UNITED STATES
NUCLEAR REGULATORY COMMISSION

In the matter of:

THE HYDROGEN CONTROL MEETING

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Room 1130, Eleventh Floor
1717 H Street, N.W.
Washington, D.C.

Tuesday, March 19,1980

The Commission met, pursuant to notice, for presentation of the above-entitled matter, at 3:32 p.m.

BEFORE:

JOHN F. AHEARNE, CHAIRMAN

VICTOR GILINSKY, COMMISSIONER

PETER A. BRADFORD, COMMISSIONER

JOSEPH M. HENDRIE, COMMISSIONER

PROCEEDINGS

CHAIRMAN AHEARNE: The second meeting is a meeting to discuss the Proposed Interim Hydrogen Control Requirements For Small Containments. We have a paper in front of us. Also, in addition to hearing from the staff here, we will hear from two other groups that had requested time and other people who have been invited. We will hear later from General Electric and Yankee Atomic. Welcome, the floor is yours.

STATEMENT OF RICHARD DENISE, ASSISTANT DIRECTOR FOR REACTOR SAFETY, OFFICE OF NUCLEAR REACTOR REGULATIONS

MR. DENISE: Good afternoon. My name is Richard Denise. I am Assistant Director for Reactor Safety, Office of Nuclear Reactor Regulations. The next viewgraph --

CHAIRMAN AHEARNE: I notice, Dick, that the issue is sufficiently controversial that you are here without the support of Harold and Ed, Bill.

MR. DENISE: I do not think it is a matter of controversy; it's a matter of need.

COMMISSIONER BRADFORD: Who doesn't need whom.

[Laughter]

CHAIRMAN AHEARNE: Go ahead. I'm sorry.

COMMISSIONER HENDRIE: It's a practice when a detached force moves through hostile country to put some forces out there to draw fire so the main body can see whether to move forward or back at that point, then the "heavies" will come up.

[Slide]

MR. DENISE: I'm always the point. This will be a two-part presentation. I will summarize the information presented in the staff paper 80-107, I think it is, entitled, "Proposed Interim Hydrogen Control Requirements For Small Containments."

Jim Norberg of the Office of Standards Development will then provide information on the status of rulemaking related to degraded core conditions, focusing specifically on the proposals for hydrogen management in containments.

The objective of the staff paper is to provide the technical basis for the staff's conclusions, that all BWR Mark I and Mark II Containments should be required to be inerted and that continued operation and licensing of other nuclear-power plants can be permitted pending completion of rulemaking proceedings to develop revised criteria for hydrogen management and other aspects of degraded cores.

CHAIRMAN AHEARNE: How many of those are there now operating?

MR. DENISE: There are not any Mark II's operated, therefore, none inerted. There are, I believe, 22 total

Mark I's, not all are presently operated. I think there are probably 18. All of their cores are inerted except two, Vermont Yankee and Hatch II.

COMMISSIONER GILINSKY: You are really talking about inerting two?

MR. DENISE: And the Mark II's will be coming along the line.

CHAIRMAN AHEARNE: How man· are there?

MR. DENISE: I do not know the number on the Mark II's. I think there are about 11 Mark II's. The first Mark II will come up for fuel load according to the present schedule in July 1980. That may be subject to some slippage.

COMMISSIONER GILINSKY: When was the decision taken to inert the Mark I's?

MR. DENISE: Probably in the prehistoric, as far as I'm concerned.

COMMISSIONER HENDRIE: It goes so far back. It goes back to let's say 1960 - '69. As far as I know, I'm about the only engineer still alive who was practicing at the time. It was a hydrogen - the hydrogen problem work question. We thrashed around and thrashed around about what to do about hydrogen evolved from zircoid water reaction.

There was a staff position fall-out over the number of position - versus -- a fall-out over a number of years that said 5 percent water reaction, that given of hydrogen, so the small containments had a problem. And the inerting was a solution to that -- not one that the operators were especially fond of, I must say.

COMMISSIONER GILINSKY: Somehow the other two were able to show entry when Vermont came down the line. That is a fascinating story. I guess it is all dead and gone now, so we can talk about it. But Vermont came down the line, on the staff side. We sort of assumed, of course, they will inert the Mark I. All the Mark I's are inerted, and what the heck.

But when Vermont presented its case to the licensing board, they laid out a case why it would be a bad idea to inert and why the safety balance lay the other way. The staff -- I guess what we did was just got them to concede that if we required it they would do it, or something like that. And we didn't bother to make a case in the hearing.

That went along fine; then the Appeal Board got "quarmy" about it and said, "Well, the applicant has made a case that it shouldn't be inerted, and the staff hasn't made any substantive case that we can see that it should be inerted,"so that is where the balance of the evidence lies before the august bodies, and no inerting.

So we then went to an appeals hearing on the thing, which was my only appearance, I will note, as a witness on behalf of the regulatory staff. And we lost.

[Laughter]

COMMISSIONER GILINSKY: I was getting ready to leave anyway. Things were complicated because at the same time, we were arguing that Vermont had to inert in order to be like all of the other Mark I's, I was also arguing that the hydrogen regulatory guide had been revised and had a whole revision laid out, and was fighting that through. We had a great time down there with the Appeals Board, where I explained to them, Yeah, you know, on the one hand, and on the other hand, and so on.

Anyhow, they came down against us; but the Commission, which in those days clearly had a vision beyond the rest of us, reached down and saved the staff on that case. However, we never did go back and fight back down the hearing line; though Vermont had made its case, and we just left them alone and they never inerted.

I guess Hatch got away on the same "wagon" by coming along and saying, "You know, we go with Vermont," and I don't know what we did.

MR. SCINTO: If that unit came on about the same time the 44 was in process, if it had been promulgated -- it came on in '44.

COMMISSIONER GILINSKY: Were they found to have a problem with 5 percent no water reaction at the design pressure of the containment or at some higher level.

COMMISSIONER GILINSKY: The problem was not directly a design-pressure one. It was that in those days we were very loath to see detonable mixture in the containment. In fact, we were very loath to allow a flammable mixture in the containment on the basis that if it flammed, or more particular, detonated, that it was going to be very hard to assure containment integrity.

That is, if that was a whole range of loadings which we then have to argue about, calculate and do some model tests and a whole series of things. And the ACRS attitude and the staff attitude as well was, "Let's just stay out of that regime." So it was less a design pressure than detonation loadings on uncertainties.

In the decade since then, and I think the staff seems a little bit more cheerful about the structural effects and the ability of the structure to staffing, because they've decided that with a certain amount of degrading, they can stand some burning on occasion.

MR. DENISE: Have I provided you an adequate answer, or do you want me to add to that?

COMMISSIONER GILINSKY: You've done very well.

[Laughter]

MR. DENISE: This briefing is in response to some request, and my presentation was designed to summarize and clarify, and to some extent amplify, the information provided in the staff paper.

The staff does seek your view and actually seeks your specific approval for its recommendation and its position, and if not, then we hope to attain some guidance for whatever future work we might do.

I think it would be helpful at this point to establish some basic perspectives on what we are looking at. It is abundantly clear from the staff paper that we are viewing this matter primarily from the perspective of TMI-2 accident.

This perspective should not, however, be construed as a narrow perspective that is tightly coupled to the details of the two TMI-2 accidents. We are simply saying that the TMI-2 accident involved a metal-water reaction, and hydrogen reaction well in excess of the amounts presently used to establish containment-design bases; and that this experience, that is, the TMI-2 accident, tells us rather forcefully that we ought to reconsider our position on the design requirements.

In addition, the accident assumptions that are given in Section 3.1 of the staff paper should not be interpreted as establishing some new staff position on what is a proper design-basisaccident.It is provided only to illustrate how, at what rate and with what timing the metal-water reactions might have come about.

It is definitely not a "straw man" set up for the vendors or the utilities to knock down on the basis of its conservatism or claims that it is not applicable to their reactors.

We recognize that this particular analysis is simple and conservative, but we have not founded our recommendations on the details or the precision of the analysis.

Our basic perspective is that the TMI-2 accident involved metal-water reaction in the 30-50 percent range, and that this accident is a significant data point. We are confident that the already-planned modifications to reactors in and their operation significantly reduce the probability of degraded core accidents.

We are also convinced that the best way to develop a proper course of action in the future is to have extensive studies performed by the best people available and rulemaking proceedings to decide in a very deliberate way, what should be done.

In spite of these convictions,however, we felt compelled to investigate how a variety of containment designs would cope with the postulation of metal-water reactions significantly beyond the present design basis, without insisting that it be the same as the TMI-2 accident in order to identify any obvious problems.

COMMISSIONER GILINSKY: What is the present basis? 5 percent?

MR. DENISE: The present design basis is as follows. You use the regulation to calculate the amount of metal water that react under ECCS conditions. That amount is not allowed to be, that calculated amount is not allowed to be overall more than 1 percent of the zirconium clad.

You then use whatever number you get from that analysis, not more than 1 percent, and multiply it by 5 to get the amount of metal water used to derive the hydrogen which goes into containment.

So that could go up to 5 percent. It will run from about 1 1/2 to 4 percent normally, depending on the design and the analysis. It is that basis that is used, or I could say, maximum use for containment design is about 5 percent.

COMMISSIONER GILINSKY: I must say I have some difficulty with your argument that one ought to use less than what was actually observed at TMI.

MR. DENISE: I hope I haven't made that argument.

CHAIRMAN AHEARNE: Your paper doesn't.

MR. DENISE: I haven't made an argument that we ought to use less than what was used at TMI. I say what we use, we ought to determine from a very deliberate process of examining what should be a proper design basis, what should be a proper metal-water reaction.

We haven't gone through that process. That is what we have been referring to as rulemaking proceedings. We have said if in the interim, when we look back and we look at the plans, is there anything that jumps out and says, "You are so far away from the TMI conditions, which I characterized as a significant data point, that you ought to do something about it."

And we have come down and said that we think we ought to do something about Mark I and Mark II containments because they are very far away from the TMI-2 data point.

COMMISSIONER GILINSKY: I thought you said a moment ago one oughtn't necessarily use the numbers that one observed at TMI, and at least in the paper, and I thought you just repeated it, that measures have been taken since then which reduce the probability of anything of this sort happening again.

MR. DENISE: Let me clarify those two points. The first part, I was referring to the specific accident scenario that is identifies in the staff paper. That scenario says that we have a complete failure of ECCS for some interim period; and that, given that scenario, we use it to show how metal-water reaction and hydrogen generation might come about.

What I have said is that that example of a calculation under a set of assumptions should not be interpreted to mean that that is the staff's position on a proper design-basis accident. I think we need more work in that area in order to determine what is proper.

I also said that we shouldn't freeze on the TMI-2 accident, and its precision as it is understood in that particular scenario. Also, as the design-basis accident, I think it is obvious if we did that we would let all BWR's escape from the start on it.

So I'm saying, let's not tie ourselves at this point to a specific accident scenario, or to the TMI specific accident scenario, but let's look at the general characteristics of this problem, and do two things: Decide to do something about them in the short term, if it appears that's necessary, as it does to us; to do something in the long term, to find out what is proper in the long term.

COMMISSIONER GILINSKY: But when you're all through, you have to assume some degree of metal-water reaction to get an idea of how much hydrogen you are going to have to deal with.

MR. DENISE: Yes, sir.

COMMISSIONER GILINSKY: As I understand your paper, you are proposing that for some of the reactors, when you are using a number less than that that was observed at TMI.

