

THIRD MEETING OF THE
PRESIDENT'S COMMISSION ON THE
ACCIDENT AT THREE MILE ISLAND

NEW EXECUTIVE OFFICE BUILDING
ROOM 2008
WASHINGTON, D. C.

FRIDAY, JUNE 1, 1979
MORNING SESSION

ATTENDEES

COMMISSIONERS

John G. Kemeny, Chairman
Bruce Babbitt
Patrick E. Haggerty
Carolyn Lewis
Cora B. Marrett
Lloyd McBride
Harry McPherson
Russell Peterson
Thomas Pigford
Theodore Taylor
Anne Trunk

STAFF

John Fabrikant
Barbara Jorgenson
Bruce Lundin
Ronald B. Natalie

APPEARANCES BEFORE THE COMMISSION

Victor Stello, Director, Division of Operating Reactors, NRC
Roger Mattson, Director, Division of Safety Systems, NRC
Robert Tedesco, Assistant Director for Reactor Safety, NRC
Joseph M. Hendire, Chairman, NRC
Victor Galinsky, Commissioner
Richard Kennedy, Commissioner
Peter Bradford, Commissioner
Joseph Ahearn, Commissioner

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CHAIRMAN KEMENY: Would the meeting please come to order. The Presidential Commission will continue its hearings of witnesses from the Nuclear Regulatory Commission and will Chief Council please call the next witness?

MR. NATALIE: Mr. Stello, would you please come forward and be sworn? Raise your right hand. Do you swear the testimony you will give before this Commission shall be the truth, the whole truth and nothing but the truth so help you God?

MR. STELLO: I do.

CHAIRMAN KEMENY: Mr. Stello, would you state just for the record what your position is with NRC and what you, in general terms, what your role has been in this particular accident?

MR. STELLO: I am the Director of the Division of Operating Gases in the Office of Nuclear Reactor Regulations. Would you like me to start with how I became involved?

CHAIRMAN KEMENY: I think that might be useful.

MR. STELLO: I went to work on the morning of the 28th, received a phone call from Mr. Boswain at approximately eight o'clock, who informed me of an incident at Three Mile Island. I asked him if there was an environmental release, and he indicated there was. I immediately called Mr. [redacted] told him to go to our operations center and try to understand the nature of the environmental release. I was meeting at the time with my deputy, Daryl Eisenhood. And I asked him to set

up a team of people in our offices at Norfolk Avenue, be able to respond to any one of a variety of questions dealing with that particular reactor. I then immediately left to report to the operations center, and got there approximately eight-thirty or nine o'clock. That would be a normal thing for me to do given that the center had been activated, I am a member of the IRAC team, responsible for assessing the technical information. O.k.?

CHAIRMAN KEMENY: I think you're too tall, Mr. Stello.

MR. STELLO: For assessing the technical information that we could and trying to understand the nature of the accident as it was progressing. We did this through information that we were obtaining through telephone communications through our Region 1 office directly from there into the site, obtaining various pieces of information regarding the status of the reactor, how it was being cooled, what the environmental releases were, trying to decide the nature of the accident as best we could, to determine what course of action we had to follow.

My focus, my attention throughout the early hours was in understanding the nature of the transient conditions that were being experienced in trying to understand what could have caused it. Early during the morning and early afternoon, particularly interested in the way in which we believed the reactor was being cooled at that time. Was it being cooled through what one would have expected from the early information through the same generators or wasn't it? We were trying to get the

plant, process parameters, determine whether or not it was true.

I don't know how detailed you'd like me to go into.

CHAIRMAN KEMENY: No, I think that's fine for the start. We understand that you became part of a large team, and perhaps you could explain what this was, and what your role in that is.

MR. STELLO: This -- I continued in the incident center. I remained there through the day and the night. And the following day. I was home Thursday night and got back in the incident center early Friday. At that time there was an indication of a very large radioactive cloud at the plant, as I remember the number was reported about 1200 MR per hour, cloud hanging over the plant, which created a new interest, specifically the sequence of events that followed from that point on lead to Mr. Denton and myself and some twenty or thirty additional people leaving for the site on Friday afternoon.

Then I was with people at Three Mile Island for the next approximately forty days. And monitored the activities at the site throughout that time.

CHAIRMAN KEMENY: Didn't you also play a liaison role with a non-NRC group during this, Mr. Stello?

MR. STELLO: We had representatives who were meeting with the industry advisory group which the licensee had put together to advise them, and we were getting information from them as to what they believed was happening and what the next sequence

of events should be. I was also a member of a management team with the licensee where I was in a position to make my views known directly during those meetings as well as the normal regulatory process. And had the benefits of the thoughts of all of the licensee people, at the site as well as the industry advisory group.

CHAIRMAN KEMENY: Thank you. Professor Pigford?

MR. PIGFORD: Mr. Stello, as I understand from your testimony to the Vidal Task Force, apparently you were aware on Wednesday that there was considerable failure of the fuel in the reactor, is that correct?

MR. STELLO: Yes, it was my belief that Wednesday there was considerable failed fuel. I believe I had also indicated that the fuel had been damaged, although I would not want to use any adjectives to describe the extent of the failures or the extent of that damage on Wednesday. I don't believe that I had sufficient information on Wednesday to use adjectives to describe it any further.

MR. PIGFORD: Well, the adjective you used with the task force was significant damage. Is that still your feeling?

MR. STELLO: It is my feeling that on Wednesday, I believed there was damage. If I have used the word significant when I was testifying before the committee, I guess I would have to withdraw the statement in terms of being able to believe that I had sufficient information to use adjectives. I did believe there was damage, I did believe the core was subjected to

conditions where it was uncovered for some period of time. I did believe that the core was damaged by overheating of the fuel. Failures that occurred, occurred as a result of the uncovering of the core and overheating of the fuel.

MR. PIGFORD: Let's try to make it more concrete. When you concluded that there was considerable failure of the fuel with large numbers of failed fuel rods, about how much damage, what percentage of the fuel did you have in mind when you said this?

MR. STELLO: With respect to the number of failed fuel rods, I would not have precluded this. My belief was that the upper part of the core, at least at that time, had been uncovered for a significant period of time, that the gap activity for most or all of the rods would have been released.

MR. TAYLOR: Could you tell us what gap activity means?

MR. STELLO: That's the amount of activity which is released from the fuel during normal operation. The center line of the fuel normally runs at fairly elevated temperatures, and the fission gasses from the center of the fuel had to fuse up through the matrix and accumulates in the gap which is contained at the top of the fuel rods for the purpose of collecting those gasses. And those release rates are very, very small in terms of the total amount of gas that's in the matrix. It's at best a very few percent of the fission gasses and it was that kind of activity.

MR. PIGFORD: So you mean more than hot for the fuel rods

had released their gap activity?

MR. STELLO: That would have been consistent with my understanding.

MR. PIGFORD: And did you conclude at that time that there was anything about the extent of hydrogen production, zirconium water reaction?

MR. STELLO: I don't believe that I would have precluded it because as I indicated earlier, it was my belief that the mechanism for failure of the fuel elements was by overheating. It was my belief that the core had been uncovered for significant periods of time. And even if the core uncovering were not extensive, that is if it were limited to the upper portion of the core, and that the temperatures had not increased to very high levels, that even lower temperatures in the range of thirteen to fourteen hundred degrees for extended periods of time, would create conditions where you could produce metal-water reactions, though be it at a very slow rate, but since the core had been uncovered for what I believed to be a long time I thought the potential was there for metal water reactions.

MR. PIGFORD: Didn't you go further in earlier testimony and say not only there was the potential but it seemed likely that there would have been extensive hydrogen, metal-water reaction?

MR. STELLO: Yes, I believe that's consistent with -- there was no water reaction that occurred on Wednesday.

MR. TAYLOR: I'm sorry, this occurred on Wednesday?

MR. STELLO: On Wednesday.

MR. PIGFORD: And then apparently you testified that during that same day, you went in and out of the incident center several times. Is that correct?

MR. STELLO: I never -- I physically left the operations center several times during the day.

MR. PIGFORD: What is the incident center, and where is it located?

MR. STELLO: It's in our Office of Inspection and Enforcement.

MR. PIGFORD: What city?

MR. STELLO: Bethesda. Now when I left the incident center, or operations center, I left there for fairly short periods to get something to eat or visit facilities. I never was very -- I was never removed from the particular location for any significant period of time. I'm not sure I understood the thrust of your question. Perhaps you could -- (interrupted).

MR. PIGFORD: Yes, well let me get at the thrust of the question. I believe that you have testified that during that day, there were Commissioners present from time to time, at the incident center, and probably at one time or another you made your views known that the core had been uncovered and there was extensive damage. Is that correct?

MR. STELLO: There were at least three Commissioners that had been present as I recall at one time or another.

MR. PIGFORD: Who?

MR. STELLO: Commissioners Ahearne, Bradford and Gilinsky. I recall talking to them. I'm sure we discussed the fact that there was failed fuel. I don't believe that I can recall leaving them with the impression that I know this now, not so much from my recollection of what I said, but from conversations that occurred subsequently with the impression that I believed that the damage that was have just been talking about for the past five minutes. I do believe that I discussed with them that there clearly was failed fuel.

CHAIRMAN KEMENY: Excuse me, Mr. Stello. This was on Wednesday?

MR. STELLO: On Wednesday.

MR. PIGFORD: And you discussed with them on that day failed fuel and your own conclusion that day was that over half the fuel had been releasing its gap activity?

MR. STELLO: I don't recall ever discussing with any of the Commissioners how much fuel had been failed, just the fact that the amount of activity we saw and the fact that I believed the core had been uncovered at previous times. That's what I believe was a consensus view that clearly everyone believed that there was in fact failed fuel. I wish to make clear that I do not believe that my views as I've been stating them now that I had communicated to others on Wednesday, I think I probably did on Thursday. My notion of the degree of damage. But I don't believe I had communicated to them any notion of physical damage to the core on Wednesday.

MR. PIGFORD: So the task force you mentioned that concerning, they probably at one time or another, your views were made known, that you expected the core had been uncovered and the fuel damaged. Is that a reasonable interpretation?

MR. STELLO: Yes, I think -- well, the only way you could have failed fuel, in my view, is by damage. It had to have been failed by a mechanism where the heat transfer deteriorated and the cladding would have had to have heated up, damaging the cladding, causing the loss of its integrity. That is the only mechanism I see for failing the fuel.

MR. PIGFORD: And in your opinion, if it got to those conditions such as temperature, would cause that loss of integrity, would it be likely that there would be zirconium-water reaction?

MR. STELLO: I've indicated before I think at that potential clearly existed, although on Wednesday we did not have sufficient information to know that metal-water reaction occurred. We did not know this until sometime later.

MR. PIGFORD: The trouble is, Mr. Stello, you and I are both technical people and potential and so forth is one thing, but possibility. Was it likely though that there was metal-water reaction under those conditions?

MR. STELLO: Well --- (interrupted).

MR. PIGFORD: You know of the background on the temperatures and the reaction rates and from your knowledge of that, was it likely that there was metal-water reaction?

MR. STELLO: That process, it was very likely that that process went on. Oxidation of the cladding occurs even during normal operations at extremely slow rate. It's the rate of reaction that's important. And at low temperatures it's extremely small. It increases expeditiously as the temperatures increase. And at eighteen hundred degrees and above it occurs at a very fast rate.

MR. PIGFORD: Fine, now let's take us to the conditions of this day. Did it get to those conditions where it goes at a reasonably fast rate so that one would expect this to happen?

MR. STELLO: I don't believe I have sufficient information on Wednesday to have determined the rate at which the reaction took place, nor the amount of reaction that actually occurred. I only believed that because the core was uncovered that indeed metal-water reaction was occurring. I could not state then based on the information I had only on Wednesday what that rate was likely to be.

MR. PIGFORD: On the recovery organization, you are listed as being a member of what is called a technical working group, headed by Mr. Arnold. Who were the other members of that group?

MR. STELLO: There was a representative at those meetings from the Industrial Advisory Group, and the actual members that attended the meetings from day to day were representatives from PPC, Mr. Wilson or one of his deputies attended. As I

recall, Jack Herbine or one of his deputies attended these meetings.

MR. PIGFORD: As members of the group?

MR. STELLO: Yes, as members of the group?

MR. PIGFORD: How many total members?

MR. STELLO: I don't recall the exact number of members of the group, but the meetings typically had between ten and twenty-five people attending. I for example would typically bring along one or more other members of the Nuclear Regulatory Commission with me at the meeting. The -- I would have to refer to a organization chart to read off the particular list of members. I don't recall.

MR. PIGFORD: Mr. Stello, I'm not really asking about all the people who attended, but I gather this is a, was a well defined group of like four or five or six people who were defined members, who had some responsibility. And it's only those I'm looking for, who they were?

MR. STELLO: The way in which the meeting was conducted I don't believe you could confine yourself to just those members. Because all of the people who were present would have a view to offer, and an opinion to state which was heard by all and used in making the decisions. It was not a meeting, I can recall where people literally voted for a particular number of people who were part of the group, I think as the group functioned, lost it's identity but the list of the organizations that attended the meetings were representatives of the PPU,

the Nuclear Regulatory Commission, the IAG, Met Ed, as I recall being identified on the organization chart, I'd have to check it to see if there were others.

CHAIRMAN KEMENY: Mr. Stello, what was the purpose of these meetings?

MR. STELLO: The meetings were two-fold: to look at the conditions that were occurring at the plant, deciding what to do on the short term basis, day to day activities, as well as to look at the longer range planning, by that I mean the next several weeks with various kinds of equipment modifications that would be needed to take the plant from the condition it was in into what was believed to be a more desirable condition, the early part of the meeting for example, directed itself to technical understanding necessary to take the plant from its poor circulation cooling mode to an excellent circulation.

CHAIRMAN KEMENY: But I'm confused about this. How did you make decisions? You said that there was a random number of people there which varied, and you said voting didn't take place, therefore it didn't quite matter who was there. I mean did you operate under unanimous concensus, or just how were decisions made?

MR. STELLO: I think in most cases the -- if a decision had to be made, the views were made known by all of us, how we felt as individuals, and the ultimate decision as to what course of action had to be taken was made by Mr. Arnold, and we as the NRC aside and separate from that meeting, had the

ability to have our views made known and to change that if we chose, to change it as part of the regulatory responsibility. Mr. Arnold as the individual who headed up the group, had the ultimate responsibility for the decisions that were being made or what course of action to follow.

MR. PIGFORD: I certainly want to get at that point. Now, whereas the organization chart, we have seen, called it the technical working group. Was it in effect then a decision group?

MR. STELLO: There were many, many decisions made in that group meeting. They were often made during the meeting, sometimes they would be made subsequent to the meeting, and they would be announced by Mr. Arnold. And if I objected to that particular decision, I had two ways in which to object this. The first one was by objecting as being a party to the working group, and then ultimately as the representative of the Nuclear Regulatory Commission if a course of action was being pursued which did not seem to be appropriate, even if the group consensus was to take this particular action. There were several examples I perhaps could cite to give some insight.

MR. PIGFORD: I want one in just a moment, but how often did this group meet?

MR. STELLO: For the period of time I was there the group was meeting at nine o'clock in the morning and at six o'clock in the evening, twice a day, seven days a week.

MR. PIGFORD: Now, could you please give us an example

of a decision that was made and how it was made?

MR. STELLO: O.k. The group wanted to open a particular valve to make a measurement of the water level in the sump early in our discussion. And I objected since I did not see the value of opening the valve since there was no preparation at that time made for what to do with the water if the water level had been going to high. There was not sufficient information to lead me to believe that there was a significant concern and I objected to Mr. Arnold after the meeting, and he agreed not to proceed with it on that basis. If there were procedures that were being developed and they weren't being developed in a way we thought was satisfactory, we would separately from that meeting make our views known to Mr. Arnold and have it changed.

MR. PIGFORD: Was this group functioning at the time there was concern on the part of NRC about the possible explosions of the hydrogen bubble inside the primary loop?

MR. STELLO: I don't believe that the organization actually went in the place until, I think it was Monday following, and the concern over the bubble was, the explosion of the bubble, as I recall, was Saturday and Sunday. So the group as a group I don't believe really existed until Monday. So it would not have been in existence at that time.

MR. PIGFORD: Did the concern over the bubble disappear on Sunday?

MR. STELLO: In my view, yes.

MR. PIGFORD: Did the concern over the potential for an explosive bubble or for oxygen to be getting into the bubble where it could be either burned or exploded -- (interrupted).

MR. STELLO: Went away on Sunday, Sunday afternoon-evening.

MR. PIGFORD: I see. Are you Mr. Stello, involved in the current NRC investigation of this accident?

MR. STELLO: At the moment I have no responsibilities for the investigation that's going on. That's being conducted by our Office of Inspection and Enforcement and of course there are a variety of other committees who are also doing investigation.

MR. PIGFORD: Is that investigation going on now?

MR. STELLO: Yes.

MR. PIGFORD: Who is leading it?

MR. STELLO: Mr. Allen, who is the Deputy Director for Region 1, as I understand it, is the responsible individual in the Office of Inspection and Enforcement for the investigation, being conducted in several parts. The operation end of the investigation as I recall is being done by a Bob Martin of that office and the Environmental and Radiological is being headed up by another individual whose name escapes me at the moment.

MR. PIGFORD: During the accident did someone from GPU approach you or your staff requesting permission for an operator to get more than the allowable dose for maintenance

or for taking a sample?

MR. STELLO: I'm not aware of any such contact.

MR. PIGFORD: Dr. Gallina, a Mr. Gallina testified to that effect for the Udall task force. Would that person have approached you, or whom would he have approached in your organization?

MR. STELLO: If such a request were made, it would have been a change to license conditions, and it should have been our office, the Office of Nuclear Regulations. He may have approached Inspection and Enforcement, our office of Inspection and Enforcement. I'm not aware of that particular request.

MR. PIGFORD: And would that have been referred to you or to whom for decision?

MR. STELLO: It would have been referred to me as I've indicated since we have the licensing authority to exempt from any of the regulations if we found it appropriate.

MR. PIGFORD: And if this request came, say on Thursday, would it have been referred to you?

MR. STELLO: If it came on Thursday, it should still have been referred to the Office of Nuclear Reactor Regulations, perhaps not me personally. If it were at the time we were up at the site it would have been. I'm not aware of that particular discussion however.

CHAIRMAN KEMENY: Mr. Stello, could I ask you a general question here. I keep hearing again and again as I hear various parts of NRC that someone is not aware of something

that's happening somewhere else in their process. Would -- what is your impression of communication amongst the various branches of NRC involved in this during this period? Would you help me understand this period? I mean, let's say from Wednesday through Sunday.

MR. STELLO: O.k., from Wednesday through Friday, the time we left, all of the decisions that had to be made were being referred to our operations center, or should have been. And there was extremely good communications between the offices since we were all present physically in the same room. And there should have been little question that we were all aware of what was going on. Within the center itself. We were of course communicating through a team of people the first team of which was composed of representatives from Inspection and Enforcement who were dispatched to the site and were informing us of what was going on through telephone link.

We sent a team of people from the Office of Nuclear Reactor Regulations on Thursday up at the site, and the communications were not very good with them, we had considerable difficulty in finding phones available to communicate back with the incident center, and communications were especially acute Wednesday, Thursday. On Friday, after we arrived at the site we were again organized and all of the people responsible for the activities were housed in trailers immediately adjacent to each other, and we were well informed of the activity going on with each other. So I know of no reason to suspect that we

had problems with communicating within the two offices who were the principle offices following the activities.

CHAIRMAN KEMENY: Yes. Given that answer, and this is Monday morning quarterbacking, but that's what this Commission is supposed to be doing, would you feel that for any such future emergency there should have been some sort of emergency communication system? Because after all there's -- those first forty-eight hours could have been decisive.

MR. STELLO: Well, I think that the Three Mile Island experience has clearly indicated to me that we have to find a way to significantly improve our ability to obtain information especially from the site, from the control room itself. I don't know how best to achieve that at the moment. But I believe that the experience that we've had is a clear indication of the need to do better in the future, yes.

CHAIRMAN KEMENY: Commissioner McPherson?

MR. MCPHERSON: Mr. Stello, it would help me to understand something about the way the Nuclear Regulatory Commission regulates. What in summary form, what contact did the NRC have with Three Mile Island between the time Three Mile Island Number Two went critical in March 1978, and this event of March 1979. What, as general rule, what does the NRC know about that plant during that, what did it know during that period?

MR. STELLO: The Office of Inspection and Enforcement continues to monitor everything that goes on within the plant, from the time it receives its construction permit through its

entire operating lifetime. It performs various inspections for a whole host of variety of reasons. The activity within the plant in terms of things that have gone astray one way or another are required to be reported through license conditions set forth in the technical specifications, and are reported as licensee event reports.

MR. McPHERSON: What do the records show for that year as to the number of such reports of things that have gone astray as far as Three Mile Island Number II?

MR. STELLO: I personally haven't reviewed those, and I cannot recall neither the number nor nature of the licensee event reports that were submitted during that year.

MR. McPHERSON: Suppose there were quite a number. But they varied from serious to inconsequential. Who makes the determination as to which they are, whether they are serious and require immediate change, or do not require -- (interrupted).

MR. STELLO: Our Office of Inspection and Enforcement has the responsibility for the followup on the LERs, and it would be their initial responsibility as an office to have made the determination.

MR. McPHERSON: When you got up there and worked on this group -- (interrupted).

CHAIRMAN KEMENY: Excuse me. Could I follow your previous question up for a moment and then back to you?

MR. McPHERSON: Yeah.

CHAIRMAN KEMENY: We keep hearing references to these

reports that the licensee must send or something going wrong, and I'm getting no feeling at all as to what they are and what they trigger at NRC headquarters. Let me take a hypothetical example. Suppose the licensee knows that a steam valve is leaking. Would the licensee have to report that to NRC?

MR. STELLO: Well, all of the conditions for which he needs to report are identified and set forth in his license. The attachment to his license contains a rather substantial document called his Facility Technical Specification.

CHAIRMAN KEMENY. Yes, well, take the particular example. Suppose there's a leaky steam valve somewhere within the containment building. Is that something he would have to report?

MR. STELLO: As a general matter, containment isolation, the allowable leakage through those valves are set forth in the facility technical specification, so I would believe that there would be a limit and he would be required to report that, yes.

CHAIRMAN KEMENY: Would you, would NRC then determine whether the licensee can wait for the next refueling or the next shutdown to repair that, or whether that should require shutdown of the plant and the leaky steam valve should be repaired. Who determines that?

MR. STELLO: The technical specification sets forth a limit on the allowable leakage from the valve. If that leakage is exceeded, he is required to shut the facility down and repair it. The permitted leakage is set forth in the text spec.

