLEMENTATION OF CONTROL GRADE
2.1.7.B	AUXILIARY FEED FLOW INDICATION	COMPLETE IMPLEMENTATION
2.1.8.A	POST ACCIDENT SAMPLING	PREPARATION OF REVISED PROCEDURES
2.1.8.B	HIGH RANGE RADIATION MONITORS	PREPARATION OF PROCEDURES TO CORRELATE DIRECT RADIATION MEASUREMENTS TO ACTIVITY LEVEL
2.2.1.A	SHIFT SUPERVISOR RESPONSIBILITIES	COMPLETE IMPLEMENTATION
2.2.1.B	SHIFT TECHNICAL ADVISOR	SHIFT TECHNICAL ADVISOR ON DUTY
2.2.1.C	SHIFT TURNOVER PROCEDURES	COMPLETE IMPLEMENTATION
2.2.2.A	CONTROL ROOM ACCESS CONTROL	COMPLETE IMPLEMENTATION

ANALYSIS AND TRAINING SCHEDULE

<u>Task Description</u>	<u>Completion Date</u>
1. Small Break LOCA analysis and preparation of emergency procedure guidelines	July-September 1979*
2. Implementation of small break LOCA emergency procedures and retraining of operators	December 31, 1979
3. Analysis of inadequate core cooling and preparation of emergency procedure guidelines	October 1979
4. Implementation of emergency procedures and retraining related to inadequate core cooling	January 1980
5. Analysis of accidents and transients and preparation of emergency procedure guidelines	Early 1980
6. Implementation of emergency procedures and retraining related to accidents and transients	3 months after guidelines established
7. Analysis of LOFT small break tests	Pretest (Mid-September 1979)

*Range covers completion dates for the four NSSS vendors

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CLK

EMERGENCY PREPAREDNESS IMPROVEMENTS
AND COMMITMENTS REQUIRED FOR OPERATING PLANTS AND NEAR TERM OL'S

<u>Item</u>	<u>Implementation Category^{1/}</u>
1. Upgrade emergency plans to Regulatory Guide 1.101 with special attention to action level criteria based on plant parameters.	A ¹
2. Implement certain short term actions recommended by Lessons Learned task force and use these in action level criteria. ^{2/}	
2.1.8(a) Post-accident sampling	
Design review complete	A
Preparation of revised procedures	A
Implement plant modifications	B
Description of proposed modification	A
2.1.8(b) High range radioactivity monitors	B
2.1.8(c) Improved in-plant iodine instrumentation	A
3. Establish Emergency Operations Center for Federal, State and Local Officials	
(a) Designate location and alternate location and provide communications to plant	A ¹
(b) Upgrade Emergency Operations Center in conjunction with in-plant technical support center	B

