NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

In the Matter of:

243rd MEETING

PART II

DATE: July 11, 1980 PAGES: 460 thru 586

AT: Washington, D. C.

ALDERSON REPORTING

400 Virginia Ave., S.W. Washington, D. C. 20024

Telephone: (202) 554-2345

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

- - -

243rd MEETING

- - -

Nuclear Regulatory Commission
1717 H Street, N.W.
Room 1046
Washington, D.C.

Friday, July 11, 1980

The 243rd meeting of the Advisory Committee was convened, pursuant to adjournment

Members Present:

MILTON S. PLESSET, Chairman
J. CARSON MARK, Vice-Chairman
CHESTER P. SIESS
STEPHEN LAWROSKI
MYER BENDER
DADE W. MOELLER
WILLIAM KERR
MAX W. CARBON
WILLIAM M. MATHIS
JESSE C. EBERSOLE
HAROLD W. LEWIS
DAVID OKRENT
JEREMIAH J. RAY

Staff Present:

R. SAVIO

MR. PLESSET: Gentlemen, before we go to the next item on the agenda, I want to address on behalf of the Committee our appreciation to a senior fellow, Bill Kasenberg, who is leaving us and who has done a lot of good for all of us. This expression of our sentiments may not mean all that much, but I am proposing to send a copy to the dean, and that may do him some good.

(Laughter.)

So, Bill, with that in mind, here is a letter of commendation. Let me personally express my thanks, and I hope the dean also appreciates it.

MR. KASENBERG: I hope so, too.

(Applause.)

MR. PLESSET: Now the meeting is turned over to Dr. Siess.

MR. SIESS: Gentlemen, you have all received a number of revised drafts. In each case you are getting the complete chapter. Just take out the old one and put in the new one. That does not mean that all the pages have been changed. It was done for your convenience.

Please turn to chapter 4, part 2, decision unit 4, Severe Accident Phenomena and Mitigation Research. It has five sub-elements. Three of them relate to essentially core melt-type things, and the last things refer to fast and gas. Bill Kerr will handle the first three. Max will

handle the last three. Is that okay with you, Bill?

MR. KERR: Yes. Let me correct two small typos. Under 11 -- line 15, the word "seem" should be "seems," I believe.

MR. PLESSET: They can't hear you, Bill.

MR. KERR: That is all right. The typos -- you have got that. Thank you, Mr. Chairman.

The first introductory paragraph is an effort to repeat what we were saying to the Commission today, which is that they need to get involved in this area and give some guidance to the staff, which would lead them to do some planning for dealing with this problem upon which eventually research can result. In the meantime, the research people have tried to plan to a program to deal with core melt and severe accident mitigation.

I see also that behavior is misspelled in 4.2, but I think that is obvious.

MR. SIESS: We just thought you wanted it that way.

MR. KERR: There is not a lot of material here, and what I have done, in effect, is to endorse the levels being requested by the last column over there in each of the three categories with which I deal, although it does not show in the copy you have, probably, because I had written it in at the end of each subsection, beginning with Subsection 2.

I would propose to add a sentence which says the requesting level is supported or is appropriate. By requesting level, I mean the level in the project column.

Now, I have also taken the viewpoint in 4.2 and in 4.3 that early work should be progressive, at least in my view, in the sense that one should first try to put emphasis on problems associated with possible cooling of a melted core inside the vessel in order to get some idea of how feasible this might be or what the probability of melt-through is on a better basis than we now have, and that that then would provide additional information for planning and further research.

I do not know whether this is a committee viewpoint. It was my viewpoint, which I did not have a chance to discuss in any detail with the Subcommittee. I have no further comments. I will try to respond to questions.

MR. SIESS: Comments, Dave?

MR. OKRENT: The program as it was presented to us by the staff is a research program which you might follow if you were going to do some kind of evolutionary program if you thought you had really quite a few years before you needed to get focused, and certainly quite a few years before there were going to be some decisions that the Commission was going to make, either with regard to operating plants or with regard to new plants. Those were

different questions, at least in part.

My own feeling is the proposed program is not sufficiently well defined and it is not adequate for a short-term -- by short-term, I mean one to four years, depending upon which reactor you are talking about. It could be one for some existing reactors, and it could be for new plants, and I don't know what the others are. I do not think it is adequate for that. At least if I were in the position of having to arrive at some judgments and wanted to have information that I thought would be useful in arriving at these decisions, I would foresee a rather different program and a rather more ambitious program. So I have that problem, which I think is not specifically identified here.

I certainly agree that the current program does not have the current benefit of Commission guidance and I do not think it has the benefit of what should have been really strong interplay between the heads of offices like NRR and the Office of Research for those people and their immediate assistants in trying to really talk over what should we do here and why and when and how and so forth.

As far as I can tell, it has not had the benefit of that. I think it would look different, in fact, if it had that kind of discretion. I think something like this ought to be said right in here, and I think something should be said that if the Commission hopes to -- unless they have

decided they are going to go the prevention route, in which case they do not really need too much of this -- or unless they decide to have a decade to decide rather than a short time scale, they need to have really an early emphasis on getting their act organized, as it were, and that they give the necessary priorities and resources in FY 81 and FY 82. That is not the situation with what we see here.

I prefer to deal with the general question. I have specific points with what is here, but I do not know how the Committee feels on the general question.

Dr. Budnitz is raising his hand, Mr. Chairman.

MR. SIESS: Bob.

MR. BUDNITZ: Dave, I am desperately trying to figure out what, in detail or in gross, is not right. If I could get you to say, I would be delighted to figure up what to do to accommodate it. It is not too late. But I do not get much specific out of this, and I generally have the feeling that what we have done is an attempt to be as responsive as we can to our best guess of what we could get from those other guys if we could pin them down.

What I mean by that is -- you just said you suspected that our program would be different if we had had the benefit of interaction from, let's say, Denton and his colleages that we all know we have not had the benefit of. How, in your view? Secondly, of course, if the Commission

is really going to as a matter of policy go the prevention route, then expansive studies of mitigation features are less important.

We have attempted to guess that they are not going to go the prevention route. We have planned the program on that basis. You say it is inadequate. How? Now, there are some things that you have mentioned as inadequate in the sense we are not going to deal with all the various

sequentially. That is one specific point I heard.

But except for that, I remain personally at a loss to try to see where the kind of direction we are heading or its general size and thrust is substantially off base. I guess I am mystified by, you know, not only just what the general thrust is but how we could have approached it in a different way.

Now, we could have approached it in a different way by trying to pin down earlier than has been possible some of the other policy-making people in this agency. I guess that is kind of like trying to capture a river, and it is not a bad analogy. It is like trying to capture a river. The river is flowing its own way, and even dams do not capture them.

Secondly, it is fair to say, I think, that the guidance we have from your committee, which is, after all,

another one of the policy-making groups that we deal with all the time and which we are trying to listen to, has been coped with as best we can. We have written letters from your committee that go all the way back to just after the accident at Three Mile Island. It has been 16 months. There is not much in that written record that I think we have not responded to. Perhaps I am missing something.

So I guess I am just pulling for being more specific so I can know how to respond to it.

MR. KERR: Mr. Chairman, I think I understand what Dave is saying. I do not necessarily disagree with the urgency and the need for activity, aside from your question. I guess I just do not see that one is likely to achieve any more specific direction, nor do I see the probability of spending any very much larger amount of money in some reasonable way until the Commission and the staff operating as a group have made more of a decision as to the approach that is to be taken.

I would agree with perhaps more specific or stronger language in the introduction to the section than I wrote. I was writing something that said in a few words that input from the staff and Commission was needed in order to plan this budget, but I cannot, unless one is going to turn over to Research the responsibility for planning and carrying out the policy, I do not see how they can do very

much more or be very much more specific at this point until they get additional input from the Commission.

MR. BUDNITZ: I want to go a little further than that, Bill. Because the staff and the Commission's views are still not yet focused -- by the way, this happens in a lot of areas. It is true in the siting rulemaking -- we have a responsbility to try to get out ahead of them, because budget planning is two years in advance, and responsibility is acutely upon us in a way that it is not upon them.

They do not have to do their things until it happens. They just have to get the people. We have to get the money. So I believe we have a responsbility to try to get out with specific programs where we had them in general areas where we do not know specifics. My point is I think we tried to do that here as best we could. If I have not exercised that responsibility fully, I sure wish you would be as explicit as possible in saying so so I would know what I am supposed to do. I will take whatever specific direction you would like and deal with it.

I then have to finish in the next three weeks because three weeks from today the Commission's mark goes to OMB. They give the mark, and then it has to be printed. It is wrapped up three weeks from today. In the next three weeks there is a substantial opportunity for me to modify

this whole budget proposal if you can give me the proper guidance, and I am willing and able. Three weeks from today I am leaving. That is separate from the fact the other thing is more important.

The Commission's 1982 budget still has as much flexibility in it as we together can provide impetus for.

MR. OKRENT: Well, I could try to give you --

MR. BUDNITZ: If not here --

MR. OKRENT: -- more detailed suggestions, and I may yet. Let me detail part of the way of thinking that it seems to me one would follow in trying to do this. You can divide the problem into parts. One part of the problem is posed by what I will call the Zion-Indian Point-Limerick group.

If you ask yourself what is the information that in the end the Commission is going to need in order to decide whether or not it will have mitigating features at Limerick, and if so, which ones and on what basis will they make a requirement, that lays out a kind of information requirement that I do not see being met in the research program. I don't know how the technical assistance program has been devised to do this, but that poses a certain set of kind of information and a time scale.

Furthermore, unless the Commission is going to change what they said about the order of magnitude, not a

change of amount but a change of years, then there is a related but not identical set of problems that arise from what I will call the operating reactors, not including those two that are already -- those three. I take it back. I included two Zion, two Indian Point, and is Limerick up here? I cannot recall. Four operating and two under construction, but the other operating reactors, which, in fact, are not identical to these, although there are new questions. In fact, the ice condenser is just one example of what is not included, but there are other more specific things.

What information should the Commission have in order to arrive at some kind of a policy with regard to these, and this is partly risk information. It is partly what kind of mitigated features could you do and what would they buy you. I do not mean, now, introductory information like a university might try to prepare to see is there a concept that might work, or even the next step that you might get out of a first cut from a national lab.

I think you really need to have some kind of an efficient technical basis to know what you are talking about. Let me just leave it at that.

MR. BUDNITZ: Alternate containment concepts of various kinds.

MR. OKRENT: Whatever. I am saying that in my

opinion, if the Commission is going to arrive at some kind of a mitigative requirement for the first group of reactors, it is going to have to know whereof it is talking and not -- if it is introducing some bad features with some good, it is going to have to know what these are, and so forth and so on, and you don't just do it with vague concepts.