CHAIRMAN KEMENY: Now, from the fact that there was a leaky steam valve as we heard from a great deal of testimony, and the fact that they were not required to shut it down, may we assume that leakage was below the limits that you have just referred to?

MR. STELLO: It is my understanding that the leakage through the valve was in fact below the text spec limit for the leakage on the valve.

CHAIRMAN KEMENY: Then I have to ask you the following question since we also had substantial testimony that the leaky valve significantly contributed to the confusion during the accident. It may almost have been the single most confusing thing. Are your specs correct?

MR. STELLO: Well, the specs themselves may in fact still be correct. Perhaps there are some additional things that ought to be done about positive identification of whether a valve is open or closed. And more direct means of determining whether or not that is the case. I think that one need not necessarily change the leak rate to accomplish the primary purpose which would be a very positive and direct assessment of whether the valve is open or closed.

CHAIRMAN KEMENY: Commissioner McPherson:

MR. MCPHERSON: Mr. Stello, when you were on this team, at Three Mile Island, did you have available to you, supplied by the NRC staff of Inspection and Enforcement, records of any events or misuse that they were aware of during the year

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from March 28, 1978 to March 28, 1979? In other words, did you, did they tell you what they knew about the Three Mile Island plant?

MR. STELLO: I had very little concern when I was at Three Mile Island for what had happened in the past.

MR. MCPHERSON: Would that include operator readiness?

MR. STELLO: At the time that I was at the site, I did not concern myself with what had gone on in the past, I was immediately concerned with the safety of the plant as it existed and what needed to be done to assure that that plant was maintained in a safe condition.

MR. MCPHERSON: Were you the senior NRC man on the scene?

MR. STELLO: I was a Deputy to Mr. Denton, and when Mr. Denton left I was the senior representative at the site.

MR. MCPHERSON: And you arrived on what day?

MR. STELLO: I arrived at about one-thirty or so on Friday afternoon.

MR. MCPHERSON: With Mr. Denton.

MR. STELLO: With Mr. Denton. Right.

MR. MCPHERSON: Did neither of you, and I'll repeat the question, did neither of you request or receive from Inspection and Enforcement or any other agency at NRC, an analysis, a description of the performance of this plant during the year previous, the performance of the operators, the state of readiness and training of the operators, or any malfunctioning

of equipment in the plant, any sloppiness in the way the plant was being operated, any lack of engineering backup. Did you, in other words, did you just come as if from the head of Zeus down without any historical experience even though it resided in your own agency?

MR. STELLO: I knew where such information could be obtained, I knew how to obtain it. I did not believe or see the need to have that information while I was going up at the site. I assumed, which I think is reasonable at that time, that the operators were adequately qualified and trained, the impression I had from the people who were working in the control room and throughout the site was that the people at the site were competent, they were doing a good job.

MR. McPHERSON: Did you hear Mr. Floyd's testimony?

MR. STELLO: I heard part of Mr. Floyd's testimony?

MR. McPHERSON: Do you know what he said about the state of readiness and training of the staff?

MR. STELLO: No, I do not.

MR. McPHERSON: He said it was inadequate. For this event. Now, he is the Supervisor, or Superintendent of that room, but the NRC felt that the operators were adequately trained and ready for this event?

MR. STELLO: Oh, if I left you with that impression -- (interrupted).

MR. McPHERSON: Well, please verify.

MR. STELLO: I would not suggest that Three Mile Island

nor any operating plant was prepared to handle the event as it occurred at Three Mile Island. That training has occurred subsequent to that. The operators were not trained for the particular accident that happened. I indicated that the type of training that we believed to be appropriate for this facility in my view, it was a correct assumption to believe that that training did in fact occur, and that it was done properly and the people there were competent, and that the equipment was performing adequately.

CHAIRMAN KEMENY: Mr. Stello, could I follow that up? In that case, the of what this means for the future is that the NRC's strategy is to prepare all this of the previous accident, and maybe the accident occurs, you will add to the training of operators?

MR. STELLO: No, I wouldn't suggest that either. I think Three Mile Island has taught us a lesson. I don't believe that we had done things in the past adequately, and I believe we need to change. Which we have been done.

CHAIRMAN KEMENY: What would you suggest, how would you try to prepare operators so they could handle a variety of kinds of possible events?

MR. STELLO: I guess I'm not prepared to enunciate all of the things that need to be done. There is a group under Dr. Mattson who will be testifying next who is going to ask and answer those very questions of what more do we need to do in the future. It is clear that the operators at Three Mile

Island were not trained for this accident. It is clear that more work in the area of training is needed, not just for this accident but as a general matter. What their training should consist of and any equipment changes that might be needed and how plants ought to be modified in the future, I just don't believe that I've had sufficient time nor has the agency had sufficient time to fully answer in detail how that should be accomplished. I think there is a recognition more needs to be done and it will be done.

CHAIRMAN KEMENY: Commissioner McBride and then Professor Taylor?

MR. McBRIDE: Yes. I have some information that the NRC has felt that there should be an arrangement for full time inspectors, representing the NRC at these plant sites, and that the Commission has made these proposals from time to time to the various administrations? Is that correct?

MR. STELLO: It is now more than a proposal. It is a program that's in place and resident inspectors have been dispatched to a number of facilities and there's a program that will eventually put a resident inspector at each and every facility.

MR. McBRIDE: How long has that been in effect?

MR. STELLO: I'm guessing, I think it began about two years ago.

MR. McBRIDE: Was there a full time inspector at TMI?

MR. STELLO: I do not believe there was.

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They'd hold the record open and make sure it's checked. I don't think so.

MR. McBRIDE: Has the budget for that kind of program been provided?

MR. STELLO: I'm not intimately familiar with the budget for the Office of Inspection and Enforcement. I need to get that information from them, I simply don't know.

MR. McBRIDE: You say the program is in effect and on its way. About how far along its way is it?

MR. STELLO: I cannot give you the details. I don't know how many plants have resident inspectors. It's handled by another office.

CHAIRMAN KEMENY: Mr. Taylor?

MR. TAYLOR: Mr. Stello, when you described to us what you now believe to be the present state of the fuel in the cladding associated with the core at Three Mile Island Unit Number II as of now?

MR. STELLO: We have issued a report that describes the work done in trying to put together an understanding of the damage that was done to the core and an assessment of the core as it exists today. I've forgotten the NuReg Number, if you wish to have a copy of it -- (interrupted).

MR. TAYLOR: We'd like to know, and we'd like to see the document. Do you remember, do you know roughly when that was published, when it was finished, or documented, or available?

MR. STELLO: It was published in May 1979, the day is

not on there. The assessment of the damage to the core is contained in Appendix A.

MR. TAYLOR: What's the number of the document?

MR. STELLO: And the document number is NuReg 0557. If you wish you may have this copy.

CHAIRMAN KEMENY: I believe the Commission does have copies of it.

MR. TAYLOR: Well, could you just take two minutes to describe as quantitatively as you think is appropriate, in terms of what has been estimated, calculated, predicted? How much of the cladding may have, is likely to have been oxidized and what fraction of the fuel has been affected, and how the distribution of severe damage may look geometrically in the core?

MR. STELLO: I wonder if I might ask you to allow Dr. Mattson to answer those questions since he was responsible for preparing this document and the Appendix thereto, and he might be a much better prepared to deal with those questions than I.

MR. TAYLOR: Allright, I'll do that. Now, let me ask this, however. That, given whatever that picture is, I presume that you have some picture in your mind, and I won't go into that now. But what I'd like to ask is this: how long ago did you become aware of the quantitative extent of damage to the core and the character of it and the extent to which any actual change of state, a physical state, might have occurred in the uranium oxide in the fuel? How far back would you say,

the picture that you now have in your head of what's out there, has sort of emerged?

MR. STELLO: I think the most significant thing that helped to generate an understanding of the amount of damage to the core was obtained from the results of an analysis of the primary coolant sample. And I believe we received those very late Friday night or sometime early Saturday morning. And those results indicated by looking at the isotopes that were released from the fuel and the various quantities and ratios that a significant portion of the cooler had to have its gasses released. The number was in the range, as I recall, about 30 percent of the core would have to have been heated to very high temperatures in order for the noble gas fraction that we saw released, for it to have been released. These temperatures would have had to have been in excess of three thousand or thirty-five hundred degrees of the actual UO₂ matrix in order for the amount of fission gasses that were released and measured in that sample to have been released. And the existence of the hydrogen bubble, the amount of hydrogen in the bubble, the belief that a hydrogen burn took place in the containment suggested a significant fraction of the fuel had been oxidized in the range of, again, thirty to fifty percent of the cladding so that it was clear then that the upper portions of the core from the mid plane up were very badly damaged, and the cladding had been badly oxidized to temperatures elevated high enough to have released fission products, perhaps getting some

melting of the fuel rods, excuse me, the control rods, which melted as I recall at about fifty to a hundred degrees, the silver cadmium rods. Although, as I recall, we did not see any of that material in the primary coolant, but it was clear the temperatures could have gotten high enough to cause this to melt it, and perhaps oxidizing some of the stainless steel tubes that house the control rods. And at that point I guess I had the picture of a core with most of the zirconium oxidized. Obviously, being brittle with the potential for pellets that have left the control rods. And I guess that's the point in time where the picture of the severe damage that we now understand first start to come into mind.

MR. TAYLOR: When did you first form that picture that you just described?

MR. STELLO: Probably as I was getting the information from the results of the primary coolant example.

MR. TAYLOR: Would that have been, when would that have been then, Friday or Saturday?

MR. STELLO: I think it was either very late Friday night or in the hours of Saturday morning.

MR. TAYLOR: Now, when you became aware, or when you formed a picture on the basis of data that had been coming in and so on, who was informed of the, who in NRC was informed, who had that picture described to them? In particular, were any or all of the NRC Commissioners informed of that situation that you just described?

MR. STELLO: I don't know the answer to that question. At that time I was up at Three Mile Island, and we were discussing what had been going on with our people who were back in the operations center, and they in turn were communicating with the Commissioners.

MR. TAYLOR: Who would have done the communicating to the Commissioners of what you had formed as a picture of the situation at Three Mile Island? Would that have been Harold Denton?

MR. STELLO: Harold Denton, possibly from the site. People who were at the incident center, Dr. Mattson, Mr. Eisenhower, Mr. Grimes, Mr. Case, or any of a variety of people who happened to be in the incident center and were having the briefings following the development of the information from Friday on.

MR. TAYLOR: Do you know when that information would have been communicated to headquarters or to Bethesda first, and do you know who at Bethesda, having received that information, might have communicated it to the Commissioners? To any or all of the Commissioners?

MR. STELLO: I honestly don't know who was doing the communications. It could have been any of the people I have listed. I was concentrating all of my energy to the site.

MR. TAYLOR: Would it seem, is it possible, would it seem reasonable that when this picture emerged at Three Mile Island among all of you, that Harold Denton would then call directly to Chairman Hendrie, or one of the other Commissioners?

MR. STELLO: He may have.

MR. TAYLOR: But you don't know whether he did or not?

MR. STELLO: I can't recall specifically.

MR. TAYLOR: In the, I realize that we're going to hear from the next witness in more detail what the present situation and what the results of the analysis has indicated. But I am interested in your, how you would answer the question, the following question: did a substantial, significant fraction of the core melt?

MR. STELLO: The results of the primary coolant sample that I referred to the first we had, as I recall, the measurements indicated that there were concentrations on the order of either I think, ten or twenty part per billion uranium in the sample, and the people who described what that meant indicated the conclusion they would reach is that there probably wasn't any fuel melting, or if there was, it was extremely a small quantity. That was the conclusion they reached on the basis of the amount of uranium that they measured in the water.

CHAIRMAN KEMENY: When was this, Mr. Stello?

MR. STELLO: As I indicated, I think it was Friday night late or Saturday, I'm not certain.

CHAIRMAN KEMENY: Mr. Taylor, do you think it might be more useful for some of the questions to ask the next witness, you may want to think about that.

MR. TAYLOR: Yes. I do want to ask one question because apparently you had formed a picture in your own mind Wednesday morning that the core had been uncovered, that the temperatures

had reached high values, -- (interrupted).

MR. STELLO: High values?

MR. TAYLOR: High.

MR. STELLO: I don't recall saying high. I said that I think that the core had been uncovered and that the mechanism for the failures that occurred, the fuel, were by overheating. That could, based on -- (interrupted).

MR. TAYLOR: I guess what I meant by high was high enough to cause some kind of physical damage without saying what it was.

MR. STELLO: O.k., high I think to most people means getting temperatures where you get to the very high oxidation rate.

MR. TAYLOR: Well, is it correct to assume that when you formed that picture you were very interested in what temperatures actually were reached? I'm not saying that you knew them, but were you interested in knowing what temperatures actually had reached?

MR. STELLO: Very much so.

MR. TAYLOR: Now with that interest on Wednesday, did you or someone on your staff ask Met Ed people whether they had any measurements of core temperatures that could be called fuel temperatures?

MR. STELLO: We were very much interested in trying to obtain information on what the in-core temperatures had been reading. The reason for that was that the hot lay temperatures were high enough to indicate that they were in a super heated condition and in my mind, the only way I saw of having the super heated temperatures in the hot lays were for the core to be uncovered. That directed our attention to trying to understand whether you could get corroborating information of what was going on in the core by looking at the in-core thermacouple responses. Several attempts to do that were not fruitful since the thermacouples were not set up to print out their information on the computer if the temperatures exceeded about 700 degrees, and as I recall, the computer was printing dollar signs or question marks indicating that they were not functioning that that was beyond the electronics of the computer itself the amplifiers. So we were unable to determine from those measurements which you are very interested in as to what the temperatures were in the core and we did inquire often as to what response those thermacouples had during the transit.

CHAIRMAN KEMENY: Mr. Stello, you didn't happen to know who programmed that computer, do you?

MR. STELLO: No, I think the limit is in the amplifier rather than the computer itself.

MR. TAYLOR: Well, we were given testimony to the effect that the Met Ed operator, the head operator, during I believe during the shift that was on duty at the time when the accident started asked one of his people to put a mellie bolt meter onto at least one set of terminals and report back to him the result and, apparently, the report the result was reported back as I remember about eight o'clock Wednesday morning with a voltage that meant, was translated, into a temperature of about 2400 degrees fahrenheit. Now, we were also told that although that information was made available to the control room, at least my understanding of it is that there is no evidence that that number was then made known to any other people. And what I'm trying to get at is the question whether anyone at NRC at any time on Wednesday or even Thursday or Friday asked Met Ed have you one way or another with a jury rig or whatever tried to measure directly or did you try to measure directly at the time when the fuel was hot, what the actual temperature was. Apparently, there was such a measurement and I get the impression that it was essentially ignored.

MR. STELLO: I was informed of a measurement that

was made. The number I recall was that it was a temperature measured of 2000 degrees. I have tried to discuss this with Congressman Weaver's task force to try to recall who it was that told me and when it was they told me of that particular measurement. I found subsequent to that one reference to that measurement in an interview, I believe it was with Gary Miller one of the plant people who indicated he had done this and that they had measurements, as I recall, on the thermacouples of 0, 200, and one measurement of 2400 degrees. I have been unsuccessful in being able to find out where it was I had heard this information or the exact date which I received it, but I did hear of it. I went back and tried to look at all the things that had happened the first day and was unable to find any reference to that direct measurement. We did ask if there was anyway in which they could increase the range on the thermacouples, and I believe they subsequently extended the range so that they could get readings up in the 900 degree range. I think that was Thursday. But the reference to the measurement with the amplifier, I've been unable to determine where I, my recollection is I think I heard after I got up at the site which would have been sometime Friday or after. I have been unable to substantiate, I do not know who told me.

CHAIRMAN KEMENY: I'm left hanging by that answer in the following sense, did you when you and Mr. Dentner

arrived on Friday, did you request further measurements of temperatures?

MR. STELLO: No. We already had been set up so that the recordings of the temperatures of the incore thermocouples were being provided to us. They were now on scale and were, in fact, reporting although high. They were up in the, some of them were up, as I recall, above 600 degrees. But we had that information. When we got to the site the incore thermocouple response was adequate. It did not need to be changed in terms of the capability to read the temperatures that were in existence at that time.

MR. TAYLOR: Do you recall what the highest temperature that was being read at that time, over the weekend presumably, do you recall any, you said above 600 degrees, could you say how much above 600 degrees?

MR. STELLO: I'd have to go back and try to review the highest temperatures that occurred right after the plant was recovered and the pump started late in the evening and that's when the highest temperatures were from that point on, and I cannot recall the exact number. It may have been up as high as 800 degrees but I'd need to go back and review the records.

MR. TAYLOR: Well we'd appreciate, I think, getting as detailed a picture as possible of what thermocouple readings were from the time of the start of the

accident, I realize that most of the readings are just simply indicate all scale readings but when they came back down and were centered on a scale such as you could read them I think we'd like to know what that temperature history is. Now let me ask you this, roughly how many thermocouples are in the core? I'm not sure what we're asking for.

MR. STELLO: 52 inch core thermocouples that are located about 4 to 6 inches above the fuel elements, a little cup on top of the assembly.

MR. TAYLOR: Would it be practical to present the data, that is to assemble the data on what all of those thermocouples have been reading and what their locations are?

MR. STELLO: For the 2 months?

MR. TAYLOR: Let's say through the end of the first week after the start of the accident. Would that be practical?

MR. STELLO: That information I know exists. It's up at the site. We don't have it here in Bethesda I don't believe yet. But yes it is possible and if you would wish we certainly could collect that information.

CHAIRMAN KEMENY: Then perhaps the last question, Mr. Lundin had one question and then we'll go on to the next witness.

MR. LUNDIN: Following up on some of Commissioner

McPherson's questions, when you stated that NRC routinely or regularly monitors the activity on site both through construction and during the operating live plant, could you give us just an additional word about how that monitoring is generally accomplished. For example, is reading incident reports from Bethesda or just include visits to the office at the site or visiting and staying on site over periods of several days observing operations. How's this monitoring generally accomplished?

MR. STELLO: The monitoring, of course, now varies from reactor to reactor. If there's an onsite inspector he's physically there. His normal work day on the site, his office is there and he's there all of the time and monitors the activities in that manner. In addition, to whether there is an inspector on site or not..

CHAIRMAN KEMENY: Let's suppose there isn't one since we haven't been able to discover one in this case.

MR. STELLO: There was not at 3 Mile Island. I'm indicating there are at others. The program for the inspection at the facilities is the responsibility at another office and at best I am not going to do their program justice by trying to describe it seeing it from my point of view. They have a program for inspection in a variety of areas at the facility. They have a set of modules that are to be followed for the inspection program that include

health physics, reviewing engineered safety features, various leak rate tests, various test of equipment, discussions with operators, reviewing records of the facility.

MR. McPHERSON: What group is this?

MR. STELLO: Our office of Inspection and Enforcement and again those are the correct people. I think they testified yesterday to get a real good picture of their program. They're the primary office, they're the eyes and ears of the agency. In addition to those activities the office of Nuclear Reactor Regulation, we review copies of the LER's as they come in to see if there are problems that we have to pay attention to and change their license condition, if needed.

MR. LUNDIN: What?

MR. STELLO: The LER's, Licensee Event Reports. These are the reports of violations of conditions at the facility that exceed allowable conditions by their text specs.

CHAIRMAN KEMENY: So the office you're referring to then those know this is the office that Mr. Davis is acting director of.

MR. STELLO: That's correct, sir.

CHAIRMAN KEMENY: That only puzzles me since the witnesses we heard yesterday all claim fairly little knowledge of Three Mile Island.

MR. STELLO: Well, I guess I'm viewing the question that I'm asked as how do we monitor what goes on at the facilities in a general way and I was trying to respond to that question. What went on at Three Mile Island following the accident is a very intensive program for which, from the time of the accident, I'd be happy to speak to.

MR. LUNDIN: We were referring to, say, the year prior to the accident. The monitoring of TMI, too, in the year prior to the accident, how much time of the monitors were spent physically on site, how much we spent in reviewing incident reports to give us a general feel for the depth and nature of this monitoring.

MR. STELLO: If you want a specific number of inspections that occurred at the site and the hours that were spent on inspections you'd have to ask that officer if you wish. I would be more than happy to obtain that information and submit it for the record. I simply don't have those facts available to me at the moment.

MR. LUNDIN: Thank you. Perhaps we should direct the questions to some other officials. May I have one more question, Mr. Chairman.

CHAIRMAN KEMENY: I'm sort of anxious to get on. We still have the safety group that seems to have all the answers and we have the Commissioners themselves. My inclination would be to excuse the witness unless Governor

Peterson wishes to ask a question.

GOVERNOR PETERSON: May I just ask two questions, please? Did you ever recommend to your management or to anyone else that the area be evacuated?

MR. STELLO: I don't ever recall making a specific recommendation for evacuation. I was in the room when that discussion took place.

GOVERNOR PETERSON: Did you think there should be an evacuation even though you didn't recommend it specifically?

MR. STELLO: I guess I never felt very strongly for evacuation. On Friday we knew that the core was being adequately cooled which was primary interest. We had a new piece of information for which I must say leaves me with some question as to how I should try to answer this question to represent the thought that it also created was the existing of the radioactive cloud over the facility which we had heard about first on Friday morning. It did suggest a degree of unknown at the time. We certainly didn't know exactly where the activity was coming from and it presented some unknown aspects of the problem. I don't believe that I could say that I recommended evacuation but I guess I must also suggest that I don't recall being animate in opposing it either.

GOVERNOR PETERSON: Does your division have the responsibility of advising or helping in any way with the decontamination of the unit, too?

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MR. STELLO: We will have people who will be reviewing and approving all of the activities on site for recovering the plant, decontaminating it, and removing the fuel. So in the context of all of the operations that will go on up there will require our review and approval in that sense, we are a part of it.

GOVERNOR PETERSON: You said earlier that no one at 3 Mile Island or any plant was trained to cope with the type of accident that occurred at 3 Mile Island. Is anyone trained to cope with this problem of cleaning up Unit 2?

MR. STELLO: I think that the clean-up activities of the contaminated water and the clean-up of the buildings themselves are activities that have been done in the past and they will require people with that knowledge and training in licensee has been making such people available to perform those tasks. They've had advice of people in the laboratories who have considerable experience in dealing with highly contaminated materials.

GOVERNOR PETERSON: How long does it likely to take?

MR. STELLO: I don't know. We have not yet received the program that outlines all the actions that the licensee will have to take in recovering the plant. Until those are laid out for us, I don't think we can make a guess as to how that will take.

GOVERNOR PETERSON: You said you were concerned

about the uncertainly connected with the release of the 1200 millioram cloud over the plant. And yet Mr. Floyd said that he had approval of, I think he said that, of the Nuclear Regulatory Commission to release the gases which led to that cloud.

CHAIRMAN KEMENY: I don't think he quite said that, Governor. I think he said State Civil Defense.

GOVERNOR PETERSON: Alright.