MR. DENISE: Yes, that's true. We are proposing judgments that way for the time being, let us not make all the reactors assume 40 percent metal-water reaction, as was the nominal experience at TMI-2 as we presently understand it. In that context, Commissioner, you are correct.

COMMISSIONER GILINSKY: On the supposition, measures you have taken since then, make that sort of event unlikely -- or what?

MR. DENISE: I don't believe we've done enough work to say anything except the measures we have taken made a very similar effect more unlikely. I do not know that we have examined measures or taken steps to make all similar events particularly in the end point, drastically less probable.

COMMISSIONER GILINSKY: When all is said and done, you are proposing that we not protect it against a degree of core damage that was observed or that was reached at TMI?

MR. DENISE: I'm proposing that we not do that today or this week.

COMMISSIONER GILINSKY: Right.

MR. DENISE: Yes.

COMMISSIONER GILINSKY: Okay.

MR. DENISE: I'm saying that we need to know more about what that proper level is. But you are correct. I am not proposing that we adopt 50 percent, 30 percent or 40 percent as the number used.

CHAIRMAN AHEARNE: For the immediate actions?

MR. DENISE: Yes. For the immediate actions. Perhaps this speaks to it a little bit. In our evaluations it is clear that we attempted to reach a balance to safety judgment and recommendation with respect to inerting. Since all but two BWR Mark I containments have been successfully operated with inerted containments, the recommendation to inert because of the potential for hydrogen release does not fly in the face of other safety considerations or uncertainties.

We believe that a similar situation will prevail for BWR Mark II containments even though none are yet operating. As for the BWR Mark III containments, none of which are presently operating, and the ice condensors, of which three are now operating, we come down on the side of more intensive study before the decision to make the present safety bases are made.

This position is based on consideration of the capability to survive metal-water reactions and the potential safety degradation associated with those designs.

COMMISSIONER BRADFORD: What are the three ice condensors?

MR. DENISE: Cook I, Cook II, Sequoia I. As a final note on this production, you need to be aware that we did not do an outstanding job in this staff paper in putting forth the views of others. We did note the ACRS views but these are in fundamental agreement with our views.

We have spoken to the General Electric staffing management on the staff on two recent occasions, but did not agree with their perspectives or their conclusions, at least not to the extent of changing our fundamental conclusions that the BWR Mark I and Mark II containment should be inerted.

We've seen the recent letter from Mr. Braid of General Electric and Chairman Ahearne, but we haven't changed our fundamental views even though we agree with some of the points made.

As Mr. Braid pointed out in his letter, the ASLB was very concerned about the reduced inspections capability brought on by inerting the Vermont Yankee Plant. The Atomic Energy Commissioners themselves recognized that inerting was a complex technical issue needing study, and an added safety of inerting carried countervailing risks. Finally --

COMMISSIONER GILINSKY: Can I take you back a moment to the ACRS view. ACRS says, "It also recommends that special attention be given to making a timely decision on possible inerting measures for ice condensor containments."

MR. DENISE: Yes, sir.

COMMISSIONER GILINSKY: What are these interim measures that you believe are responsive to that?

MR. DENISE: I would have to say that the interim measure largely involves a study to see what is the proper thing to do. I will get to some interim measures which are possible, which we haven't reached any decision on, primarily.

We view the ACRS comments as saying it is clear on the face of it that ark I's and II's ought to be inerted. Secondly, there are some other types of plants out there that need some attention, and you ought to get on to it expeditiously.

CHAIRMAN AHEARNE: Did they give you any specific measures to consider?

MR. DENISE: No. I would endorse the view that we get on with this as expeditiously in examining these things. I personally am afraid this rulemaking might drag out longer than is warranted.

Finally, our own Probablistic Assessment Staff recently concluded and told the ACRS, among other things, that,one; inerting appears to have small value in reducing overall accident risks. This was, by the way, October 1979. Hydrogen control measures that may be adopted pursuant to TMI-2 should have benefit of overall risk based insights in context. And number three, WASH 1400 emphasize core meltdown accidents.

The risk-reduction benefits of current licensing hydrogen control measures for such accidents appear small. In summary, the Probabilistic Assessment Staff says from their perspective, looking at core melt accidents, the money is not well spent in inerting containments, then you ought to do something else with it.

COMMISSIONER GILINSKY: Let me understand that point. They are not saying that inerting is not effective in reducing the risks from hydrogen burns or detonations. They are saying this isn't . something that one ought to be worrying about, at least at the top of one's list?

MR. DENISE: I don't think it is the same point, quite that way.

COMMISSIONER HENDRIE: I think the key point is that if you get enough hydrogen so you need to be inerted to keep from blowing the containment apart, you probably got enough core damage so you are going to see it out the bottom pretty quick anyway.

In that case, probably a filtered vented containment which assures that the eventual breach of containment is either controlled out the filtered vent, or down into the ground, reduces the consequences, the casualty list by many orders of magnitude.

COMMISSIONER GILINSKY: That wasn't the case at TMI.

COMMISSIONER HENDRIE: That wasn't the case at TMI.

MR. DENISE: Can I try that a little different way. I've discussed this with the Probablistic Assessment Staff, and it seems to me that they are saying that, for the dominant scenarios that they examined in WASH 1400 for BWR's, that in many cases -- in fact, in most cases, we are faced with containment failure from other causes before you are faced with containment failure due to hydrogen generation.

You are faced with containment failure due to over-pressurization because the scenario includes loss of heat-removal capability, and so forth. So they are saying that if we operate in their framework on their accident scenarios, then worrying about hydrogen is "closing the barn door when the horse is out."

And therefore, that you ought to interrupt the scenarios before the containment fails and before, therefore, the hydrogen is generated. I don't know if any PAS people are here today, but I've seen their scenario, and I believe that's a valid interpretation of their views.

I say I understand that perspective, and I could even agree with parts of their conclusion, except the one that says, "Don't do anything about inerting, do something else." I'd rather do both.

Okay. I plan now to summarize the pertinent technical points of the staff paper, and I don't plan to speak about how we determine the pressure capabilities except to amplify one point for clarification.

The staff paper notes that failure pressures are higher than the design pressures, as would naturally be expected; and that failure pressures are assessed to be 2 to 3 times higher than design pressures.

COMMISSIONER GILINSKY: Who did the calculations, who does the calculations reported on in this paper?

MR. DENISE: I received those from Jim Knight's organization in NRR.

COMMISSIONER GILINSKY: Are they performed by NRC or contractors?

MR. DENISE: I would have to check.

COMMISSIONER GILINSKY: Who was the contractor?

DR. BUTLER: I don't know the name.

MR. DENISE: It may have been O.Bridge. I can look it up for you.

COMMISSIONER GILINSKY: Would you let me know?

CHAIRMAN AHEARNE: Do you know there are two to three factors, it seems to me, whether it is steel or reinforced concrete?

COMMISSIONER HENDRIE: That's just typical of the kind of margin-to-failure that you get out of the standard code requirements, whether it is concrete, reinforced, prestressed or steel.

MR. DENISE: I think those margins do apply, as Commmissioner Hendrie said.

COMMISSIONER BRADFORD: What does the term, "design pressure" actually mean then?

MR. DENISE: It means the pressure at which the containment is designed to conform to the particularly ASME code if it is a steel containment, or the American Society of Concrete, ACI.

COMMISSIONER HENDRIE: It is also these days a division of --

MR. DENISE: ASME.

COMMISSIONER BRADFORD: What it is that is not supposed to happen below the design pressure, but is considered at least possible above the design pressure?

MR. DENISE: What is supposed to happen below the design pressure is that your stresses stay below -- that is, low, below yield, below creep, able to take long-term steady-state pressurization of the containment.

It is similar to a reactor vessel. It's designed so that you can operate 40 years at pressure, except with a duty cycle -- you can cycle it up and down. It is that kind of integrity.

COMMISSIONER GILINSKY: What is the significance of the range you report in your paper? For one of the cases you say it is 32 poiunds - to -- I don't know what 38 pounds?

MR. DENISE: Yes.

COMMISSIONER GILINSKY: Is there some probability it will fail in that range -- or what?

MR. DENISE: The range that you have there is based on some view of the uncertainty that the evaluators had. It is not directly related to the difference between 12 psi design and 15 psi design, although that enters into the range where we try to summarize them the way we have.

The people doing the evaluation are trying to place a uncertainty band on that calculation.

COMMISSIONER GILINSKY: Would you regard there being any chance it would fail below the lower number?

MR. DENISE: Yes, I would think that there would be. I was going to say to that -- well, let me say what I was going to say, and we'll see if that question goes away.

I wanted to alert you to the fact that as the pressure increases beyond the design pressure, the level of certainty that the structure will stand decreases.

COMMISSIONER GILINSKY: That is what I would think.

MR. DENISE: You will want to know what the probability is, and I cannot give you that answer. I'm not sure anyone can give you that answer. I personally am convinced, however, that when we are speaking on the order of twice containment-design pressure, assuming now a well-engineered, maintained containment, that we are talking about at least a 99 percent probability that that containment will survive.

COMMISSIONER GILINSKY: What about the time and history of the pressure? I assume it would behave one way if it was just a steady pressure -- differently, if it was a shock. How do you factor that in?

MR. DENISE: These calculations were done at a steady pressure. I do not know the time interval that they used, but I assume it was on the order of hours, and maybe up to 24 hours that they assumed the containment was loaded.

When it is designed, it is designed at steady-state loading; so that we talk about long-term loading. This is, in fact, one of the things that gives you the built-in factor of safety, is that the actual conditions to be encountered are likely to be much less than the conditions for which it is designed.

When you are up above that design pressure, for example, when you are at twice design pressure, you are encountering some yielding of containment. That is, the material is outside the elastic range. This is not all dead.

But this is why I say, there is some uncertainty as to how far you can go.

COMMISSIONER GILINSKY: What would be the direction of a burn or detonation?

MR. DENISE: The direction of the detonation itself is on the order of seconds. Detonation, I would have to say, is miliseconds. And a burn would be on the order of seconds. It could, if there was a source. It depends on how you said it was burning.

If it was just flaring out of a pipe, it could be on the order of 10 minutes or 15 minutes. But if you take the scenario where the containment is filled up with hydrogen and/or some percentage, maybe 8 or 9 percent, then suddenly ignited, the burning would take place in the order of seconds.

The pressure loading on the containment from that would last -- from the burning, that is -- would last on the order of minutes. The impulse from the detonation would last on the order of miliseconds.

COMMISSIONER HENDRIE: Once you get a mixture that is flammable, as you go up in concentration of the burnable element, the flame propogation velocity which starts out being non-zero only in the upward direction, generally increases, and then gets so it will propogate in all directions.

It propogates faster as the concentration goes up; and what you mean by the detonation of it is really the place where the flame propogation velocity goes over sonic for the local conditions in the mixture and you begin to develop a shock wave. So the loadings which are of interest from detonation are then both shock-wave loadings.

And the loadings from a burn occur on a time scale, which is, as far as the structure is concerned, those are practically steady-state loadings, because they occur at a low enough rate so they don't excite vibrations, that kind of thing.

CHAIRMAN AHEARNE: Dick, in the chart that you guys generated for me, in the burn, those are not detonations; is that correct?

MR. DENISE: That's correct.