I do not really think it is an impossible task to try and structure for future reactors, the reactors not yet designed. In fact, there are some other options that are posed. At least, unless the Commission says we are going to exclude certain kinds of options, there are options which are, you know, really quite different, and you have to ask yourself should there be at least a preliminary kind of research on other options on which you develop early information so there can be a review, and some kind of a judgment or whatever within the NRC; should there be a next step or whatever.

Also, you obviously have, from the Zion point of view, more flexibility in what you do for a reactor not yet designed. So I would not lay this out myself as a research program, which is the way it tends to be, and the bulk of the money is looking at certain kinds of phenomena. Not that you don't have to understand some phenomena well and some partly to do this, but I think a different kind of information is needed more generally.

MR. BUDNITZ: I understand the point.

MR. OKRENT: The time scale is what, in my opinion -- the sophistication of information --

MR. BUDNITZ: Let me try to ask a question to clarify the thought. As I said, it is not too late for me to make some changes here, but I have to try to understand where you are driving. Take, for example, the idea of a filter vented containment. It is only one idea of a list that actually extends all the way to very novel and not well-thought-out schemes for brand new reactors.

Now, you might ask the question on the filtered vented containment whether the Commission wants to require them, for example, on reactors already running. So then your point would be that the agency is not in a position to address that question without certain kinds of research, and those research issues involve, for example, exploring some accident sequences for which that gadget might be counter-productive, in trying to balance them against those for which it would be productive so as to assure you are not compromising safety in one way, or if you are, to understand how.

That is the kind of thing you are driving at, as well as other phenomena. Is that an example?

MR. OKRENT: Only part.

MR. BUDNITZ: That would be accident sequence-type

work, to try to see which sequences it gets involved in in the wrong way. But that is only part of it.

MR. OKRENT: I think before the Commission is going to be able to arrive at an opinion on, let's say, existing plants, it is going to have to have some designs in mind. I do not think you can make the decision in terms of accident sequences and phenomena. If we had a simple way of protecting against pressure vessel failure --

MR. BUDNITZ: We would do it.

MR. OKRENT: For a million bucks per plant we would have already, and we thought it would work and so forth. But nobody has come up with a design which we --

MR. BUDNITZ: Let me carry this further, because without pursuing this, we really do not come to the understanding. The point would be you might take a specific reactor and look at a specific design, not to force the design on somebody, but in the same spirit that Norm Rasmussen went to Surrey. You take a specific reactor. You design such a gadget in order to understand for that specific design the issues that you cannot get generically, and then from that -- you do this for a great range.

Having done that for a series of designs, you would have the sort of insight that would enable you to decide whether they should be required: if so, how, what basis, what time scale for different ones, yes or no. I

understand that.

MR. OKRENT: I think you had better know where you did not have enough information, perhaps, to decide or how to design it or whatever, and you will have a more focused research program. That is all I am saying.

MR. BUDNITZ: To take, then, the specific example I cited, let's walk through how we would go about that. The first thing we would do is what we have already done in filter vented containments. We have done sort of a scoping study that Sandia did for us which examined the basic issues of how it would work, the parameters, size scale, rough cost, things that it will do, things it won't do.

Beyond that, you would then want to take that conceptual framework and pick six or eight typical but generic containments like MARK III or ice condenser or whatever, and for each do a specific design. There what we are attempting to do is to get DOE to do that. That is inadequate because we can't get them to respond so far.

I am afraid, though, that in the present peculiar environment -- maybe you ought to write something about this -- we cannot do that detailed design. We are precluded. We are precluded by OMB direction. We are told we must get the Department of Energy to do that. Part of our problem has been that folks over in Germantown have not yet put it in their plan, and those of you who have seen the DOE plan for

this year and next year see that it is not in there.

I have tried to twist their arm, and finally I think we have them on board, but it is hard. They have recently reorganized, and some of the people who did not lik this are now no longer with us, at least interacting with us as much. But there is an example of a progression of research in which we have to stop somewhere. I think it is unfortunate. We ought to be able to do that. That is the way the world is now for us.

After you have done this -- suppose we did -- then we would be able as an agency ourselves to come up with an evaluation. We could say to the Commission this ca be accomplished, that cannot be. Without that, we have not done an adequate job. From that point of view I do agree with you.

MR. BENDER: Bob, your elucidation at least helped clarify my thinking to some degree. I am not convinced that you have to go to the point of having a design.

MR. BUDNITZ: I am not really convinced but I understand its efficacy.

MR. BENDER: But setting aside that fact, you have the conceptual ideas. It does seem to me that another aspect of the matter is to say what do you have to do to verify the conceptual ideas, setting aside the business of designing something.

MR. BUDNITZ: Design is at different levels of detail.

MR. BENDER: Of course. But you can do a certain amount of proving of principles, things of that sort that have to do with the device itself as opposed to trying to find out what a melt is doing, even though both are important. I do not get any message from what you have told me so far. From what I know about this plan here, that tells me that the proof of principle of these things is being attacked.

MR. BUDNITZ: I understand. Is that your point, too, Dave?

MR. OKRENT: Yes. In other words, there are two steps of design. I am not proposing that you go out and design the system that would go into a plant.

MR. BUDNITZ: We cannot do that. The architect-engineer has to do that.

MR. OKRENT: There is a step before that where you can call it detailed conceptual, whatever you want. I don't see why the NRC --

MR. KERR: A severe accident mitigation program could certainly do that.

MR. OKRENT: So I do not buy your statement that only DOE can do it, because I think you can always stop short of a point, and I do not know that you do a single

design for the MARK-III.

MR. BUDNITZ: That is true, as well. That was only an example.

MR. OKRENT: Maybe what you have to do is look at the MARK-III and say what are the possible approaches, and after you look at them, none of them may be good, or they may all be good, or whatever.

MR. BUDNITZ: I understand your point.

Now, on the question about us and DOE, I do believe that right now we are precluded from going very much further than kind of a scoping conceptual design.

MR. SIESS: Precluded by whom, Bob?

MR. BUDNITZ: OMB. OMB originally said --

MR. SIESS: They did not want you to do anything.

MR. BUDNITZ: Nothing experimental. They just said think, no experiments. We went and objected to that, and my feeling is the way it came out was --

MR. OKRENT: We don't have that category any more.

MR. SIESS: Yes. So you have them beat. You have conceptual design in (e)(3)(A).

MR. BUDNITZ: Yes, we do.

MR. SIESS: If they can do it on a time scale that will help anything, fine. If they can't do it, I think you can't, and by conceptual design I mean this other thing Dave was talking about.

MR. BUDNITZ: I understand. Let me reiterate. I guess I have to go back and make sure wherever this dividing line is, it does not matter where it is except insofar as the work has to get done. It has to get done our way even if it is done that way, because if it is not done our way, it is of no use either.

MR. SIESS: There are some ways that DOE just does not want to do anything.

MR. BUDNITZ: Yes, that is right.

MR. SIESS: Where does this go in here? The severe accident mitigation. There is almost a caveat against doing the work here. The improved design -- I am sure that is not what is meant. Am I correct, Dave, that this is what you are really addressing at 4(c)?

MR. KERR: You may not like the language. As I said, I wrote it.

MR. SIESS: I am trying to find out whether he likes it.

MR. OKRENT: I am looking at the general topic. First the question is the whole general decision unit. In fact, I might find some parts of what is proposed as premature to spend the money there, some experiments proposed.

MR. SIESS: The last discussion is on accident mitigation and fuel melt behavior, and I was trying to see

if we can address this concern in 4.4. If you have concerns about 4.2 or 4.3, we can try to address them.

MR. OKRENT: They are inter-related. That is why I started with the -- in my opinion, this whole decision unit should be formulated and addressed toward answering as it can, giving information, or much of the information that the NRC will need for its various phases, the Indian-Zion-Limerick group, the other ones, the future reactor kind of thing, and it should be structured in that way and the resources should be there so that the information will be, hopefully, there on the appropriate time scale.

After you do that, then you look at some of these things and you may say yes or no, that should be in FY 82 compared to something else.

MR. BUDNITZ: So I understand the point about work in the area of mitigation, which is either gadjets added on to existing reactors or totally new concepts for reactors not yet designed. Now, if you look at the other two parts of this, on the board there is this fuel melt behavior, fission product release and transport. Those are in our plan oriented towards phenomena.

We are trying to understand in a generic way the phenomena that occur in these classes of accidents so that we can work towards the third thing, which is the mitigation

part, properly. If aerosols have a lot of CO-2 in them, there is a big difference than if they don't. Just to take the TMI example, if the iodine in TMI went mostly in the water, as we know it did, that is a different accident than was previously thought.

Do you have suggestions there about where this is oriented improperly or requires more emphasis or whatever?

MR. OKRENT: Well, I guess if I were going to try to lay out a phenomenological portion of the program, I would first try to make, let's say, an outline of what are all the phenomena of potential importance and why, and which of these are likely to be sticking points in the design of plants, which of these may be sticking points in trying to decide the efficacy or whatever it is of plants.

In fact, I would look hard to see whether I can really provide information that is going to change my ability to arrive at a decision. Just knowing more about this does not always get you far enough to change the basis by which you arrive at a decision.

MR. BUDNITZ: That is a good point.

MR. OKRENT: Right now, clearly you know fuel melt is related to what we are talking about, so you can say research in the fuel melt area must make sense. And similarly, we are interested in fission product release, too. What one does not see in what you have written, and, I

would say, understandably since it had come in, I think, from the kind of approach that I have been suggesting, is somebody trying to say, well, you know, if we try to go down this design path or that design path or that approach or whatever, where are we likely to run into difficulty and what kind of research information are we likely to need, and why?

Now, you might say there are going to be certain types of situations where we are going to want to know should we turn water on or not or so forth. All right. But then you have to say what is it that I want to do for an experiment that would help answer the question. Just doing an experiment of itself does not, so I prefer, as I say, to try to write down the kinds of questions that I would like to get answered by the research, and then see is there research that is going to make a big contribution: how much do you get back per dollar?

You cannot put $200 million into this. Clearly, if you can put an increased amount in, there is a limit. So should you be spending $10 million on core melt compared to $10 million on something else? That is a question that has to be part of the process.

MR. BUDNITZ: Those comments are right on the mark. I think that is the way we started. But I also think that you have to realize that we started with an incomplete

list and an incomplete capability. We obviously -- and this is sort of human nature -- we began by asking the sorts of questions that our own in-house people and their close colleagues in the field were most familiar with because they had been dealt with by those same people in the LMFBR area.

MR. KERR: This is a further complication and we are sort of ignoring it. We are teetering on the bring of shall we quit doing all the LMFBR-type work.

MR. BUDNITZ: Or will we be directed to, of course. But we started by using those people without skill, answering their questions or asking them. Then we took that same team and broadened it to include people, thinking about questions that do not come up in the LMFBRs. LMFBRs don't have water. There are a whole long list of questions involved with water and solubility that are very different in water reactors.