MR. STELLO: I don't ever recall being asked that question or aware of anyone who was asked.

GOVERNOR PETERSON: If State Civil Defense, then I asked the wrong person. Sorry. Thank you.

CHAIRMAN KEMENY: Thank you. The witnesses are changing.

MR. NATALIE: Dr. Mattson and Mr. Tedesco please come forward.

CHAIRMAN KEMENY: Incidentally, could we ask you to avoid that particular microphone there. It seems to be faulty.

MR. NATALIE: Raise your right hands please. Do you and each of you swear that the testimony you will give before this Commission shall be the truth, the whole truth, and nothing but the truth, so help you God?

CHAIRMAN KEMENY: Dr. Mattson, I know a number of commissioners have been anxiously awaiting this moment since

we have heard testimony under oath that you are the repository of all knowledge on all the difficult questions. Perhaps before we get into that verage, I'd just like to get the slightly more general feeling, not so much as to what your role was in this particular incident, what role does your office play in the licensing of plans?

DR. MATTSON: I am the Director of the Division of Systems Safety in the office of Nuclear Reactor Regulation and I report to Mr. Dentue in helping with material understanding. I'm roughly parallel to Mr. Stello. He is responsible for operating plans. My division is responsible for most of the technical review of construction permit and operating license applications. So I have the plans before they go in operation and Mr. Stello has them after they go into operation.

CHAIRMAN KEMENY: Yes. Professor Lewis.

PROFESSOR LEWIS: Dr. Mattson, I'd like to go back to a question that I raised yesterday or day before on the safety record of this plant before it went into operation. Richard Hatfield, Director of the NRC's Management and Program Analysis Office, says that in 1978 Unit 2 had 50% more reportable occurrences than the nationwide national average. Were you aware of that and could you really go into the safety record of this plant before it went commercial in January of 1979?

DR. MATTSON: I was not aware of that. I'm not quite sure of what you mean about the safety record before it goes into operation.

PROFESSOR LEWIS: Before it went commercial in December. It was in operation through the whole year of December 1978, but before it actually went commercial.

DR. MATTSON: So you must be referring to the start-up testing...

PROFESSOR LEWIS: Exactly, yes.

DR. MATTSON: ...and what I generally call the debugging operations before the machine was declared commercial.

PROFESSOR LEWIS: Right.

DR. MATTSON: I'd have to say basically the same thing that Mr. Stello said. That the responsibility for following the activities at the site, the construction activities and then the start-up testing, is one that falls to our office of Inspection and Enforcement. In fact, the work by my division on 3 Mile Island Unit 2 would have been completed a year or more in advance of those dates. Our work is essentially completed for an operating license when we write what we call a Safety Evaluation Report. And that's the descriptor of the staff's review, what we looked at and what we found, what we required them to change, and how the design of the facility comports with the commission's regulations. If there's no hearing, no public hearing, involved in an operating license

and for a number of them they're not, then my technical people would turn away from 3 Mile Island and turn to the next plant seeking a license.

PROFESSOR LEWIS: In other words, up to the beginning of 1978, you were involved. But after it actually went into operation, your office really isn't involved. Is that what you're saying?

DR. MATTSON: I would say more than a year before the 1978 date. My office involvement would have been considerably diminished. There are things that get referred on occasion if the Office of Inspection and Enforcement discovers a difficulty in construction or a difficulty in the start-up testing that requires a depth of technical review or technical understanding that they might not have in their staff, then they would formally refer that specific item back to the Office of Nuclear Reactor Regulation and if it's prior to operation, it would come to my division. If it's after operation, it would go to Mr. Stello's division.

PROFESSOR LEWIS: Alright. Let's go, let's, before I go onto your relationship to the grouping, I gather you're talking about it then passes to King of Prussia to the group there.

DR. MATTSON: It would pass to the Regional Office and then from the Regional Office to INE Headquarters.

PROFESSOR LEWIS: Right. Let's go to the time of

construction, can you tell us a little bit about the licensing procedure when you allowed it to go on line in the first place. What was the record of this plant in relation to other plants?

DR. MATTSON: Well, I can give you some general recollections. One thing that might help is we have underway a what we're calling a cronology of the TMI II licensing process. We're starting with the sequence of licensing steps that's reported in a safety evaluation report and trying to bring it up to date to encompass the period between the completion of the SCR and the start-up of the reactor. But generally, things I recall about TMI II had to do with the fact that the second unit was somewhat delayed from the first unit, although they came in at the CP stage essentially together, by the time they were constructed and got around to operating, there was some distance between them. What would customarily happen in my division, that would have been actually before I took command of that division, would be the majority of the review at the OL state would have been conducted on Unit 1 and there would be carry over things for Unit 2, things that were specifically needed to be looked at based on the experience of Unit 1. Now since these units had different architect engineers, I'm speculating, I haven't read the record, but I can speculate that there was a fair amount of Unit 2's specific work that was done on that plant. I had occasion yesterday, just coincidentally, to talk to the

project leader from Unit 2 and he confirmed this general recollection of mine that Unit 2 was sort of drug out over a period of several years.

PROFESSOR LEWIS: Why? Why did he say it was drug out?

DR. MATTSON: Well, because the construction was slower than Unit 1 and, evidently, the utility did not have the need for that unit in the same sense that it had for Unit 1, and they staged their construction correspondingly.

PROFESSOR LEWIS: Were there design faults that had to be corrected during that time?

DR. MATTSON: No, I wouldn't say that was the specific reason anymore than what we would find in the normal course of an OL review. One thing might be worth the recognizing in that context and that is that regulatory requirements are review requirements are not static. They change in time. And one point, one fiducial if you will that's interesting in this context is a thing we call our Standard Review Plan. This was issued in about 1975 for the first time, the fall of 1975. Standard Review Plan is a set of detailed guidance to the license reviewers, which says if you're in such and such a branch you're responsible for looking at the following scope of equipment or analysis or whatever, that you should approach that scope with certain procedures, using certain approved documents and what have you, that when you finish looking at

that equipment or that scope, there are certain acceptance criteria that you should apply. Now 3 Mile Island Unit 2 fits in in an interesting way to that Standard Review Plan. When the Standard Review Plan was issued, it was generally felt to be somewhat of an advancement of regulatory requirements. That is, there were more regulatory requirements, more sophisticated there, than had ever been issued before, and more details of how the Commission's regulations should be implemented. 3 Mile Island Unit 2, I believe would have been one of the early OL's after the issuance of the Standard Review Plan which was not required to conform to the Standard Review Plan. There were a number of plants grandfathered. Subsequent to that there were a number of plants where the license applicant was not required to justify deviations relative to the Standard Review Plan, rather the technical staff was required to search through the design and draw out the differences and then, if possible, rationalize or justify the differences or require them to be changed. We are just now, in 1979, entering an era where license applicants are required to justify the deviations themselves. This is a sort of grandfathering of plants that would receive their construction permits, that is their basic approval, prior to the Standard Review Plan, were under construction then while the Standard Review Plan was issued, and in a basic sense of equity, I guess, were excluded to some extent from fully

complying with the Standard Review Plan. Now that does not enjoy the full force of the commission's regulations, it is as I said a viable or living interpretation of the commission's regulations.

PROFESSOR LEWIS: I'm trying to grab onto all this official ease. You're saying that you have a Standard Review Plan but because it took so long to build Unit 2 you did not impose that as a requirement or you made exceptions to that requirement in the case of the building of Unit 2, am I correct?

DR. MATTSON: I would not attribute it to the so long to build reason so much as I would attribute it to its placement in the sequence of plants that have been built over the years. The Standard Review Plan was applied in full force to all new construction permits after 1975 and was applied in a gradual fashion to all operating licenses after 1975. Today, we are beginning to require for the new operating licenses full conformance with the Standard Review Plan or a sufficient justification in particular instances that it need not conform. The reason I think that's important is because you'll come to specific instances in examining the chronology of events at 3 Mile and some of the things that went wrong that you can trace to the Standard Review Plan. One good example I'll give is the containment isolation provisions. There's been a fair amount of discussion as to why was the water pumped out of the

sump early in the accident into the auxiliary building and basically the reason is that the actuation initiation for containment isolation derived from containment high pressure signal. The standard review plan says you must have diverse actuation of containment isolation and, for example, you could use initiation of the emergency core cooling system or high radiation level inside of containment. I believe if we go back and look at the scenario for 3 Mile Island, had that diversity been required, then, perhaps, the isolation of the containment would have occurred proper. There could be other instances that could define interests.

CHAIRMAN KEMENY: Dr. Mattson, could I just ask you to clarify that there were and's and or's in your statements that weren't quite clear to me. You mean that under the standard requirements now each plant must have a choice as to which of these it uses or must have isolation?

DR. MATTSON: No, under the Standard Review Plan you would be required to have 2 and they must be different and there are several kinds you can choose from. You could choose from containment high pressure, containment high radiation or emergency core cooling system actuation. Those are the three traditionally used in the Standard Review Plan and it says you must use two of those.

CHAIRMAN KEMENY: You must on at least two of those go automatically on isolation.

DR. MATTSON: Either of those two should be able to initiate containment isolation.

CHAIRMAN KEMENY: But again you said should be able to initiate. Does that mean that isolation would automatically occur?

DR. MATTSON: Yes.

PROFESSOR LEWIS: That's very interesting. So if you had imposed the Standard Review Plan on Unit 2, at least one aspect of this accident might have been prevented, is that a fair assessment of what you say? The problems in terms of isolation.

DR. MATTSON: Yes, unless the applicant, which he is allowed to do, had made a convincing case in the licensing process then he needn't have it. That probably would have been difficult because we are requiring it uniformly in all new plants.

PROFESSOR LEWIS: O.K. I'd like to then trace what the thinking what the NRC was in allowing Unit 2 to slip through this particular provision.

DR. MATTSON: Well, the decision to not, let me use some regulatory jargon. The decision to not backfit the Standard Review Plan was a conscience decision on the part of the Nuclear Regulatory Commission. That decision was made some time in 1975. That is on the basis of some policy considerations.

PROFESSOR LEWIS: Like what, economics.

DR. MATTSON: Well, economics would enter into it, yes. Practicability is probably the better word and that counter balanced with some judgment as to whether the differences between what was thought to have been Standard Review practice down through the years, the difference between that Standard Review practice and this newly articulated Standard Review Plan was significant whether there were important things in there.

CHAIRMAN KEMENY: Could I just ask one more point of clarification on that. The new plan, just speaking for myself, sounds admirable and I'm asking the question from that point of view. Are you saying that a plant that was grandfather or built before then would then be allowed to operate for 40 years, which I understand is the expected lifetime of a plant, without meeting that standard?

DR. MATTSON: I think I ought to explain that three layers of requirements that basically are applied to Nuclear Power plants. First and most formal and most important are the Commissions regulations in 10CFR. Flowing from those regulations are, what we call, Regulatory Guides: a series of more detailed technical documents which do not enjoy the same force or authority as the regulations, rather they are statements of what the staff has found as an acceptable way of meeting the Commissions Regulations in one particular narrow

area. Then, a third tier being the Standard Review Plan that I have spoken of. Now you can imagine just as they grow in detail they grow in size. The 10CFR being a relatively small and general document. Regulatory Guides being a shelf full of documents and the Standard Review Plan being a shelf full of documents.

CHAIRMAN KEMENY: Dr. Mattson now I'm having trouble with official ease. I'm asking a very simple question. Would TMI 2 have been allowed to operate out its entire lifetime without requiring ..?

DR. MATTSON: I did forget your question. Yes, but the Commission has a program called the Systematic Evaluation Program which is a program that was initiated several years ago to go back starting with the earliest licensed nuclear power plants, to break them into groups and to compare them with current standards if you will. To say for those plants that were licensed 10 or 15 years ago how do they match up with today's requirements? Now that was decided several years ago to be taken in phases. Phase 1 was the 11 oldest plants. That program is now, roughly, a year old. Those plants are being compared against current standards, the thought being that when that group of plants was finished then decisions would be made about what next group of plants to take, whether it should be all of those between the initial 11 and those that had been found fully in

conformance with the Standard Review Plan or some smaller set. So, yes, they would have been allowed to operate for 40 years with the provisos or the understanding that the SEP, Systematic Evaluation Program, would eventually have come up to that vintage of plant and either said in a judgment that they needn't be re-reviewed or, for some instances, they need to be re-reviewed.

CHAIRMAN KEMENY: I must confess I find that shocking. I mean that philosophy applies to some minor issues I find acceptable. I mean you obviously cannot review everything all the time on every plant but I would think the issue of when containment isolation occurs is probably the single largest safety issue that you have to face on any plant. It's certainly one of the crucial ones as far as protecting public health is.

DR. MATTSON: It's an important safety issue. I don't think I could call it the single most important issue.

CHAIRMAN KEMENY: O.K. Well, it is certainly one of the vital ones. Surely the fact that in 1973 you put a new system in there must have been on the basis of a conviction that this was important for safety. How would anything that important not be made applicable at least over a reasonable time table to the existing plants?

DR. MATTSON: Well, it was one of a number of safety issues treated in the review. Perhaps its significance then

was not appreciated as it is appreciated today but I think I am inclined to agree with you. I do not know how it could have been omitted.

PROFESSOR LEWIS: Dr. Mattson, may I, cause I'd like to probe that, I think it's awfully important, you've mentioned, I suggested economics and you agreed that, you called it practicability, when you are making these safety decisions are you cranking in considerations of economic viability for a nuclear power plant? Is that one of the factors when you are, are you weighing those economic factors against safety regulations?

DR. MATTSON: No, not in that broad a sense. When I say practicability I mean in a much narrower sense because the Atomic Energy Act really doesn't allow us to make it in that broad sense nor do I think we should. Rather we use the economic considerations in a much more narrow sense. We say here's a safety problem, we'd like to solve that safety problem. There are probably several ways of doing it. Talk to several groups of competent engineers and they'll come up with slightly different ways to solve the safety problem. If the problem can be solved sufficiently with one solution as opposed to another solution and the first solution was cheaper there's no reason not to take it. So that kind of cost benefit trade-off does occur but the standard should be that the solution to the problem is sufficient.

Now when a decision was made to not backfit the Standard Review Plan simultaneously a decision was made to not go through a detailed cost benefit analysis of the various elements in the Standard Review Plan. So there would have been in those days no requirement to look specifically at containment isolation, for example, and say is one source of containment isolation sufficient and two are more expensive so the one is good enough. Rather, it was a blanket type of forward fitting only of the Standard Review Plan requirements.

PROFESSOR LEWIS: Are you saying then that you didn't weigh the fact that two would cost more than one in making this determination?

DR. MATTSON: Probably not specifically to that example.

PROFESSOR LEWIS: Are there any documents that could be made available to this Commission to show what deliberations went into that decision?

DR. MATTSON: Well, this isn't the first time that this issue has come up. 3 Mile Island is not the sole Genesis of questioning in this area. I think we've tried to look back into those days and understand what was on the minds of the people who made the decision and what documents were written. We can resurrect that information. I think it's probably not hard to find but I can't promise you that it has a lot of detail and a lot of justification in it. It was more of a

judgment.

PROFESSOR LEWIS: But there would be documents or memos of something in which that determination was made?

DR. MATTSON: There certainly are documents which issue, promulgate, require, what have you, the application of the Standard Review Plan and list which plants it applies to and which it does not. Thorough going documentary evidence of the basis for that decision don't exist to my knowledge.

CHAIRMAN KEMENY: Would that be a decision at the level where the Commissioners, as a group, would have to vote on it?

DR. MATTSON: I do not know, sir.

PROFESSOR LEWIS: Thank you.

CHAIRMAN KEMENY: I believe, Professor Taylor, you'll be waiting for answers to certain questions.

PROFESSOR TAYLOR: Dr. Mattson, would you describe to us what you now believe to be the state of the fuel and the cladding in the reactor.

DR. MATTSON: Just to qualify what I'm going to say, you must understand that I'm a mechanical engineer. I manage people who are responsible for the details of these analyses. I think I'm conversant in this question. If I err it's an honest error. As I understand what the core at 3 Mile Island looks like today it is, it's basic structural configuration is still there, but in the middle and upper

regions of the core where zirconium cladding was severely oxidized and would have shattered upon quenching by cold water there is what we've grown to call a rubblized section of the core. It extends downward into the core probably something in the shape of an inverted bell, downward 4 to 6 feet, perhaps. The material that's in that inverted bell today can be thought of in thermohydraulic terms as a fluidized bed. It is particulates of uranium dioxide, zirconium oxide, probably some oxidized stainless steel fragments, if you will, of the original materials in the core. Now exactly how far down on the periphery of the core that damage, that kind of damage might extend is uncertain and I should qualify all of this by saying they're very indirect measures. You take them from hydrogen generation, from oxygen depletion measurements to tell you about how much hydrogen was generated. You take them from core-flow measurements which are a more indirect measure but confirm what I'm talking about. You take them from thermocouple indications in the region above the core and you do a lot of back calculating. My personal opinion is that the region of more destruction or heaviest destruction probably extends downward from the top of the core at the periphery some distance, may be a foot or so in that order of magnitude. I know other competent people who say it may not be on the periphery at all, that it's more localized to the center.

One of the things you'll read about in this new Regul557 that Mr. Stello referred you to are some estimates of what the core pressure drop looks radially, how it looks radially and, as I recall, the numbers, they're in the document, something on the order of 95% blockage of the normal coolant flow, that is the cross sectional area of the core with the higher blockage being in the center of the core locally 100%. I guess that's a general picture of what... well, I ought to say that in the peripheral rods and in the lower portion of the rods that are not rubblized, probably considerable oxidation, probably all fuel rods are perpherated but the strength, the structural capability to stand and be cooled is good. The flow passage is disturbed but it's there.

PROFESSOR TAYLOR: Is there any question in your mind now about whether the flow blockage is sufficient to put into any significant question the capacity to cool the core at the power level it is now?

DR. MATTSON: None whatsoever. I see no way that that geometry can change with the flow conditions that are there today.

PROFESSOR TAYLOR: How about the state of the control rods? Mr. Stello suggested that there was at least a possibility that they may have melted. Is that correct? Do you think it's a real possibility?

DR. MATTSON: Yes, I think it's a real possibility.

The primary coolant chemical analyses that have been done have not detected silver indiumcadmium in any significant amounts, it's a difficult measurement to make and not highly sensitive silver indiumcadmium is contained within stainless steel sheathing just as a thermocouple lead wires are contained within stainless steel flatting. So inferring from the survival of the thermocouples that the stainless steel probably is basically intact. One can infer that the control rods may be intact and we didn't stop there in doing safety analyses of what the core looks like and how it should be configured and controlled over the long term. We've made limiting physics calculations, assuming there were no control rods and assuming the very conservative configurations of the debris in the core and if you provide a sufficient level of sufficient concentration of boron in the primary coolant you can assure no criticality for the fuel in the TMI II vessel. Even if the fuel rods are gone.

PROFESSOR TAYLOR: Could you assure no significant chance of criticality without the boron in the coolant.

DR. MATTSON: No, then you'd have to depend upon the control rods and there's too much uncertainty about the control rods to do that.

PROFESSOR TAYLOR: Is there any possibility right now that if there were no boron in the water that the system would be critical or supercritical?

DR. MATTSON: I guess I'm going to have to defer on that question. I'm not a good enough physicist to know the answer to that. I think the answer is probably yes, there is a possibility of that.

PROFESSOR TAYLOR: Who would be looking at this question now that so that if the answer were yes or no...

DR. MATTSON: I could certainly give you the answer to that.

PROFESSOR TAYLOR: Where would you expect it to come from?

DR. MATTSON: It would come from me.

PROFESSOR TAYLOR: It would come from you. I guess what I'm asking is where within NRC or among a possible contractor's or national laboratories or whatever they're responsive to you when you make requests. Where would that be likely to be going on?

DR. MATTSON: That expertise is sufficient within the staff itself. It would come from micro performance branch and I could have an answer to that question to you rather quickly today if you need it. More to the point I think is the boron's there. It's not difficult to keep boron there and not difficult to measure the boron that's there.

PROFESSOR TAYLOR: Is the boron concentration being carefully monitored now?

DR. MATTSON: Yes, it's being periodically monitored.

PROFESSOR TAYLOR: And do you know off hand what the concentration is?

DR. MATTSON: I don't know what it is today. It's been generally over 3,000 parts per million since within the first couple weeks of the accident.

PROFESSOR TAYLOR: Is there a target concentration below which, is there a concentration that has been made clear, would be dangerous to get below or something you would not want to get below?

DR. MATTSON: I believe the, yes, I believe that exact number's in this document. I'll state it from memory and subject to confirmation of the document - 3,000 parts per million is sufficient to take the core in any theoretical packing density in the bottom of the vessel with no control rods and assure that it's subcritical. If the core isn't in the bottom of the vessel, it's basically where it started. It's been rubblized a little in the center and at the top, a little, a lot. And control materials are probably still present through most of the not so badly damaged portions of the core. So there's considerable margin in that 3,000 parts per million. The exact numbers we could get for you if you need them.

PROFESSOR TAYLOR: Do you believe that there's any significant amount of the utectic of uranium oxide and it's not clear to me whether what's been talked about is zirconium

oxide or zirconium. Could you tell us what your picture of that possibility is?

DR. MATTSON: The analysis in Appendix A of this document does not treat the formation of uranium zirconium utectic. That is a subject of interest that has arisen in the last six weeks as to the possibility for the formation of a utectic.

PROFESSOR TAYLOR: Where did that first arise as a subject of interest? Do you know?

DR. MATTSON: Well, I know where I first became aware of it was when I was making a presentation to our advisory committee on reactor safeguards on what we thought the maximum temperature might have been in the course of the accident. Mr. Lavine of the Director's Office of Research presented some summary information on the utectic question. So I believe that the thinking about the utectic is going on in the branch in the Office of Research, headed by Bill Johnston who is working with industry and national laboratory experts doing further analysis and developing a better understanding of the core than is represented in this Regul 537. Recall those analyses were done in the first couple weeks of April and there's been time to think and calculate and do things to much more detail than they were than there was then.

PROFESSOR TAYLOR: Is someone, you or someone in your office in fairly direct touch with the people in the

Reactor Safety Research Division, keeping sort of on line with that they're doing?

DR. MATTSON: Yes, Mr. Ralph Myer, my section chief for fuels, is a part of that ongoing effort.

PROFESSOR TAYLOR: Well, I've seen, I have several memoranda that were put together by that group concerning this possibility and would those automatically be sent to your office, more or less directly? I can't tell from the distribution. I just don't know whether you got them or not.

DR. MATTSON: I know the work is going on. I encourage that work to go on. My attention in the last few weeks has been more directed to this lessons learned activity that you may have heard about and less to the detailed engineering evaluation of 3 Mile Island. I could certainly supply people or reaction to those documents. I haven't seen them.