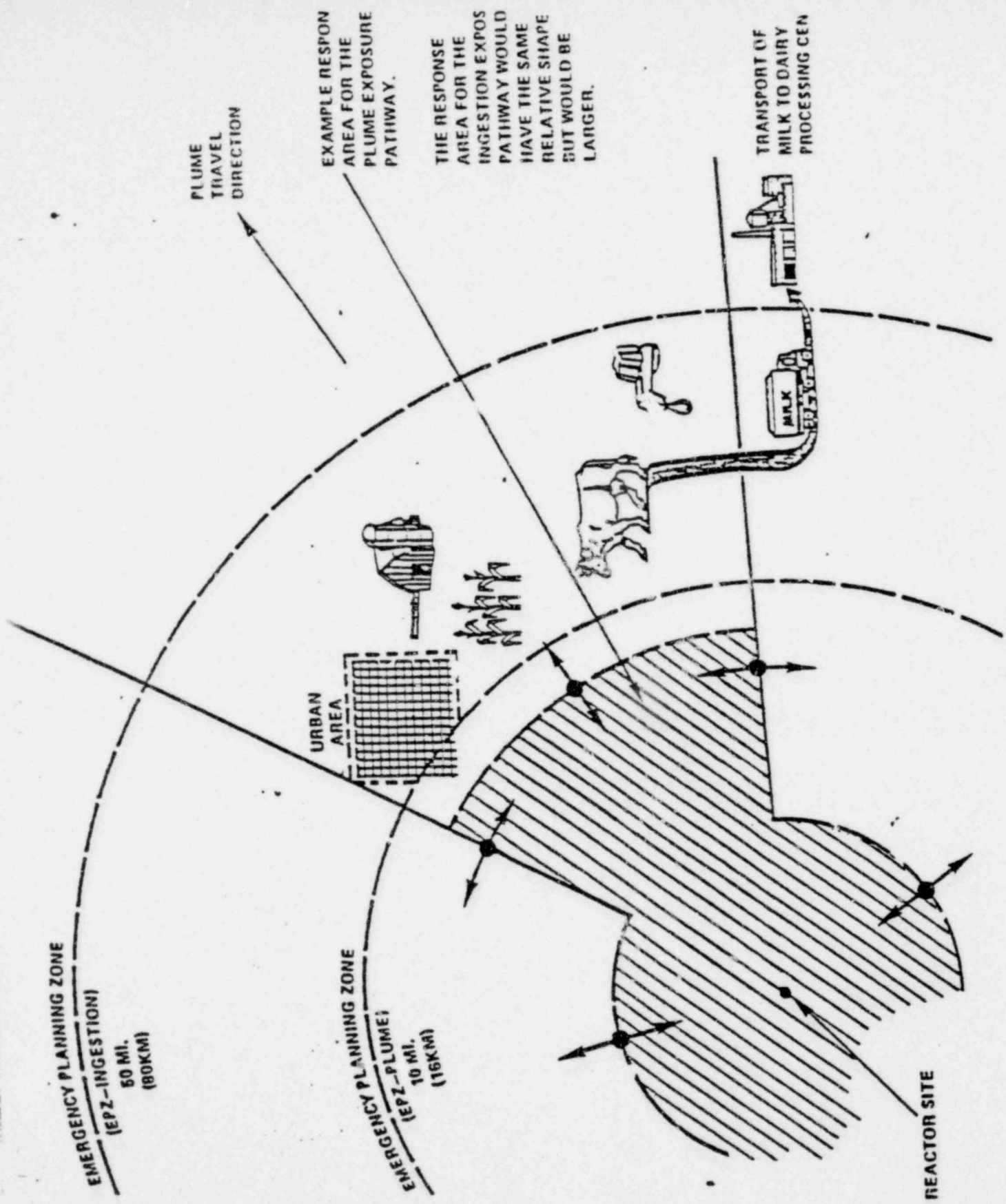
^{1/}
Category A: Implementation prior to OL or by January 1, 1980 (see NUREG-0570)
Category A1: Implementation prior to OL or by mid-1980.
Category B: Implementation by January 1, 1981.

^{2/}
The implementation of the Lessons Learned task force recommendation item 2.1.3(b) instrumentation for detection of inadequate core cooling, will also be factored into the action level criteria.

<u>Item</u>	<u>Implementation Category</u>
4. Improve offsite monitoring capability	A ¹
5. Assure adequacy of State/local plans	A ¹
(a) Against current criteria	B
(b) Against upgraded criteria	
6. Conduct test exercises (Federal, State, local, licensee)	
(a) Test of licensees emergency plan	A ¹
(b) Test of State emergency plans	A ¹
(c) Joint test exercise of emergency plans (Federal, State, local, licensee)	
New OL's	B
All operating plants	Within 5 years

RELATED INITIATIVES ON EMERGENCY PREPAREDNESS

1. Upgrading of Power Reactor Emergency Preparedness
 - Six teams formed
 - Regional meetings held
 - Review of first six plants underway
2. Concurrence in State Plans
3. NRC (Carter) Task Force - complete
4. Rulemaking
 - Task Force submittal of draft for Commission comment August 9
 - End of comment period on advance notice of rulemaking August 31
 - OSD submittal of rule changes September 21
5. NRC/EPA task force recommendation on issuance of policy statement on Emergency Planning Zones
 - SECY-79-461 July 25
 - EPA approved policy statement - will be published in Federal Register about September 15



EXAMPLE RESPON AREA FOR THE PLUME EXPOSURE PATHWAY.

THE RESPONSE AREA FOR THE INGESTION EXPOS PATHWAY WOULD HAVE THE SAME RELATIVE SHAPE BUT WOULD BE LARGER.