What we ended up with is a broad based -- two things to do at once. First, we want to try to get the information in the next year or two, or maybe quicker if we can, but the next year, or two, or three at most, that will help some of the short-range decision making.

Secondly, we decided that we had better plan a program that was five years in extent or more that would provide this sort of long-range understanding that we will be glad we had in the mid-80s.

We did not want to compromise that second goal for the first too much, we also did not want to compromise the first for the second. It turns out that it was not easy, I admit. Maybe we did not hit the balance quite right. If we didn't, your advice would be helpful. But you have to recognize that we didn't.

We had the two goals in mind, and complicating that whole was what Bill Kerr mentioned, we had to fold in the fact that we had this Cnsford and DLMFBR program which could be as big as zero in '82, or as big as $10 or $20 million. I don't know what they are going to direct.

Our planning was pretty much involved in that, and again if you think there are places where we are exploring phenomena in the wrong order, the wrong level of detail, or prematurely or whatever, or putting things off, by all means just tell us so that we can benefit from it.

By the way, just to comment on what I mean, the probability of getting more money than we asked for if the '82 authorization were to have become our spending limit, we would have had more money to spend than we asked in '81. The authorizing committee put in more money than requested, while appropriations does not seem they are going that way. The fact is that that $10 million there has no real relation to what Congress is going to do for us a year-and-a-half from now. I must say that that is an immeasurable complication to the whole problem.

If I sound like I am trying to explain to you why we have the troubles we have, that is really what I am trying to do. Let me just finish by saying that the things that you have written here are useful, but a few specific things in the report would help me, as well.

MR. OKRENT: While I do not know what position the committee wants to take in connection with this decision unit, there are at least some members who did not think this was the single most important research area. I don't know whether they think we should urge more support than is being asked -- I cannot tell.

I have indicated what I think the Commission should be doing, but the committee has to decide.

MR. SIESS: Why don't you say what you think ought to be said in those two sections here, and see if anybody

agrees?

MR. MATHIS: Dave, could we give Bob an example, or some examples that would be specific; that may help him.

MR. OKRENT: I thought I had.

MR. BUDNITZ: That would help.

MR. OKRENT: I thought I had given him a way.

MR. BUDNITZ: Just put that in the report, it would really be of help, just a paragraph to outline that process explicitly than for no other reason than that paragraph is going to be read by some new guy whose name I do not know, who is going to run this place in August.

MR. LAWROSKI: Would this be an appropriate place to put in your suggestion of establishing a task force. There has nobody as real user for this.

MR. OKRENT: Well, in fact, I have some revised wording from a bill for the introductory section. So, without using the words "task force," it says that kind of thing.

MR. LAWROSKI: We should try to get a focus on this, so that the generalization that Bob complains about is corrected.

MR. OKRENT: I guess my own feeling is that they need to do more, and different really than what is proposed here, even if it means they have to take it out of other parts of the budget, including seismic.

(Laughter.)

MR. BUDNITZ: I am willing. Just tell me what it is.

MR. OKRENT: Even if they are stuck at the PPPG level.

MR. BUDNITZ: We are willing, but we have to know what it is.

MR. OKRENT: The single most important question, where the Commission could benefit from information that the research program might possibly hopefully develop.

MR. KERR: I do not believe that in FY-82 -- I don't know what will happen next year. In October of '81, we are talking about spending about $19 million in this area in a situation which in FY-81 we spent about $6 million, and in '80 we spent about $2 million. I don't think that that program is going to increase that rapidly in a productive way. Maybe it can.

MR. OKRENT: I prefer we not say, we know how much money it is, because I do not think we know. But I think we could say that what is proposed in FY-81 does not --

MR. KERR: FY-82 or FY-81?

MR. OKRENT: Let me finish.

What they propose to do in FY-81, and the amount of resources does not look like enough for what the Commission's needs are, and that they should in fact

reorient what they are proposing in FY-82 and put in enough resources to meet the Commission's needs. It is likely to be more than they show with these kinds of words.

MR. SIESS: What does the Commission do when it sees those words?

MR. OKRENT: All right, then --

MR. SIESS: It seems Bob's request for this much money, the EDO mark for this much money, what does it do?

MR. OKRENT: It depends on how much time they have.

MR. KERR: Three weeks.

MR. OKRENT: After they see the words, they could say, "Mr. Denton and Mr. Budnitz, I am going to give you 72 hours --

MR. BUDNITZ: And Mr. Minogue.

MR. OKRENT: Whoever they decide. "I am going to give you 72 hours, or whatever, to come in with your definition of what you think the Commission should have in this area, the kinds of information needs." I hate to use the words, but an action plan.

(Laughter.)

MR. SIESS: What did NRR say about this before to get something in this report.

Right now we have to concentrate. It is very nice, and you can give Bob all this good advice, and if he can pass it on to his successor it will be very helpful. He

has about three weeks or less. But I think we need to get something into the report that will back up whatever he passes on to his successor, and one way I can see to do it is to rewrite the introduction, if necessary.

Certainly, we could take 4.2, or 4.3, and 4.4, the three areas, and replace them by a single item that outlines the approach you have recommended, and give perhaps an example and conclude the statement that we think that to do this requires more money than is listed for these three sub-elements, and indicate about what level it should be that they flag to the Commission.

Do you think you can do that? Is that a way of doing it, replacing the three separate items, the three sub-elements by one discussion. You can still list the three sub-elements.

MR. BUDNITZ: Mr. Chairman, let me describe what I will do with this. I will take directly to heart in any event what you write. I will take to heart this precision, and I will sit down with Harold, and I must say that means that Charlie Kelber sits down on that sort of things, too, and we will see if, for example, the severe accident mitigation lying up there is, in fact, woefully inadequate in terms of its funds because at this stage it is getting the funds there that give us the flexibility over the next several months to get together the right programs.

If a conclusion is arrived at that this is really low $N million, I will go to the Commission and say, "EDO mark or not, we want to do this and that, and are willing to do that." After all, a late budget is better than none.

On the other hand, your specific suggestions in the report, even though you have recognized they are only example, would be of tremendous guidance and benefit. I really cannot over-emphasize that because I would have a hard time getting people's attention. The "bean counters," I must say, are unanimously far less flexible than I can be. They are going to go wild when I come in and say, "Hey, we have already come this far, and you are going to take $3.9 and turn it into some other number." Whatever it is, I am willing, but your explicit-guidance would be a way around it.

MR. SIESS: You have $18.7, is that right?

MR. BUDNITZ: Right.

MR. SIESS: For those three items that is what NRR would have endorsed.

MR. BUDNITZ: Yes, that is right.

MR. SIESS: With the further expanded budget through the RECLAMA, they might have endorsed more, but you do not know.

MR. BUDNITZ: It was not the highest priority thing, because in their lower budget they only put

mitigation at $2.9 instead of $3.9, whereas we stuck with that number right through.

MR. SIESS: This is more than mitigation, if I hear Dave right.

MR. BUDNITZ: In that particular element, it was certainly so.

MR. SIESS: That is how you understand what Dave is saying of the $18 or $19 million, there needs to be certain things done. They don't necessarily follow in these categories with the $10.5 for fuel. Is that right?

MR. BUDNITZ: Yes, I understand.

MR. SIESS: If that is what the committee things ought to be done in this area -- We have informed Mr. Budnitz of that.

The next question is, how do we inform the Commission of that, and the draft we have just does not say that. In the first place, it endorses each of the three decision units at the levels indicated which clearly is not what is consistent with what Dave said. It does not provide the flexibility, and second, it endorses the research request, whereas Dave feels that it should be considerably greater. So perhaps 4.1 has to be written.

Mr. Okrent, are you prepared to rewrite it?

MR. OKRENT: I can.

MR. SIESS: It is only a page.

MR. OKRENT: I don't mind writing something.

MR. SIESS: I have not heard any disagreement here with what you have said.

MR. KERR: I personally am in favor of what I have written. I have not disagreed because I, too, agree that this is the committee's report. I just do not think that any very much larger amount than the amount being projected there can be spent wisely.

MR. SIESS: There are other differences, Bill, more important.

MR. KERR: I guess I do not quite understand what Dave is saying cannot be fit within that budget.

MR. OKRENT: In fact, I would not rule out the possibility that you decide in '82 to defer large expenditures on the first item because you do not know quite what it is you want to do that is worth that money. You put a lot more in what items are there. I think that could be a way of getting some of the resources that you would need.

I do not know that the resources available, if you shift that way, are adequate or not in view of the time scale, the number of different reactors, the number of different combinations, and so forth. I think, in fact, when they get into looking at specific designs they will get ideas where they want additional studies, hopefully not $10 million chunks like that first item. But I again, I would

not rule out -- You could defer some of the concomitant work in PBF where they have a chunk almost the same size.

MR. SIESS: They cannot do that very easily.

MR. OKRENT: It depends. I find it depends on what you are interested in doing sometimes.

MR. SIESS: Moving between decision units that requires reprogramming, as we have been told and demonstrated that it takes nine months to a year. Can you move between sub-elements without re-programming?

MR. BUDNITZ: Yes.

I wanted to make a point here. I do not know what 84 means, or why that turn over is there. I think we ought to ignore that. I want to suggest an approach. The committee can, and I assume will endorse this very large group as a trend, that would help. The thing that causes problems for "bean counters," and I use those words in the most perjorative sense, is they are just left to say, "You cannot grow 200 percent." Usually, they are right. But, they say that, and they tend to cut back on large percentage growth without thinking that a large percentage growth can actually be quite small in absolute terms. This is large in absolute terms. They can take a decision unit that was $300,000, and is going to be $2 million, and say, "You cannot grow by a factor of six in one year."

It is trivially manageable in an operation of our

size, and I think that it would be of great use if you could point out that even larger growth could be manaaged sensibly, if you think so. I am not sure about that, and I notice that Bill Kerr has expressed some skepticism, too. If you add your imprimateur against those arguments that very rapid growth is per se unaccomplishable, a waste of the government's money, and therefore ipso facto everything gets delayed because of it --

MR. SIESS: There is no objection being raised to rapid growth. I don't see it. Bill's work supports $18.7 million.

MR. BUDNITZ: Rather than being neutral about it --

MR. SIESS: It supports a level $18.7, knowing '81 was about $6.

MR. BUDNITZ: '80 was small.

MR. SIESS: Bill was supporting a level of $18.7. Dave was suggesting that it might be even more, although I am still not clear whether Dave is looking at the $18.7 and wants to redistribute it, or if he was looking at the $3.9 for severe accidents.

MR. KERR: I assume the redistribution is almost trivial.

MR. BUDNITZ: It is trivial within the decision unit. That is our decision.

MR. SIESS: They will not have any trouble in th

world spending $12 million on fuel melt at the rate they are going.