PROFESSOR TAYLOR: I'm going to ask you now question that would have to do with some extent with semantics because it's on many people's minds and that is - keeping in mind the possibility or perhaps the likelihood that this utectic formed, how would answer the question, did a significant part of the fuel melt? I realize there's a semantic question, it's important in that.

DR. MATTSON: Yes, and it is an important question. I guess I hadn't appreciated that semantics question until some-

one told me yesterday you'd been interested in it and I haven't had time to think about it very much. I understood the utectic question to be more one of trying to explain the kinetics of fission product transport out of the fuel matrix. That is, if there had been a utectic formation, fission product migration is enhanced by the formation of that utectic. And I, frankly, dismissed that maybe too lightly when I first heard it because I said the utectic formation between zirconium and uranium must have been a surficial phenomena, not a volumetric phenomenon, and the fission gases that were released or fission products that were released must have come from a more significant volume of the core than the surficial utectic formation would have explained. I hadn't appreciated it in the same light that you seem to be.

PROFESSOR TAYLOR: Well, let me say that I don't, I'm certainly not a physical chemist and I don't understand this in any detail. The first that I heard of the possible existence of this utectic was the week of March 17th, on Monday, when I spoke informally with some of the people at Silver Spring. Pardon me.

DR. MATTSON: March 17th?

PROFESSOR TAYLOR: No, I'm sorry. May 17th. But as I understand it the melting point, at least at some ratios of zirconium and uranium oxides, is substantially lower than the melting point of uranium oxide itself. Possibly as much

as 1,000 or maybe even somewhat more than 1,000 degrees lower and I also understand from that conversation that there had been some experiments in West Germany that it carried uranium oxide zirconium clad fuel up to temperatures where this eutectic starts to form and that it did form in the experiments and that what one winds up with is not, evidently not, drops of melted eutectic which then plop downward or flow easily, but what's been described as sort of sticky chunks that are...it's be hard to say whether they really are large melted chunks or what they are. But I do understand that there has been experimental work done in West Germany right on this question and that this is getting a fair bit of attention. Could you comment on that?

DR. MATTSON: Well, I think that's interesting information and I'm sure that the people are looking at it. We've been considering the safety of the natural circulation cooling mode for 3 Mile Island. We're concerned that there may have been local melting of the fuel. As I said, all of these indications of fuel damage are indirect and regulators are supposed to be skeptical and doubting Thomases and we tried to be. So we said, "at if they're all wet? What if there was local fuel melting?" There were some indications which would corroborate with such a hypothesis.

PROFESSOR TAYLOR: By melting you mean direct melting of the uranium oxide?

DR. MATTSON: Yes. Whether by eutectic formation or maybe we're 2,000 degrees off in that estimation of the maximum damage, but we didn't see how we could be but maybe we were. Could there have been, and we asked ourselves, globs as you've described them, locally in the core which would severely inhibit local cooling when we went from the four circulation mode to the natural circulation mode, because in making that transition, we dropped about a factor of 20 in local flow rate in the core. And although the core was being cooled nicely at the higher flow rate, the question was what would the local temperature be at the lower flow rate. Some limiting analyses were done, in fact, I reported again in Regul 357, which looked at isolated hot channel heat transfer to account for blockage of that sort. We estimated that the core could be cooled by natural circulation even if that were the case and therefore thought that it was safe to go to natural circulation. Now what happened when we went to natural circulation, of course, is that the temperature rise

DR. MATTSON: ...of course, is that the temperature rise was much, much lower than these localized hot channel calculations would have indicated, which, again, is another indirect confirmation that it's more in the nature of oxidized material, small-sized, like a fluidized bed, that is capable of redistributing itself when the flow configuration changes. Again, those are indirect measures.

MR. TAYLOR: I understand. I have a lot of interest in this particular subject and I think we could go along for a long time. We don't want to take up time now, but we certainly want to get together later. There are a couple of other questions I'd like to ask . I'd like to clear up what I think is a misconception, and, if so, then this can be done very quickly. It has been claimed by several people, among them, John Goffman, Dr. John Goffman, that if TMI had been operating more or less at full power with a high capacity factor for a much longer time than three months that, then in fact, given the circumstances of the accident, there would have been a major core melt. What's your response to that claim?

DR. MATTSON: Well the fission product inventory would have continued to increase beyond three months. The fission product inventory does go up fairly rapidly, I'm afraid I don't know - I can't draw you the curve today to say where the value is. But, if it had been older than three months, the decay heat level would have been higher,

the fission product release would have been higher. I think it's very speculant to say it would have melted the core, given all of the things were constant, that that would have led to a core melt. I think that's probably amenable to calculation. People are doing engineering calculations today where they take the sophisticated codes, input the conditions measured in the Three Mile Island event, and calculate other parameters which can be compared then with other measurements and there is today in several places in the country, a fairly good capability to reproduce the thermal hydraulics of the accident. B&W has done that to benchmark their computer codes, which were used for subsequent analysis and to justify the re-start of the B&W reactors. I think you would be able to take those codes and do a detailed thermal analysis of the core and factor in things like your concerns with and what have you, and much advance the state of understanding reflected in new rego 557. you could do sensitivity studies on top of that - that would be aimed at giving a better picture of local damage in the cores that exist today. Certainly, there are tools in science to support that. Then you could add in to that different initial conditions - you could say, put it at one hundred percent power at an equilibrium core and see what the difference would be.

MR. TAYLOR: Well, what you - your response has been that this is calculable and it sounds somewhat complicated to do. Let me give you my response and get your reaction to it. And, that is, the time during which the temperatures were quite high in the core appears to have been certainly within a few hours of the trip, perhaps most of that within hour number two and hour number three. The decay heat at that time is coming from short-lived fission products, primarily. Therefore, my reaction is that it would have made no difference to the prospects of a core melt if that is a mechanism that was beginning to be approached within just a couple of hours of the scram, but, in fact, there is no possibility that I can see that the conditions so far as the heat rate in the reactor are concerned within two or three hours after scram were affected significantly by how long the reactor had been running. Does that make sense to you or not?

DR. MATTSON: Yes, there's sense in that argument, but (interrupted).

MR. TAYLOR: Do you have qualifications to it, because I really want to know (interrupted).

DR. MATTSON: Yes, there's a difficulty to the argument, it makes sense in that first two or three hours. As time goes on, it makes less sense.

MR. TAYLOR: Yes, I understand that.

DR. MATTSON: And the period from eight to fifteen hours, there was a prolonged period of core uncover, would become a more interesting period to understand that hypothesis that you make. I suspect, though, that the short-lived radio isotopes don't care much whether it's two or three hours or eight or fifteen hours, you're talking about the things that are within the first day, two days, eight day half life. And so the hypothesis still may be valid out in time, certainly you could make the calculation and confirm it. I guess I'd rather not speculate.

MR. TAYLOR: Well, I would hope that that would be cleared up very quickly, whatever the answer turns out to be, and then made public, because I've heard this statement made a number of times, that we were all just damn lucky that TMI II hadn't been running for more than a couple of months, and my sense says that's not correct.

DR. MATTSON: Yes, my sense says that that's an overstatement, that a lot of the fission products that are going to get there are there in three months. And the additional difference accounting for the short-lived materials makes them even closer.

MR. TAYLOR: Going back to the present situation out there at TMI, I'd like to ask just a couple of questions. First of all, what do you think are the total penetrating gamma ray, basically, radiation dose level rates, dose rates, in containment, let's say, near the top of the dome or

somewhere that's kind of seeing the whole area. What do you guess that they are now?

DR. MATTSON: Well, I'd rather not guess. People have made measurements of those dose rates, using measurements outside of containment and backing those measurements through the shielding effect of the containment structure.

MR. TAYLOR: Isn't that rather difficult to do, because of the very large shielding attenuation factor, so that introduces a big uncertainty (interrupted).

DR. MATTSON: It does introduce a lot of uncertainty, that's true.

MR. TAYLOR: Do you have a feeling for how big an uncertainty - are we talking about a factor of two or a factor of ten or twenty?

DR. MATTSON: I think you're more talking about not orders of magnitude, less than orders of magnitude.

MR. TAYLOR: OK. So, with that, what would you say these measurements now correspond to.

DR. MATTSON: Well, I've heard them, not heard them within the last two weeks. I recall, several weeks ago when we were reporting on these things to the ACRS and to the commission that the measurements early in May were on the order of hundreds of R, coming from materials deposited on the inside surface of containment, and coming from sort of free field activity in the air or in the watering containment. That contrasts to best estimates to what the

radiation field was early in April of several thousand R per hour.

MR. TAYLOR: Several thousand and not several tens of thousand.

DR. MATTSON: Well, there's been some debate over that, in fact, I guess if you put Mr. Stello and I up here side by side, we still have a little debate over that. Let me try to characterize it.

Early in the accident, there were indications from the dome monitor that were on the order of tens of thousands of R. There were other indications, instruments lower down in containment on the refueling deck, as I recall, in the order of tens of R. And then there were measurements from outside of containment after several days which people tried to use to corroborate, one or the other of the measurements inside. I should add some qualification to the dome monitor. It is a meter that measures in the hundreds of R range, and then has local shielding, to protect the meter, I guess, and (interrupted).

MR. TAYLOR: Is that the one with about four inches of lead?

DR. MATTSON: I don't recall that number - I've heard it, but I don't recall it. But, you must extrapolate through several orders of magnitude, as I recall, so it was when you said you got a measurement of tens of thousand of R, you were actually getting hundreds of R on the meter. Now, an

extrapolation of that sort, as I just described, one for the containment, shouldn't be subject to an order of magnitude difference, so that instrument plus corroborating measurements from outside containment led us within the first three or four days of the accident to conclude that there was on the order of one to three thousand R per hour pretty much uniformly throughout containment. There's been some debate as to whether we should have believed the radiation monitor high in the dome. I think that the studies that have gone on since that time tend to support the judgment of one to three thousand R, probably three thousand maximum. And, if you take those kinds of numbers and decay them, from radioactive decay, down to what is being measured today, there is fairly good agreement. So, I think a thousand or so R, early in the accident, a hundred or so R, early in May, and it's still increasing today, of course.

MR. TAYLOR: Do you have an estimate of the fraction of the core's inventory of _____ that is now in containment, roughly?

DR. MATTSON: We have an estimate of the fraction of the core inventory of the various radio nuclides that would be in the primary coolant and in the water on the floor of the containment, that is, the fraction release, I do not have (interrupted).

MR. TAYLOR: That is in the report?

DR. MATTSON: No, it's not. Those numbers have been generated from primary coolant sample measurements in the past several months - they're clearly easy to obtain.

MR. TAYLOR: I've heard numbers in the range of the order of ten percent, not one percent and not fifty percent, but in the range of ten percent. Does that sound reasonable from what you know?

DR. MATTSON: I recall orders of magnitude for the iodine and some other things that I was perhaps more interested in on the order of ten percent, I do not recall for cesium.

MR. TAYLOR: Well, the reason I asked that is that one can, if one knows roughly how much cesium is there, one can then make some guess or estimates of what the radiation levels might be due to the cesium. And that would be helpful.

DR. MATTSON: Yes. Well, I believe that's what's been done - that kind of analysis has been done to calculate what the plate out is of radioactive materials on the inside of containment, and then to take measurements from outside of containment of the radiation being emitted by that plated-out material and I'm quite sure that kind of analysis has been done. It would not be done in my division - you're a little bit out of my range of expertise.

MR. TAYLOR: This brings up the last of two questions. The first one is, is that cesium likely to be spread over

the stainless steel - the steel on the inside of the containment vessel - and to have migrated into that steel sufficiently so that it can't be washed off or scraped off and is going to have to be dealt with as some kind of significant benefit large area of material.

DR. MATTSON: You're out of my area of expertise, but you're asking a question I've been asked before and did make some effort to understand, and I suspect, although I can't confirm it of my own knowledge - this is something that needs to be settled once and for all because I think that that is wrong, from what I've been told.

MR. TAYLOR: I see.

DR. MATTSON: As I understand it, cesium migrates in stainless steel at high temperatures - it's a kind of thing, for example, that people worry about in LMFBR fuel design - the migration of cesium into the stainless steel cladding of the fuel. But, that's a very high temperature phenomena. Cesium also has unique plate-out characteristics, released as a gas and then allowed to settle out at cooler temperatures, like it would inside the containment vessel at Three Mile Island. But I'm told that those peculiar plate-out characteristics are something that people deal with routinely in spent fuel storage pools, for example, and, that although it's a unique cleaning operation, it's one that people have in hand and understand from some years of practice, and it doesn't involve migration into the stainless steel. I dug

that answer out by talking to two or three experts in NRC one morning very early. I haven't gone back to do a more searching examination. I know it's important to the people who are concerned with the long-term clean-up and, perhaps by approaching those people, you could get a more informed answer than I've given you.

CHAIRMAN KEMENY: Professor Taylor, could I make a suggestion here just to expedite matters? There clearly are a number of highly technical questions here that it is important for us to get out. Wouldn't it be more efficient if you prepared a list of those questions for staff and make sure that staff obtained the answers from the appropriate people within NRC?

MR. TAYLOR: Yes, that's my last question, was anyway. I completely agree that we should do.

CHAIRMAN KEMENY: Professor Pigford.

MR. PIGFORD: I'd like to follow up briefly on one of Professor Taylor's questions. He asked you about your own prior knowledge of the UO₂ zirconium oxide eutectic, and you answered that. In preparing the ounces, would you also prepare information on the prior knowledge of you staff, and the NRC staff, and the ACRS, and also when that issue may have appeared in previous licensing actions on the existence and the effect of the UO₂, ZROU₂ eutectic. Would that be possible?

DR. MASTSON: That's certainly possible. Just so

there's been no misunderstanding, I was speaking of my knowledge of utectics between zirconium and uranium in the context of Three Mile Island, and the estimation of whether there had been core melt or whether there had been a further explanation for the fission product transport. I think that knowledge of utectic formations with uranium have been around for some time - they predate Three Mile Island, certainly.

MR. PIGFORD: Thank you. Dr. Mattson, according to the recorded transcript of your telephone conversation with the commissioners on March 30, it appears that you have recommended to the commissioners that their, that evacuation be implemented on that date. Is that correct?

DR. MATTSON: That's true.

MR. PIGFORD: Was that recommendation based primarily on the concern about the possible explosion of the hydrogen bubble with oxygen in it, inside of the primary luke?

DR. MATTSON: No, sir.

MR. PIGFORD: What was the primary basis for that recommendation?

DR. MATTSON: I'd like to state the primary basis, because I think it's something that deserves further understanding. And, then I would also like to relate that in time to the concern over the possible explosion of the hydrogen bubble inside of the reactor vessel.

Maybe I should back up a little bit further than that to give you some context of - just momentarily.

I was not involved in the Three Mile Island accident until Thursday afternoon, the 29th of March, approximately 2:00 p.m. I am not on the emergency teams that you've heard described to you earlier. I was not called to the response center. I had another reason for being in that response center at 2:00 Thursday, and was drawn in to the activities surrounding Three Mile Island. I was primarily concerned that Thursday afternoon, Thursday night, Friday morning, with implementing directions from Mr. Stello, actually, who said he was convinced there had been significant damage to the core - I think you'll find those words in this transcript to which it is referred - that the temperature indications that we had from the core exit thermal couples were the best information we had and we needed to understand them more. I went off in a separate room with a team of people and worked very hard to understand those temperature measurements. In the course of understanding the temperature measurements, other engineering information concerning the status of the plant became available to me, most particularly the existence of a non-condensable volume of gas in the primary coolant system. The projection was that that was predominantly hydrogen, mostly derived from the fact that we couldn't make it - or the operators could not make it condense. It may very well be today with other corroborating information, that not all of that volume was hydrogen, that there may, in fact, have been a significant,

although I wouldn't say majority, fraction of that volume that one could attribute to a steam void that still existed in the core. I recall the temperatures locally in the core were still above the boiling point on some of the thermal couples, and did not, in fact, go below the boiling point until almost coincident with the rapid disappearance of the bubble, if you will, that occurred Sunday and Monday of the following week. Probably, that disappearance was associated with some of the hydrogen breaking up into smaller volumes, being swept along with the coolant flow, rather than being localized in the upper head of the vessel or the candy canes of the steam generators.

OK. So, Friday morning, March 30, we had knowledge that there were thermal couples still indicating the high temperatures locally in the core. There had been a tendency to not believe the thermal couples, because there was knowledge that they had been at high temperatures, but we ascertained very early Thursday in my involvement that those thermal couple materials were capable of withstanding temperatures in the twenty-three to twenty-five hundred degree range, the thermal couples. So, it's sort of a preconceived notion I decided to believe them. And what they told me was that there were still areas of core that were not being cooled as well as other areas of the core, and that the behavior was pretty much as one would expect, that is, the thermal couples will still coming back

on scale. There was one thermal couple still increasing slightly, which said that the stability of the core wasn't there yet - there were still things moving, going on within that core - moving in a heat transfer sense, not in a physical motion sense.

That information, combined with the information that was a bubble on the order of a thousand cubic feet at a thousand PSI, convinced the experts that I was leading, and me, that it was not advisable to decrease the pressure of the primary coolant system and to try to cool the reactor by the normal decay heat removal system, that, in depressurizing the reactor, the volume of the bubble would grow, the simple pressure-volume relationship, and that it would grow to a sufficient volume by the time you reached the cut-in point of the decay heat removal system, that the entire core would be voided, it would be the water in the core. And that the time available to remove the hydrogen, if it were conservatively assumed to be all hydrogen, out of the power operated relief valve, was too long. You would be in a horse race, as I described it in the transcript, a horse race between the water trying to penetrate into the core and the hydrogen trying to leave the core and go up through the pressurizer and out into containment. So, we were dead set against de-pressurizing the primary coolant system.

Sometime Friday morning, early, I became aware of the off-site releases that you've heard Mr. Denton, Mr. Stello and the people from INE describe, and others - I have some knowledge in that area, although it's not my expertise, and I have some knowledge of emergency preparedness. I knew that one point two R in a plume, that was a meandering and not widely dispersed plume because of the meteorological conditions that day, was a significant radiation plume. I think Mr. Denton explained how he related that plume to the EPA protective action guidance. Clearly, it's below the EPA protective action guidance. But, based on the information I was obtaining and, as I recall, it was directly from the INE man who was on the telephone that you've heard described to the Unit Two control room and the Region One Headquarters, the source of the release was periodic venting from the vent header. I understand there's some confusion, I heard a little of it yesterday when I was here, and I read about in the newspaper this morning.

MR. PIGFORD: Mr. Mattson, excuse me, I don't want to get you - interrupt your train of thought. I know it's very important for you to describe all of these things. We need to get - I'm getting towards a different issue, perhaps, than what you're getting on. Could you kind of summarize the bottom line of what you're saying, and then maybe you could amplify it in additional written testimony? Could you get to that point for us quickly?

DR. MATTSON: Well, the point was that the waste gas decay tank capacity was diminishing, and there was an indication from our communication channel that the plant thought they were going to have to leave the cooling mode that they were in at the moment, and go to the decay heat removal system, because the intermittent venting from the vent header was going to turn to a continuous release from the vent header. It turned out not to be the case - another method was found to cope with the intermittent releases - they were stopped. But, based on that information, that is, the likelihood that they would have to go to the decay heat removal system - and my professional judgment that the decay heat removal system would probably not work - I recommended evacuation. I did so in a precautionary vein on the basis of projected releases.

MR. PIGFORD: Thank you, Dr. Mattson. Now, we find though the transcript of the commission deliberations on that day and on the following days abundant indication that what the commissioners' perception was that there was a problem of hydrogen-oxygen explosion, and it appears from that perception that - and I mean a hydrogen-oxygen explosion in the primary system in the reactor vessel - was the information that they were using on that provided to them by you?

DR. MATTSON: Yes and no. I'd like to explain.

MR. PIGFORD: If you can do it very briefly, please.

DR. MATTSON: The question of the combustibility of the hydrogen in the primary coolant system did not arise to my knowledge at all on Thursday or Friday. The first indication I had of concern with the explosion potential, or the burning potential, of the hydrogen inside the primary coolant system - I'm being specific, now, not the hydrogen inside the containment vessel, because we had dealt with that on Friday. First concern over the explosion of the hydrogen inside the vessel that I recall, and it is on the transcripts that have been described to you that are not transcribed yet, was 2:00 a.m. Saturday morning, in a call I received from Chairman Hendry, where he asked if we had looked at the explosion potential, that he had done some calculations himself, I believe he said, on radiolysis. I replied to the effect that, no, that question had not been raised by the people that I was working with, that they were, most of them, home in bed, having only been there a short period of time, I suggested that we wait until Saturday morning to take it up. We did that. In the course of the day Saturday, having no personal knowledge of sufficient detail to calculate radiolysis or to speak to the flammability or detonation limits for this particular case, that is, when will hydrogen burn as oxygen grows in it. I know something about when will an air mixture burn as hydrogen grows in it... (interrupted).

MR. PIGFORD: Excuse me, to be sure that we converge on our answers, let's stick to Saturday, then, and the question is, was that information supplied by you?

DR. MATTSON: The analyses that I relied upon, yes, it was supplied by me... (interrupted).

MR. PIGFORD: Thank you.

DR. MATTSON: Came from a variety of sources, however. I'd turned to our office of research.

MR. PIGFORD: Excuse me. You are certainly getting into the answer to the next question I was going to ask, but let me ask it first.

DR. MATTSON: OK.

MR. PIGFORD: What was the source of data that you supplied for the amount of hydrogen that was there in the primary loop?

DR. MATTSON: Metropolitan Edison.

MR. PIGFORD: By that, do you also include this industry task force team that we have heard about?

DR. MATTSON: No, they had not been informed by Saturday. This was information from two measurements that had been taken by the operating crew, change in pressure, change in volume type measurements, one indicating a thousand cubic feet, another indicating fifteen hundred cubic feet.

MR. PIGFORD: Thank you. What person or persons supplied the data?

DR. MATTSON: The INE telephone communication link with the control room.

MR. PIGFORD: Do those people have names that you remember?

DR. MATTSON: I do not remember the names. It would have been several people over a course of some hours... (interrupted).

MR. PIGFORD: Would your records show the names of the people?

DR. MATTSON: I think they would - they would be on the tape recordings that were made.

MR. PIGFORD: And that's something that you could retrieve?

DR. MATTSON: Yes, that's something that could be retrieved.

MR. PIGFORD: Now, the source of the oxygen in that primary loop - what was that? I'm sorry, the source of information - who provided that information to you? I'm looking for names of people.