COMMISSIONER GILINSKY: Do you have to worry about things other than the containment? That is, the effect of a burn or detonation on equipment inside the containment? Does that come into your analysis at all?

MR. DENISE: Yes. In the staff paper, we made some assessments of the effective temperature on the components which are important to safety -- are fundamental in the conclusion that we gave here is that it is likely to see the kinds of transients similar to those encountered in a main steam-line break. Even though the initial temperature would be higher, it is likely that this will die out because there really isn't much heat capacity in this air.

Even though it may go up to 2500°F locally, it will cool off; and the components respond so slowly that they wouldn't be overheated.

CHAIRMAN AHEARNE: Could I get back to that question?

COMMISSIONER GILINSKY: I guess I'm a little surprised that 2500°F air doesn't do damage to components.

MR. DENISE: It would if it were able to become effective on it. But for example, if you were to consider --

COMMISSIONER GILINSKY: I understand what you are saying.

MR. DENISE: I do not think we've looked deeply at things like wires strung out somewhere, but there aren't any of those.

COMMISSIONER GILINSKY: If you are talking about the temperature coming down.

MR. DENISE: In minutes.

COMMISSIONER GILINSKY: In minutes?

MR. DENISE: Right.

COMMISSIONER GILINSKY: There would be equipment that would be subjected for minutes to temperatures between 2500° and few hundreds of degrees?

MR. DENISE: Yes.

COMMISSIONER HENDRIE: But probably not even minutes because, as you transfer energy out of the foundary layers in the gas into the heat sink of the metal shell, or whatever, of the component, you begin to develop yourself a gas blanket insulation for conduction and convection, or at least a limited amount of insulation.

You get radiation from the hot gas beyond, but it isn't as though you were transferring at, say, metal conduction rates from a 2500° infinite source -- by a long shot.

MR. DENISE: I think the point we made in the paper is that the heat transfer coefficient between this gas and the components is low. But when you compare that coefficient of heat transfer with the temperature differator which is driving the heat transfer, it comes up very similar to a main steam-line break which we have examined in some detail.

That similarity is what kind of temperatures do the components reach because of energy that is transferred to them.

COMMISSIONER HENDRIE: And we have run an experiment. The fan coolers are working, instruments work.

MR. DENISE: Let's have viewgraph 3.

[Slide]

CHAIRMAN AHEARNE: Could I ask you a question? On the pressure pulse and the relationship to failure pressure, it's a long time since I've looked at that kind of stuff, and until just about a year ago we were trying to scrounge around and get a better idea of the information. There didn't seem to be any readily available.

Have there been a number of experiments done, or data on, or prohibition -- this range pressure pulse? What is the relationship given logistics, simple material like the steel shell that would enable you to go through to the design pressure as such, then as a function of the pressure pulse, the yield is such so that you can then correlate a burn with a minute-size pulse with respect to a design pressure to say, Here's what the failure pressure would be?

MR. DENISE: I haven't done any of that and I haven't done any of that lately. I can say a couple of things about it. One is WASH 1400 pretty much concluded that containments probably wouldn't fail from detonation of pulse loadings.

Secondly, there are some people doing some work I forget whether it's Sandia at LASL, that reached fundamentally the same conclusion from a structural-role analysis viewpoint.

CHAIRMAN AHEARNE: They wouldn't fail independent of what the relationship was between the pressure pulse and the detonation?

MR. DENISE: I'm sure that is not true. I'm sure it was looked at over the range of interest, and there may just have been Surry or some others. I haven't checked the details.

I can say this: In a previous assignment that was associated with the liquid mall fast breeder reactor program, we did an awful lot of work on impulse loading because we were dealing with accident scenarios, that the core is exploding basically. And we found that relatively-thin vessels, reactor vessels, were able to take a tremendous amount of energy in the impulse loading.

We were assisted in that with tests by contracted by our contractors and others, and by the Naval Ordnance Laboratory, and others. It is something that perhaps ought to be examined in more detail. I feel relatively comfortable today, with it, but as we go down the road to get new design requirements, it certainly needs to be examined.

CHAIRMAN AHEARNE: I guess then -- I'm not sure how I would interpret it. Let us take the ice condensor here. You have the fact that pressure at pressure at 30 percent metal-water would burn, is roughly 42 psig?

MR. DENISE: Yes.

CHAIRMAN AHEARNE: And you have the percentage for each -- percentage is around 25 percent. There's a drop in the operator air, and I guess that's around 45 or 40, that you are saying is probably the estimate that you made the failure pressure?

MR. DENISE: On the ice condensors.

CHAIRMAN AHEARNE: My question is, how do I interpret that. From your last comment, I would conclude you are saying that, Yes, it reaches -- it may reach roughly 40 psig failure pressure but it's not going to fail?

MR. DENISE: I'm sorry. I think we are talking on two different wave lengths. When you are asking me about pressure pulses, I thought you were speaking about detonations rather than --

CHAIRMAN AHEARNE: I was talking about the minutes, which from my understanding is the burn pressure pulse?

MR. DENISE: Yes. Right. The proper way to interpret that chart -- do you want me to show you that in there? Or do it later?

CHAIRMAN AHEARNE: Fine.

MR. DENISE: Jim, are you awake? Try chart No. 10. Presentation Chart 10.

[Slide]

MR. DENISE: The proper way to interpret this chart for ice condensors, to give you an example, is that the bottom line, which is literally the bottom line, is that with a 25 percent metal-water reaction, we would expect to reach the failure pressure, which is in this case about 36 psi at 25 percent.

CHAIRMAN AHEARNE: Right. I'll go back to my original question, which was: Experimental data relating pressure pulse to failure?

MR. DENISE: No. To my knowledge, we don't have anything in that range. I can tell you that my own "gut" feeling would tell me that pressure pulses loaded over a few minutes time would tend to give us larger numbers of capability than what was shown to you here, just because of the way that it was calculated. That is my "gut" feeling.

We are not so far into the elastic range that we would be concerned that the containment would come apart.

CHAIRMAN AHEARNE: I wonder if you might go back to whe is your contractor to see if there is any experimental data. My experience of the pressure pulses are a much shorter pressure pulse, I have the feeling myself.

COMMISSIONER GILINSKY: How sophisticated is the analysis?

COMMISSIONER HENDRIE: These are --

MR. DENISE: They are qualicized data analysis.

CHAIRMAN AHEARNE: Is a couple of minutes -- static loading?

COMMISSIONER HENDRIE: Static loading for these purposes.

CHAIRMAN AHEARNE: So you mean if they estimate the failure at 36, and you end up calculating 40, and that it has failed?

COMMISSIONER HENDRIE: Within the estimate of both the estimate of failure pressure and the estimate of actual pressure -- yes. That is your optimum. On the other hand, what they have done is to set the failure pressure at about twice the design pressure.

MR. DENISE: On the ice condensor, we are saying about three times.

COMMISSIONER GILINSKY How sophisticated is that analysis?

MR. DENISE: I'm not prepared to speak to the details. From the report that I got, it is reasonably sophisticated. It is not sophisticated as you can do. I think that is why I tend to think it is a little bit conservative.

COMMISSIONER GILINSKY: You've said sometimes two times, sometimes three times pressure? In this case, it makes a difference.

COMMISSIONER HENDRIE: They looked at a couple of specific cases, didn't they?

MR. DENISE: They looked at the Sequoia, and the McGuire containments.

COMMISSIONER HENDRIE: And at those in some detail, but the general comments putting that out across the whole body of containments -- just, I think, reflects both those detailed calculations on a couple of specific designs and general observation that for pressure-containing structures designed to the code -- the safety margins that are built in generally result in factors of at least two, and more likely, three to a two-failure pressure from design pressure.

MR. DENISE: I can either redo you what we've got or I can send you a copy of what we've got, or I can get you a better answer.

COMMISSIONER GILINSKY: Depending on how long it is, you can do any one of those.

COMMISSIONER HENDRIE: Do the short one.

MR. DENISE: Do you want me to do the shortest one?

CHAIRMAN AHEARNE: How would it be -- I think it best to table it the way you have.

MR. DENISE: I know that we calculated it in a conservative pulse.

COMMISSIONER GILINSKY: So you do know?

MR. DENISE: I know what he made, but I don't know whether they did it with a finite element code or how well they mocked up some of the sections, and so on.

COMMISSIONER GILINSKY: But your recommendations are based on these numbers?

MR. DENISE: Oh yes. Yes.

COMMISSIONER GILINSKY: We're not sure who came up with the numbers?

MR. DENISE: I don't know which contractor they used to develop these. I have a feeling it was Oakridge National Laboratory, but I'm not confident.

CHAIRMAN AHEARNE: It was Knight who passed these on?

MR. DENISE: It was Jim Knight. Actually, it was Fran Schower, the branch chief.

CHAIRMAN AHEARNE: I think I have completely separated you from your page. If you want to go back --

MR. SCINTO: I think we have some highly sophisticated information on Mark I's and Mark II's as a result of that exemption practice that we had a couple of years ago, so we may have some fairly-sophisticated work on Mark I's and Mark II's in the house someplace with connection with another activity.

MR. DENISE: That's possible.

COMMISSIONER GILINSKY: It seems to me we have to be pretty confident about these numbers, whichever way we go here.

CHAIRMAN AHEARNE: Yes, I think you're right.

MR. DENISE: I agree with that.

COMMISSIONER HENDRIE: I think the decision which you make at this time cuts more roughly -- one of the staff's proposal --

CHAIRMAN AHEARNE: What staff's proposal I would agree, but there are really several other decisions.

COMMISSIONER HENDRIE: The other decisions are going to lead you into attempting to establish ground rules for the degraded core condition rule, if there is to be one. And I would suspect that we ought to approach some scoping of that effort on a somewhat broader view than how much metal-water reaction with burn produces the projected failure pressure in some ice condensor containment.

That is at the end of a long corridor that leads off the central chamber, which is the degraded core conditional rule, if there is to be one, again I say, if there is to be one.

CHAIRMAN AHEARNE: Dick, why don't we try to get back to where --

MR. DENISE: Go back to Viewgraph 3, and stick 10 behind 9, Jim. This viewgraph is just going to show you some basic conclusions that you already know.

[Slide]

MR. DENISE: You can go to the next viewgraph, Jim.

[Slide]

MR. DENISE: That's one prepared a long time ago. This viewgraph shows the parameters that govern the LWR plans capability. You see we've listed up there the containment volume, containment pressure and the amount of Zircaloy Cladding -- these, too, differed among the plants; not in the first two, but in the third.

The amount of Cladding is involved in a BWR. It is about 40,000 pounds; and then the PWR's is about 50,000 pounds. I'm sorry -- that's not correct. It's about 50 and 100. I was thinking two different sets of numbers. 50 and 100 is the numbers. That's about right.

The assessment parameters were listed at -- those are parameters that we used to determine whether containment will survive, and that is what kind of a hydrogen concentration will it reach, what are the detonation limits, the combustion limits, what does it do to containment pressure when you have non-condensible gas addition, energy addition and heat-removal system capability, which is to say that the only question involved is not if you have inerted and done away with hydrogen burning, have you solved the problem. Because that isn't always true.

[Slide]

MR. DENISE: The next viewgraph I have here just shows a plot of our chart showing volumes and design pressures.

COMMISSIONER GILINSKY: Can we get a listing of all of those plans in those categories?

MR. DENISE: Yes, sir. Surely. We know, if you want a complete listing rather than examples -- I can give you examples, but we can give you a listing.