MR. BUDNITZ: My second point was, if you would like to endorse, as you seem to be considering, a budget allocation larger than we asked for -- by the way, I might come back in a week, after having talked to Harold like I said I would, and agree. This has been very fruitful. It should would help if you could have the following thought, that there is nothing wrong with asking for a lot of money for which detailed programs have been explicitly written out.

The other trick that "bean counters" like to use on you is to say, you know we will ask for a growth in staff from six to 12, "How many of them are such 'ologists'?" We say, we don't know yet. They say, "We are sorry."

I want to insist that your words can be of great use in pointing out a program is "soft," that is another word that is used by "bean counters." Soft means that everything is written out already. Those things are real hopeful, folks.

MR. SIESS: That is not the question at all.

MR. BUDNITZ: You can help us.

MR. SIESS: I think what has to be done in the report is two things: First, the introduction has to be rewritten. As it is written now it refers only to the fuel

melt, the first three items. The introduction should be rewritten to say that work in this decision unit is divided into categories. The first involves sub-elements (a), (b), and (c), and relates to the degraded core cooling rulemaking, etc. The second involves advance reactors, fast reactors. The next section of the report should lump the first three items. We should point out that the work there is necessary, and that level of work be significantly greater than it has been in '81, and at the level they asked for in the RECLAMA or at the level they asked for originally, wherever we think it ought to be, and then give some indication that it does not have to be spelled out in all that detail, but there are certain kinds of things that ought to be done.

The next section will deal with the last two decision units. Bill, could you rewrite that. Could you come up with something that this committee could consider.

MR. KERR: I can certainly try.

MR. SIESS: If you want to argue against it at this point in time, you might want to argue about the level.

MR. KERR: I do not know what I am arguing against. I don't want to argue against redistribution. I just assumed that the budget was firm enough --

MR. SIESS: It is not just redistribution. There is some redirection in there.

MR. KERR: I did not hear Dave discuss anything that to me could not be done within the existing budget. If Dave wants to be specific that is great.

MR. SIESS: I think it is clear that research would be reasonably happy with the revised research request in the last column. They might be happier with the one in the first column, which was a little bit larger. It was $20.2 versus $18.7.

MR. KERR: I don't want to argue against anything.

MR. SIESS: We are not in large disagreement of the level.

MR. KERR: What sort of level are you going to suggest, Dave?

MR. OKRENT: I really do not have sound basis for picking a level now, and I don't know whether I could have one even now after trying to sit down for an hour.

MR. SIESS: I am not sure, if we say the specific level, if we say the $18.7 which is about three times what they have got now, and say that three times is what is needed and can be used and justified, that is going to a big help. We have hope that even though the EDO mark is only $1.5 million lower, this might just get cut.

MR. OKRENT: Kelber made an estimate which I think was another $10 million higher or something.

MR. SIESS: It is not going to go for the kind of

stuff you are talking about.

MR. OKRENT: No. I am just saying, I think there exists --

MR. SIESS: But --

MR. OKRENT: I think I told Charlie in Los Angeles that Hall High was, let us say, sympathetic toward trying to move on this program. I did not agree necessarily with the way he was going at, because it was filled phenomenologically -- If there was $29 million, $24 million or whatever it was on the phenomena, and the $5 on answering the questions.

MR. BUDNITZ: I think it is fair to lay that the program that he started with had more of that. I indicated that before. You remember when I said, we began with the sort of people who were doing this sort of work in LMFBRs, and they did the LWR program plan in that light, and then we had to go back and impose on that a different perspective. You are saying that it was not enough, that may be. I understand that point.

There is another thing you need to know, and that is that Kelber's original budget proposal to Murley and to me in this area -- See, it says, $30.2. -- he had almost $40 million, and the difference was nearly $10 million to undertake a couple of very large facility things.

MR. SIESS: I don't think that it is going to make

too much difference whether we recommend $17.2 or $18.7, or whatever. What is going to make a difference in our report and its effect on the Commission is what kind of priority we assign to this. I think that that is a much more important decision than whether we ought to recommend $17, $18, or $20. $17, $18, and $20 are all a heck of a lot higher than $6.4.

Unless there is a fairly high priority assigned to it, this is going to be an area that gets cut. The only good thing about it is what they don't cut out is the advance reactor stuff, and they might not look too far.

MR. OKRENT: Congress will put it back in, and they will take it out of the same pot.

MR. SIESS: All I can suggest right now is that Bill try to rewrite the introduction and justify the two areas, and that Dave write something that puts down his ideas so we can see what they are, and discuss them. He ought to have a dollar value, but more importantly words about priority.

I would suggest that we support the revised request, the RECLAMA request, and give the higher priority to what we want. You can put in $25 million without a high priority, and that would not be as effective.

I say, let's go on to the advance reactor thing.

MR. LAWROSKI: Do you recall what the '81 number

was at this time? There was a category exactly like that, severe accident mitigation.

MR. OKRENT: There was.

MR. BUDNITZ: The 0.8 is due to some redirecton or reprogramming we have done.

MR. SIESS: Is that the improved reactor safety stuff?

MR. BUDNITZ: Only four-tenths of it was. The reason we cannot put in any more is that in '80 we are still bound by the increased safety handcuff which we have gotten away from, eliminating it in '82.

MR. OKRENT: You are bound unless you go to the Congress and say, we would like to change it.

MR. BUDNITZ: Which takes 10 months.

MR. OKRENT: If you were to strike now --

MR. SIESS: You can't start until --

MR. OKRENT: The day after they do it.

MR. BUDNITZ: We are in process as follows. After you do the '82, and then you are back into what '81 has, and that is only a few weeks away. That is the way the place tends to work.

MR. SIESS: The $800,000 was alternate containment and alternate decay heat removal, I think, out of improved reactor safety. It might have been alternate containment, I don't know. Alternate containment was in '81 at $800,000.

You did not know just what you would get.

Max, you have the floor.

MR. CARBON: Okay.

Let me start out by saying that these are pretty much my own thoughts rather than the subcommittee which has not officially acted. I would like to start a little bit farther back than the figures given on the board there, and point out that for this current year Congress authorized $13.7 for LMFBR work, and for Fiscal '81 it is still uncertain, but the House Appropriations Subcommittee has authorized $11, and the Senate Appropriations Committee authorization has authorized something like $19, or $22, or something for Fiscal '81.

The Commissions and we endorsed a level in the $16 to $18 million range, an then for '82 research has proposed $8 million, which is shown on the board up there, and OMB and the EDO have both proposed zero. I guess the major reason that research has dropped from its earlier expenditures and recommendations up in the $10 to $15 million range, down to the $8 million, is that they intend going in the direction of diverting 50 percent or more of their effort toward degraded core coo
ling problems in LWRs that we have just been talking about.

While all the budget activity is going, there is simultaneously a lot of technical activity and DOE is

MR. BENDER: I think it would be useful to get the staff to say what postulate as far as what fission product goes with the over pressuring of containment. Has the staff done that exercise?

MR. BUTLER: Let me try to understand the question again.

MR. BENDER: You want me to ask the question again?

MR. BUTLER: Yes, please.

MR. BENDER: Assuming that we get a condition where hydrogen has been generated to the extent that we are concerned about over-pressuring containment to the point of rupture, and I believe that it is somewhere in that range already, what is the fission release postulate that goes with that?

Presumably large fraction of the cladding has reacted with water, what fission products would one assume in the containment environment that might come out if you used filtered containment?

MR. BUTLER: In our analyses to date of the issue, we have ignored the situation with respect to the fission products. It is our view that the fission products do not interact at all with the thermo-dynamics of the containment. We have not taken the analysis to the dose consequences of release.

MR. BENDER: Maybe I did not make my point clear.

I understand that the pressure is more or less independent of the fission product release, and that is what you said.

MR. BUTLER: Yes.

MR. BENDER: But there is some fission product release occurring at that time.

MR. BUTLER: Yes.

MR. BENDER: What I am saying is, what would you postulate as being the fission product release, would it be like TMI II, or somewhat worse, and if worse, how much worse?

MR. BUTLER: I have no opinion to express on that.

MR. MYER: Jim Myer of the NRR staff.

Is your question directed to having a filtered vent in place, or a release of the failed containment?

MR. BENDER: I put the filtered vent in place, and now I want to decide whether I can release or not. I see these high doses up there, 900 rem, which would make me uncomfortable, but I don't know whether that is based on all of the noble gases being available to be released, or some fraction of them.

What I am asking is, how much should I assume for this particular event?

MR. MYER: I can't relate how much is released to this particular study, but in the filtered vent study designed at Indian Point, we have considered options that release all the noble gases, and some of the organic iodine,

all the way through to concepts that hold up all of the xenon. So we covered the full spectrum in terms of releases.

MR. BENDER: But the whole quantity of noble gas is available to be released?

MR. MYER: That is correct. We assume 100 percent of the xenon and krypton.

MR. BENDER: Is that consistent with the TVA analysis?

MR. PLESSET: He said that they took all the noble gases and assumed they came out.

MR. DINTWORTH: I said it was my recollection that we assumed that all of the noble gases were released through the driving force of the transient that occurred with the hydrogen burn. I will commit it again to send this in for confirmation to Dr. Okrent.

MR. BENDER: Thank you.

MR. EBERSOLE: George, I take it that these are deep bed charcoal filters, among other things. Did you capitalize on the fact that in the passage of xenon and krypton through charcoal there was a delay factor?

You are not dealing with many feet of xenon and krypton, and it does not break through with the rest of the gases. It is held for stated periods of time, at the end of which you can close up and then withstand the residual pressure that comes out.

MR. DINWORTH: Here again, to the best of my recollection, we took full credit for the filters that we had in the study. I have said this now three times. We are going to send you the information --

MR. LAU: This is Wang Lau, again.

The charcoal bed we are using is so thin relative to the BWR charcoal tank that the residual time is so small that we do not take credit for it.

MR. EBERSOLE: I suggest that you take a look at a thick bed filter because it has a beautiful hold up characteristic.

MR. LAU: We know that. In the case of a BWR, we do have those big, long tanks, and they do hold up. but that is not what we have here.

MR. EBERSOLE: It might be very advantageous for you to look at them.

MR. MILLS: As I said before, we are not saying that the filter vented containment might not be what is needed for some types of accidents. We are talking primarily about our concern on controlling hydrogen.

MR. OKRENT: Actually, if I were to guess, I would have assumed that you would need something like the pre-ignition, or something like that, because you have a small containment with a relatively low design pressure. I would say that I am not surprised that you have found that

not adequate by itself..

MR. PLESSET: Why don't you go on?

MR. DINTWORTH: I believe that every question that has been asked on filter venting would apply to item 1 of the additional containment, so I will not go any further into this.