DR. MATTSON: Yes, I can give you those. No one said to me, there's oxygen in the primary coolant system, rather, people raised the question, could oxygen be generated by radiolysis to form free oxygen and go into the hydrogen bubble and lead to a potential for combustion? Those questions I asked of the following people: Mr. Levine and Mr. Budnitz of the Office of Research. They, in turn,

turned to a Mr. Bob Ritzman of Science Applications, Incorporated, I believe, formerly of Battell-Columbus Laboratories, who was the hydrogen expert on WASH 1400, the reactor safety study. They turned to the Idaho National Engineering Laboratory, and I've learned since, but I did not know at that time, the Brookhaven National Laboratory. I also turned internally to the NRC staff, Mr. Tedesco, who is with me here today, who is my Assistant Director for Reactor Safety, and he has responsibility for reactor systems and containment systems. He, in turn, used the staff expertise, within the staff. He went to the Nolls Atomic Power Laboratory. We were given a name by Westinghouse management and we were in contact with Westinghouse experts. I do not recall specifically in those early days, we turned to two other sources of information, but we did later - the National Aeronautics and Space Administration... (interrupted).

MR. PIGFORD: After Saturday?

DR. MATTSON: I believe it was after Saturday.

MR. PIGFORD: Let's stick to Saturday.

DR. MATTSON: OK. A source I did not turn to, but I understand today was also involved in the analysis of the bubble was Mr. Stello. He and I corroborated on Sunday on this and there were other people involved, but I'll stick to Saturday - that's the list.

MR. PIGFORD: All right, which of these sources provided the data that you finally used?

DR. MATTSON: Well, on Saturday, they all agreed with one another. And they agreed on roughly the order of magnitude of oxygen that could be generated by radiolysis, and they agreed with the others and they were commenting on two separate points: (a) could oxygen be generated, or at what rate would oxygen be generated by radiolysis and (b) what concentration of oxygen in a hydrogen environment would be required for first, flammability and second, detonation.

MR. PIGFORD: Fine. That's the question I was going to ask next. Let's stick to the amount of oxygen generated. Which sources did you rely upon?

DR. MATTSON: As I recall, Mr. Levine and Budnitz came with information of that sort from both INEL and from Mr. Ritzman and, as I recall, Mr. Tedesco came with information of that sort from the NRC staff and it's unclear to me whether that sort of information was asked of Kappel.

MR. PIGFORD: Would you have records that would show this?

DR. MATTSON: I believe Mr. Tedesco may know.

MR. PIGFORD: I'm just asking if they exist, that's all.

CHAIRMAN KEMENY: Mr. Tedesco.

MR. PIGFORD: I'm not asking who they are, I'm only asking do the records exist - that's all.

MR. TEDESCO: But Dr. Pigford I have a set of notes that I was keeping during this period and, among the notes

are some names that I'm obtaining from the people at (inaudible) Atomic Power Lab. And they were sending us information based on some experiments that they had run where established... (interrupted)

MR. PIGFORD: Yes, excuse me. Fine, I'll want to find out in detail about them - they do exist, apparently, is that correct?

MR. TEDESCO: There in my notes - they're handwritten notes.

MR. PIGFORD: Fine, thank you.

DR. MATTSON: There are some others. I kept handwritten notes, also. Some of them entered Mr. Tedesco's list, others of them are at the site the last time I saw them.

MR. PIGFORD: Thank you. Now, you also requested estimates of the explosion and detonation limits. Is that correct?

DR. MATTSON: Yes, sir.

MR. PIGFORD: From what source did you request them?

DR. MATTSON: Same sources. That is, my primary contacts were Mr. Levine, Mr. Budnitz, Mr. Tedesco. I did not speak to any of the other people that I've listed, that they in turn contacted.

MR. PIGFORD: And they contacted the same people you've listed?

DR. MATTSON: I believe that, to some varying degrees, these other people responded to that question also. As I

recall, INEL was focused more on the question of how could oxygen - or what would the rate of generation of oxygen be, whereas Ritzman, the staff and Kappel worked both questions.

MR. PIGFORD: Thank you. Now, what was the conclusion, and let's try to make it brief. At what time was it predicted - at what future time did you estimate that the oxygen would grow to sufficient concentration to cause an explosion, if ignition were to occur?

(Pause)

MR. PIGFORD: Do you understand my question?

DR. MATTSON: Yes, I understand your question, I have to go through a couple of numbers in my head to remember the days, because we were working with a different set of numbers. We were working with five percent and, as I recall, eleven percent... (interrupted).

MR. PIGFORD: I'm asking on Saturday.

DR. MATTSON: Yes. On Saturday, we were saying five percent for a flammability limit and eleven percent for a detonation limit, and that would have transposed into something on the order... (interrupted).

MR. PIGFORD: Excuse me, limit meaning minimum?

DR. MATTSON: Yes, we were working with very conservative numbers, it turns out. That would have meant a minimum of reaching the flammability limit, at which there had never been observed a spontaneous flammability under these conditions, by the way, on about Sunday, March, or April

the first I believe was Sunday, and the detonation limit some days down the road sticks in my mind we were estimating five days minimum.

MR. PIGFORD: Thank you. Now, then, did you have some, one estimate the pressure that would be generated if you got into this, what you call, flammability limit, and had an explosion?

DR. MATTSON: Yes, sir.

MR. PIGFORD: And what was the pressure that was estimated.

DR. MATTSON: Well, it varied depending upon who you talked to... (interrupted).

MR. PIGFORD: What is the one that you provided to the commissioners?

DR. MATTSON: I believe we spoke to the commissioners on Saturday afternoon in terms of thousands of PSI in the reactor pressure vessel from flammability, and tens of thousands for detonation.

MR. PIGFORD: Thank you. Did you then compare that estimated pressure with some material strength limit of the pressure vessel?

DR. MATTSON: Yes, but that wasn't what our real concern was with the flammability... (interrupted).

MR. PIGFORD: Yes, I will want to learn about your concern, but I just want to know what is the comparison of that pressure with the strength limit of the pressure vessel?

Did you have a comparison?

DR. MATTSON: Yes, I recall we did. I do not remember.

MR. PIGFORD: Well, was it greater or less?

DR. MATTSON: Oh, it was less at the flammability limit and the strength limit for the reactor pressure vessel, in my recollection. However, it was sufficiently damaging that it was a very difficult pressure to contend with.

MR. PIGFORD: All right. Now, you wanted to state your concern, please go ahead.

DR. MATTSON: Well, the concern was that, while you can probably sustain pressures in the five to six thousand PSI range in a primary coolant system, if you make your best estimate of what the strength really is, there are components of the primary coolant pressure boundary that would not remain functional at those pressures and, primarily I would be interested in the operability or functionability of isolation valves and reactor coolant pumps, and things like that.

MR. PIGFORD: Now, Dr. Mattson, to refresh my memory, your estimates as of that time on Saturday were that you had reached the flammability limit on Sunday and detonability, the detonation limit on what day?

DR. MATTSON: Approximately five days in the future.

MR. PIGFORD: Now, did you hear Mr. Denton's testimony last evening?

DR. MATTSON: I heard the first portion, but I did not hear the rest of it.

MR. FIGFORD: I'm sorry, it was the wind up portion and, my recollection is, that he said the estimate was that you would not reach an explosion limit for ten days. Is there some inconsistency there?

DR. MATTSON: Yes. I've heard that number elsewhere. My recollection may not serve me. There was some uncertainty in the hydrogen generation rate, but, when I said people agreed, they agreed within a reasonable range of uncertainty.

MR. FIGFORD: You mean oxygen generation rate?

DR. MATTSON: I'm sorry, oxygen generation rate. And it may be that we were speaking of a range of days, and because it's two and a half months since, we remember them somewhat differently. I've said a few minutes ago that I think I'm stating the conservative end of the range. We were also trying to state realistic numbers. People asked us for both kinds. It turns out our realistic number was highly conservative and our conservative number was even more conservative.

MR. FIGFORD: On the conservative end, there appears to be one commissioner who, evidently, had the idea that five hours was how long you had before it reached the explosion limit. Do you recall that?

DR. MATTSON: There were discussions on Saturday of the sort of estimating the uncertainty of what we were

dealing with where people said, you mean we could have reached it already, and answers to that were yes. I would - I remember most clearly being of the conclusion Sunday that, if our numbers were right for the oxygen generation rate, and if our numbers were right for the flammability limit, we had reached it by Sunday. I may have been of the opinion Saturday, earlier, that we had reached it - my recollection doesn't serve me as well there.

MR. PIGFORD: Did you check your estimates with those that were made by the Metropolitan Edison people?

DR. MATTSON: I did not.

MR. PIGFORD: Did anyone on your staff do that?

DR. MATTSON: Not that I'm aware of.

MR. PIGFORD: Then was it on Sunday that you reevaluated the extent of oxygen production?

DR. MATTSON: I arrived at the site on Sunday. Mr. Stello and I talked immediately upon my arrival. He was firmly convinced we had aired on the side of over-conservatism. I do not know whether he was basing that judgment in part upon things he learned from Metropolitan Edison.

MR. PIGFORD: Was that the day you re-evaluated it?

DR. MATTSON: In the course of the day Sunday, there was an intense re-evaluation of the hydrogen bubble throughout the nation.

MR. PIGFORD: On that day, did you come up to some new conclusion on the amount of oxygen that was formed and how

rapidly it was being formed?

DR. MATTSON: Yes.

MR. PIGFORD: And, what was your source of information for that conclusion? Was it the same as before?

DR. MATTSON: The same experts as before, plus two others that I can name.

MR. PIGFORD: Who?

DR. MATTSON: The Bettus Laboratory and the General Electric Company, both of whom were contacted by Mr. Stello in the course of Sunday, as I went back to the original sources of the information while he was working with these two other sources.

MR. PIGFORD: Now, which of all these sources provided the new information which you used?

DR. MATTSON: I believe all of them.

MR. PIGFORD: They all agreed?

DR. MATTSON: Yes.

CHAIRMAN KEMENY: Mr. Mattson, could I ask a question here just so us lay people could get into the act? The question is, you said on Saturday a certain set of sources gave you one set of information, on Sunday, they gave you a different set of information. What changed their mind?

DR. MATTSON: Well, the thought had been around on Saturday that there may have been inhibition of oxygen generation because of the conditions in the reactor coolant system. But there seemed to be some uncertainty about

exactly how much that inhibition would be because of the boiling environment that was still going on in the core. Subsequently, on Sunday, the question was asked, perhaps more forcefully, of these sources, but how can you generate oxygen in a hydrogen-rich environment? Which seemed to cause them all to step back and scratch their heads and think again, and, to which they came up with another answer. However, I'd like to - Mr. Tedesco does have one piece of paper I was using on March the 31st, 1979, at 10:50 a.m., it says, I asked for six questions to be answered about the oxygen. I wanted to know it's evolution rate, I wanted to know how soon it was flammable, I wanted to know if the oxygen was stripping and going into the dome, I wanted to know is it staying dissolved, and I wanted to know what does it mean as we go to the flammability limit, that is, what happens if it burns, and how does the flammability limit change at high pressure? Perhaps that was not the right question, or not clearly enough stated, because, when on Sunday we asked the question more directly, what about oxygen generation in a hydrogen-rich environment, we certainly got a different answer.

MR. PIGFORD: Did the answer that you got on Sunday correspond to what normally occurs in boiling water reactors, scaling them to the heat production rate after reactor shutdown.

DR. MATTSON: Yes. One way to inhibit oxygen formation is to put in a hydrogen over-pressure that's done in the normal shutdown of a pressurized water reactor. However, that's done without... (interrupted).

MR. PIGFORD: Excuse me, I'm sorry, maybe you've misunderstood my question. I said did the data that you got on Sunday - the new data - correspond with the oxygen production rate that normally goes on in boiling water reactors at shutdown? Boiling water reactors at shutdown. The reason I ask the question is, it is my understanding that the boiling water reactors normally operate at the pressure TMI was at that time, and that they operate in such (inaudible) which is evidently what TMI was at at that time. Do you now understand my question, or shall I repeat it?

DR. MATTSON: No, I think I understand your question, I did misunderstand it before. Yes, I believe that - that they're roughly comparable. But, there's an inconsistency in your question. Normal shutdown of a BWR would not be at a thousand PSI and would not involve the same amount of boiling that it has... (interrupted).

MR. PIGFORD: Thank you. I mean, at the time of shutdown. I would presume that... (interrupted).

DR. MATTSON: Oh, at the time shutdown was initiated, you mean?

MR. PIGFORD: Yes, yes.

DR. MATTSON: The answer to your question is yes.

MR. PIGFORD: And, your division is also active in the licensing of boiling water reactors, isn't it?

DR. MATTSON: Yes, sir.

MR. PIGFORD: Yes. Mr. Mattson, you also mentioned to the commissioners on that Friday that you - that Metropolitan Edison was hooking up a firehose to cycle gas from the auxiliary building back to the containment, is that correct?

DR. MATTSON: Firehose is probably too flip of a word to have used. They were making a temporary connection back from the waste gas decay tank to the containment building, yes, sir, and I believe I used the word firehose.

MR. PIGFORD: Yes. What is your understanding of what they actually used to make that connection?

DR. MATTSON: Stainless steel tubing.

MR. PIGFORD: Yes. Now, was that - had that been tested prior to March 31st?

DR. MATTSON: In the first several days of the installation of that temporary hook-up, there were several attempts at opening it and it had leaked. My memory doesn't serve me as to when that occurred - it was in that first weekend, because it occurred before I went to the site, so, the transfer was not successfully made until many days later after the source of those leaks were found and the transfer line was fixed.

MR. PIGFORD: How do we converge (inaudible) had it been tested prior to March the 31st? Do you know?

DR. MATTSON: No.

MR. PIGFORD: You don't know if it had been tested, is that correct?

DR. MATTSON: Tested after its installation, after the accident? It certainly wasn't tested before that because it was installed sometime Thursday or Friday. Whether it had been tested... (interrupted).

MR. PIGFORD: The 31st was on what day? Saturday?

DR. MATTSON: Saturday.

MR. PIGFORD: All right. Then, I'll ask had it been tested on Friday, by the end of Friday?

DR. MATTSON: I don't recall, it may have been.

MR. PIGFORD: You don't recall having testified on this subject before?

(Pause)

MR. PIGFORD: I'm sorry, I'm going to withdraw that question. I'm not sure.

DR. MATTSON: If I have, I don't recall it, that's right.

MR. PIGFORD: With regard to these papers, and there's some yellow sheets there and other documents relating to the calculations of the hydrogen-oxygen explosion. Has any request come to you to provide those to the commission?

DR. MATTSON: No.

CHAIRMAN KEMENY: Chief Counsel has reminded me, let me hereby make a request that photo copies of the handwritten

notes would be satisfactory, and any related documents you may have (inaudible) to this.

MR. PIGFORD: Certainly. I asked it because it was requested of Dr. Henry on April 27, and he also... (interrupted)

DR. MATTSON: Well, we have been asked to save the things that we have and it may be that we haven't given them to the right people yet. We're certainly saving them.

MR. PIGFORD: Thank you. Besides saving them, we wanted them transported. We also requested on that same date to provide the calculations of the radio nuclide inventory, which is relevant to questions (inaudible) asked earlier. May I ask one more question - I'll try to be brief.

CHAIRMAN KEMENY: Certainly.

MR. PIGFORD: In the testimony, Dr. Mattson, on that day of March the 30th, you are communicating to the commissioners, and you are putting out to them, quite appropriately, a severely damaged core, and it appears that you are also telling them that the fission product release is comparable to that of TID 14844 or even worse. Now, as I recall, that document you are referring to requires the assumption of a release of one hundred percent of all the mobile radioactive gases and a release from the fuel of fifty percent of the radioactive iodine, and you evidently felt at that time the releases had been equal to or greater than that amount. Is that correct?

MR. MATTSON: At that time, we did not have the results of the primary coolant sample radio chemical analysis from Bettus, as I recall. It came in that day. In any event, I based that statement at that time, very clearly in my recollection, upon advice that I received in the response center from people who were analyzing what little we had from that primary coolant sample... (interrupted).

MR. PIGFORD: Can you give us their names, please?

DR. MATTSON: Yes, Mr. Brian Grimes would have been primary basis of my reliance.

MR. PIGFORD: Is he an NRC man?

DR. MATTSON: Yes, he's an assistant director that works for Mr. Stello. And, as I recall, Brian was deriving his information from projection from the initial radiation reading that had been made on contact from the primary coolant sample as it was prepared for flight to Bettus Laboratories. I recall that number was a thousand R per hour. We subsequently know, of course, today, that it was not as large as TID release. We thought that morning that it was.

MR. PIGFORD: Thank you. Now, with regard to the fraction of the total iodine inventory that was, in fact, released. What fraction of the total was released to your best estimates as of this date?

DR. MATTSON: It's on the order of ten percent, slightly higher and slightly lower depending upon which laboratory

analysis you look at, and there've been several and they correlate fairly well, but there's a slight spread.

MR. FIGFORD: And, are your calculations on that subject both at the time of the accident, at the time of March 30, as well as now, available that we may review?

DR. MATTSON: Yes. I know - yes, I believe they are. The one on March 30 is the one I'm hesitating over and I'm quite certain it's been retained. I think I have a copy in my office, but I'm sure we can get them.

CHAIRMAN KEMENY: You'll check that, then, and provide what is available. Thank you. Commissioner Lewis.

(Pause)

CHAIRMAN KEMENY: No. I thought you had a question.

MS. LEWIS: Oh, you wanted me to - I was going to ask...
(interrupted)

CHAIRMAN KEMENY: You were making a suggestion - it's your question, you ask it.

MS. LEWIS: Oh, all right, fine. I just wondered if, Dr. Mattson, you might tell us what happens to the Michaelson Report, I mean how it happened that it never got to the Met Ed officials as a warning?

DR. MATTSON: I think we have to make some definitions to make the conversation go a little easier. The Michaelson Report I think you refer to is the January 1978 typed version of the report.

MS. LEWIS: Yes.

DR. MATTSON: And then, there are two other Michaelson reports, which I understand to be draft Michaelson reports, if you will - one applying to B&W reactors and the other applying to combustion engineering reactors. These are handwritten reports.

I first became aware of the so-called Michaelson Report and its predecessor drafts in April of this year, after Three Mile Island. We have been, since that time, finding out that the draft material was available to one member of my staff, either in late 1977 or early 1978.

MS. LEWIS: Who was that?

DR. MATTSON: A Mr. Sanford Israel. Apparently, that material was provided to him informally by a Mr. Jesse Eversol of Tennessee Valley Authority and a member of the ACRS. It was provided in connection with an informal discussion, as I recall being told, between Mr. Israel and Mr. Eversol in connection with the construction permit licensing of the Pebble Springs reactor, Portland General Electric Company. I have not spoken to Mr. Eversol, I have spoken to Mr. Israel. It's my understanding that the draft material was never responded to formally, although he did read it and react on substantive matters contained in that material to Mr. Eversol. More focused on natural circulation questions than on some other questions which now appear more interesting, perhaps, in light of Three Mile Island. There's another document that relates to that, if you want

me to anticipate your question, or wait for your question.

MS. LEWIS: Well, I guess the point of my question is how is it when, obviously the NRC or some segment of the NRC was aware that there were warnings of this kind of problem, that it just never reached the people who really needed that information. I mean, what happens when you do get this kind of material, does it just, where does stop and why does it stop, and why doesn't it go on to the operators who could use that information? What procedures do you have for this kind of thing?

DR. MATTSON: I think you have to start with an understanding that our business is generating concerns and raising questions. And, I can't put myself in Mr. Israel's shoes, but I can say how, generally, the staff responds to new information. Information comes from a variety of sources, ACRS, industry, national laboratories, our own staff. Questions get raised, they get considered, and judgments get exercised. People compare new information to what they have studied in the past and what they know from their careers in reactor safety. In this particular case, I'm told that Mr. Israel focused on the question of natural circulation, thought it was an interesting question, studied it some, and exercised his judgment that it wasn't an important safety concern. Subsequently, to Three Mile Island, considerable computer analyses have been done with natural circulation, and they confirm his judgment about the natural

circulation portion, in the paper. Now, there's another portion of that paper that deals with the inability of the pressurizer level indicator to give you direct information about level in the core, or in the reactor vessel, when voiding has occurred. Mr. Israel says to me he doesn't recall spending much time in the context of the Michaelson Report thinking about that, but he did spend some time thinking about it in the context of the Davis-Besse accident or incident transient that occurred in September of 1977, which led him to issue, or write, the memorandum that Novak signed as a review reminder to the members of the reactor systems branch, saying for new construction permits and operating licenses, this is something you ought to be sensitive to.

MS. LEWIS: What happened to that?

DR. MATTSON: Well... (interrupted)

MS. LEWIS: That didn't get to Met Ed, either.

DR. MATTSON: That one didn't get very widely distributed either, you're right. It got distributed to the members of the branch and I believe the document shows a carbon copy to the assistant director for reactor safety, which was not Mr. Tedesco at that time. Understanding procedures in the office, the staff is required to make a certain judgment when they issue a new requirement, it's part and parcel of the standard review plan description I gave you earlier. That is, if it's a significant new requirement,

it's supposed to go to a management committee for review and consideration before it's placed upon applicants for licenses. This is the so-called Regulatory Requirements Review Committee. Now, the judgment the staff has to make is whether this is a significant new requirement or not, or just something that ought to be looked at and studied perhaps a little bit. I must judge at this point that the judgment was made by the Reactor Systems Branch Chief, Mr. Novak, by Mr. Israel, by the Assistant Director, that this was not a significant ratchet or change in regulatory requirements, nor was it a significant safety question in their mind. It was something that deserved further study, but not then judged to be of significance, perhaps more theoretical than real. In any event, they did not provide that information to the Division of Operating Reactors, for example, where it would have been considered for application to operating plants and might have been communicated to people like Three Mile Island. One question that occurs to me in trying to understand what happened there is, if the staff knew of the pressurizer level potential failure mode, and made a judgment that it wasn't that important, hadn't others perhaps made that same judgment. I came across a document in the course of April - it looks like early May - from Babcock & Wilcox Company, which treats this subject at least in passing - document directed to Davis-Besse Nuclear Power Station - which contains certainly a sentence on the second page which is

germane to the question. It says, "The pressurizer level and reactor coolant system pressure assure that the reactor coolant system is filled; the steam generator level and pressure assure adequate decay heat removal." Now, that doesn't come right out and say, watch your pressurizer level gates, but it does say, watch two things, not one thing.

MS. LEWIS: This is April and May, this is after.

DR. MATTSON: Well, I became aware of it in May. A newspaper reporter provided it to me.

CHAIRMAN KEMENY: What's the date of that document, (interrupted).

DR. MATTSON: August 9, 1978.

CHAIRMAN KEMENY: OK. So, that's a pre-accident document?

DR. MATTSON: Yes. I don't have any other knowledge of this. I referred it to our Office of Inspection and Enforcement, for the same reasons that I bring it up here. The point being, the judgment is exercised... (interrupted)

CHAIRMAN KEMENY: We certainly are requesting a copy of that.