COMMISSIONER GILINSKY: Please.

MR. DENISE: It was typed earlier today. To figure out how you would interpret this chart because it doesn't have an easily visible figure of merit on it. I've made some numbers that are basically the design pressure times the volume, and large design pressures and large volumes tend to give you more capability to accommodate hydrogen.

And divide those numbers by the mass of zirconium, which I say large masses of zirconium tend to reduce your capability to tolerate metal-water reaction. And I would say that using that figure of merit, if it means anything, the one on the end shown as a dry containment -- it is a small dry containment, a PWR containment.

The ranking tends to be about in the order that you see, and with the most for a given containment on the right and the last for a given on the left, except for one thing: The Mark II's ought to be shoved over to the other side of the Mark I's: that is, if the Mark II's are not as forgiving as Mark I's. And probably Mark III's are less forgiving than the ice condensor.

CHAIRMAN AHEARNE: Just as a curiosity, what did you end up with on your numbers?

MR. DENISE: I will read them to you across the page. This again is the product of design pressure times volume divided by mass of zirconium. Mark I is 225, Mark II is 169, ice condensor 340, Mark I's 281 -- I'm sorry, Mark III's 281, sub-atmospheric, 1892, small dry 2272. And one you don't know in there is large drys, 2663.

Now thinking on this other side to look at what happens if we normalize them. So I normalized on the large dry containment and said, instead of giving it a 10, I give it a 1. And therefore, 10 is popular these days.

Therefore, when I normalized those numbers, I get Mark I's .08, for Mark II's .06, ice condensors .12, Mark III's .1, sub-atmosphere .6, small dry .79, and large dry 1.0.

Now, I'm not sure those numbers are all that meaningful, but it gives you a perspective of the ability to tolerate a given percentage of metal-water reaction. It doesn't say the likelihood of getting that in that particular design, or anything else.

[Slide]

This viewgraph shows the volume percent hydrogen in the containment versus the metal-water reaction for these various designs. I have hand-drawn on this viewgraph the definition of it up there at 18 percent. That is -- the guess was detonated at 10 percent concentration. the burn range between 4 and 8 percent.

That doesn't mean it will burn up at 16 percent. It just means it's kind of where it starts,depending on the conditions. Then those vertical slashes you see on there mean that the first one, if you look at the BWR Mark I and Mark II line, the first line says that the Mark II design can only take about 9 percent metal-water reaction before you exceed the value pressure if it burns.

End:el
JWF01s

I'm sorry. I think that number is 6 percent rather than 9 percent. This is Mark II. The next one on that line is the Mark I, which says that you can take 9 percent. The BWR Mark III's are shown at about 23 percent, I believe: 23 percent metal-water reaction without failure if it burns.

The ice condensor and sub-atmospheric gets about 25; small dry BWR up in the 95 plus percent, and the large dry in the 100 percent range.

I can point out that the best information I have tells me that the TMI-2 experience is between 30 and 50 percent, most likely at around 40 percent metal-water reaction. It's comparable to a small dry container containment, the TMI-2.

COMMISSIONER BRADFORD: What is the possibility of failure, the point at which you expect something to seep out?

MR. DENISE: We take this to mean for this particular calculation that the metal or the conrete is moving sufficiently to open a very large break in the containment. It is not a seepage thing.

Whether that would continue to be an extremely large crack would depend on the conditions and the crack-propogation rate and how long the loading lasted. But it is not seepage; it is large leaks.

[Slide]

MR. DENISE: It is intended merely to show what we are dealing with in terms of volumes and hydrogen gas. I mentioned earlier that the only problem was in burning the hydrogen. Thus you can see the numbers but what it basically shows is that when you are dealing with BWR's, particularly Mark I's and Mark II's, you are going to generate 700,000 cubic feet of hydrogen if you have 100 percent metal water reaction and there is only 300,000 cubic feet of space in the container.

You obviously are going to have a pressure buildup of at least twice the atmospheric one. These numbers are all given at standard temperature pressure, so we've allowed it to cool down and so forth.

It also shows that if you are working with the small -- what I call the small dry containment on the bottom, the hydrogen generated is only 25 percent of the available volume. This merely shows the potential for overpressurization from hydrogen gas alone, not considering burning.

The next vue graph (slide) shows the various energy sources involved in an accident, perhaps a local accident, in metal water reaction. It shows you the LOCA Blowdown energy 400 million BTU's, the exothermic metal water reaction, that is 100 percent metal water reaction. I've divided those two into BWR and PWR; the larger number for the exothermic metal water reaction is the PWR because there is more clad.

The same thing is true for combustion of the hydrogen after it is generated. The energy in the steam generator only applies to the BWR and the decay even the first hour is shown for typically a 1200 megawatt electrical reactor.

The heat sinks are as you see listed there, the suppression pool, the ice condensors, four ice condensors, and fan coolers, further designs and sprays and the cooling system. That is to give you some idea of what kind of energy is involved in this.

The next vue graph (slide) is a summary vue graph that I intended to use before I got asked to put more details on it, which was, by the way, a good thing. This shows two things. The first thing shown is without hydrogen combustion and the second is with hydrogen combustion.

I need to point out that this vue graph is not clear in the second column under each of those headings. That is where it says, "Estimated Value Pressure". That doesn't mean that is actually the estimated value pressure; it should say, "At the Estimated Value Pressure", so that we can take 100 percent metal water reaction in a BWR Mark I; if it doesn't burn without exceeding the failure pressure, about 100 percent is the number.

I move over to illustrate this. The second column says that, "In the BWR Mark I to reach the design pressure, it takes about 5 percent metal water reaction with the hydrogen burning and it takes about 9 percent metal water reaction without hydrogen burning to reach the failure pressure.

I need not read the numbers to you. We have indicated a remark that inerting should be made a requirement for Mark I's and II's and that the inerting may not need to be a requirement but we ought to get on with the work for the others to see what needs to be done with them.

COMMISSIONER GILINSKY: So in the past when the decision was made to inert the Mark I containments, the approach was rather more conservative than the one you are proposing?

MR. DENISE: I don't really think so. Entry, not really because that approach accepted the ice condensors and Mark III's uninerted.

COMMISSIONER GILINSKY: I'm just looking at the Mark I's which could go up to 9 percent without failing and our assumption was, we had only 5 percent metal reaction that took place and that when you inerted them, you could take 100 percent metal water reaction and get away with it.

MR. DENISE: That's the other column.

COMMISSIONER GILINSKY: I'm saying that in making the decision to require inerting --

CHAIRMAN AHEARNE: But wasn't that --

COMMISSIONER HENDRIE: I don't think we calculated they could stand with a burn and then said I would like more margin to 5 percent than that. It was the fact that they got up into the flammable range and if you went a little further, even into the detonation range and drove the inert, not some calculation out of what effect failure containment pressure would be with a burn.

MR. DENISE: I'm a little bit troubled that I don't understand that remark because your remark tended to say that whatever I have said has come across the opposite way than I meant. So be sure I have understood and answered your question.

COMMISSIONER GILINSKY: The analysis that you present, as I understand it, bases a decision on whether or not the containment could withstand the pressure that would fail if the burn took place or detonation. If we applied the same sort of logic here to the Mark I's but assumed only 5 percent water metal reaction, you would leave them uninerted.

MR. DENISE: Yes. I think so. If I said that the limited water reaction was 5 percent, yes, that is the present limit in the regulations. What I am saying is we ought to go beyond that kind of thinking and require them to be inerted and as a vehicle, use the change in the rule that says not withstanding everything we've said before, inert those Mark I's and II's.

CHAIRMAN AHEARNE: Okay.

MR. DENISE: I think the last vue graph (slide) -- no, not the last one, that is this one. Do you care to go over it again? Any questions on it?

(No response.)

MR. DENISE: Let's proceed to the next vue graph.

(slide) This merely outlines some of the potential methods which can be used for improving the hydrogen management capability. On top is inerting. There is such a thing as a Halon suppression system which could be used. We could use the filtered vent system which is possible to relieve pressure if it is large enough sothat the hydrogen burn isn't too bad. That has to be put in place early in the scenario before you reach very high concentrations and get very large pressures or you will not be able to clear a reasonable size relief system in, you will have huge openings.

Some sort of hydrogen combustion system could be used and that simply means that some distributed sources of ignition such as spark plugs or flames which would insure that hydrogen is burned as it is evolved and it would reach large concentrations and therefore, double its heat and containment at one time.

Other methods are catalyst and gas turbines. The gas turbine merely means burn up all of the oxygen and then when you think you might get some hydrogen, then we will do some inerting.

These are not exactly happening but we haven't examined them in any great depth, that we know more perhaps about inerting and the Halons suppression system than others.

The next vue graph (slide) merely repeats our conclusion; as a good presentor, we let you know where we are heading and that is where we are.

6

COMMISSIONER GILINSKY: Can I ask you what role did steam play in your analysis? How did that affect -- what assumptions were made about the amount of steam in the containment?

MR. DENISE: By and large, we said that steam is going to leave after a while, so in all of the numbers we gave you, we did not assume that steam was there as a diluent to suppress the hydrogen.

We brought out this fact -- it is probably not well explained -- to show that you are probably not going to have large concentrations of hydrogen and steam at the same time in coincident loadings but if you did, the steam would tend to suppress the hydrogen burning. After a while --

COMMISSIONER GILINKSY: That is what I was trying to get at.

MR. DENISE: After a while you have systems in place intended to remove heat and when they remove heat, they are going to remove steam and they are not going to remove hydrogen. After a while, you are going to get back to the hydrogen which will burn.

If you could keep these things full of steam, you could take much higher concentrations of hydrogen than just in air because it tends to inhibit the burning.

That completes the planned presentation. I have about 25 backups if you want to see them.

CHAIRMAN AHEARNE: What kind of immediate change is the 44 over?

MR. DENISE: I think that Jim Norberg will speak to that. He is on next. The immediacy is one issue and the kind of changes that I had in mind, is if it is not legal language but it says something to me, that in Part 50.44 where we talk about how one ought to design containment and what the rules are for coping with hydrogen, that it ought to be no extending everything we said before, if we want the BWR Mark I's and II's inerted. Jim will go into that.

COMMISSIONER GILINSKY: I think you answered this before but when do the -- how far down the road are the Mark II's, first the Mark II's?

MR.DENISE: The first Mark II is supposed to come on for fuel loading, I believe, it is June of 1980 on the present schedule.

COMMISSIONER GILINSKY: That is which plant?

MR. DENISE: Zimmer and the Mark III is '81; that is Randolph.

CHAIRMAN AHEARNE: General Counsel has cautioned me not to get into discussions about specific plants that are --

MR.DDNISE: This is just as generic discussion.

CHAIRMAN AHEARNE: That was an issue he alerted me.

MR. DENISE: I'm sorry.

MR. BICKWIT: Are you going to talk to the last phase, pending completion of the additional studies in rulemaking?

MR. DENISE: I hadn't planned to talk to it but let me address it briefly. We have -- I think you have been exposed to something called the Task Action Plan. We spent a few hours on it; even that is kind of laid out in that Task Action Plan.

Jim, I think you are going to speak to part of that on the schedule, the additional studies. I don't have the latest version of the Task Action Plan before me but the schedule has been accelerated beyond the first version.

COMMISSIONER GILINSKY: Is this proposal then before the ACRS to enact?