Couple containment is essentially using the unit II, and using the unit II as the additional containment volume. We have the same problem that occurred in the other two, it is not effective for rapid pressure transient. It has a potential for degrading the safety of the second unit. It would provide a large operational penalty for the second unit. It would minimize radiation release to the public.

This concept here we talked about this morning, controlled ignition sources, but very briefly, again, when we looked at that we felt that it had a high potential for effectiveness during most accidents leading to declared oxidation, no effect, or very little effect on plant operation.

We recognize that it has technical development required. We feel that the phase II system work that we are going to do will allow us to put in more local hydrogen monitoring than we now have. It has moderate initial cost, and should have low O&M cost.

MR. OKRENT: How much local monitoring do you think you would need? In other words, how many hydrogen monitors do you need, and why?

Is it something that you think you would only turn on when you thought you needed it, or would you turn it on if you had a suspicion you were getting substantial amounts of hydrogen in the containment, and not worry about it exceeded the value somewhere?

I am trying to understand what your psychology is, or philosophy?

MR. DINTWORTH: We are beginning right now a safety review on this concept, Dr. Okrent. Our phase I system that we have talked about, what we plan to do there is to not rely on hydrogen monitors, but to use the time that we normally would see in the kind of accident scenarios that would start leading us to degraded cores that would produce the hydrogen that we would turn these things on ahead of time, and have plenty of time to do so, and igniters would be functional before any hydrogen was released.

We want to look at the possibility in our phase II program to see if there is any benefit of getting the operator more intelligence of what is going on, where he could turn on and off igniters.

In other words, if we saw that the hydrogen

content was too high, or he would be fearful to turn it on because he might get detonation in a certain compartment, the ice condenser being compartmentalized as it is, it might be beneficial to give him that intelligence. We were looking at the Halon system also, possibly going into this, and he want to use Halon, and turn Halon on.

So we just don't have all those answers yet, but we have already decided that that it would be beneficial to add additional hydrogen monitors in our plants, and we are coming up with a policy on all of our plants to increase hydrogen monitors. We made this commitment last year in our nuclear program review, and carrying it out.

As far as the rationale of how we will use it, we still need a few weeks to crystalize the phase I, and then be more definitive on the phase II. Then when we come back to you, if it is within the next two months, or whenever we decide to discuss this issue again, we will have more details on that for you.

The concepts which prevent combustion was the third category of mitigating schemes we looked at. Hydrogen inerting was the one that would, of course, come to everybody's mind first. This has been used already in most Mark I and II BWRs.

We think that without a doubt it is effective in prevent hydrogen combustion. It is largely a passage

system. However, it is extraordinarily difficult, if not impossible, to properly back fit it to an ice condenser containment. It would almost be the situation that you would be operating an ice condenser rather than a nuclear reaction. We have been doing that for 18 months now, and we are ready to operate a reactor.

(Laughter.)

MR. MOELLER: What are the back fit problems, and could you enumerate a couple of them? Is four one of the main reasons that you cannot back fit it, or is that just an operational problem?

MR. DINTWORTH: I won't stand here and say that that you cannot make modifications to an ice condenser containment.

MR. MOELLER: I thought, in the simplistic sense, it would mean getting a tank of nitrogen, of course there is a big volume, but putting nitrogen in your containment instead of air. What is the difficulty in back fitting?

MR. DINTWORTH: Ice condensers, there are three types of plants that you could look at that could be inerted. One, as I said, is the Mark I BWRs. Those plants were designed from the onset to not have within the primary containment things that you have to do daily or with surveillance.

MR. MOELLER: It is the operational difficulties

that it brings about rather than, to me, back fitting.

MR. DINTWORTH: We looking at trying reducing those operational difficulties by moving as much as we could outside of the containment.

MR. MOELLER: You just couldn't do it.

MR. DINTWORTH: We came up with adding 200 more penetrations to the containment, which of course increases the link path that much more. We are convinced, if we have ever been convinced of anything, that inerting of an ice condenser is the worst containment you can ever figure out to inert.

This would be repeating, but we feel like you have a potential for degrading safety if you reduce the surveillance, or give the operator not the opportunity to send someone to check on something, and see what is happening.

Increased loss of ice due to the purge and inerting process that you have to go through, sublimation where you would lose ice, we have come up with figures of anywhere from 5 to 20 percent per year in increased loss of ice. High initial cost, and extremely O&M costs more than anything you could look at or visualize.

MR. BENDER: What would be the effect on the load factor if you really had to operate the ice condenser in the inerted form?

MR. DINTWORTH: The studies that we have performed indicate that indicate that we would probably lose at least 15 percent on the load factor availability.

MR. BENDER: Thank you.

MR. DINTWORTH: Also, to put it in would probably take two years of construction time -- not to put in the system, but to modify the containment.

MR. OKRENT: Would you put your view graph of results and conclusions on?

MR. DINTWORTH: That I showed this morning.

MR. OKRENT: As I indicated earlier, I am inclined to agree with you that if you are considering hydrogen control, filter vented containment for the ice condenesr is probably not the way to go for the kind of reasons you gave about the problem with rapid transients.

But I think your conclusion about the dose needs some additional thought, when you look at the complex of considerations on degraded core accidents, including not only those where there is a hydrogen release but not much else, and those that go beyond and so forth where you may generate other means of pressurizing your containment, and also if you consider the possibility that even with your emission system doesn't work, or if he turns it on at the wrong time, or whatever, and that you might get a release from a ruptured containment which is now not only noble

gases but is amplified by, let us say, all the items 131 which will probably give you whatever you have got here times 100, or much bigger factor on whatever you calculate is in the low population zone.

I think the question of unacceptable from leak dose has to be looked at in this broader context, is what I am saying. What I am asking, in effect, when you look at filter vented containment, or other options as contrasted to nothing other than, let us say, an emission system, and you ask yourself about release dose, you don't delimit your range of accidents so that it goes up to the point your existing system can accommodate, but it does not go beyond it.

In the same way the existing containment has worked beautifully for accidents up at the TVA, and it even worked beautifully for the accidents at the TMI, but there can be a class of accidents where one such as the TMI might not work so beautifully.

I want to indicate that there is a need for qualifying that particular statement sort of along the lines that I have just stated.

MR. EBERSOLE: George, did you look at and dismiss what I will call oxygen stripping; do you know what I mean?

MR. DINTWORTH: No.

MR. EBERSOLE: I will take suction on a

containment and consume the oxygen fraction in it by some combustion process, which I will not name. I will return to the containment only the combustion products.

MR. DINTWORTH: You are saying something like a combustion turbine?

MR. EBERSOLE: Whatever.

I will return water to the containment, as a matter of fact, and achieve a sub-atmospheric result, I hope.

MR. DINTWORTH: We did look, if I am not mistaken, not very closely, but we did look at the idea of using combustion turbines, but we were concerned of the heat generated problem.

MR. EBERSOLE: There is no problem on cooling the discharge.

MR. DINTWORTH: Dave, can you help me on that?

MR. GAYSER: Both of these studies looked at things that resulted in the stripping of the oxygen. We have several things that are unfavorable with respect to that. One, there is a heat loading that comes into the containment from doing it.

MR. EBERSOLE: Excuse me, before you go further. Is that not removable by stripping and heat exchanges?

MR. GAYSER: It depends on what accident sequences one is talking about with respect to what is available as features.

A second problem that comes in with a containment that has a turbine within it, particularly if you have sprays available, is having stripped oxygen out, you put yourself in a position when you condense the steam, you could well go very much sub-atmospheric, and end up in a situation --

MR. OKRENT: What are you going to do here with your ignition system? If you burn hydrogen and oxygen here, you are going to need some way of handling the possibility of condensing that steam.

MR. GAYSER: We are looking right now, as George has mentioned, in the studies at the analyses of the events to see what actually does occur. We have not seen sub-atmospheric results as we move through this even with the sprays on, and the sprays do provide a considerable heat sink to take it out.

MR. MILLS: We are designed for 2 psi negative pressure.

MR. EBERSOLE: I understand you have very big vacuum relief valves, and you have a strong secondary containment which would go sub-atmospheric, too, which is impervious in its own right. So you are pretty well off, and this sub-atmospheric problem may go away.

MR. DINTWORTH: That is correct.

MR. EBERSOLE: This seems to be something that you

should document the refusal on.

MR. DINTWORTH: We get your point, Jesse, and we look a little stronger at other -- One of the things that we are doing in our phase II and phase II programs on the degraded core cooling is looking further than where we are now.

What we are really saying about the ignition system is that we don't believe that you are any worse off than you are today. We have an uncontrolled ignition system in every plant that is operating in this country, and we want to put one in that we have a little better ability to control.

We think that we will reduce risk by doing so, and we think that it is advantageous to Sequoyah to do it, and do it soon. With the proper safety review by us and the staff, and your concurrence, I feel that we can get it done.

MR. OKRENT: If I understand correctly, are you saying that the most negative delta P you will get is 3 psi, or something, even if you burn all the oxygen in the condenser?

MR. GAYSER: That is not what I said. I believe the numbers that have been spoken to, George quoted I believe a minus 2 psi negative pressure, or pressure away from atmosphere. It is the containment's capability. What

I had said was that our analyses, the preliminary analyses that we are doing with a couple of transient code on this, have not shown us going sub-atmospheric at this point because we are not burning all the oxygen within the containment as the hydrogen is consumed.

MR. OKRENT: It is a limiting condition that it is a burn of all the oxygen with hydrogen in the condenser that this would drive you sub-atmospheric?

MR. GAYSER: I don't know the answer to the question.

MR. EBERSOLE: That is a question I asked, and you said no.

MR. PLESSET: The maximum you could get would be 20 percent of one atmospheric pressure; do you buy that?

MR. EBERSOLE: That is too much.

MR. PLESSET: That is the maximum possible.

MR. EBERSOLE: But it is too much.

MR. PLESSET: I will agree with that.

MR. EBERSOLE: By a long shot.

MR. PLESSET: Yes.

Max, did you have a question?

MR. MOELLER: How much Halon do you project injecting?

MR. PLESSET: I think that we interrupted that presentation. Do you want to go back to the Halon slide?

MR. DINTWORTH: Your question is, how much Halon would we have to inject?

MR. MOELLER: What fraction of the containment atmosphere has to be Halon?

MR. DINTWORTH: I will refer to Dr. Lau.

MR. LAU: Yesterday, a delegation of people from Duke, AEP and TVA met with one of the potential consultant in the neighborhood. About six years, they spent about three years making a Halon study for the U.S. Department of Commerce for 300 megawatts BNW maritime reactor. The knowledge they had was very useful to us, and we got a report of what they had.

We talked to them. The results were quite encouraging.

MR. MOELLER: Approximately how much do you have to put in?

MR. LAU: I am leading up to that.