DR. MATTSON: Have this one. Judgment has to be exercised as we consider safety questions, and people have to sort the important ones from the...

DR. MATTSON: ...and people have to sort the important ones from the less important ones. There's rules and procedures that help make sure those judgements are good. And hindsight, perhaps today, tells us that that judgement wasn't so good that exercised in late '77 early '78. With foresight only, I'd have to conclude today that it was a close call, that this accident was one that evaded detection and treatment beforehand narrowly. There were close calls.

PROFESSOR LEWIS: Dr. Mattson, yesterday Mr. Denton admitted that part of the problem has been complacency at the NRC, a tendency to feel, you know, it never happened, it never will happen, and this is the greatest technology in the world. One is getting the same impression from what you're saying where they had been warnings, but you say, "Well, we'll ignore that. That's really not significant." Would you then support Mr. Denton's statement yesterday that this indicates a kind of complacency about safety at the NRC?

DR. MATTSON: I didn't hear a statement precisely, but I'd agree with yours. I think that's the greatest lesson learned from 3 Mile Island. Accidents can happen. And, perhaps, you see it in the Standard Review Plan description I gave you. Decisions in '75 were made that what had been done before was pretty good and that the backfit of the Standard Review Plan didn't need to occur. I think 3 Mile Island raises questions about those kinds of judgements and

they have to be relooked at.

PROFESSOR LEWIS: I just want to make one comment that it seems a little horrifying to the general public that it takes an accident of this dimensions to get a federal agency to face up to it's responsibilities.

DR. MATTSON: I didn't say the agency hadn't been facing up to it's responsibility. I'm saying that it's judgement over a period of years had grown, had been tempered by the fact that they'd apparently been doing a good job. And then this one slipped by us. And it happened. That raises the question of whether it was a good enough job.

CHAIRMAN KEMENY: Could I just call a timing problem to the Commission's attention? I think in courtesy to the Commissioners.

MR. MCPHERSON: One question. I can't decipher the lingo that you have used about what happened to these minor report holes or pressurize the level and core level problem that had raised. But you said it was not considered a significant safety problem at the time, but it was reserved for further study, or something of that kind, further examination.

DR. MATTSON: Yea, it wasn't totally dismissed.

MR. MCPHERSON: Exactly. What is the nature in the process of the NRC, not necessarily with the Michaelson Report although we'd be quite interested in knowing what happened to it, but what's the nature of the NRC's further examination of

these things? Who does what to find out if Michaelson is right and is there a simulation run on the B&W reactor to see if what he said was correct?

DR. MATTSON: Now you're going to the more general question of Michaelson's concern with the decay heat removal in the case of a small break. That work has already been completed. Runs have been made by the babtociu...

MR. MCPHERSON: Take the thing that happened, that the pressurizer level was not giving a clear picture of the state of water inventory in the core.

DR. MATTSON: That's true.

MR. MCPHERSON: What happened when that was not considered an urgent safety matter requiring a bulletin or something of that kind? When you say it was put out for further examination, what happened? Who examined it?

DR. MATTSON: Well, I can't answer your question today. I should mention that the Office of Inspector and Auditor of the Commission is investigating the circumstances surrounding the Michaelson Report.

MR. MCPHERSON: Mr. Chairman, I think it's essential that the NRC be requested to give us a specific analysis and account of what happened to the problems raised in the so-called Michaelson Report. What happened from the time it was received and considered not to be of significance and emergency as to require a bulletin, but to require further examination.

What kind of further examination took place by the Commission or by agents or contractors of the Commission.

CHAIRMAN KEMENY: I do so request.

DR. MATTSON: I can tell you today a little bit about that.

CHAIRMAN KEMENY: No, I don't think we wish that, I think we wish an official report from NRC on this.

DR. MATTSON: We can do that.

CHAIRMAN KEMENY: The witnesses are excused. We are going to have a 2 minute and I do mean 2 minute intermission just to be able to fix one of the microphones so we can hear all the NRC Commissioners.

CHIEF COUNSEL NATALIE: Mr. Chairman and Mr. Commissioners, will you please rise? Raise your right hand, please. Do you and each of you swear the testimony you'll give before this commission shall be the truth, the whole truth, and nothing but the truth so help you God?

MR. CHAIRMAN AND COMMISSIONERS: I do.

CHAIRMAN KEMENY: First of all let me apologize that in 2 days of hearings we fall behind schedule and we kept you waiting which also puts us into the uncomfortable position that we don't have as much time as we would like to because it is essential for us to have an Executive session this afternoon to plan the future of the Commission. Therefore, I think we're going to concentrate on some big issues

rather than trying it this time to draw out the detailed questions. I'd like to lead off by just trying to get some feeling of how you as a group of Commissioners work. Decision making processes are always fascinating and committee decisions..I live in an institution where I'm not always certain that Committee decisions are always the best way to reach decisions. I had wondered, for example, do you, have you, somehow, as you learn to work together, each acquired certain specialties or do you defer to certain commissioners on certain issues or can you describe, Mr. Hendrie, in general, how you feel your commission works as a decision making body?

MR. HENDRIE: The Commissions operation is very much a collegial one. By the way, I will apologize for the condition of my audio equipment today.

CHAIRMAN KEMENY: As somebody remarked yesterday, I think anyone who has been connected with this accident will go hoarse before we are through, I suspect.

MR. HENDRIE: I'm having a recurrence of a flu bout and I seem to have infected Commissioner Ahearne as well which may be one of the few ways that a Chairman on this Commission can influence other Commissioners. We operate in a collegial mode and we have not, at least within my 10 years as Chairman, developed a tendency toward having lead Commissioners but I know that at times in the past under the old AEC there

were lead Commissioners for one area or another. We have not gone in that direction and I haven't detected any inclination of the present body to do so. It is, of course, inevitable that individual Commissioners have personal interests that run more strongly in one area of the Commission's business than another but I guess that wherever that's the case the other 4 of us have not felt that we would draw back and let that individual be our lead in that area but we all participate.

CHAIRMAN KEMENY: Let me try to take, as an example, since safety is very much on our minds, when the Commission votes regulations on safety, you would do this in a collegial manner talking it all over together.

MR. HENDRIE: Yes, of course. The authority of the Commission to adopt a regulation, to issue orders, to take other actions is a collegially vested power.

CHAIRMAN KEMENY: Yes, I understand that. Now I'm trying to understand in what level of detail you might get involved in deciding what regulations should be that would qualify a nuclear power plant as safe. Does this staff work up that you approve or does the Commission itself make a major contribution to it.

MR. HENDRIE: Regulations can only be promulgated by the Commission by order of the Commission and are brought into being by a process called rule-making in which the staff

a rule-making sense at least that I recall.

CHAIRMAN KEMENY: How about the other Commissioners. Do any of you remember being involved in such a discussion?

MR. GILINSKY: I don't, Mr. Chairman. I think it should be said that most, many if not most of the safety requirements of the NRC are not in the form of rules, formal rules. They usually have a less formal status and, therefore, would not be acted on by the Commission. But specifically on the question of control rooms that's a matter which I think has not gotten a great deal of attention.

CHAIRMAN KEMENY: It has not gotten a great deal of attention.

MR. GILINSKY: Before 3 Mile Island.

CHAIRMAN KEMENY: Commissioner Bradford, were you going to say something?

COMMISSIONER BRADFORD: I was just adding the phrase before 3 Mile Island. It has been discussed as the Chairman said not in a rule-making context..

CHAIRMAN KEMENY: In what context was it discussed?

COMMISSIONER BRADFORD: It seems to me that it's come up on one or more occasions when we've met with the staff since 3 Mile Island as part of the areas of concern but I can't give you a date and the place and I wouldn't want to tell you that the discussions had been an extensive one.

CHAIRMAN KEMENY: And this, you said, was since 3

Mile Island.

COMMISSIONER BRADFORD: Yes.

CHAIRMAN KEMENY: You see, this Commission has difficulty knowing quite how your Commission excersises its authority. I mean let me ask control room is a rather large faction of wlether a system is safe. Why would your Commission not in recent years have discussed whether modern technology should have been applied to control rooms?

MR. HENDRIE: I really don't know. I suspect because neither external petitioners nor one of the staff offices chose to bring the matter before the Commission and because none of the sitting Commissioners in the past have generated it on their own as a topic of discussion.

COMMISSIONER BRADFORD: I can only speak personally but it didn't occur to me that it hadn't.

CHAIRMAN KEMENY: It didn't occur to you that it hadn't come up?

COMMISSIONER BRADFORD: No, it did not occur to me that modern technology had not been applied to control rooms.

CHAIRMAN KEMENY: Have each of you visited a control room at some point during your Commission? I see. Let's see, I just have one more line of inquiry and then I'll turn it over to other Commissioners. The other sort of thing still, just trying to get the feeling of how the Commission operates, I will ask each of you simply to say when you first heard about the accident, when you first became aware that it

was serious, let's say, at what point you felt they had been serious core damage, Chairman Hendrie?

CHAIRMAN HENDRIE: I guess it would have been sometime late morning or early afternoon on the 28th. On that Wednesday, I was at the Washington Hospital Center with a daughter who was to undergo surgery that afternoon and in calling into the office, as I will typically when I'm away, my administrative assistant said there had been an incident at one of the plants that the response center had been activated and the emergency management team was in place, that they were getting some reports through the things at least at that point seemed not desperate. And through...

CHAIRMAN KEMENY: Excuse me. This was on Wednesday afternoon?

CHAIRMAN HENDRIE: That would have been Wednesday and I can't tell you whether it was late morning or early afternoon, but it would not have been, you know, eight, nine o'clock, ten o'clock, it would have been much closer to noon. There was fire in some of the operating rooms that created a little diversion there where I was at the time. I would have called, I did call the Response Center then, periodically, through the afternoon and evening. Let's see. Thursday, we had a briefing by the staff on the accident. Thursday afternoon, I was down testifying at either a hearing or a briefing, of some congressional committees, and it was Friday morning

in the first reports I had that I found the staff had concluded we had a much more serious situation at 3 Mile Island than had been projected up to that time. I guess the staff sort of the staff forming that as a concensus view would have occurred some hours earlier during Thursday night, probably, but Friday morning it became clear that we had a substantially damaged core on our hands. I became aware at that time of the non-condensable gas volume in the primary system which could of only been hydrogen. And that in turn meant substantial core damage.

CHAIRMAN KEMENY: Thank you. Commissioner Adhearne, what was the time table from your point of view?

COMMISSIONER AHEARNE: When I first heard about the accident was early on Wednesday morning. I got into the office and I think it was Mr. Davis who called me. Shortly thereafter I went out to the Emergency Response Center and spent all day Wednesday leaving there sometime after midnight. During that day, it was clear that the staff was working very hard trying to develop an understanding of what was going on with the machine. By the time I left after midnight, they seemed to feel that having got the pumps going earlier in the evening that things were now going to be relatively well in hand and, certainly, Thursday morning when they came up to brief us prior to going up to the hill to talk with Chairman Jespoke, it seemed that they were fairly confident that yes, it was

now going to be in a stable mode. It was Friday morning that we then found or I believe that was when I first understood that there were serious problems with the core.

CHAIRMAN KEMENY: Yes, so you went on your long stint on Wednesday. You did not get an impression that serious damage had happened to core?

COMMISSIONER AHEARNE: Correct.

CHAIRMAN KEMENY: Commissioner Kennedy?

COMMISSIONER KENNEDY: Mr. Chairman, I was also notified very early, I think, on Wednesday morning. Coming into the office sometime between 8:30 and 9:00, I recall, I think that's correct, in that order. And again my experiences essentially as you've heard thus far, through the day on Wednesday, we were collecting information, but it was essentially sparse. Toward the last there was a growing understanding so we thought of the situation and certainly the feeling by the end of the day the machine was in a stable mode. Thursday, we had that impression. Late Thursday afternoon, it seems to me, I recall, growing concern about the situation, but nonetheless, still not a feeling that a, certainly not a feeling of the seriousness that we came to recognize may well be facing us on Friday morning. It was Friday morning, I think, that we, my recollection is that we were rather clearly of a notion we'd now had some serious core damage and had that sort of problem to face.

CHAIRMAN KEMENY: Commissioner Gilinsky.

COMMISSIONER GILINSKY: Mr. Chairman, it was about nine o'clock when I was informed Wednesday morning of the accident. It was considered a serious matter, but again, it wasn't until Friday, sometime in the morning, that the full severity of it became apparent.

CHAIRMAN KEMENY: Commissioner Bradford.

COMMISSIONER BRADFORD: I learned of the accident from my technical assistant at 9:20 on Wednesday morning. I decided to go out to the Response Center, not at the time, because I appreciated the seriousness of the accident, but because I wanted to see how the Response Center functioned. I had not been there during an event or an accident previously. As I remember both the rest of Wednesday and Thursday, as well, this was clearly a serious accident and I remember thinking that it was clearly the most serious accident that had occurred in a commercial nuclear power plant. But my sense, through all of those days, for both of those days, was that the whatever had happened, the worst of it had happened at the beginning and matters were improving. What changed on Friday morning was that perception. On Thursday evening, there was a concern over the dumping of waste water and some confusion over just what had been dumped and why it had been necessary. But that didn't involve a new, an appreciation of the accident seriousness until Friday morning.

CHAIRMAN KEMENY: Commissioner Bradford, did your concern then escalate over the weekend? We heard, clearly, you must have been getting some conflicting signals from some of your key staff on the dangers of a possible explosion or such. Did you have a sense of escalating concern Saturday and Sunday?

COMMISSIONER BRADFORD: The transcripts in some way would be a better guide than my own recollection, but to sketch it briefly, my concern Friday morning was primarily with the report that there had been a release on the order, measured on the order, of 1200 milligrams 600 feet above the stack. It's duration was uncertain and the prospects for other such releases in the near future seemed, they seemed likely. By the middle of the day on Friday, we had Roger Mattson's concern about the state of the core. But that did not include the hydrogen oxygen concern, which was not raised at that time. His concern was more with what he has described himself as the horse race aspects of efforts that might be made to remove the bubble and bring the core to a co-shutdown stage. It's hard to describe exactly one's level of concern, but roughly mine, I think, was very high on Friday morning with the prospect of the releases, high again on Friday afternoon after Dr. Mattson's phone call, diminished somewhat when Harold Denton arrived at the site and reached a somewhat more sanguine assessment of conditions there. And raised again on Friday

evening, which was the point at which I first heard of the oxygen hydrogen concern from Chairman Hendrie at approximately a quarter of eight. That was a serious concern. Really, from then on until Sunday afternoon when the calculations showing that it was a serious problem finally merged with those that indicated that, in fact, no oxygen could be evolving into the bubble.

CHAIRMAN KEMENY: Commissioner Gilinsky, what did your timetable be from Friday to Sunday kind of period, your degree of concern?

COMMISSIONER GILINSKY: Well, the morning of Friday, we were reacting to the 1200 milligrams per hour reading that Mr. Bradford has referred to and the effect that might have on offside doses and how we might deal with the source as to contain it. Obviously, our concerns were very high then. In the afternoon, the severity of the damage to the fuel in the core, we came principle focus concern. I can't really place the point where we begun to think about the possibility of there being a hydrogen oxygen explosion or reaction within the core, but somewhere between Friday and Saturday. This became a subject of some concern.

CHAIRMAN KEMENY: Did it, for example, lead to discussion by the full commission, Commissioner Gilinsky?

COMMISSIONER GILINSKY: Well, we were, all of us, in a continuous session, you might say, either the Chairman's

office or next door, discussing these matters as new information became available. At the same time, one had gotten a larger team of NRC personnel to the site and they seemed to feel the situation was more under control than they had thought before they'd left. And that was a calm effect. And simply the fact that it was a great deal more technical strength up there, it was a factor for any more confidence in our ability to handle the situation.

CHAIRMAN KEMENY: At what point in that Friday to Sunday period did you personally consider that an evacuation might be important?

COMMISSIONER GILINSKY: Well, it was something was in some sense under consideration continually. As you know, we had recommendations early in the morning Friday that the surrounding area would be evacuated. We were sending Mr. Denton more or less at the same time to the site and it seemed reasonable to get a first hand report from our senior person in react to safety. But we continued to discuss the matter and it didn't just turn on the possibility of an explosion. There was simply the various uncertainties about the situation, the question of the ability of various systems to keep functioning, reliability back-up systems, and so on. And this is a matter we actually discussed at some length, I think, on Saturday, but I can't place it exactly.

CHAIRMAN KEMENY: How about by Sunday, had your

concerns diminished?

COMMISSIONER GILINSKY: Well, in some sense, yes. But let me say that between Saturday and Sunday, I spent a good deal of time working on a document that would be a decision document for an NRC decision on evacuation, setting up criteria, various types of events that might take place in the reactor that might trigger a decision to exercise one or another evacuation plan, and put a team to work on this Saturday night. They worked through the night and Sunday morning, I came in rather early, I think around 6:00 in the morning.

MR. MCPHERSON: Mr. Gilinsky, did I understand your response to the last question. Is the NRC's responsibility and authority to order evacuation or to recommend it to the Governor?

COMMISSIONER GILINSKY: We would be recommending it. Yes. We produced a document on the subject.

CHAIRMAN KEMENY: Yes, so you did have a staff document that would say that under certain circumstances evacuation should be recommended.

COMMISSIONER GILINSKY: Right.

CHAIRMAN KEMENY: Did any of the conditions that were in that document actually occur?

COMMISSIONER GILINSKY: I don't believe so.

CHAIRMAN KEMENY: Could we request a copy of that

document?

MR. GILINSKY: I would say Mr. Bradford is raising questions about that.

MR. BRADFORD: One would want to look at the document but there was at one point at least a form of the document dealing then with what we still thought was the possibility of an oxygen-hydrogen mixture. And one of the possible triggers was that reached a level of flamability. Flamability had not been a concern, as I remember it, on Friday and Saturday. The concern then was that it would reach a point that if, the higher point of percentage of oxygen in which it might detinate. By Sunday calculations were produced sugessting the flamability alone would generate sufficient pressures and to be of concern for the integrity of the reactor and that, as I remember, was one of the, flamability was then inserted into the matrix and at least there was uncertainty at that point as to whether the conditions were already reached. Now within an hour of that I should add the Chairman was at the site meeting with Victor Stello and others and the information came, then began to come in indicating that, in fact, no oxygen would be evolving. So in very quick succession it appeared, as I remember it, appeared that there was some uncertainty at least as to whether a trigger point had been reached and then certainly the other way that in fact it could not have been.

MR. GILINSKY: I think that's about right.

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CHAIRMAN HENDRIE: About noon, as I remember.

CHAIRMAN KEMENY: I find that puzzling, Chairman Hendrie, if that was the period in which there were some of the greatest uncertainties at least. Was it wise to advise the President of the United States to appear on the site?

CHAIRMAN HENDRIE: Well, I don't, the Commission did not advise the President to, that we wished him to go to the site. The President felt it would be a useful thing to do and did it.

CHAIRMAN KEMENY: Commissioner Bradford.

COMMISSIONER GILINSKY: Let me say, Mr. Chairman, that I was asked about it and I had assumed that he would not be on the site but near the site and my comment was that if there was a ready way to evacuate him that there would be some minutes before any radioactivity would reach that point even in the worst case.

COMMISSIONER BRADFORD: I balk a little at the description of Sunday as the day of greatest uncertainty. There were at least two factors that for me were lessening the concern about the oxygen-hydrogen mixture. One was, as I said, the belief that mere flamability was not a problem. That turns out to have been wrong but that was a reassuring belief through until Sunday afternoon. Second was that there appeared to be no way of, in fact, generating a spark that would ignite the mixture. And, consequently, there is, it is

not until Sunday afternoon when the flammability reassurance was peeled away for that short period of time that it seemed to me that Sunday would fit that description of being the period of greatest uncertainty. Otherwise, I would have said it was Friday.

CHAIRMAN KEMENY: At what times did the Commission take an official decision as to whether to recommend, Chairman Hendrie, as to whether we recommend an evacuation or not to recommend one?

CHAIRMAN HENDRIE: No, Friday, Friday morning in the midst of the confusion over the, that series of releases from the ventator early in the morning. I talked to the Governor and agreed that it was wise for people to be asked to stay inside and it seems to me it was later on Friday after some further discussion of the Commission that I talk to him and we recommended a, that he advise young children and pregnant women to leave the area if they didn't have, if it was reasonable and convenient for them to do so. With regard to evacuation at other times, as you have heard, the subject was certainly a constant one before the Commission as a possibility but we didn't take any action. If we had we'd have notified the Governor and suggested that he move people.

CHAIRMAN KEMENY: Commissioner Gilinsky, were you going to say something?

COMMISSIONER GILINSKY: No.

CHAIRMAN KEMENY: Commissioner Ahearne.

COMMISSIONER AHEARNE: I think that the three of us who were in Bethesda on Sunday afternoon had reached the conclusion that unless the people in the site, including the chairman, had a newer or better analysis, that then we were going to recommend evacuation at least around the, the few miles around the plant. But at, and when we were, we were in the process of relaying to 3 Mile Island at the same time they were in the process of reaching the conclusion that the problem that we had thought was there was not there.

CHAIRMAN KEMENY: That was Sunday afternoon.

COMMISSIONER AHEARNE: Yes.

COMMISSIONER KENNEDY: In my own recollection of that, and I was one of those three, Mr. Chairman, was just very slightly different. We certainly had discussed it. My own recollection was not that we had reached quite perhaps as quite a definite view. We certainly wish to communicate our and were in the process of communicating our concern to Chairman Hendrie and the others at the site. The reason for doing this was to heighten our own acuity in the matter and to take a look at the situation as they saw it there recognizing the concerns that we felt based upon the information that we had. The relatively new information concerning the flammability question. Because it was getting late in the afternoon and if an action had to be taken it certainly seemed prudent to us to

do so before the hours of darkness to lessen the trauma that might otherwise be involved.

CHAIRMAN KEMENY: Just out of curiosity who was the third Commissioner?

COMMISSIONER KENNEDY: Commissioner Bradford.

COMMISSIONER BRADFORD: I am the third but I think, if I remember right, that Commissioner Gilinsky was there virtually to the end of that discussion and in effect left a proxy. So that it was really a 4-Commissioner appraisal.

CHAIRMAN KEMENY: And your recollection is approximately the same?

COMMISSIONER BRADFORD: Yes, it is.

CHAIRMAN KEMENY: Yours also, Commissioner Gilinsky?

COMMISSIONER GILINSKY: Well, actually I was away, was called on the telephone and told that the other 3 Commissioners had concluded that, I don't remember the precise words, but at any rate they would support an evacuation if the Chairman thought it was appropriate and, but left it in effect up to him in being at the site and in better touch with the facts and the question was would I support that recommendation and I said yes.