CHAIRMAN AHEARNE: To enact?

COMMISSIONER GILINSKY: To enact I's and II's?

MR. DENISE: To enact I's and II's.

COMMISSIONER GILINSKY: And not to enact the others or take other actions?

MR. DENISE: I don't think we specifically discussed this action. We've only addressed the issue sufficiently to say to us that you ought to enact the Mark I's and II's and I forget the context of the presentation. We ought to get on with finding out what we ought to do on the other ones quite expeditiously. Does Dr. Butler know what the context of the ACRS letter was?

MR. BUTLER: I believe it was to the -- in response to the learned recommendation, short term recommendations.

MR. DENISE: Which are consistent with what you see.

Jim Norberg is next.

CHAIRMAN AHEARNE: Yes.

MR. NORBERG: I am James Norberg of the Office of Standards Development and I will give you a very brief rundown of the status of the rulemaking related to degraded core conditions, specifically what we are proposing regarding the hydrogen management containments. First slide please?

(Slide)

We see four general elements for the regulations dealing with degraded core conditions. The first element is an immediately effective rule addressing certain specific items to improve safety in this area. I will go into these items in a minute.

The second element is an advanced notice for rulemaking on degraded core cooling. This notice will inform the public of NRC's intent to conduct the rulemaking and will address a broad range of reactor accidents which involve core damage. Radioactivity released beyond that currently considered in the design basis approach would be addressed.

The industry and the public would be invited to advise and make recommendations on several questions to help NRC shape the regulation and operational improvements to deal with degraded core cooling.

The immediate rule and the advanced notice for rulemaking are going forward concurrently and the schedule calls for

Commission consideration in April.

We are now working on the drafts of these two actions. The third action is a longer range effort which will systematically review the regulations and regulatory guides relative to degraded core conditions and make changes as may be appropriate.

Some changes to regulations and guides are currently being considered. Others must await the outcome of the rulemaking action.

The fourth element is the comprehensive rulemaking on degraded core cooling. Following the advance notice, the proposed rule would be prepared using the advice and recommendations obtained from response to the advance notice.

All of these actions are directly related to Section 2B8 of the TMI action plan. I think you are familiar with this.

At this time, I would like to focus only on the immediate rule and in particular on the hydrogen situation for Mark I and II containments. Next slide please?

(Slide)

This is the third slide in your handout. In addition to addressing the hydrogen situation, the immediate rule on degraded core accident conditions will condify several requirements that are not being or have been implemented under the short term lessons learned.

The elements of this rule include requirements for hydrogen management in containment. That is inerting Mark I and Mark II BWR's and requirements for hydrogen control such as dedicated penetration for hydrogen recombiners.

CHAIRMAN AHEARNE: But not the recombiners?

MR. NORBERG: Not the recombiners. It will include requirements for high points vents on the reactor vessel and the primary coolant loop to control non-condensible gas buildup in the reactor coolant system.

It will include requirements for radiation protection, of equipment important to safety and to provide adequate access to vital areas during and following and accident that releases large amounts of radioactivity.

It will include requirements for post accident handling of the reactor coolant and the containment atmosphere without incurring excessive radiation to operating personnel. Next slide please?

(Slide)

It will include requirements to maintain leakage of highly radioactive fluids outside containment to its lowest practical level. It will include requirements for safety-related instrumentation that is capable of monitoring the course of serious accidents. This includes instruments to make extended measurements of containment atmospheric pressures of hydrogen concentration in the containment atmosphere, the containment water level and at high radiation levels in the containment and in plant effluence.

It will include requirements for special instrumentation to detect inadequate core cooling such as the sub cooling meter and reactor vessel water level.

CHAIRMAN AHEARNE: I thought we had already required that. Are you saying that --

MR. NORBERG: We are codifying these now.

CHAIRMAN AHEARNE: I was questioning you about going without a rule. Are you saying that we do need a rule to require it or is this just to put into some special regulatory language?

MR. NORBERG: Yes. We are now --all of these actions except for the inerting of Mark I's and II's -- are undergoing now either throughthe lessons learned and we are now codifying this into the regulations in this rulemaking.

CHAIRMAN AHEARNE: Just out of curiosity then, other than the Mark I and Mark II, you can't have come up with a strong justification for immediately effective than the others could you?

MR. NORBERG: The justification for immediately -- we have already commented at the end of this but thus far we haven't seen one which would justify immediate effect. We recognize that everyone is talking about a very prompt turnaround, including even that long but we haven't seen one on an immediately effective.

CHAIRMAN AHEARNE: Okay.

MR. NORBERG: I guess this is still in the draft stage with the staff and in fact, it has not had complete staff review although we have been coordinating with NRR, with the legal staff.

The rule also requires a training program to insure that operating personnel know how to recognize control and mitigate the consequences of accidents inwhich the core is severely damaged.

Like I said before, you are familiar with all of these requirements, from the short term lessons learned in the TMI accident accident plant. As you know, all of these requirements except for Mark I and II inerting is being implemented or soon will be implemented. I will go on to briefly discuss what the staff proposals for the rulemaking to require the inerting of Mark I and Mark II containments, next slide?

(Slide)

As you know, in order for the staff to require an early Mark I and II containment, we had to make a change to the regulation, 10 CFR 50.44, Part A; 50.44, specialized standards for combustible gas controls.

COMMISSIONER GILINSKY: What is the basis on which Mark I's are required immediate inerted now?

MR. SCINTO: May I comment? They are not required now -- I'm going to give a procedural answer. There is no requirement. The present rule is 50.44 and if a Mark I facility came in and applied for application -- following your present regulations, they may do so.

COMMISSIONER GILINSKY: That's right, yes.

COMMISSIONER HENDRIE: The great change which we were working on in '74 became 50.44, would have allowed either all or most of the Mark I's to back off inerting. It is very interesting, the fellows who haven't inerted, they don't want to inert. It is like the end of the world. There are fellows who have inerted and gotten used to it. They would rather stay inerted than go through the paperwork of filing and amendment to uninert.

CHAIRMAN AHEARNE: Our ultimate threat.

(Laughter.)

COMMISSIONER HENDRIE: It shows that going through this process really is the thing that hurts.

CHAIRMAN AHEARNE: The enforcement policy, that is the other action.

MR. NORBERG: To go on then, we have to do something about 50.44 in order.to require BWR's to inert. So what the staff is proposing is a simple statement that is added to the end of 50.44. I think Dick alluded to this.

It says, in effect, that notwithstanding all of the rest of the rules --

COMMISSIONER HENDRIE: All of the foregoing, not to the contrary.

MR. NORBERG: All Mark I and Mark II containments shall be inerted. This has been put in legal language and we are still working on what the exact language will be but that is the thrust of the rule change. That is straight forward.

In addition to that, the staff wants this analysis performed on all of the containments to evaluate the measures that can be taken to mitigate the consequences of large amounts of hydrogen.

CHAIRMAN AHEARNE: Do you intend to qualify what "large" means?

MR. NORBERG: We have a number that we are kicking around through the staff and it has not been decided but this is only for analysis purposes. You have to recognize that. We are talking about 75 percent, right now, metal reaction, which is large -- greater than 50 and something like this number is loose.

The purpose of this analysis --

COMMISSIONER GILINSKY: Let me understand that. If you are talking about 75 percent, metal water reaction, I guess we are just asking to analyze and see what happens?

MR. NORBERG: We are using that for analysis purposes, not to lay upon a requirement or anything like this. That number of what this design basis should be or will be is the subject of the rulemaking, the long range rulemaking, the broad rulemaking that we alluded to and are now putting out an advance notice for.

That is where we hope to shake out, as Dr. Hendrie said before, what the metal water reaction should be for the design basis. That is one of the many things that will come out of that.

CHAIRMAN AHEARNE: Is it correct or not correct that in order to get the 50 percent or to get to the inerting, we have to make that change? Can we order the inerting independent of making a change in 50.44 or must we make a change in 50.44 in order to order inert?

MR. SCINTO: The Commission can do a lot of ordering process but you would have a regulation outstanding, which said it would be all right to do it at the present, the numerical value, you've got to say something about that regulation.

Probably the best way to do that is with a regulatory change.

COMMISSIONER GILINSKY: For the moment, the only effect would be to force two plants to inert?

CHAIRMAN AHEARNE: Well, that too.

MR. SCINTO: With those two, I am not quite sure what you are going to do with respect to all of the PWR's. You get some numberand it still says this 5 percent for that design hydrogen combined system.

The papers we've seen so far say don't inert but it doesn't quite say you are not going to do anything, a larger number, I am not going to --

CHAIRMAN AHEARNE: My question was driven by the staff as proposed that we require I and II to be inerted, in other words, the two ones that are already there and the other that are in the line. My question was, in order to do that, must we go through this rulemaking on 50.44 and put out an immediately effective or can we just go ahead and order it?

MR. SCINTO: Through a regulatory-powered order, you might accomplish that through your powers to make sure that things are safe.

COMMISSIONER GILINSKY: Do you have to explain why you are doing it?

MR. CUNNINGHAM: The answer is yes, you can order but then you right to a hearing, in the case of two plans, that may be a risk you are willing to take and you may have to show -- that is the reason for requiring something, in addition to the requirements in the regulations.

MR. CUNNINGHAM: Is it inconsistent with the regulation? Are you simply writing something in addition to the regulation or are you requiring something that is really in violation of the regulation?

MR. SCINTO: It's in addition to.

MR. CUNNINGHAM: That's my understanding.

COMMISSIONER HENDRIE: You could say that inerting with regard to hydrogen is in addition to but the inerting with regard to the ability for quick access to the containment, to inspect equipment and acrue the same increment that derives therefrom, you are losing.

MR. BICKWIT: But depending on how you come out on that question, the answer to that question will be the answer to your question. You cannot order something even with the right to a hearing that is inconsistent with a rule that is on the books. You will have to suspend that rule, if what you are ordering is in addition to the rule, then you can do it.

MR. SCINTO: But this agency can make sure that plants are safe. They have the power to take quick action to make sure that plants are safe.

MR. BICKWIT: We know that this is a question of whether you have to change the rules to do that and it depends on the answer to the questions that Commissioner Hendrie was addressing.

COMMISSIONER GILINSKY: Could we hear something about this point of increasing the difficulty of access to the containment and why that is so and what the effect of that is and does that play a role in your thinking?

MR. DENISE: I would think that General Electric and the Vermont Yankee people have a prepared presentation on that. We have considered it and as I said in my presentation, we down saying that we have a whole bunch of Mark I's out there operating successfully. We have inerted containments; we do not see how two more is going to break anybody's back and endanger public safety.

We also have an idea that Mark II's can tolerate inerting since were at one time designed so that they could be inerted. I have not looked in detail at the consequences of restricted access for inspection and so forth for this purpose.

I think the Vermont Yankee and CEP will have something interesting to say.

COMMISSIONER GILINSKY: Have you looked at that question in the -- condensor plants?

MR. DENISE: Yes, sir. We have.

COMMISSIONER GILINSKY: What did you conclude?

MR. DENISE: We concluded that the present operational experience as experienced by the -- two units tells us that containment has to be entered at the pretty high frequency and that is, at least, a variant and probably a couple of times a week for a variety of inspections, many of which are related to maintaining the ice condensor concept as maintained in the ice, make sure there is not leakage pass, make sure the refrigeration equipment is working, maintained and so forth.