The reactor is not quite the same as ours, and the containment is not quite the same as ours, so before we have a complete study, we cannot tell you. But from what little knowledge I have, if you put in something to the order of no more than 5 psi of Halon, 30 percent, 40 percent, you practically quench everything you can imagine. That is subject to confirmation.

MR. EBERSOLE: That is a lot of Halon. It is

about half million dollars worth of Halon.

MR. BENDER: George, a question on the ignition sources. Have you gotten to the point of trying to decide what kind are available?

MR. DINWORTH: We are almost to the point of buying some. We got several that we have been looking at. We are looking at glow types and pulse types, and we want to use both kinds if possible. There are some things that we will need to do in the testing of them to make sure that the operation would not be detrimental to the safety of anything else that was already there.

MR. BENDER: How are they to be turned on?

MR. DINTWORTH: They will be turned on in the auxillary building at a breaker cabinet, right now in the phase I system. When we finish our phase II work, we feel sure that we will do it in the control room, but right now we plan to do it from the auxillary building, exactly where, I am not sure.

MR. BENDER: Would that be turned on on some signal like pressure at some level?

MR. DINTWORTH: They will be turned on, I believe, because of the procedure the operator will be following, but the state of the plant will determine when he will turn them on.

MR. BENDER: Have you given thought to the

testability of them?

MR. DINTWORTH: Yes, definitely. We are working on some procedures of what we want to do when we test them. We plan to test them, and get NRC staff to agree with the test before we turn them on.

MR. BENDER: Thank you.

MR. DINTWORTH: We hope to be able to provide them with some of the igniters we buy so that they can do some short-term testing in the next month or so.

Mr. Chairman, I don't know what else I can say, except that I will try to answer any more questions. We have filled the gaps, I think.

MR. PLESSET: All right, we will see whether there are any more questions.

Does anyone else have a question?

(No response.)

MR. PLESSET: I guess not. Thank you.

We are going to go to the staff if the applicant feels that he has given us his story.

MR. MILLS: I believe that this is all we have, Dr. Plesset, unless there are some questions.

MR. BUTLER: My name is Walter Butler with the NRC staff.

Last month we made a presentation characterizing the staff's position. At that time we asked that the

committee indicate its recommendations relative to the staff's position. The staff's position has not changed significantly from that point. The only new item is that TVA now intends to propose the installation of these igniters, and intends to do so in the relatively near term, within the next few months.

The staff encourages that effort by TVA, and will undertake an accelerated review program of the design that TVA comes up with, and of the safety analysis report that TVA prepares. We intend to include in our review program a combination of an experimental phase and analytical phase of that proposed program.

We feel we need to have a measure of the reliability of these ignition systems. We feel we also need to understand the capability of instruments to measure the concentrations of hydrogen, and understand different kinds of scenarios to assure ourselves that the addition of the system, and use of the system for all credible accident sequences will, in fact, improve the safety margins.

We would like very much to include in our experimental studies an evaluation of the combustion processes includes barriers to mean mixtures of hydrogen and air systems. We hope also to add steam in those systems to understand what steam might do, and also what turbulence might do to the ignition and the propagation of combustion.

The second part of the program --

MR. KERR: You are talking about an experimental program which you would either carry on, or have someone carry on for you?

MR. BUTLER: Yes. We are looking either to Sandia Laboratories, or the Lawrence Livermore Laboratories to conduct these ignition tests.

MR. PLESSET: I thought that the Bureau of Mines had been studying the thing for decades.

MR. BUTLER: There is a lot of literature on it.

MR. PLESSET: They have also been doing experimental work, and they have written a lot of papers.

MR. BUTLER: Yes.

MR. PLESSET: But they are not involved with what you are proposing.

MR. BUTLER: We intend to study the literature that has been prepared, a lot of it, of course, by the Bureau of Mines. But the thing missing in the Bureau of Mines' work is the presence of substantial amounts of steam and also the substantial turbulence that one might expect in the atmosphere inside containment. We need to augment their work with these parameters.

MR. PLESSET: But you are going to a new laboratory. Why not go to an old one?

MR. BUTLER: We are not considered going to the

Bureau of Mines. We have open paths to go to these other laboratories for short term contracts. We have existing systems for funding work in these laboratories.

MR. KERR: What do you expect to learn, that the combustion will be different, or things like that?

MR. BUTLER: That the ignition characteristics might be different. It might take a heftier spark for longer duration to in fact tstart the ignition. The propagation characteristics might differ with the presence of steam.

MR. RUBINSTEIN: You might want to expand on the fact that we are trying to track the igniters to perhaps use the same glow or sparkplug that TVA is using. This is a very limited, very focused effort to get the staff up to speed in a compatible study to what TVA is doing over the next two or three months. This is not a part of a major, long-range research effort.

MR. EBERSOLE: I did not understand what you said, it might take a larger spark of longer duration. I was under the impression that this was going to be a 60 cycle arc that would fire the time. Am I wrong? I did not understand it as a sparkplug.

MR. BUTLER: We don't have a description of the spark device is going to use. But there are different kinds of sparkplugs.

MR. EBERSOLE: I did not think that it was intermittent like a sparkplug. I thought that it was going to be a constant firing.

MR. BUTLER: They characterize it as two systems. One would be a kind of heated wire, and the other part of it would be a sparking device.

MR. BENDER: Do you know what they are going to get?

MR. LAU: We have not procured the igniters yet. But we are looking at a few of them. Right now, I can give you a little bit of an idea of a couple of models that we are looking at, and this will give you a general idea of what we are thinking about.

The glow type is very simple. It is just like the type that you use for space heating, and it will have a service temperature of around 1500 degrees Fahrenheit. The ignition temperature is around 1100. So we think that there is a margin there.

The spark type is not a sparkplug. It is more like a spark probe, kind of like a geiger counter. One model that we looked at is about a foot long, about half an inch in diameter, with a center wire. What you do is to take the 210 volts AC time formula to about 2500 volts, rectified it, and then attach a capacitor. The capacitor would discharge at around 2000 volts, then it will send a

spark across. The spark is about 3 microseconds in duration, about 12 jules in energy, and 0.1 millijule will be required to set a spark in ideal conditions. It is that kind of thing.

MR. EBERSOLE: I am impressed by the novelty of this, when I think, Jerry, of your old coal burners. You have beautiful ignitors for your oil fired systems which are a hell of a lot better than this.

MR. LAU: This is precisely what it is. The one that I am describing, they use it in oil fired systems in the Navy also.

MR. EBERSOLE: There are ignitors which are 60 cycle arcs just using high voltage transformers that just sit there and fire without a break. You can't miss. I don't know why you are not looking at them.

MR. MOELLER: Will NRC have an observer at the research effort that TVA is carrying on?

MR. BUTLER: We will very closely with them, and at appropriate times we will have observers there.

The research efforts they have are more keyed to the longer term efforts. The shorter-term effort will not include experimental aspects to it.

The analytical task that we hope to complete within the next few months includes --

MR. BENDER: You talk about the size of the spark,

what about the reliability of these things, their ability to fire under the environmental conditions. Does NRC plan to investigate that, or does TVA plan to investigate that? I guess I don't really understand the environment.

MR. MILLS: Mr. Bender, TVA does plan to investigate that. The environment that these would have to operate in is one of the things in the phase II study that we want to get the answer to.

MR. PLESSET: If it does not ignite with these sparkplugs that they are talking about, I don't think that we need to worry about the hydrogen, Mike, if you will pardon my saying so.

MR. BENDER: Sir?

MR. PLESSET: If the environment is such that these sparkplugs will not ignite the hydrogen, can't you forget about it?

MR. BENDER: No. If it is being ignited by some sort of electrical delivery system, then I want to know whether the electrical delivery system will keep the spark alive, and that is likely to be an important question.

MR. EBERSOLE: I will tell you a piece of practical information. An oil burning domestic furnace, when it runs it fires a 6.5 arc on 60 cycles every minute of the time it runs, and it has been running for 25 years.

MR. BENDER: I realize that, and the radio

nuclides in your furnace are something that I am not going to worry about either.

MR. PLESSET: We appreciate your concern, Mike, but we don't think that we should worry too much.

Why don't you go on.

MR. BUTLER: One element of the analytical task that I would like to mention is the fact that the staff feels that it ought to take a look at the ignition strategies that might be used in conjunction with the ignition system. We feel that there ought to be procedures pre-developed and prescribed beforehand before we approve the use of the ignitors. We hope to complete this program in the next few months.

There is a longer term program which we will work through our Office of Research, and we hope to get it started with the user's request that we mentioned last month. The basis thrust of this is to develop an information base for our use in conjunction with our rulemaking proceeding on degraded cores and core melts for LWR containment.

The short-term phase will be for over the six to 12 months, and the short-term phase will be confined to the degraded core conditions for two classes of containments, the ice condenser containment, and the Mark III BWR containment.

The object there is to understand better the hydrogen generation rate, to understand the containment's thermo-dynamic response to these hydrogen generation rates, and to evaluate the various mitigation devices associated with these varied scenarios.

Finally, the second part of that work would be the long-term phase where we intend to cover the other containment types, and we intend to address all the different mitigation features with the object of fully supporting the upcoming rulemaking proceeding.

We hope that with the rulemaking proceeding we will be able to develop the design basis for hydrogen management, recognizing that for the near term, that is the use, for example, of the ignition system, we don't view that as a design basis system, but it is a supplementary system that is not engineered safety feature grade. We expect that if approved it will improve the safety margin with respect to hydrogen management.

MR. KERR: Mr. Butler, did you say that you were going to do this as a user request to research, or as a technical assistance program, or did you say?

MR. BUTLER: The longer-term portion would be through the Office of Research, and the short-term, that is over the next few months, would be via a technical assistance request.

MR. KERR: What is the short-term?

MR. BUTLER: The evaluation of the proposed ignition system would be with the help of a technical assistance program through either Livermore or Sandia Laboratories.

MR. KERR: Thank you.

MR. PLESSET: You would like to go to Livermore or Sandia because you have an arrangement, more than anything else, even though they may not be terribly experienced in this field.

MR. BUTLER: We believe that Sandia, certainly, has had a substantial background of experience not only with respect to the ZIP studies, and the research efforts on improving the containment safety, but also their prior work with respect to weapons development. Similarly, Livermore has that kind of experience.

MR. KERR: This is going to be a shaped hydrogen charge.

MR. PLESSET: Thank you, Mr. Kerr.

Any other questions?

MR. OKRENT: I just wonder what portion of the work you give them they have to send out of house because they are saturated.

MR. BUTLER: We have had preliminary discussions with the Livermore people, and they claim that there is some

availability of an existing facility there at Area 300.

MR. PLESSET: Do you have any further comments that you would like to give us?

Are there any questions that you would like to put because I think we should consider a kind of caucus and an executive sessions if you have no further questions.