COMMISSIONER BRADFORD: The transcripts are reasonably good on this specifically from pages about 130

on on Sunday transcripts.

CHAIRMAN KEMENY: Very good. Thank you. Commissioner Marrett.

COMMISSIONER MARRETT: I'd like to go back to the issues having to do with the structure and operation of the Nuclear Regulatory Commission. I admit I'm still a bit confused about the way the Commission operates and, particularly, the staff arrangement. Do I understand first that each Commissioner has his own staff in addition to the general NRC staff?

CHAIRMAN HENDRIE: Well, in a formal sense, yes. Each Commissioner has an office which is staffed by up to 6 people including the Commissioner. Typically it will be a couple of clerical people, and perhaps a legal assistant, a technical assistant, and so on. That's quite, those are quite small offices against the scale of the agency as a whole which runs 27; 26 or 2700 people.

COMMISSIONER MARRETT: What about the kind of information that that technical person would have on your personal staff? Would it, would items come from the larger agency staff or are there independent kinds of materials that the technical person would come up with that may vary from one Commissioner to another..

CHAIRMAN HENDRIE: I think it does and I think it depends totally on the technical assistant and the same is true for legal matters for legal assistants and so on. There is a

primary channel obviously up through the staff, the main staff the agency and also those Commission offices that are established to report directly to the Commission but Commissioner's assistants can get information from people outside the agency, from any source.

COMMISSIONER MARRETT: Well, let me ask it more specifically of particular Commissioners then. Commissioner Ahearne, how do you use your own personal staff? First of all, what's the make-up of that staff and how, what ways do you make use of the staff?

COMMISSIONER AHEARNE: Certainly there are two secretaries who handle most of the flow of material that comes through and try to keep track of the action items so that we all know when a deadline is coming up. There is a legal assistant, a lawyer, who primarily looks at the legal issues that come, there are a number of legal cases, appeal board decisions that we are asked to address, interpretations of law that the Commission has to make a judgment on, particularly in the export area and so she spends most of her time on those aspects and then after having delved deeply into that then will talk it over with me so that I can develop the necessary understanding of the key points of it. I have a technical assistant who spends, who had been spending a large amount of his time on waste management issues trying to develop a detailed understanding of the problems in nuclear waste management, the

various programs both in the NRC and in the Energy Department, President's Review Groups report, tries to also work with the staff when there is a particular technical issue on, let's say, pipe cracks, which had been another issue, in an area that I would believe that I have to develop a, at least in enough knowledge in my staff that then I can spend some time discussing and debating that particular issue. As I say, most of his time had been spent in nuclear waste management because I had seen that as being probably the most critical technical issue that had been facing us.

COMMISSIONER MARRETT: So in that case you would ask your technical assistant to take on an issue you feel that you need more information on. That's the way that it operates.

COMMISSIONER AHEARNE: Yes, that's right. And then the third staff member is a person that spends most of his time on trying to develop an understanding of the program and budget process of the NRC in an attempt to get a better, what he had been spending most of his time on trying to work with various elements of the staff to get a better process for reviewing budgets, developing program and overall Commission policy on a variety of issues.

COMMISSIONER MARRETT: Commissioner Kennedy, what about your staff.

COMMISSIONER KENNEDY: It's quite similar in

character to the story you just heard from Mr. Ahearne and I used them in very much the same way, not on specifically the same subjects. I have a young man who is a nuclear engineer and a young man who is a lawyer. I also have two interns who come from the staff who, one a lawyer and the other a nuclear engineer, a young lady. They're there not only to help, but hopefully to learn something about the way the organization functions in a larger sense, and to see something of the functioning of the entire organization across the spectrum of its activities. And I use these people to look hard at questions and issues I think we're going to have to be dealing with to be sure that we're asking all the right questions.

COMMISSIONER MARRETT: Well, for example, your technician, the nuclear engineer I suppose is your technical staff, what kinds of issues would be assigned to that person currently, for example?

COMMISSIONER KENNEDY: Currently? Currently, he's looking at all kinds of questions about TMI. Previously, however, I, too, had been spending a great deal of time in the technical side looking at waste management questions. And, in deed, we had made an effort to visit a number of waste management activities to find out precisely how those things were functioning, what problems and issues we saw were going to have to be dealt with, both in a safeguards and safety sense, looking to the time that the licensing activity in

this field might well become an immediate question to deal with. So those are the kinds of things that they do, to say nothing of the fact, of course, that there is a continuing liason relationship that worked out with the larger staff in order that we can get a regular flow of information and get questions addressed quickly and followed up on. I would add one more thing that the chairman alluded to briefly and that is the commission offices, there is an office of General Counsel who provides a broad scale legal service and acts as the organization lawyer, the commissioner's lawyer. In addition to that there is an office of Program Evaluation which does specific study work for the commissioners as a group.

COMMISSIONER MARRETT: Yes, I'd like to come back to the whole matter of the agency, well, the commission office and the relationship to the agency staff. For the other commissioners, is it the case that what's been described is fairly typical of the way you use your staffs...

COMMISSIONER BRADFORD: More or less.

COMMISSIONER MARRETT: ...as well. Well, let me...

COMMISSIONER AHEARNE: Ms. Marrett, could I... Remember for about the last three months I have had a White House fellow sitting in my office. You're familiar with that program that's the program where they bring in people to do a number of things, one of which is to get a better understanding

of the way some government agency operates and I've had a gentleman who had been with the State Department for the first seven months of his time and had spent the last three months with me, primarily carrying on very similar aspects he had been working on the non-peripheration acts interaction in the federal government.

COMMISSIONER MARRETT: Alright. Let me go back to the matter then of the relationship between the commission and the larger agency. I understand, Chairman Hendrie, when you began, you talked about the possibility that issues may come up from a number of places. Your personal staff, I'm sure, would be one. There may be public kinds of issues as well as the items that come from the larger agency staff. Of the possibilities, are the issues that the commission takes up, what proportion would perhaps be the issues that come immediately from the agency staff?

CHAIRMAN HENDRIE: I would guess perhaps 70%.

COMMISSIONER MARRETT: So most of these would be agency staff?

CHAIRMAN HENDRIE: I would think so. I would judge that the bulk of the rest come in and become issues before the commission as a result of outside actions - partitions by members of the public, court actions, results of litigation and so on. Occasionally, there would be an issue coming before the commission which originates in the office of the

General Counsel or another office that reports directly to the commission, small office about eighteen people called Policy Evaluation who in some sense correspond. They are to the technical side in some sense with the lawyers and the Counsel's office are on the legal side.

COMMISSIONER MARRETT: Then I guess the question I'm getting to and, perhaps, either Commissioner Bradford or Gilinsky, since I didn't give you a chance to get into it earlier, can respond to this. And that is, what's the relationship as you see it then between the commission and the staff? There are a number of different possibilities ranging from those in which the staff does most of the kind of work and simply passes on material for commissioners to review. There may be other kinds of things where a commission chooses to act very independently and given that so many other things arise internally to your staff, what do you perceive to be the relationship then of staff and commission? I guess Commissioner Bradford to begin with.

COMMISSIONER BRADFORD: I'm sure we all have different perceptions to that. It would much easier to give you an accurate answer on a subject matter, by subject matter basis. That is, for example, export licensing, the initiative comes primarily from the commission, I think. On the other hand, reactor licensing, historically at least I think, the time I've been there I would say that the, certainly the bulk,

certainly the reviewing is done entirely by the staff of individual applications. And the inspecting and enforcement is done entirely by the staff except to the extent that cases may be appealed up to the commission through our licensing boards or through other processes that allow questions to reach us. There are many other areas but why don't we, why don't you state your concerns and I'll try and respond.

COMMISSIONER MARRETT: Reactor licensing. Let's be concerned with that. You're saying that during the time you've been on the commission that has been largely a staff function.

COMMISSIONER BRADFORD: Well, I was focusing on the initiatives. That is the commission has to pass on many different types of decisions, but the initiative, I would say, have come primarily from the staff, not exclusively. Commissioners will occasionally from one source or another come up with a question or a concern about a particular plant or a type of issue, discuss it with staff, request a briefing from the staffs, send a memo to the staff. But I think by any rough measure of initiative, the bulk of it is with the staff.

CHAIRMAN KEMENY: Could I just follow that up with one question? While you've been under commission, has the commission itself turned down a staff recommendation to license a plant?

COMMISSIONER BRADFORD: The short answer I think is no, but I also think that that misstates the, to leave it at that is to misstate the process somewhat.

CHAIRMAN KEMENY: I'd be happy to have a longer answer in that case.

COMMISSIONER BRADFORD: And, in fact, Commissioner Gilinsky has pointed out to me that depending on how one reads the Zeabrook Case, it may not even be a right answer. But the licensing applications are reviewed in the first instance by the staff and the advisory committee on reactor safeguards. They are then contested, if in fact there is a contest. Both if the construction permit and operating license stage before a licensing board. That board's decision, if it's favorable, is enough to commence either construction or operation, but appeals can be taken to the Atomic Safety and Licensing Appeals Board, which would be a three member panel. And from there, appeals can in many circumstances be taken to the commission. So that...

CHAIRMAN KEMENY: Excuse me, I'm naive on these things. Would the appeal be made always by the applicant?

COMMISSIONER BRADFORD: Well, if the licensing board had turned the applicant down or had imposed a condition that the applicant thought unacceptable, then it would come that way. Certainly, an appeal could be taken by the commission's lone licensing staff which functions as a separate party or an

appeal could be taken by an intervener, whether an environmental group or a state government, any of the parties to the proceeding before the licensing board had taken appeal on up. The reason though that I thought your question needed that more extensive answer is that by the time most of these questions would reach the commission, if there were fundamental objections to the plant, they would have been dealt with either in the discussions between the applicant and the staff or as part of the proceedings before one of the lower boards. What tends to reach us, not always, but what tends to, is a more specialized single issue out of a particular case and not the broad question of the fundamental acceptability of the plant. That is not always true, but that is the tendency. Let me urge that you not take my response as being definitive as to the relationship between the commission and the staff. Other commissioners have different backgrounds and may interact very differently.

COMMISSIONER MARRETT: Well, that's why I was interested in Commissioner Gilinsky's. Has there been any change as you perceive the relationship, especially around this question of how broad are the licensing questions? Are there any difference between the current commission as you see and the commission that you've known it in earlier years?

COMMISSIONER GILINSKY: There's been a change over time. Let me preface my remarks about that with an observation

about our role. We have a variety of roles. We have an executive role in that we're the public overseers of the agency. We appoint the principle staff, make the principle management decisions. The chairman, of course, to the chief executive officer. We have a legislative role in that we make the rules. Certainly, the formal rules which only the commission can promogate, but also, at least some of the less formal roles and policies in the commission. We also have a judicial role in that we're in effect the Supreme Court of nuclear licensing. We have boards that sit on particular cases. There's also an appeal panel, but the final word comes from the commission. And occasionally, we do hear a direct argument. On the matter of reactor safety, which I think is your principle concern here, in part because of the commission's judicial and part because of the traditions established in AEC, the commission has not injected itself into that area as much as it should have, I think. It's been, I'd say, well, diffident about getting involved to a very great extent. In part, because there's legal barriers on particular cases. There's ex-party considerations, in other words, we can't deal easily with our staff, which is a party to a particular proceeding without at the same time dealing equally with all other parties. And that introduces various complications in lines of communication. In part, simply because a tradition became established during, which really continued partly out

of, I think, bureaucratic inertia, during the AEC period when that commission really had very large responsibilities of a different sort having to do with developmental programs, weapons, and in addition, in some cases, had a direct financial stake in some of the facilities that were being regulated by the regulatory part of that agency. So, for these reasons, a tradition got established which was not easy to change. Another reason why...

CHAIRMAN KEMENY: Excuse me, could you just briefly summarize what that tradition is?

COMMISSIONER GILINSKY: The commission not delving into safety matters I think as deeply as it did into other areas. I want to give you another reason why that came about and that is when the commission was formed in 1975, the safety area was a functioning enterprise and was underway in a way that other parts of the agency which dealt with other of our responsibilities having to do with safeguards and export licensing and so on were not and the commission had to in a sense build up those areas. Waste management is another one. And so it...

COMMISSIONER GILINSKY: ...another one. And so it, those areas took up a great deal of time.

COMMISSIONER MARRETT: So among this very area you're saying that the commission has not, safety has not been as high on the agenda as you've seen it, seeing that agenda..

COMMISSIONER GILINSKY: No, I wouldn't put it that way. Safety is still the number one area for the Commission, there's no question of that but it has not delved deeply, I think, into the details of that area of decision making as it has in other areas. I think there's no question that in terms of our overall responsibilities those I think stood foremost.

COMMISSIONER MARRETT: I see. Commissioner Kennedy.

COMMISSIONER KENNEDY: I just want to add that I would agree with Commissioner Gilinsky's characterization and all his facts except a slight nuance and I think, I think really that's what he was saying as well. There isn't any question in my mind that in the 5 years or 4* years of the Commission's existence that safety has been its primary interest and concern. But it is expressed in a somewhat different way. It has, the Commissioners themselves have not become as directly and personally involved in lesser, if you will, lesser level decisions in the safety area as they have in the others for the very reasons that Commissioner Gilinsky suggested.

PROFESSOR LEWIS: Could I interrupt for a moment? I just want to follow that up. So that in terms of what we're talking about, TMI II plant, we heard earlier today from Dr. Mattson that that plant was exempted from the Standard Review procedure. Now obviously from all we can gather that was to the advantage of the plant owners. So you would never directly deal with that issue because it obviously would not be appealed up to the Commissioner level. Am I right in saying that the only time you, it really would come to your attention is where a plant operator was, or perspective operator, was disturbed that the agency was being tough on him but where a potential plant operator was perhaps getting an easier ride in terms of the agency itself? You would really not be aware of that at the Commissioner level.

COMMISSIONER KENNEDY: Well, the plant operator is not the only avenue to the Commission, of course.

PROFESSOR LEWIS: That's what I'm trying to find out.

COMMISSIONER KENNEDY: Indeed, as Mr. Bradford pointed out, matters can come before the Commission and indeed are raised with the staff and the Commission is aware of that. From a variety of sources, by petitioning, so it's possible, quite possible, that someone, someone who had been concerned about that particular plant, if he or she felt that an action by the staff or the Commission was not wholly in accord either

with the regulations or with good practice they could raise that with the Commission directly.

MR. MCPHERSON: Was that raised in this instance?

COMMISSIONER KENNEDY: I simply don't recall, Mr. McPherson.

PROFESSOR LEWIS: And who is likely to have that, I mean outside of the potential plant operator and the NRC? Who would really have access to that information of what the arrangement was so that some appeal could be made? I'm looking for public information here obviously.

COMMISSIONER KENNEDY: Anyone in the public who is interested, the information is available because everything is public. And indeed there is a local public document room near the installation in the vicinity to which all relevant documents pertaining to that installation are provided and kept up to date.

CHAIRMAN KEMENY: Could we try to pin that down more specifically? Let's use the example we used with Dr. Mattson. I'm not sure all of you heard it so let me repeat it. According to the standard procedure, which I guess will be in effect for all future plants and was somewhat partially in effect in this transition period, containment isolation cannot depend on one single factor, such as it did at TMI II. On the other hand we were told that the decision was made that plants that were in the process then or already existed would not have

to meet these standards. Commissioner Kennedy, were you aware of this fact?

COMMISSIONER KENNEDY: I must have been but I simply don't recall that, that must have been a grandfathering that occurred some years ago. I simply don't recall it now, Mr. Kemeny.

CHAIRMAN KEMENY: Could I ask if any of you were aware of this grandfathering?

COMMISSIONER GILINSKY: I don't recall it.

CHAIRMAN KEMENY: You see, that's what I suspected you would answer, that's why I asked the question. This is what bothers me.

CHAIRMAN HENDRIE: Let me upset your thrust and say that although I was not on the Commission in 1975, since I had a good deal to do with the preparations of the Standard Review Plans, as a matter of fact, it was quite clear from the beginning of that effort that there would be a number of plants in the review chain that would be grandfathered from one or all of the revisions of the plan.

CHAIRMAN KEMENY: Yes, but still my question would be if a majority of the Commission was not aware of this, it seems to me that this was a terribly important change in safety standards that we now know in retrospect would have made an enormous difference to TMI II and to the health hazards in it. Is there something wrong with the system if a

majority of the Commissioners are not aware that grandfathering had been given on a terribly important safety matter?

COMMISSIONER KENNEDY: Mr. Chairman, may I say something to that. First, I'm, I simply could not testify that I was not aware at the time of the fact that X number of plants were being grandfathered with the inception of the Standard Review Plan. I may well have been, I would hope that in fact that I was, but, on the other side of the question, I'm not at all sure that at that time as one looked at the individual questions whether they would have been deemed to have been such important safety questions, in fact, had they been deemed, at that time, and seen in the light of one who is understanding of the technology and the state of the art at that point, had they been seen to be vitally important safety questions they wouldn't have been grandfathered.

CHAIRMAN KEMENY: Yes, but you see, we are coming from a quite different point of view, we're naive laymen. Commissioner Bradford, you were going to say something.

COMMISSIONER BRADFORD: Well, there is one further point about containment isolation as the specific issue and I'm not sure it's germinated to the general point that you want to make but when Robert Pollard, who is now with the Union of Concerned Scientists, left the NRC in 1973 or 1976 he wrote a letter to the then Chairman naming several issues that he thought were of safety concern in nuclear power plants.

Containment isolation was among those. I have only glanced at the particular paragraph and I have no idea of what the agency's response back and forth was but I wouldn't want to have left you with the impression that, first of all, there are, there was that channel, too, by which an issue could reach the Commission...

CHAIRMAN KEMENY: Is that on the unresolved safety issues list?

COMMISSIONER KENNEDY: No. His was a smaller and more personal list.

CHAIRMAN KEMENY: Smaller and more personal list. Because what I was going to say as we got into it and got staff briefing there I noticed a number of us who knew nothing about nuclear power or nuclear engineering. We just jumped to the conclusion that naturally isolation would take place once a high level of radiation was reached and I at least once horrified to find out that this was not true about the plant and it seems to me that that's the kind of issue I would have thought your Commission would be discussing.

COMMISSIONER GILINSKY: Well, Mr. Chairman, I think that, let me go you one better. Reactor licenses are issued typically without the matter passing before the Commission. Unless there is some appeal it is gone up several steps, which is something that I think ought to be changed. I think it, the Commission ought to pass on every one.

MR. MCPHERSON: Does that include siting?

COMMISSIONER GILINSKY: It may. Again, it depends on whether the matter is brought before the Commission as a result of an appeal.

MR. MCPHERSON: If a local group, I apologize for jumping in, but I was interested, if a local group protests through several layers of appeals and finally gives up or runs out of money, then you would not, the Commission *avenitio*, that's the wrong phrase, but on it's own motion, would not consider the siting question unless someone was up there raising it, is that right?

COMMISSIONER GILINSKY: No, it may. I mean the Commission always has the authority and the right and the freedom to pick up an issue, any issue in any case.

COMMISSIONER AHEARNE: It would be less likely in the absence of someone having raised that issue.

CHAIRMAN KEMENY: Let's see, there were 2 Commissioners. First Commissioner Haggerty.

COMMISSIONER HAGGERTY: I'm somewhat concerned perhaps because of all the questions one gets the impression that the Commission is overwhelmingly involved with what amount to reactive issues. In any complex situation the group at the top has the primary responsibility for worrying about and spending time on the future rather than simply reacting to things as they exist. How does the Commission,

given the very large role that the NRC has to play with respect to all of nuclear power, how does it raise with respect to the future questions of the very structure of regulations, questions with respect to the functioning and design of nuclear power reactors such as this containment vessel as again as they relate to the functions of the NRC and finally such questions of safety in which the containment vessel is a part and I'm not talking about the detailed specifics, but how do you grapple with the future, how do you decide how it ought to be done 10 years from now rather than how it's been done for the past 20?

CHAIRMAN HENDRIE: Well, with a certain amount of difficulty clearly, Mr. Haggerty. As specific issues are brought up and brought to Commissions attention or are generated by Commissioners and from whatever source we'll ask one or another of the staff offices to develop some background, some information on the subject and it will be a subject to Commission discussion. We may or may not take action. The general framework in the reactor safety area has been in place for a few years now and that body of regulations, in particular the general design criteria in the appendix to Part 30 form a reasonable, general framework from which to work and we periodically raise the question or the question is raised to us about review, refurbishing, extension, so on, of particular parts of the Commissions regulations as these age

and current conditions suggest that they ought to be supplemented or changed in some way, that have a current long range effort going on, for instance, with regard to siting which is primarily covered by Part 100 of the Commission Regulations.

COMMISSIONER AHEARNE: One of the problems I had thought existed in the Commission after I got there last August was this lack of, what to me coming out of a much more structured department, the Defense Department, I felt ought to be there. Some mechanism to have the Commissioners or the people at the top focusing on those longer range broader policy questions, making sure the efforts of the agency were oriented to solve problems that we might see coming up many years in advance. As I had mentioned in one of the early questions that's why I hired an individual to begin trying to put that together. I think that is a gap in the way the Commission structure operates, I think it is very much a fact that it's still only 4 years old as an agency and developing that kind of a structure in a regulatory agency is a little more difficult than in a normal type of agency, major funding. But that is a gap in the way we work, there is too much of this, as you say, reactive and not enough of the longer range focus.

COMMISSIONER HAGGERTY: I raise the question, of course, because in all complex institutional arrangements there

are two ways that things happen; what I would describe as peripheral, that is the things that happen because you're there, because of the structure, because of your own case, the law and then the things that happen because you make them happen and, by and large, the future, the future changes the things that need to come into past, the constructive, creative things almost always are dependent on how the groups at the top see their long-range roles. That's the part that I was bothered about.

COMMISSIONER KENNEDY: May I add one thing, sir? That's correct but in mitigation, if you will, going to the relative newness of the organization it came into being very largely because of an intense concern that it be separated from any activity that could be seen to be developmental and that tended, I think, and has tended until very recent days and within the last year or so there has been an increasing attention to looking out and thinking in terms of better design, not just better action with present design. But there was, I think, an inhibition, if you will, built in by this intense concern to separate it from anything that looked promotional or developmental.

MR. McPHERSON: I have a question about that. How does the Commission work so far as design is concerned? Suppose you think that a pressurizer, those of the Michaelson Report that we've been talking about a lot here, had

percolated up to you fellows and you had gotten the notion that the B&W pressurizer was not a, might not give a fair indication of the inventory of water in the core. Would you go to B&W and say build a better mousetrap or would you refuse to license the next B&W reactor that came through? How or what would be the typical way, you don't have your own factory to make a reactor?

CHAIRMAN HENDRIE: More along the latter line, Mr. McPherson. The first thing we would almost certainly do is that to ask the technical staff for an evaluation and a judgment.