COMMISSIONER HENDRIE: There are significant topological differences between the Mark I's and II's where, for instance, all the essential instrument lines come out, two transmitters are outside the dry wells or wet wells by -- in the secondary containment building and the ice condensors in Mark III's where all of that is still within the thing you call containment for hydrogen purposes, even though there is a dry --

COMMISSIONER GILINSKY: What are these things that you say --

COMMISSIONER HENDRIE: Things like insurance transmitters and things that you need to get to maintain --

MR. DENISE: To maintain, calibrate and so forth.

COMMISSIONER GILINSKY: How heavy did that weigh in the balance here in your coming up with a decision that the ice condensor plants did not need to be or should not be inerted?

MR. DENISE: I would say that it didn't weigh enough to tilt in the weighting direction. It is possible that we could have said in spite of the capability to combinate 25 percent metal water reaction, it still ought to be inerted but we know that there were problems of practicality in operating those plants inerted at this stage.

I can tell you that if the capability to withstand the metal water reaction were in the range of 5 percent for ice condensors, that I personally would have recommended that they be inerted or the --be done right away and I mean right away, within a few weeks or a month or so. I don't know how to give you weight on that thinking but as far as I am personally concerned, the fact that it would give them difficulty didn't weigh heavily; the fact that we told them to do it and they did it, might be counterproductive on safety, did have some weight.

CHAIRMAN AHEARNE: Thank you, Dick.

MR. NORBERG: That was my last.

CHAIRMAN AHEARNE: What I would like to do now is, we had said we would hear from GE and Yankee Atomic. They had, I believe, been told they had 30 minutes, some 15 minutes each. First will be GE and the names I had listed here show Bob Buchholz and Steve Stark. Glenn?

MR. SHERWOOD: Should I stand here?

COMMISSIONER HENDRIE: Or come up here, whichever. Why don't you all come up here. Could I get in a comment or two to the staff while our next set of folk are arriving at the table? I have some concerns that run in the following direction.

It worries me that we are moving in the direction of establishing free hydrogen design basis in the containments once more on a basis which is separately, literally independent from unconnected to the other accident and safety system design bases of the plant.

We did it before because it ruined the practice and I defended it pretty hard and we took a metal water, which was inconsistent with the licensing grade calculations for the ECCS performance and argued that yes, it was appropriate to have some additional margin in the containment system and in effect, an overlap beyond what you would calculate from the ECCS calculation, also coolant accident calculations.

We were talking there about 5 percent or subsequently five times what you would calculate in the ECCS and it was a relatively limited amount of degradation of the core passed the ECCS minimum performance standard point.

Now we are talking about TMI hydrogen at about 40, a possible calculation called for in the rulemaking, the early rulemaking of maybe as much as 75. I am concerned that we end up going in a direction in which we establish certain ground rules for hydrogen production, which are going to be extremely severe in terms of equipment requirements and operational requirements and that these are going to be inconsistent with, in many ways, requirements we would establish over here for other things, other ECCS requirements, requirements to deal with accidents beyond a design basis range.

I think we ought to package these things into a single logically consistent package. It is not clear to me that the design basis accident concept is still a good working basis but it is also clear to me that we are on the verge of, or maybe have already started, to take account again of our overall licensing process of accidents beyond the design basis.

In a practical sense, this is sort of emergency planning provisions which we are now dealing with, which are for that purpose.

CHAIRMAN AHEARNE: Right.

COMMISSINER HENDRIE: And as we talk about the possibility of looking at accidents beyond the design basis in the environmental analysis, on a best estimate basis, we want to -- over in that realm.

I just have the feeling that charging ahead on hydrogen is going to get us sort of ugly looking machinery and operating conditions which is not going to fit well and logically and efficiently with all the rest of that.

I think, for instance, the comments of the probability assessment growd ought to be taken with some -- ought to be looked at with some care. That is, I really hate to see us go ahead and impose a set of requirements which may be extremely burdensome in cost effort and downtime and so on on plants and then find that when we stand back and make a rationale risk assessment, we have done damn little for safety and in fact, the things that would make a difference, we have yet before us to do.

I guess I would be inclined here, for myself, to be a little slow on the immediately effective part of this and to try to move as rapidly as possible on the degrading core cooling rule to get the development bases for that in hopes that we could thrash this whole array of things out in a more rationale fashion.

I note, for instance, is it clear that for Mark I's

II's, that a combination of filtered vent at about 1.6 times rated pressure, together with a set of hot wires to make sure that it burns as it comes out, leaves you perceptibly worse off than the ice condensors? I don't know.

There are a lot of these things that one would like to shake down. So I want to leave that thought with you that at the moment, I must say I am scratching my head.

CHAIRMAN AHEARNE: That covers both the question of one and two and the others or is it just the others?

COMMISSIONER HENDRIE: I am not so sure that it is worth making major changes in the operational modes and the two remaining Mark I's are setting some equipment procurement direction for the Mark II's until you have a little better handle on what I will call the more comprehensive, degraded core rule and the directions you would like to go and begin to look at some of these questions, which are what are -- what does enormously lagge hydrogen evolution add in the risk spectrum?

It may be that Three Mile Island is a very peculiar animal.

COMMISSIONER BRADFORD: One hopes so.

COMMISSIONER HENDRIE: One hopes so on the general ground that one would not like to do that sort of thing very often, if ever. That is certainly true but in the sense that here is a case where we managed to come, it may turn out, very close to optimizing hydrogen production conditions but stay away from a general core meltdown.

Now you know we don't require the design basis or we don't yet, under the Atomic Energy Act requirements, require a core melt design basis or a total failure of ECCS design basis. As I say, we are moving in directions to take account of those accidents, the environmental assessment and in emergency planning to be sure, but Ithink it may still be appropriate to cut the design bases somewhere short of that.

If you are going to do that, does it make sense to pick a hydrogen evolution which is sort of way out and say but that is a design basis? It is just not clear to me that is our --

CHAIRMAN AHEARNE: Until 10 years or so ago, wasn't the relief that the contianment would contain even a core melt; wasn't that the concept?

COMMISSIONER HENDRIE: That pretty well went down the drain in the early '60's.

COMMISSIONER GILINSKY: I was just reading a book by Glen Seborg from 1971 that maintained that.

CHAIRMAN AHEARNE: Commissioners have always been the last to know.

COMMISSIONER HENDRIE: The reactors got past a few hundred megawatts thermal.

COMMISSIONER GILINSKY: Wasn't that looking back, in other words that wasn't the realization didn't come just at the moment the power increase passed 100 or 200? It was, I thought, in the late '60's?

COMMISSIONER HENDRIE: No. We know that in '62-'63 in the course of redoing WASH 740 at Brookhaven, that very speedily became apparent, that the power levels had gone up so that you could not expect simple internal convection to the wall external convection from the standard sort of containment to take out the stored energy and after heat without going through pressure regimes inside that would go up and give you a problem.

So it was certainly well known by '64 or something like that.

COMMISSIONER GILINSKY: Mister --

MR. MALSH: Despite the usual horrible accident assumptions, we've always assumed that the containment didn't fail even though it was -- that would be associated with at least a partial core meltdown. It is sort of a high situation; you are postulating sort of an accident --

CHAIRMAN AHEARNE: Glen,do you have anything to add to the point that Mr. Hendrie made?

COMMISSIONER HENDRIE: You have to talk about why it's good to be able to get into the containment.

MR.. SHERWOOD: That was one of my conclusions so I may just refer to your comments when I get to that conclusion.

By way of introduction, for the record, I am Glenn Sherwood, Manager of Safety and Licensing for General Electric. With me is Mr. Steve Stark and Mr. Bob Buchholz, who will provide some details after my introduction.

You have a letter from Mr. Phil Bray to whom I report. Mr. Bray wrote to you recently describing the GE concerns on the recommendations for inerting Mark I and II and so I would elaborate on some of those plans.

General Electric strongly objects to the recommendations of the staff, as I will try to elaborate during the next 15 minutes. We object fundamentally on two grounds, one on principle and then the second on application.

With regard to principle, our concern is that the recommendation for inerting Mark I and Mark II is prescriptive. It follows from a concern from TMI and it does not take into consideration the unique design features of the BWR.

This is of concern to us since in the past, we have been laboring with the staff in areas such as ECCS and containment on the design features, on the multiplicity of ECCS systems, low and high pressure, our double containment and what have you and we have not been given credit for these and we understand, to a large extent why this tends to happen.

However, this continues to happen and now as a result, I want to relate to you my concerns. The request is being made for immediate inerting of Mark I and II. We fundamentally believe that inerting of Mark I and II is counterproductive to safety. There was no one killed at Three Mile Island, has been at least one person killed in an inerted containment that we know of and one or two more that we know of that were close to death.

I won't say much more about the counterproductive aspects of inerting. I am going to leave that to our friends at Yankee Atomic. However, the issue of the principle of the BWR's is something that concerns us.

We feel that little understanding has been included in the staff's analysis for recommending an early no card I and II. We have a very simple, but we feel adequate design in terms of a boiling water reactor. We have two levels of ECCS systems, some 13 pumps.

We went through an experience of grounds -- where we lost all ECCS systems and there was no core damage; indeed, there was not even any rod damages. We went through an experience at Oyster Creek where all research systems were turned off; there were no research systems -- we were able to retain natural circulation.

We don't need natural circulation, we don't need research pumps to maintain natural circulation and as you well know, in the Brownsberry incident, that core was covered by a backup set of pumps when some 13 pumps failed.

So that GE's intrinsic design over the last 20 years has been to emphasize prevention and our feeling is that the best design is to emphasize prevention rather than mitigation. We have mitigation obviously in the sense of a vessel in a double containment but we feel that inerting is essentially the wrong place to put our time and efforts.

We feel, and we agree with the comments made earlier, by Dick Denise and seconded by Dr. Hendrie that WASH 1400 and the people from your own PRA group argue that inerting is the wrong place to emphasize safety.

We, as a matter of fact, feel that inerting a Mark II is equivalent to putting rubber bumpers on a DC-10 as opposed to fixing the engine supports. We have done metal weter reactions and we disagree with the ones shown by Dick Denise.

Again, the basis reason is that these calculations were done with PWR's and not with BWR's high water reaction; at the minimum, would take a half hour for any initiation with the loss of all ECCS systems and even backup pumps such as CRD pumps.

Therefore, the buildup of pressure in the BWR system, although the BWR system is small, is very slow and would give the operators at least a half hour to a hour to take action to turn pumps back on.

Even with loss of offset and onsite power, this is true, so we feel, gentlemen, that much time and effort was spent in the design of the BWR and we believe that this should be given credit in the thinking for TMI fixes.

Now, in this regard, we also believe that the Commission has a good program initiated in terms of trying to understand what happens when an accident does start and what must be done to mitigate the accident in various types of designs.

GE is participating in that program. As a matter of fact, we have already, at our own expense, conducted several man years of failure modes and effective analysis to ferret out the various small break accidents.

We have already discussed this with the staff. I think -- staff to conclude that the BWR is very insensitive to small break accidents of the type of TMI. As a matter of fact, the TMI type accident we are designed for so that is if the TMI accident were to happen to our BWR, that would be a transient.

Therefore, we strongly recommend that the Commission not require immediate inerting of Mark I and Mark II and that this be postponed until a larger study which can be done which takes into consideration all aspects of the design basis for BWRs and PWRs, but especially in our case that credit is given by staff for the preventive systems which we have in place.