MR. EBERSOLE: A point of clarification. This is for one unit; right?

MR. PLESSET: That is what I understand.

MR. EBERSOLE: The number one unit, that is.

MR. PLESSET: Is it one unit or two; we are going to get that straight.

MR. TEDESCO: I have a letter covering both units.

MR. EBERSOLE: I understand that there is a substantial transition from certain modes of cooling, one from the other, new intake building, transitional operation to go from one to two. Is the staff aware of all of this?

MR. TEDESCO: We have considered interaction, and we will do it.

MR. EBERSOLE: I don't mean that. The two unit mode is substantially different from the one unit mode of operation, especially as regards shutdown. It uses another intake building, as I understand. It abandons the use of certain towers. It abandons four-bay cooling. It is quite grossly different. Have you considered both modes in the

transitional operation?

MR. MILLS: I believe that this is described in the FSAR. We described it briefly to the subcommittee.

MR. EBERSOLE: I was not there.

MR. TEDESCO: That was covered on Wednesday, I am sure, on the interaction.

MR. PLESSET: So I was wrong. It is for both units.

MR. TEDESCO: Yes, sir.

MR. EBERSOLE: Has the staff examined the position and orientation, and general protection of the intake building against the potential barge impact, and if so what is their story?

MR. TEDESCO: At this time, I cannot give you a precise answer. I don't have the people here. I am sure the review we have done covers a lot of areas like that.

MR. EBERSOLE: I just asked the question, Mr. Chairman, and I did not get an answer.

MR. TEDESCO: We will get you an answer.

MR. BENDER: Mr. Chairman, I am not sure what the question is you are trying to ask us right now. Are we going to be polled concerning the ability to write a letter on Sequoyah?

MR. PLESSET: That is the point that I was going to get to. Are you ready for it?

MR. BENDER: I don't have any objection to it. I just wanted to know what you were asking.

MR. PLESSET: That is what I was proposing to get to.

A question has been raised, and this is to the applicant. What is the schedule on unit 2?

MR. MILLS: Our estimate right now would be fuel loading in January of next year, 1981.

MR. PLESSET: Thank you.

MR. OKRENT: How realistic is that?

MR. MILLS: Dr. Okrent, with the history we have on unit 1, I would hate very much to predict how realistic that is. Our present best schedule is January 1981.

MR. MARK: These people have been listening to for some time, so that on Wednesday we got an answer on the date of the SER in exactly the right form. July 31st with 50 percent confidence; on August 4 with 90 percent confidence.

(Laughter.)

MR. OKRENT: I think we need not decide right now whether we are going to write a letter, assuming we do write a letter on the one unit or both. That can be separated.

MR. PLESSET: On what basis, on the basis of the kinds of questions that Jesse is raising.

MR. OKRENT: It could be, or there could be other reasons conceivably.

MR. PLESSET: That is up to the committee. You have raised the point.

Jesse, what is your reaction?

MR. BENDER: We don't have to decide it tonight.

MR. PLESSET: We don't have to decide it tonight, that is true.

MR. OKRENT: That is what I was thinking.

MR. EBERSOLE: Offhand, I think I can't help but say, how can anyone write a letter on number two unit in the presence of a defensive answer from the staff on just one question.

MR. PLESSET: I think there are people who have the answer.

MR. EBERSOLE: But they are not here.

MR. PLESSET: That is right.

MR. KERR: Have you read the SER?

MR. EBERSOLE: We can leave it on that basis.

MR. KERR: Is it not covered in the SER?

MR. EBERSOLE: I can't say.

MR. TEDESCO: I have the SER, and I am going through it. This morning we had the staff, and there are a lot more than just the two of us.

MR. EBERSOLE: It might well be covered.

MR. BENDER: Jesse, is that the only question you have on one and two?

MR. EBERSOLE: That is the only one I can think of. I happen to have been familiar with an old cooling system.

MR. BENDER: I just wanted to be sure that if you got the answer to that one.

MR. KERR: Is that the condenser cooling system, or a safety related system?

MR. EBERSOLE: Condenser cooling.

MR. PLESSET: I don't know, but I would be surprised if it had not been considered.

MR. EBERSOLE: If it had been considered, I would have expected an impromptu answer.

MR. PLESSET: We don't have the people here at this time.

MR. TEDESCO: March 1979, Section 2.2 talks about the intake pressure being protected against a barge collision, and so on, gasoline barges, a drifting barge striking the intake structure.

MR. EBERSOLE: Okay.

MR. PLESSET: Is that all right, Jesse?

MR. EBERSOLE: Yes.

MR. PLESSET: The first thing I want to ask is, do you think we can write a letter on both units, or do you want to just postpone that and say that we will write some kind of letter?

What is your pleasure on that?

MR. EBERSOLE: Why don't you poll us on whether we will write a letter on one or more?

(Laughter.)

MR. OKRENT: I think that that is a good question.

MR. PLESSET: All right, that is agreeable to me.

Is there anybody who has a negative feeling about it?

MR. OKRENT: I don't have a negative feeling but I would like to indicate some thoughts about the letter, if I can.

It seems to me that we have heard described in a preliminary way the hydrogen controls are potentially useful, and we probably should indicate a thought of this sort without saying we know for sure that this is clearly the right way to go since we do want to hear from the staff. They may come up with some question, or TVA may find something that changes their mind, or whatever. But nevertheless I would be inclined to commend the applicant.

MR. PLESSET: Dave, I can see how painful this is.

(Laughter.)

MR. OKRENT: Let me give a second comment. In our letter on the final report of the Lessons Learned Task Force, one thing we did recommend was that each licensee

acting individually or jointly develop a reliability assessment of their plant. This is aside from the IREP. The applicant has told us that he plans to do this, and I think we should acknowledge this also.

MR. PLESSET: Right.

MR. OKRENT: It is something which is really my opinion.

There was one other thing that we recommended in our letter on the final report of the Lessons Learned Task Force, and that was that each licensee make a study of possible hydrogen control, and filter venting systems which have a potential for mitigation of accidents involving large scale core damage or core melting.

They have done part of that, and I think we should recommend that they do the rest of it on a reasonable time scale.

MR. PLESSET: I am sure that this will be given due thought in the preparation of the letter.

MR. EBERSOLE: Mr. Chairman, before we close out on this matter, we have always had a common interest in the character of the intake building from the standpoint of external impacts and environmental influence. I can set up a scenario and have the staff answer to it.

I am going to take a foggy night with a drunken pilot, and a half-mile long --

MR. TEDESCO: The people are not here to answer.

MR. PLESSET: We can get the answer.

MR. EBERSOLE: I will take a half-mile long tow which is going to impact on the intake building upstream, and ignite. I presume that that has been properly looked at.

MR. TEDESCO: It is in the SER.

MR. EBERSOLE: It may be my own ignorance for not having read it in detail. Usually an SER does not get into much of this stuff. They just say that it is properly protected and let it go at that.

MR. PLESSET: Let me say, Jesse, I can almost guarantee that we will get you an answer to that kind of question.

MR. EBERSOLE: I am just thinking of the Florida bridge that we just took out not long ago.

MR. PLESSET: We understand.

Unless I get overruled, I am going to declare a recess.

MR. TEDESCO: Mr. Chairman, if you have an expectation of that information point, it would be helpful if we had a clarification of what you want so that we can get it.

MR. EBERSOLE: The depth of your consideration in this respect.

MR. TEDESCO: Of the loss of the intake structure, or --

MR. EBERSOLE: If you think that such an impact is susceptible.

MR. PLESSET: They are going to try to get you some more information, and so let me go back to my declaring a recess, and this item is closed.

Thank you all.

(Whereupon, at 6:20 p.m., the meeting was closed.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

---

in the matter of: ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
243rd Meeting

Date of Proceeding: July 11, 1980

Docket Number:

Place of Proceeding: Washington, D.C.

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

David S. Parker

Official Reporter (Typed)

Official Reporter (Signature)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

in the matter of: ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
243rd Meeting

Date of Proceeding: July 11, 1980

Docket Number:

Place of Proceeding: Washington, D. C.

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

Patricia A. Minson

Official Reporter (Typed)

Patricia A Minson

Official Reporter (Signature)