MR. MCPHERSON: Well, assuming that that had been done and they said that the danger is there, that Michaelson was....

CHAIRMAN HENDRIE: If they concluded that there ought to be a different form of level indication. I don't think they would certainly, think let us know as an information item but I don't think the staff would come and just stand around until the Commission had deliberated on the matter. They would immediately go and send out notices to operating plants that had that problem and say what are you going to do to fix it and wouldn't license new ones until it was fixed.

COMMISSIONER KENNEDY: They would have set up a performance standard which would have to be met and then anticipate that the, either the licensee, the utility, or the

manufacturer would provide alternative means of meeting that standard.

COMMISSIONER GILINSKY: Well, personally, no matter how serious the matter was. I mean it might be so serious you would decide that the normal reactor with that equipment can operate. On the other hand, if it was less serious you might take another course.

CHAIRMAN KEMENY: Mr. Taylor.

MR. TAYLOR: We've been provided with transcripts of various meetings that were held by the Commission on the days following the, following Wednesday when the accident started and I have a couple of questions about the mechanics of those meetings because I'm somewhat confused now. The cover sheets, the labels that have appeared on these transcripts are 3 types at least of the transcripts that I have seen. One says closed meeting, another says public meeting, and a couple of the meetings don't have any indication of whether they were open or closed, public or closed. That may be that we didn't get all the paper. Now what I'd like to ask is this: first of all, what defines whether or not you are having a meeting, a formal meeting? In other words, when do you say we are having a Commission meeting?

CHAIRMAN HENDRIE: If 3 or more Commissioners gather to discuss business of the agency in any fashion, it's a meeting, under the Sunshine Act, unless the circumstances are

for instance, as they are now. We are all here but this is a public meeting and it's a proceeding of the, your Commission. Similarly when we go to Congressional hearing we'll all sit there together but that's not regarded as a Commission meeting to fall under the requirements of the Sunshine Act. The distinction is important because if it is a meeting under the Sunshine Act then we have to have a record of the meeting. It has to be announced, either that or we have to vote a short notice meeting for emergency reasons, transcripts have to be kept and so on.

MR. TAYLOR: I'd like to ask, does that become troublesome mechanically, let's say on the days, particularly Friday and Saturday after the accident when you were all, at least many of you were...

CHAIRMAN HENDRIE: I'd get half mad.

MR. TAYLOR: close to each other and the question is this: do you find yourselves actually having to avoid a situation where there are 3 of you in a room?

CHAIRMAN HENDRIE: Sure, you'll come to someone's office and look in and they'll be in there with one of your colleagues and you say oops, sorry and turn around and go.

MR. TAYLOR: I understand. Now on....

CHAIRMAN HENDRIE: And I'll say with regard to these transcripts that it seemed to us that observance of the protocol of Commission meetings was a good deal less important

than the public safety and whatever contribution we in our discussions could make to it and we went ahead and talked to each other as we felt necessary and member of the secretariat and the council's office and the historian's office tracked us all around with portable recording equipment and made such transcripts as they were able.

CHAIRMAN KEMENY: Chairman Hendrie, I think Professor Taylor is probing in the opposite direction, not criticizing you for the nature of your transcripts. I think...

PROFESSOR TAYLOR: No, not at all.

CHAIRMAN HENDRIE: Nor was I really apologizing for them. I think some of them are very interesting.

CHAIRMAN KEMENY: Could I ask you a very pertinent question, because you have no choice but this commission at least has the right to make certain recommendations.

CHAIRMAN HENDRIE: Just so.

CHAIRMAN KEMENY: Should one consider a recommendation that in an emergency situation a commission such as yours should have certain exemptions under the Sunshine Act?

CHAIRMAN HENDRIE: I think it would be helpful, frankly.

COMMISSIONER AHEARNE: Commissioner, before you reach that conclusion I think you should work through what ought to be this structure of NRC responding to a crisis.

CHAIRMAN KEMENY: I quite understand that. I

believe he's only probing whether you felt that the requirements of the Sunshine Act really were a hinderance to you because we sort of have the impression that it certainly didn't help.

COMMISSIONER BRADFORD: I'm not sure.

CHAIRMAN KEMENY: You're not sure?

COMMISSIONER BRADFORD: It certainly didn't help in the form that we were in. But I think what you face and I don't know what my own conclusion is yet is balancing. That is there may be a considerable amount of public understanding of what was involved in 3 Mile Island, including your own commission's understanding that will laminate from the existance of those transcripts.

MR. TAYLOR: I'd like to follow that particular point, Commissioner Bradford, in this sense. As I understand it, all of you more or less at the same time Friday morning became aware of the probable fact of very serious core damage, high temperatures, uncovered core, and the existance of hydrogen, or at least the possibility of an explosion, which is generally a rather scarey blue of situations. Now, given those circumstances, you then found yourselves, a good part of the time I gather, having meetings in the sense that there were three or more of you together. And in the course of that, trying to put myself in one of your shoes, it would seem to me that there would be bound to

to whoever wants to look at it. What's the difference between what you formally call a public meeting and a closed meeting?

CHAIRMAN HENDRIE: I assume for an open meeting the transcript goes to the public document room as soon as it's prepared. She's typically typed within twenty four hours.

COMMISSIONER KENNEDY: I would want to add, Mr. Taylor, that I think I'm correct is that a public meeting does not require a transcript. We have elected as a commission to do that as a further effort and openness in our process on the assumption that people might have an interest in our proceedings who were not physically able to be present. And so we have elected to make transcripts, verbatim transcripts, of our meeting, our open meetings, our regular meetings. But that is not required. For a closed meeting, it is required.

MR. TAYLOR: It would seem to me that, particularly in the circumstances after the accident, those few days, let's say the first week after the accident, that there would be times when you would want to assure that during a public meeting, as I understand it, members of the public can actually be present, essentially walk in and sit down, I presume. And my question is this - did you find yourselves having to decide prior to, for example, the April 4th public meeting, that there were certain subjects that you simply

come up situations in which you, with the public safety and welfare in mind, would have certain pieces of information in your head which you thought should not be released to the public, should not be available to the public, should not be made available, should be kept close. There are indications of that in the transcripts of a couple of the closed sessions. I don't want to get into that in detail now, but I want to start off by expressing a sort of sense of sympathy for the idea that there would be certain things that you, as individuals, not necessarily collectively, thought would be best withheld from the public. I would imagine that there would be a very wide spectrum of feelings about what should be told formally, through a press release or whatever mechanisms you use, and what should be carefully withheld. Yes, Commissioner Bradford?

COMMISSIONER BRADFORD: Two points. One, remember that the meetings themselves were closed and the tapes were not made public until we felt that the purpose served by having closed meetings in the first instance would not be frustrated by the release of the tapes. So that it isn't everything we said were being made public the next day. As long as one can control the timing of the release, that concern diminishes.

MR. TAYLOR: Well, that gets into a strictly mechanical question. What is the difference so far as the timing of the accessibility of the transcript of the meeting

would not discuss? And did you have any discussion of those subjects? I don't want to get into the specifics of what those subjects might be at this stage. I think we will perhaps if it turns out to be a problem for you, mechanically, here. I don't want to get into that.

CHAIRMAN HENDRIE: I don't recall a, that there were things that we wanted specifically to go unmentioned or and I certainly don't recall that we met on it.

MR. TAYLOR: Are you saying that none of your closed sessions, was there any statement to the effect that any of the information being discussed or documentation available should not be released to the public? Let me say that...

COMMISSIONER AHEARNE: Certainly there was during some of the closed meetings.

MR. TAYLOR: But that's what I'm getting at.

COMMISSIONER GILINSKY: There were closed meetings and I understand, although I think it probably is a good idea to take another look at the Sunshine Act, I don't remember either our movements or discussion being hampered. The way all this worked is that we just went about our business and the secretary followed us around with tape records.

MR. TAYLOR: Did you go about your business uninhabitedly whether or not it was an open or closed meeting?

CHAIRMAN HENDRIE: Yes, I think...I think the answer is yes. Why don't you ask another question and see where you...

MR. TAYLOR: My question is whether you found yourself inhibited, that certain things that occurred to you that you wanted to inquire more about from the staff. I think, particularly, the April 4th staff briefing in which you were presented with...this is the week after the accident and presented with the sequence of events and I believe that you were presented with at least a first cut at what sort of major things that went wrong were, I believe there were six of them. During that meeting, did any of you find yourselves inhibited in discussing any aspect of the accident because, let's say at that meeting? That's right, Commissioner Bradford.

COMMISSIONER BRADFORD: I just don't remember that one meeting clearly enough, but my instinctive answer would be not for two reasons. One, during almost all of those days, and I would assume the fourth was one of them, we had a closed meeting in the morning during which we could discuss matters of concern and we would have had one, I think, on the fourth and probably on the day following as well. There are enough other ways to pursue particular questions, either individually with the staff or in closed meetings ourselves that I don't think great inhibition arises. Secondly, it's a matter of no great complexity to close a meeting if it's under any one of the exempt categories from the Sunshine law. The structure of the law is basically that our meetings are open unless they fit one of several categories and can be closed. Sometime on

Friday morning, if I remember right, we voted to close these meetings on 3 Mile Island until further notice. So in effect, we had a continuing closed meeting from then on. That is a very easy procedure to do. An open meeting simply means that we hold it in the big conference room like this, put up a notice that it's happening, and the public can attend. The distinction between open and closed has nothing to do with whether or not a tape is kept, it is solely as to whether the public is able to attend the meeting.

MR. TAYLOR: Well, in connection with both the closed and open meetings, our commission, the Kemeny commission has been supplied with a set of transcripts. I have no basis for knowing whether these are all the transcripts that had been made. Some of them were, I guess, transcripts of tape-recordings that were asked for by, I believe, the Udall Committee. And I read all of those which dealt with Friday, Saturday, Sunday, Monday, Tuesday, I believe Tuesday, and Wednesday following the accident. And, quite frankly, was very surprised at the lack of quantitative discussion about in particular, the state of the fuel in the core. There was nothing that I found, and I have to say I read these rather quickly and in places I skimmed them, because I was looking for one particular thing. And that is the extent to which you were in either type of meeting discussing the implications of so many thousand cubic feet of hydrogen, or thousand cubic

feet of hydrogen at a certain pressure, how much hydrogen that corresponded to, whether that had been produced by the zirconium water reaction, how much zirconium was involved, how much fuel that involved. In other words, there was no, at least I didn't see in what I read during those about four hours last week, any indication of the basis really for the concern that we've all expressed on Friday, with perhaps one exception. And that is there was a lot of discussion, I believe on Sunday, of peak pressures that might be achieved might be the result of an explosion inside the pressure vessel. In so far as the fuel is concerned, the state of the fuel, whether it was in a form where it might block any effort to try to cool it convectively, I found in at least what I read, no discussion of that. Now, I find it hard to imagine that there weren't intensive discussions of just these questions quantitatively and how much of the core lost its cladding. In fact, the connection between hydrogen and zirconium wasn't evident in at least what I read of the testimony. So, I guess one of my questions is how were these really detailed questions discussed among the commissioners during this period, particularly Saturday and Sunday. And let me say most particularly Sunday morning before the President of the United States physically committing himself took off or whatever he did to go to 3 Mile Island. It seemed to me there were a lot of issues that bore directly on the

whole matter, for example, of the evacuation question which is as I understand it was somewhat up in the air Sunday morning. It was a question to what extent...let me put this as a specific question and that is did the fact that the President was scheduled to visit 3 Mile Island Sunday afternoon have any direct affect or indirect, but closely couple the fact, with your deliberations about whether to recommend to the Governor an evacuation? And let me say I'm not thinking in terms of concern for the President's safety, personally, but rather whether or not it would be inauspicious for a recommendation from the NRC to the Governor to evacuate, to become public, which it certainly would if it were a decision to evacuate, at about the time the President arrived at the site. Did that enter in into your discussions?

CHAIRMAN HENDRIE: I would not have thought so, but let the others answer since I was at 3 Mile that day.

COMMISSIONER BRADFORD: No, sir. Unequivocally not. I can't remember exactly when I learned that the President was going, but it certainly wasn't something that I knew on Friday or on Saturday. I think, I would guess that I probably learned it sometime mid-morning Sunday.

CHAIRMAN KEMENY: Then how about the earlier question that Professor Taylor got away from. Did you have quantitative discussions, you know, the dangers.

CHAIRMAN HENDRIE: To some...I can recall discussions

about the probable condition of the fuel, about evolution rates, some of the early estimates that came up of evolution rates, net evolution rates of freoxy, which I haven't subsequently found in the transcripts of the Friday, Saturday, the things that have been typed up. I'll just speculate without knowing for sure that the secretariat and the people who were trying to record these conversations were not 100% successful. That is that there may very well have been discussions between three or more commissioners that are not reflected in their transcript material.

COMMISSIONER KENNEDY: Perhaps for the simple reason, they ran out of tape at some point and the machine went off.

CHAIRMAN HENDRIE: And if a phone call came through and there was one commissioner with me and another one in the outer office and there was something that we needed to talk about, I'd say hey, and the three of us would talk about it and the fact that the secretariat hadn't arrived yet with the taping machines, I didn't regard as a legitimate reason not to deal with something that seemed urgent at hadn. I'll also comment in addition to the fact that I think there's a fair possibility that some discussions were not taped at all. That the conditions for recording were not auspicious and my impression is that the transcribers ability to get off the tape everything that was said isn't all that great in these

circumstances, so I think particularly the numerical stuff seems to have come through either not at all or very poorly.

CHAIRMAN KEMENY: I see two other commissioners wish to comment. Commissioner Bradford and then...

COMMISSIONER BRADFORD: I agree with everything that Joe has just said about the taping and the conditions. But beyond that, I think there's rather more in the transcripts of those three days than you allow for. I think at the last sixty or seventy pages of the Friday transcript, if you start around Page 40 on the Saturday transcript and Sunday afternoon transcript that you've already alluded to, are largely the types of discussions I would have said that you had in mind, except that they had to do more with the oxygen hydrogen concern than with the question of whether the state of the fuel rods would prevent coolant. And I think that was simply because one was concerned that the oxygen hydrogen mixture, if in fact that had been a problem, could have lead to a much quicker release of serious radioactivity than the discovery that the core was simply not cooling itself adequately.

CHAIRMAN KEMENY: Commissioner Ahearne wanted to comment also.

COMMISSIONER AHEARNE: I just wanted to comment not in the student of the transcript so I can't address that specific question, but on Sunday, which is the one time I

can recall any detailed discussion primarily focused upon the amount of oxygen, amount of hydrogen, what were the burn rates, the combustion rates, and the production rates. That was the time when the Chairman was in Pennsylvania, so we're automatically down to four. Commissioner Gilinsky was not there part of the time. I was not there part of the time. So I think one of the things you'll find is whenever it got down to two, there was no transcription.

MR. TAYLOR: I would like to ask this general question then. During those days up through, let's say, Wednesday, the week following the accident, was there an agreement between the commissioners formally or informally with respect to certain knowledge of the accident, any aspect of it whether it had to do with radiation dose levels perceived to exist off site or the state of the core or the possibility of a hydrogen explosion that you agreed you, with the public interest in mind, should withhold from the public and not release?

ALL: No, sir.

CHAIRMAN HENDRIE: Not that I know of.

MR. TAYLOR: I'm sorry. Do you all agree to that?

COMMISSIONER BRADFORD: Could you state the second half of that again? That is...

MR. TAYLOR: I'm not sure I can remember it.

COMMISSIONER BRADFORD: That is the timing, I think,

matters that were some...

MR. TAYLOR: No, at the...let's say, at the time when you knew it, were there any pieces of information that you did not, I don't mean as individuals, but collectively in the collegiate sense, agreed that should not at this time be released to the public?

COMMISSIONER BRADFORD: I think that in particular the evacuation matrix was not made public immediately.

COMMISSIONER GILINSKY: I'm sorry. I understood you to be asking whether we were not discussing certain matters or agreed not to discuss matters.

MR. TAYLOR: Well, I guess I've had two lines of questions. One is what the general character, which we're discussing at the meetings, and I don't want to probe that any more. But the specific question is whether there were specific items of information of an important sort concerned with the accident that you decided should, the release of which should, be withheld for any significant time.

COMMISSIONER BRADFORD: If you mean details of what was going on in the reactor...

MR. TAYLOR: Yes, yes, that's correct.

COMMISSIONER BRADFORD: ...then I would agree that the answer was no.

COMMISSIONER KENNEDY: Also, Mr. Taylor, one of the reasons for closing some of those meetings was in order

that we could discuss the question of the need for or no need for an evacuation to arrive at a conclusion as to what recommendation we might wish to make to the governor. Now, obviously, we, in the circumstances, believed any discussion of that kind ought to be held to ourselves until after such time as we had made any recommendation to the governor. But that I think is different from what you're talking about.

CHAIRMAN KEMENY: Commissioner Ahearne.

COMMISSIONER AHEARNE: One thing that might fit in that category, there was a time on Sunday when I had wanted to make sure that some information we had was really accurate information that had been generated in Bethesda and before release I wanted the people in Harrisburg and 3 Mile Island to have had a chance to look at it. That's the only scientific time I can recall.

MR. McPHERSON: Could I just ...

CHAIRMAN KEMENY: Yes, just one question and then Professor Pigford question.

MR. McPHERSON: Related to that, we asked Mr. Denton yesterday what his philosophy was as far as what he said in Harrisburg and he said it was candor which is commendable. But the question that would recur would be what would you say, Mr. Denton if you had recommended evacuation as he said he did, but no decision had been made by the Commission. And you were asked at that point when you had recommended it by press in

Middletown, How are things going? What is he going to say? Should he say, "I have recommended evacuation, or should he say, "Things are fine?" or "No comment." Did you give him any guidance as to how he should handle matters like that?

CHAIRMAN HENDRIE: No. what we agreed as Harold went down to the site, we agreed, in fact, after he was down there, that he would be the spokesman for the agency and I guess the power company after a while decided they let Harold talk for them, too, rather than having multiple information sources. He was obviously, he did not go down with specific instructions, don't talk about this, you can talk about that. As a senior officer of the Commission, I think he's, was very well aware that in a situation like that where the very high tension in the public that you try to tread a very narrow line. You would like to make, be as candid as possible and make as much information as you think is reliable available as possible. On the other hand, you really ought not to get drawn off into more speculative areas and perhaps lead to a panic or near panic situation where there's no valid justification for it and you know, I think he attempted to keep a reasonable balance in this press conferences.

MR. McPHERSON: But the answer is you relied on his good judgment in that regard.

CHAIRMAN HENDRIE: Sure.

CHAIRMAN KEMENY: Professor Rigford.

PROFESSOR PIGFORD: I would like to try to focus a narrower area of questioning for a few moments. I'm interested in what the role of the Commissioners was on March 30, 31 and April 1st. Dr. Gilinsky, Commissioner Gilinsky said we were going about our business but I want to know what your business was, was this some special role that the Commissioners have in the case of emergency and, before you answer, in reviewing the testimony, I'm sorry, reviewing the records of those days, it appears that there were 4 things going on and I'd like to see if you think these are correct. One, you were receiving information from your site representatives, like from Denton and Dr. Mattson. Two, you were discussing what advise to give to the Governor regarding evacuation. Three, you were discussing some press releases and Four, you were working out evacuation plans. Now was this the role that the Commissioners were supposed to be taking in this accident situation?

CHAIRMAN HENDRIE: Well, I think the Commission got drawn in because of the severity of the accident and as the senior management entity of the agency inevitably had to answer a lot of questions and deal with a lot of things that for a lesser incident would have been handled by the Executive Director and the Emergency Management team at the response or under our more normal emergency planning guideline but Governors wanted to talk at least Commissioners and Chairmen

rather than staff members if possible and so the Commission inevitably got drawn in.

PROFESSOR PIGFORD: Excuse me, maybe because of my questioning unfortunately did, was not specific. Has there been in the past any thought on of what the role of the Commissioner should be in a case like this and was that being implementing?

CHAIRMAN HENDRIE: No.

PROFESSOR PIGFORD: Yes, Commissioner Bradford.

COMMISSIONER BRADFORD: I have perhaps a slightly different impression. My impression of the emergency response plans was that they specifically excluded a role for the Commission probably on the assumption that accidents would move more quickly than this one did and that the fundamental decisions would have to be made on the site between the site and the Governor's office at most between the response center, the site and the Governor's office and what in some ways is, was unusual about this accident was that its duration was such that the Commission became involved in a way that the response planning did not contemplate. What the Chairman is certainly true, that is, there had not been discussion of the Commissions, of how the Commission should act. My impression is because that it's because a decision had been made that in fact the Commission would not act in an emergency situation.

PROFESSOR PIGFORD: Yes. In the previous planning

of emergency actions, weren't these 3 functions all ready designated for some other group, like advise to the State and like development of press information and working out evacuation plans?

CHAIRMAN HENDRIE: Yes.

PROFESSOR PIGFORD: Yes, now the kind of accident that licensing normally considers is a loss of coolant accident which is a far more severe one than this in terms of actual releases and I'm surprised to hear from Commissioner Bradford that it had been expected that kind of accident would be over with a lot quicker, namely, you have indicated this one lasted longer. Did I misunderstand you?

COMMISSIONER BRADFORD: Over with quicker, if I said it, would have been a poor choice of words but that the decisions on whether or not, is my impression. Well, but the decision as to whether or not to evacuate was conceived of as one that might have, might well have to be made very quickly without the luxury of chains of telephone calls, luxury or drawback, whatever from the site to the response center, to Bethesda and back and therefore the planning had conceived of this decision being made without the involvement of the Commission.

PROFESSOR PIGFORD: You're saying that the possible evacuation decision times in your normal analyses at the loss of coolant accident do not include this time period?

COMMISSIONER BRADFORD: I'm saying that they contemplate the possibility that the decision would have to be made much more quickly.

PROFESSOR PIGFORD: And also much more later to, don't you think?

COMMISSIONER BRADFORD: Conceivable.

PROFESSOR PIGFORD: I think this is a matter of fact. Don't the emergency plans as spelled out in licensing, including your criteria of the licensing, go from an early evacuation as short as two hours to a later evacuation of much longer time than was dealt with here, Commissioner Bradford?

COMMISSIONER BRADFORD: I have not reviewed them in that detail. I'll take your word for it.

CHAIRMAN HENDRIE: Let me try to help, Professor Pigford. Yes, that's generally true for the design basis loss of coolant accident. The containment is at pressure and has got mad fision products in it literally and in seconds certainly a minute or two. So that if any action, protective action, is going to be taken you know you've got a problem practically immediately and presumably it's taken immediately. The emergency plans, I guess, do allow for longer running situations and certainly our response plan in terms of putting the response center the emergency management team its backup functions in place does contemplate a variety of incidents some of short time sequence and others of longer time sequence