I also might mention that as you mentioned earlier inerting -- D&D inerting is sort of like a tar baby that never goes away but I did want to refer to some comments from the Appeal Board session of 1974.

The bottom line conclusion was they said, simply stated, the evidence establishes that inerting creates more safety problems of greater consequence than those it is intended to solve. That may be before TMI but we believe it still contains the essence of the argument and the pros and cons of inerting.

COMMISSIONER GILINSKY: Can I ask you what has been the experience of the operators who had inerted? If I understood the previous discussion correctly, they have not --

MR. SHERWOOD: We have two categories. We have two plans, two Mark I's that have not been inerted and they will defend to the end -- I think you said it very well -- being able to operate the plant.

Our other customers feel the same and they were in the process, especially Commonwealth and some of the large ones, of making applications for deinerting when Three Mile Island happened.

I think you pointed out that after the hearings were completed in '74, the rule change did not come until the end of '78. So we were working with a number of our customers preparing the TMI happened and it was turned around.

So the experience that we have, and I think it will be described well by our customer, is that inerting is critical to safe operation as well as availability capacity, unless there is a non-inert containment.

COMMISSIONER GILINSKY: What you are saying is the other operators want very much to stop --

MR. SHERWOOD: Yes.

COMMISSIONER GILINSKY: -- inerting their containers?

MR. SHERWOOD: That's right.

COMMISSIONER HENDRIE: Among other things, you say the cost of the nitrogen, that's a whale of a lot of nitrogen, you have the -- of the system, yet you also end up -- let's see -- I guess what we did to start a shutdown problem was to let the deinerting begin 24 hours before you did the shutdown so you could get ready for a shutdown and then --

MR. SHERWOOD: You still lose about a day of capacity.

COMMISSIONER HENDRIE: On the other hand, you could start up and take 24 hours to get fully inerted and the end was to try to create an aperture within a noted system where you could still get in on a weekend where the loads are down a little bit, but even that's a nuisance. You get this gas running around and people --

COMMISSIONER GILINSKY: Is that gas recaptured?

MR. SHERWOOD: I don't think so.

COMMISSIONER HENDRIE: No.

MR. SHERWOOD: Let me summarize so that we can get on. We recommend that the Commission not agree with the inerting recommendation. We feel that this should be part of the larger study and we would hope that the NRC works with the vendors in terms of the present kind of inerted containment.

We feel that the lesson from TMI is that we should spend most of our time on the high probability of events and we concur with that, we don't feel that inerting is in that vein.

Finally, we would like to see the staff --

COMMISSIONER GILINSKY: How is that the lesson of TMI?

MR. SHERWOOD: We feel the lesson of TMI is to concentrate the higher probability of events, operator errors, small breaks and so forth as opposed to the design bases accident and things such as inerting.

COMMISSIONER GILINSKY: Isn't one of the lessons to guard against the unexpected?

MR. SHERWOOD: Yes. The question I think -- the answer is that is true but we want to put our effort in the right place. We do not feel that inerting is putting our effort in the right place. If you have a 50 or 80 percent metal water reaction, you have a problem with that plant. We feel that can be prevented or even terminated if the operators understand the plant and they have sufficient systems that disposal -- to terminate the sequence. I think that is a new term you will hear from the vendors and industry and EPRE as we do our -- and so forth. We will talk about -- and prevention in terms of terminating these things before they get to an accident.

We feel every effort ought to be in preventing accidents as opposed to inerting, which is essentially a fairly poor scheme for mitigation.

That concludes my comments. Steve wanted to make a few detailed comments with regard to the features of our systems.

MR. STARK: I would like to move ahead to slide four. We will try to speed things up. (Slide) My name is Steve Stark. I am Managerof the BWR Evaluation Programs at General Electric. I will provide some background information to support the conclusions that Dr. Sherwood just presented.

First of all, I will consider the question of hydrogen generation and how this question can be addressed both through prevention and mitigation. Next, I will move along to the aspect of inerting and over what spectrum of transients and conditions this helps reduce the risk.

The question of inerting is not just risk reduction; it also introduces some risks and I will look at that. Finally, I would like to give you some comments we have on the staff position paper.

Could you move to the next slide, please? (Slide) The ability to protect against the results of hydrogen burning can be provided by one of two ways, either prevent metal water reaction or else to mitigate the consequences of the hydrogen presence in the containment after it has been generated, or that is, after the horse is out of the barn.

We believe that the best solution is to prevent hydrogen generation in the BWR design and provide features to assure that this goal is accomplished.

Let us review some of the design features that are unique to the BWR and assure that hydrogen -- significant levels of hydrogen will not be generated following either transience of accidents. Let us move along to slide six please? (Slide)

Here we have listed some of the design features that are unique to the boiling water reactor. One of the most significant ones is measurement of the water level within the reactor vessel itself. This is a direct indication provided to the operator and it is really the operator's primary parameter that he uses in following the response to a transient accident.

The BWR has a highly redundant water delivery system and there are six high pressure pumps and seven low pressure pumps that can deliver water to the reactor vessel and maintain core coverage. Only one of these pumps is needed for a small break accident or a transient to prevent core damage.

Connecting the high pressure condition and the low pressure condition is our automatic depressurization system and it provides a boiling water reactor with the capability to rapidly depressurize.

Also these pumps are connected to cooling systems that have a diverse phenomological pooling capability. They provide the BWR with a planning capability and direct spray capability onto the top of the core.

You probably know the TMI is almost to pressure and the BWR in contrast for any accident scenarios can be depressurized by pushing a button.

COMMISSIONER GILINSKY: Am I right in saying that all this adds up to your concluding that we really don't need, in the case of BWR's, to protect against core damage or metal water reactions up to some substantial fraction of the core, 25 or 50 percent, whatever?

MR. STARK: We believe that boiling water reactor, as currently configured, and also as supplemented by actions taken after TMI, provides assurance that we will not get significant metal water reaction.

COMMISSIONER GILINSKY: I understand that. You are saying that it is so improbable that we don't need to guard against it?

MR. STARK: Yes. That is our design goal and we feel we have achieved it.

MR. SHERWOOD: That's right.The answer is yes. If in the course of the rulemaking, if one wants to postulate scenarios as Dr. Hendrie did a little while ago, then we are willing to work with the Commission in terms of their scenarios.

The one that you describe in terms of what if, in the event of containment --

COMMISSIONER GILINSKY: Let me tell you what bothers me about --

MR. SHERWOOD: Essentially that is a systematic approach to the problem and not a knee-jerk.

COMMISSIONER GILINSKY: Let me tell you what bothers me about this scenario approach. That is, it assumes that we understand these systems very well and perhaps we finally do but we have been fooled alot of times in the past, over the years and have had some nasty surprises.

In task force after task force, they have made recommendations over the past 15 years and concluded that things were reasonably enhanced and then we have discovered that there was still something to learn. So I am not sure that one can solely rely on a specific scenario that one understands in specific --

MR. SHERWOOD: I would be the first to agree with you. However, if one wants to postulate some accident scenarios, we ought to do that on a more systematic basis and study the PWR and its virtues and the BWR and its virtues in terms of how to take care of these fixes. I think over the next year or year and a half we will have some good answers but we do not think that inerting is the right way for a quick fix for a BWR. In other words, it is expensive.

COMMISSIONER GILINSKY: I was not addressing my comments so much to the inerting, just that general approach to thinking about --

MR. SHERWOOD: We are taking the whole issue of TMI very seriously in the BWR world. We have a major task force, and we are spending several million doing fault trees. That's a very large effort so we hope in another year and a half to do a very substantial level of what can go wrong with the plants.

COMMISSIONER GILINSKY: Even with the fault trees, I think analysis is important and should be undertaken time after time. You know we had the Brownsberry fire and you -- we found out that wasn't in the fault trees.

MR. SHERWOOD: But nothing happened to the pack.

COMMISSIONER GILINSKY: I don't want to argue that here. The point is that it was a serious event and one that had we thought of it before, and really analyzed it, we would have taken it seriously.

I am just saying that we cannot entirely depend on all of those probalistic analyses or any other kind of analyses of this sort. One simply has to take some measures on the basis of a difference in reasoning.

MR. BUCHHOLZ: The purpose of issuing this chart was not to close our eyes to the kinds of concerns that you are expressing but rather to point out, as strongly as we can, that the BWR is a different kind of machine than we have been studying before. If the medicine should fit the illness, if you will, that looking at metal to water reaction may be appropriate for one type of machine but may not be appropriate for another type of machine.

We are trying to point out that there are some very real physical differences between our design and the PWR design which, in our judgment anyway, make metal to water reaction not a valid parameter for use in the sort of endeavor that you were talking about.

COMMISSIONER GILINSKY: Maybe I haven't gotten into it deeply enough.

MR. BUCHHOLZ: Just for example, in using the staff's numbers, there is an estimate of something like 48 seconds to core uncover for a DVA. You know if you look at the types of transients, like a loss of feedwater transient or -- fail transient for PWR, and assume there is no water put in through multidegradations, you will find that there is a 15 minute time before you even uncover the top of the core and another 15 minutes before you get significant metal water reaction. Those are the sorts of differences that are embodied in our design that we are here asking to have accounted for in any sort of prescriptive action on the part of the staff.

COMMISSIONER GILINSKY: Let me tell you that I don't mean to be saying that we ought to ignore the nature of the design or not consider what kind of reaction you have. I certainly think that all of that has to be taken into account but we have gotten into trouble time after time, simply depending on explicit scenario.

You reason that we didn't really have an emergency planning program; it doesn't directly involve the reactor here. I am just trying to --

MR. BUCHHOLZ: All I am trying to say is that if you are going to make an arbitrary requirement, perhaps you have to tailor the arbitrary requirement to the product that you are doing and that is really our point in the slide.

COMMISSIONER GILINSKY: If you are saying you ought to be selectively arbitrary, I will agree with that.

MR. BUCHHOLZ: If you feel it is necessary.

COMMISSIONER HENDRIE: Arbitrarily selective.

(Laughter.)

COMMISSIONER HENDRIE: I think the points --

MR. SHERWOOD: There ought to be -- before there are fixes.

COMMISSIONER HENDRIE: The point is well made. You have other points, Glen, because we do want to hear from Yankee? If Yankee intends to rush in and explain --

MR. STARK: I won't go through the rest item by item but I might point out that on the last items, the BWR does have some other features already in it that are being recommended now after TMI is at its high point -- whatever.

For example. --

CHAIRMAN AHEARNE: If you are going to read through all of that, Yankee is not going to be heard.

MR. SHERWOOD: Why don't you just finish up?

MR. STARK: Okay. I'll make it very brief.

CHAIRMAN AHEARNE: We are now about 25 minutes into the 15.

MR. STARK: We believe that the recommended inerting of Mark I and Mark II is only a fix for a small spectrum of possible conditions. It protects over only a limited range and there are other considerations that ought to be taken in effect. The BWR containment has a build in protection already, for example, because the containment is so small.

There is only a presence of oxygen to support burning of 17 percent of the Zirconium liberated from the core. Also we feel if you are looking at the pressurethat results from burning of hydrogen in the containment, that is only one of the concerns to the hydrogen generation.

There is also core melt and other failure mechanisms to be considered.

CHAIRMAN AHEARNE: Glen, I would suggest that you attempt to pull that impression together and submit it to us and particularly since youtake exception to some of the numbers calculated by the staff. Some alternate numbers might be appropriate.