TRANSPORT OF MILK TO DAIRY PROCESSING CEN

PLUME TRAVEL DIRECTION

EMERGENCY PLANNING ZONE (EPZ-INGESTION) 50 MI. (80KM)

EMERGENCY PLANNING ZONE (EPZ-PLUME) 10 MI. (16KM)

URBAN AREA

REACTOR SITE

Figure 1 Concept of Emergency Planning Zones

Hendrie Repo 47
E.L.K.

March 13, 1975

Commissioner Gilinsky

Thru: Acting Executive Director for Operations *Sty*

TECHNICAL ISSUES

Attached you will find, in accordance with your oral request, discussion of some technical issues I believe to be important subjects for Commission consideration, although not necessarily in the immediate future. The list is confined to reactor safety topics.

I have also appended a list of some reactor safety policy issues that have come to my attention in technical reviews.

These enclosures represent my personal views and have not been staffed out with the organizations normally concerned with such matters.

Stephen H. Hanauer
Stephen H. Hanauer
Technical Advisor

Encls

1. Technical Issues
2. Policy Issues

cc: w/encl
Chairman Anders
Commissioner Kennedy
Commissioner Mason
Commissioner Rowden
L.V. Gossick
E. Case
H. Kouts
F. Schroeder
A. Giambusso
R. Minogue



1. Design Objectives and Safety Design Basis for Water Reactors

Although your mother-in-law and your Congressman will tell you that the safety goal is zero risk, we know that this is unattainable and that some non-zero risk must be accepted in all activities. The social question involving cost/risk/benefit comparisons of the various alternatives that are realistically available needs to be established. The Rasmussen Study made an important first step in quantitative risk evaluation but the technology is not yet available to resolve this question in a completely quantitative way. The study has pointed out a disparity between (a) our present "design basis" safety approach in which all potential accidents are either put into the design basis for complete mitigation or remain outside the design basis and have no safeguards compared to (b) the more realistic viewpoint of a spectrum of accidents each with probability and consequences of its own. Serious consideration should be given to modifying the present all-or-nothing approach in the light of reality.

2. Design Objectives and Safety Design Basis for Non-Water Reactors

For non-water reactors, we have neither the operating experience nor the Safety Study to guide us in developing criteria. The situation is reasonably well in hand for HTGRs, but the potential for autocatalytic positive feedback leading to core nuclear explosions in LMFBRs is creating great uncertainty regarding their design requirements. Calculations of such violent events are increasing in scope and sophistication. However, the results presently depend to a considerable extent on the phenomena postulated to occur. For the near term, the staff has already decided that a core disassembly accident must be part of the licensing design basis. This decision is subject to future revision based on further research that ERDA is convinced will show that such events are so improbable they need not be considered.

Adequate safety must be provided. Too much safety - added safety equipment not actually needed to provide adequate safety - wastes scarce and valuable resources. Attention to improbable severe postulated events tends to short-change, more probable but less severe accidents that should be considered.

An important corollary issue is whether the planned LMFBR safety research programs meet the totality of NRC needs.

NRC has not established quantitative reliability criteria for safety-related systems. The operating plants are one of our chief sources of information but we do not know whether the rate of abnormal occurrences now being experienced is a satisfactory one or not. We do know that nuclear unit availabilities and capacities are not satisfactory. We need to find out whether safety system availability is satisfactory and to improve whatever aspects of reliability need improving.

4. Human Performance

Present designs do not make adequate provision for the limitations of people. Means must be found to improve the performance of the people on whom we depend and to improve the design of equipment so that it is less independent on human performance.

The potential for internal and external sabotage constituting a public safety hazard, and the degree to which design and operation needs to take sabotage into account, need to be delineated. Studies now underway should help, but some of the issues are non-technical. In spite of this difficulty, technical criteria are needed.

The relative roles of human operation and automation (both with and without on-line computers) should be clarified. Criteria are needed regarding allowable computerized safety-related functions and computer hardware and software requirements for safety-related applications.

5. Plutonium Dose Criteria

Present accident dose guidelines values are given only for whole-body and thyroid doses. Other dose components (lung, GI tract, bone) should be covered by similar guidelines. A number (or numbers) for plutonium is particularly badly needed and will be particularly hard to establish.

6. Siting

Present criteria for siting are in need of improvement in the following areas:

a. The design basis external events now in use for licensing are founded on various schemes for estimating a "probable maximum" event. We do not have any good way of estimating the return interval or the frequency of the earthquake or flood calculated in this way. Furthermore we are not likely to develop good methods for doing so in the near future because of the short

history (a few hundred years at best) and the long recurrence interval desired (sometimes we talk about a million years). Various developmental methods for estimating frequencies of design basis events, chosen as we choose them, give recurrence intervals substantially shorter than a million years. The lack of knowledge and the desire to be conservative is going to make resolution of this problem very difficult.

b. Our population siting criteria are indefinite at best. The applicant is required to study population distributions around a site and to project them for the life of the plant which, of course, he can do only very crudely but our criterion for population distribution surrounding the plant are very vague. Recent attempts to be more quantitative in this area met with great resistance from the industry and from the old AEC. They tend to be oversimplified, but I believe we could do better than has been done. A related problem is our present total lack of control over what goes in near the plant after the site is approved. We have some vague words about the licensee's responsibility to stay informed about subdivisions, ammunition plants, LNG terminals and other post construction materialization of things that would have made the site unacceptable if known before licensing. Someday some operating reactor is going to have a new neighbor of a really abominable kind and we are going to have trouble coping with it.

c. I believe we are not being serious enough about siting alternatives that may offer substantial safety improvements. An obvious example is underground siting about which we are just starting a study in RES.

7. Degree of Detail and Realism in Safety Evaluations

The great improvement in computer codes available for use in analyzing the course and consequences of postulated accidents has rather naturally led to a corresponding increase in the depth and detail of Regulatory review of these accidents. On the face of it this is a good thing. It leads to better technical understanding and increased realism in evaluations. But is overall safety review enhanced by such detailed examination of certain design basis accidents? It is at least arguable that a broad brush treatment, with plenty of arbitrary conservatism, gives at least as much safety with a lot less work on everybody's part. A recent and obvious example is the new ECCS regulation, which specifies in gory detail exactly how these calculations are to be made. There are many arguments for and against use of such details and the subject is about right for reopening, in my opinion.

A related subject is the very large increase in the capability of the NRC staff to make independent calculations in many accident areas. This has proved to be invaluable in increasing the staff's technical understanding and should be continued even if some of the details are recognized as too detailed for licensing.

1. Internal Quality Assurance

We are not taking our own medicine with regard to a quality assurance program in Reg. We do not have a quality assurance organization, independent of the line, reporting to higher management and we have very little auditing and QA in the line. If 10 CFR 50, Appendix B, is good stuff, then it should be applied to the NRC organization. This must be applied to the quality of our product - safety decisions - as well as the quantity and timeliness of our output.

2. Making Better, Faster and More Generic Decisions

Our recent record is mixed. A good example is ATWS and a bad example is turbine missiles, about which we seem not to be able to make up our minds. Future technical safety review should not be endless and mindless repetition of what we have been doing for the past couple of years but rather consolidation into general decisions and general principles, better identification of what is truly important (risk evaluation?), and increasing automation of routine evaluations.

3. Stabilization of Regulation Requirements and Standardization of Designs

Our recent reviews of the standardized designs that have been submitted and recent discussions on standardization (and piggy-back), show the following:

a. The standardization designs submitted are not consolidations of previous experience. The proposed standard designs include a large number of "improvements" not yet actually designed. So, these first standard CPs will be based on a bunch of promises, even more than recent custom CPs.

b. New information from design and operating experience and safety research programs, and new insights as a result of this experience and research have pointed the way to improvements in safety that seem worthwhile and in some cases necessary. The pace and guidelines of the standard reviews has not permitted implementation of these, so they are hanging over our heads as a serious threat to standardization.

c. As a result of a. and b. and of the long time lag between today's bunch of promises and construction and operation of standard plants, more attention needs to be paid to the execution of standardization over the next several years and stabilization of Reg requirements.

This is closely related to Item 3. In the past couple of years surprises have come both from operating experience and from improved understanding by both Reg and the industry of safety problems we thought were put to bed. An obvious example is all the trouble we had with ECCS evaluation models. Innovation by applicants will continue to generate surprises. We must develop methods for dealing with these surprises, in cases and generically, without having a fire drill each time.