MR. SHERWOOD: We will do that.

CHAIRMAN AHEARNE: I think to treat your arguments fairly.

MR. STARK: I will let Yankee Atomic cover the plant safety and plant cost estimates.

MR. BUCHHOLZ: Mr. Stark had some other comments having to do with specifics on the paper which with your offer here, I think we can accommodate that way.

MR. STARK: Okay.

MR. SHERWOOD: Thank you.

CHAIRMAN AHEARNE: All right, Yankee.

MR. SILFER: These are copies of the slides that should be presented.

CHAIRMAN AHEARNE: Let me tell you since I think you are down to about 10 minutes --

COMMISSIONER HENDRIE: Let's give one to Sam, okay?

MR. CHILK: A record copy.

CHAIRMAN AHEARNE: Since we have the charts. GE and Yankee had roughly 30 minutes and GE has used up 25 of the 30 minutes so speak rapidly.

MR. SILFER: Thank you, Mr. Chairman. My name is Bruce Slifer, Manager of the BWR Transient Analysis Group for the Yankee Atomic Electric Company representing Vermont Yankee today.

I would like to thank you for giving us the time to speak to you. I think because of our operational experience operating one of the two BWR's with Mark I containment which -- early today, gives us the opportunity to give you the benefit of our operational experience and to give you our ideas as to why we think it is a good idea to operate, why we are concerned about the recommendations of the staff to inert the containment.

If there is anybody there with the slides, I would like to see slide one, please? (Slide)

I would like you to consider the following points before you make any kind of decision on inerting. First, we have some real life considerations, operator risk or real early containments.

There has been some mention of at least one death in the inerted containments.

COMMISSIONER GILINSKY: Where was that?

MR. SLIFER: In India, Terapour --

CHAIRMAN AHEARNE: We have struggled so long about whether or not to send fields there, now you are telling us now there is a down side that we hadn't appreciated?

MR. SLIFER: I will address -- Bob Sojka, who is the Operations Supervisor, who has made a number of containment entries for the plant, has been -- will address that question -- maintenance benefits associated with inerting.

What we feel is at issue here is the balancing of these real life concerns against a hypothetical situation. That is the risk reduction associated with trying to mitigate large releases of hydrogen in the event of severely degraded core condition.

We would also like to have you consider the two actions alluded to today,one of them is the rulemaking on the degraded core accidents and secondly, the fact that we and General Electric are doing fault tree analyses to try and quantify the risk and benefits associated with the emerging issue.

We have a 1 year contract right now with MIT, Professor Resosen (phonetic), Department of State --

COMMISSIONER GILINSKY: I think you could help us most if you would explain the risk and benefits of inerting and the benefits of getting into the containment.

MR. SILFER: Why don't I go right ahead and let Mr. Sojka speak to that, go into his part of the presentation because I think you have heard some of the other points before.

MR. SOJKA: My name is Robert Sojka. I am the Operations Supervisor at Vermont Yankee and my purpose here is to try to present some actual operator experiences, some real world data, if you will.

Without attempting to delay any of your time further, could we have the next slide, please? (Slide)

Some of the advantages that we have actually experienced at Vermont Yankee include four areas, one, the first and most obvious, operating with a non-entity containment has vastly increased our ability to locate, evaluate and isolate system leakage.

We found it is -- to increase even minor equipment malfunctions, many of these long before we begin to even approach tech spec limiting additions.

We find also that we are able to minimize unnecessary thermal cycles on the reactor systems simply because we are able to cope with relatively minor issues which if left unattended could develop into major equipment malfunctions.

Equally significant, we have found that we feel that we have been able to erase entirely the wait and see attitude which inerted plants must endure. If we could have the next slide, please? (Slide)

You will see -- I am going to restrict my thoughts to just the last 5 years of Vermont Yankee's operation. Let me direct your attention just to the extreme lefthand column where you will find dates followed by a number in parenthesis which reflects the number of containment -- that were made on that specific date, the percentage that relates to the proper level that the entry was made at.

You will see in the next column the reason for most of these entries was for leakage inspections, the excess totaling 21, presents the significance of this point. There were, in the last 5 years, 21 entries into our non-inerted containment while the reactor was either at a power operating condition or had just grounded and scrammed and it was being returned from that scrammed condition.

CHAIRMAN AHEARNE: Do you have any idea how this Examiner's Table would look for a plant that is inerted?

MR. SOJKA: I am sorry; I can only speak with expertise on Vermont Yankee. I have to believe that for a plant that does inert, you will find they cannot enter the drywall as often as this and must wait and see until an opportunity is made available to cope with some problem within the drywall itself.

I would like to say that by not inerting, we have been able to increase the operator's incentive to correct even minor equipment malfunctions and our operating records will show that we have responded to minor symptoms of problems within the containment, one very specific symptom is a minor indication of leakage within the containment.

If we respond to that much sooner, they will find that a plant with -- containment is capable of responding the tech spec limit.

CHAIRMAN AHEARNE: Are you saying that on the basis of logic, that would lead you to that conclusion or of a comparison you know of with respect to plants that are inerted?

MR. SOJKA: I am saying that if you have a problem within the containment, you must enter and gain access to the containment-- you must at least be inert. That takes typically up to 8 hours, so you must at least wait the 8 hours. At Vermont Yankee, we do not have to wait that 8 hours and as we move along on some of these slides we will see where the -- has happened in the past. Next slide, please?

Our discussion at the moment is increased incentive and on slide five (slide), we will note that on Christmas Day 1977, I and two other men at the plant find ourselves in the containment at the power level of 75 percent to evaluate what was a rather minor leak, the case represented by the slight increase in the chart on the lower righthand side.

You all know that leakage is only on the order of 2.1 gallons a minute. The tech spec number is in fact 25 in this case. I do not anticipate that other plants -- but our inerted containment leakage is up as high as 25 gallons per minute -- where there is no alternative, not do it and see and watch this sort of symptom until it develops into a more serious and obvious condition.

This is the type of increased incentive that results from non-inerting. If we could go back to the previous slide for one moment (slide), you will see that out of 21 entries that were made in the last 5 years, all of them were successful.

In fact, the third column on the right indicates there were eight entries of the 21, that resulted in successful leak isolation. There were, indeed, four entries that identified a more serious problem which required an immediate plant shutdown.

There were other entries in which no leakage was found and I conclude this is just as successful an entry as those in which we were successfully able to isolate a leak. The average time for a drywall entry at power is only on the order of 2 to 4 minutes in a non-inert containment.

The procedure is quite simply generally reduce power level to something on the order of 40 to 50 percent,enter the containment, assess and evaluate the leak and exit the containment. That really has not taken any longer than 2 to 4 minutes.

Once outside the containment, we have been largely successful on the order of 70 or more percent of the time to be able to remotely and electrically backseat the valve or the source of leakage, that is just opening the valve fully to a condition where the backseat actually isolates the leak. and then make an even briefer reentry into the containment to confirm that the leakage has been adequately isolated and then return back to full power.

My final thought, gentlemen, is that those plants which inert must, of necessity, wait and see. They have to take the wait and see attitude rather than prematurely take the plant off-line for a slight increase in containment leakage an increase of perhaps of 1.5 to 2.1 gallons per minute. They must watch and plot the leakage and when they see that leakage taking a dramatic trend or approaching the value which they probably determine themselves, something more conservative than the textbook, but 25 gallons per minute, then they begin to take the corrective action.

CHAIRMAN AHEARNE: I guess realistically we ought to talk to someone who is running an inerted plant to find out what they do as opposed to what you believe them to do.

MR. SOJKA: I am --

CHAIRMAN AHEARNE: I can see your point logically would lead you to that conclusion.

MR. SOJKA: With one other reservationand that is that they must, of necessity, be inert. That, in itself, takes some time.

CHAIRMAN AHEARNE: So it concerns the rapidity?

MR. SOJKA: I would like to show you two illustrations which further evidence the no redundancy attitude at Vermont Yankee if we could have slide six. (Slide)

We will see that on May of 1977 we saw a rather dramatic spike that you see -- just below the pencil scratching on our drywall sump leakages, again on the order of 3.9 gallons per minute. The timeframe is of significance here, however.

At 2135 hours, we noticed the spank -- if you will notice further, at 2335 hours, three men entered the drywall to assess the leakage and that is only 2 hours after the spank occurred. No inerted plant can do that.

You will note further that 3 hours and 4 minutes after the spank occurred, the men were clear of the drywall, identified the leak and the valve was electrically backseated and a second entry made to confirm the leakage had stopped. Next slide. (Slide)

I am moving along rapidly in the interest of time, Mr. Chairman. You will see a copy of the operator's log book taken January 5 of this year. You will note that at 0100 hours in the morning, there was a symptom, a minor symptom of drywall particulate, some drywall pressure and some drywall temperature showing an increasing indicating a rather small leak was developing.

You will notice within an hour plant management was notified. You will notice further by 0430 hours, within 3 1/2 hours, there was an entry made into the containment. If you wade through the penmanship here, you will find there was a leak identified as a packing leak on a valve RA2R81V which happened to be a manual, non-cylible valve.

The leak was such that we could not send the man into the vicinity of the valve to backseat the valve so we got us an immediate plant shutdown at 0545 hours. That is a no wait and see attitude that an non-inerted containment can inspire.

One point I would like to make, if we could go back just briefly to slide four, of the 21 entries that were made in the past 5 years, on the average of 4 a year, none of these entries would have been made if the containment had been inert because all of these were made with the reactor at power operating conditions somewhere between 40 and 100 percent power.

CHAIRMAN AHEARNE: But some of them might have been made shortly after you had concluded that you would have to be inert, and most likely some of them would have been postponed until a convenient time to shut the plant down -- and make the inspection.

MR. SOJKA: Gentlemen,to the best of my knowledge no plant which inerts currently allows drywall entries. We would not if we were required to inert.For the reason that I have attempted to rush through, I suggest that inerting may not be the solution to the problem. There may be other alternatives and I offer Vermont Yankee's operating history as testimony to that.

Are there any questions that I could attempt to answer for you?

CHAIRMAN AHEARNE: I guess what I've got to do is ask some of our people to give me some sense of what this would look like with an inerted plant and do a comparison of the amount of entries as a function of -- of the last several years' operations so I can get a better sense of comparison. I can certainly understand your point of what you can do since you -- inerted but I would like uninerted or not inerted -- I would like to get a sense then of what the comparison is against -- there are a large number of plants that have been operating with the inerted system. I've got to get that sense of comparison for myself. I am going to get GE's comments that they will be putting in.

COMMISSIONER GILINSKY: I think that was a very clear and useful presentation.

MR. SOJKA: On behalf of Vermont Yankee, I thank you for your time.

CHAIRMAN AHEARNE: Thank you.

COMMISSIONER HENDRIE: How is the capacity factor running this year?

MR. SOJKA: Better than ever. Yesterday morning, when I left, the plant was running at 99.8 percent power. We like to think it is going to stay there.

COMMISSIONER HENDRIE: Knock on wood. How long has this run been going on at the plant level?

MR. SOJKA: Dr. Hendrie, we did have a shutdown at the end of January that had to do with implementing the TMI fixes on the pressure relief valve and rails and safety valves but it has been successfully operating at full power since that time.

CHAIRMAN AHEARNE: Thank you all.

(Whereupon, the Commission adjourned at 6:00 p.m.)