FULL POWER NON-TMI ISSUES
ON SEQUOYAH UNIT NO. 1

COMPLETE	8
INCOMPLETE	5
TOTAL	13

FULL POWER TMI ISSUES
ON SEQUOYAH UNIT NO. 1

COMPLETE	15
DATED ITEMS	13
NON APPLICABLE ITEMS	1
RULEMAKING ITEMS	1
I/E FUNCTIONS	1
NOT COMPLETE	9
TOTAL	40

INCOMPLETE NON-TMI ISSUES ON SEQUOYAH UNIT NO. 1

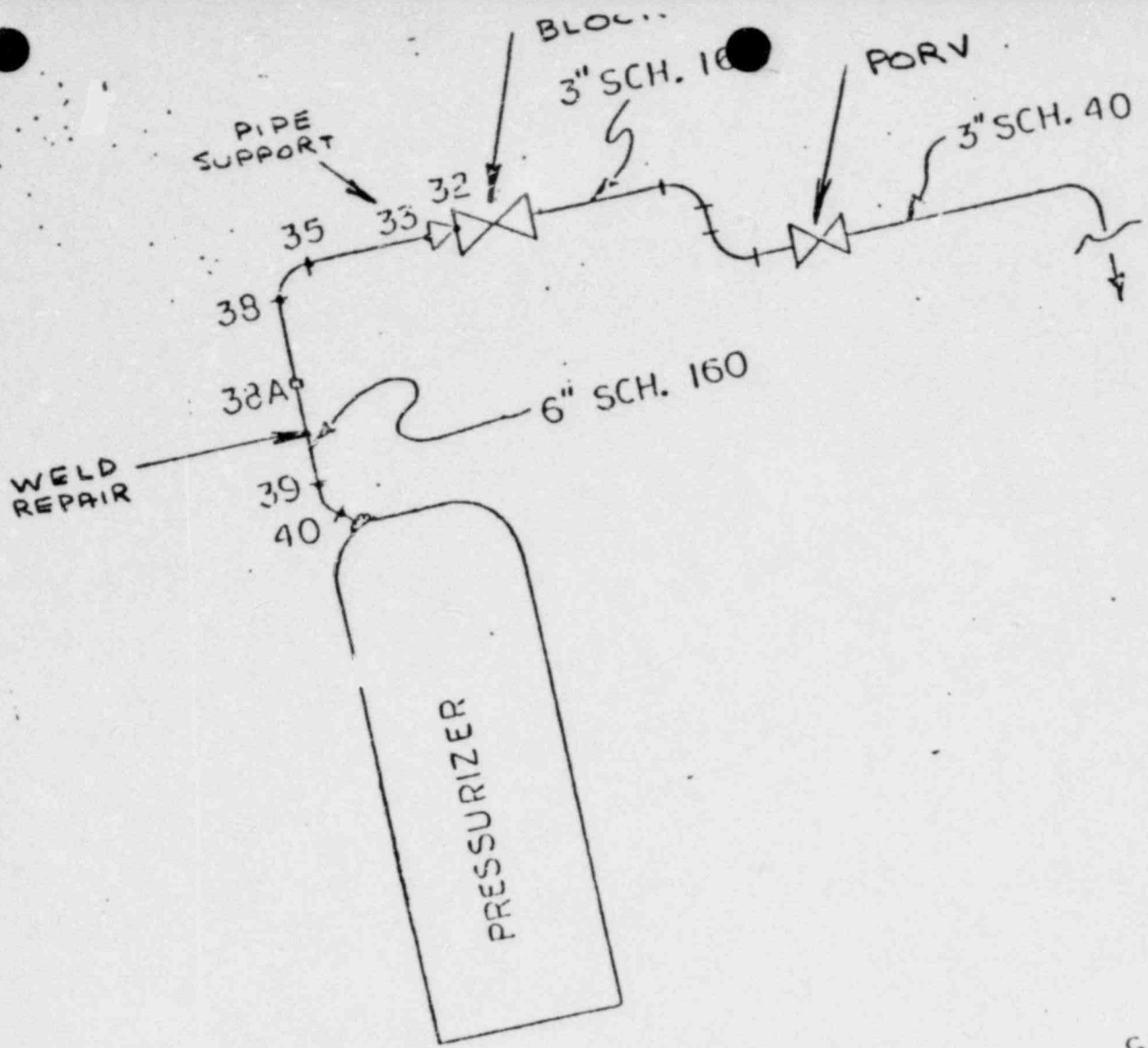
1. Seismic Audit per ACRS Letter
2. Position Required Regarding Foudation Monitoring on Settlement
3. Position Required on Containment SUMP Debris
4. ECCS Evaluation Model Concerning Fuel Clad Swelling
5. Position Required Regarding Process Control Program
6. Equip. Qualifications Comply With the Guidelines of NUREG-0588
7. PAD 3-3 Performance Code - Complete Evaluation Regarding Restriction In the Use of this Code
8. ATWS - Review and Approve Operating Procedures
9. Compliance of IE Bulletin 79-27, Loss of Non-Class IE Instrumentation & Control Room System During Operation
10. Diesel Generator Reliability - Compliance with R.G. 1.108 and NUREG/CR-0660
11. Topical Reports WCAP-9226, 9230 and 9236 Related to Main Steam & Feedline Break Accidents
12. Q-List Complete Review of "Q-List" Requirements
13. Compliance of OIE Bulletin 80-06 Related to By-Pass. Override, Reset Circuits

FULL POWER TMI ISSUES
ON SEQUOYAH UNIT NO. 1
(CONTINUED)

ITEM	TASK NO.	ISSUE	STATUS
*20	II.B.7	Analysis of Hydrogen Control	Complete
21	II.B.8	Degraded Core - Rulemaking	
22	II.D.1	Relief & Safety Valve Test Req.	D.I. - 6/81
*23	II.E.1.1	AFW Reliability Evaluation	Complete
24	II.E.1.2	AFW Initiation & Indication	D.I. - 1/81
*25	II.E.3.1	Emerg. Power for Pressurizer Heaters	Complete
*26	II.E.4.1	Containment Dedicated Penetration	N/A
*27	II.B.4.2	Containment Isolation Dependability	Complete
28	II.F.1	Add. Acc. Monitoring Instrumentation	D.I. - 1/81
29	II.F.2	Instruments for Inadequate Core Cooling	D.I. - 1/81
*30	II.K.3	Final Recom. of B&O Task Force	Complete
31	III.A.1.1	Upgrade Emerg. Preparedness	SAR - 7/18/80
32	III.A.1.2	Upgrade Emerg. Support Facilities	D.I. -1/81
*33	III.A.3.1	Define NRC Emergency Role	Complete
*34	III.A.3.3	Communications	Complete
*35	III.B.2	Impl. of NRC & FEMA Respons.	Complete
36	III.D.1.1	Primary Coolant Sources Outside Containment	Test Results & Proc. Req.-7/18/80
37	III.D.2.4	Offsite Dose Measurements	
38	III.D.3.3	In-Plant Radiation Monitoring	D.I. - 1/81
39	III.D.3.4	Control Room Habitability	
40	IV.F.1	Power-Ascension Test	I/E Function

FULL POWER TMI ISSUES
ON SEQUOYAH UNIT NO. 1

ITEM	TASK NO.	ISSUE	STATUS
1	I.A.1.1	SHIFT TECH. ADVISOR	D.I. - 1/81
2	I.A.2.1	IMMED. UPGRADE OF SRO & RO QUAL.	D.I. - 8/80
3	I.A.2.3	ADMIN. OF TRAINING PROGRAM FOR LICENSING OPERATORS	D.I. - 8/80
4	I.A.3.1	REV. SCOPE & CRITERIA FOR NORMAL LICENSING EXAMS	D.I. - 8/80
*5	I.A.3.1	REV. SCOPE & CRITERIA FOR SIMULATOR EXAMS	COMPLETE
*6	I.B.2.2	REACTOR INSPECTOR AT OP. REACTORS	COMPLETE
7	I.C.1	SHORT TERM ACC. ANALYSIS & PROC. REVISION	SER - 7/31/80
8	I.C.6	PROC. FOR VERIF. OF CORRECT PERF. OF OP. ACTIVITIES	
*9	I.C.7	NSSS VENDOR REVIEW OF PROC.	COMPLETE
*10	I.C.8	PILOT MONITORING OF SELECTED EMERG. PROC. FOR NTOL APP.	COMPLETE
11	I.D.1	CONTROL ROOM DESIGN REVIEW	
*12	I.G.1	LOW POWER TESTING TRAINING	COMPLETE
13	II.B.1	REACTOR COOLANT SYSTEM VENTS - DESIGN REVIEW	SER - 7/18/80
14	II.B.1	REACTOR COOLANT SYSTEM VENTS - COMPL. OF INSTALL.	D.I. - 1/81
*15	II.B.2	PLANT SHIELDING - DESIGN REVIEW	COMPLETE
16	II.B.2	PLANT SHIELDING - COMPLETION OF MODIF.	D.I. - 1/81
*17	II.B.3	POST-ACCIDENT SAMPLING - DESIGN REVIEW	COMPLETE
18	II.B.3	POST-ACCIDENT SAMPLING - COMPL. OF INSTALL.	D.I. - 1/81
19	II.B.4	TRAINING FOR MITIGATING CORE DAMAGE	SAR - 7/31/80 SER - 3/ 1/80



PRESSURIZER RELIEF PIPING SKETCH

R. Gamble

I. NECESSARY CONDITIONS FOR STRESS CORROSION CRACKING

II. EVALUATION OF REPAIR WELD

III. CONCLUSIONS AND LICENSING ACTION

I. NECESSARY CONDITIONS FOR STRESS CORROSION CRACKING

A. STRESS

HIGH STRESS NEAR YIELD NECESSARY
(RESIDUAL STRESS USUALLY DOMINANT)

B. SENSITIZED MATERIAL

C. UNFAVORABLE ENVIRONMENT

II. EVALUATION OF WELD REPAIR

A. STRESS AT REPAIR WELD IS ASSUMED NO DIFFERENT FROM FULL PENETRATION WELDS (HIGH ENOUGH TO BE AN ACTIVE CONTRIBUTOR TO STRESS CORROSION CRACKING)

B. ALL WELDS IN STAINLESS STEEL PIPING (INCLUDING REPAIR) AT SEQUOYAH ARE SENSITIZED TO SOME DEGREE

- REPAIR WELD COMPLETED USING SAME BASIC PROCEDURES USED TO MAKE FULL PENETRATION WELDS
- REPAIR WELD IS WITHIN SAME POPULATION AS FULL PENETRATION WELDS

C. ENVIRONMENT

SERVICE EXPERIENCE INDICATES NO CRACKING HAS OCCURRED IN PWR PRESSURIZER LINE WELDS MANUFACTURED TO SIMILAR PROCEDURES

III. CONCLUSIONS AND LICENSING ACTIONS

- REPAIR WELD FABRICATED USING SAME BASIC PROCEDURES ALLOWED FOR FULL PENETRATION WELDS
- WELD MAY BE SENSITIZED AND IS INCLUDED IN SAME POPULATION WITH FULL PENETRATION WELDS
- SERVICE EXPERIENCE INDICATES THAT SENSITIZED FULL PENETRATION WELDS IN PWR PRESSURIZER LINES DO NOT HAVE HIGH POTENTIAL FOR CRACKING
- NO DEFECTS HAVE BEEN FOUND IN REPAIR WELD
- INTEGRITY OF REPAIR WELD IS AT LEAST EQUAL TO FULL PENETRATION WELDS
- REPAIR WELD INCLUDED IN AN AUGMENTED INSERVICE INSPECTION PROGRAM (INCLUDING THIRD PARTY INSPECTION)

REACTOR VESSEL NOZZLE
UNDERCLAD CRACKING

Background

Westinghouse French Licensee Detected Cracking:

- IN BASE MATERIAL OF REACTOR VESSEL NOZZLES
- IN BROAD AREA OF NOZZLE BORE - MORE PREVALENT IN THICKER SECTION
- CONFINED TO HAZ OF SECOND LAYER OF CLADDING
- ORIENTED PERPENDICULAR TO CLADDING DIRECTION
- 1.0 INCH IN LENGTH, 0.28 INCH IN DEPTH
- BY DESTRUCTIVE AND NON-DESTRUCTIVE (UT) EXAMINATIONS

Cracking Believed to be:

- HYDROGEN-INDUCED
- RESULT OF WELDING PROCESS/HEAT TREATMENT USED IN CLADDING

EUROPEANS HAVE INSPECTED ≈ 80 NOZZLES

- MOST INSPECTIONS IN THE SHOP
- NO FIELD INSPECTIONS OF OPERATING PLANTS

W HAS INSPECTED ≈ 35 NOZZLES

- MOST INSPECTION IN THE FIELD
- INSPECTIONS OF OPERATING PLANT SCHEDULED FOR 1980
- SEQUOYAH INSPECTION CONSTITUTES A BASE LINE AND WILL BE REPEATED

CHRONOLOGY OF EVENTS RELATED TO REACTOR VESSEL NOZZLE UNDERCLAD CRACKING

Early October 1979

- NRC and Northern States Power Company (NSPCo) advised of cracking found by French licensee and that Prairie Island Units 1 and 2 (operating plants) have French-manufactured reactor vessels

October 26, 1979

- W/NSPCo Meeting

November 26, 1979

- NRC/W/NSPCo Meeting
- W presented status of ongoing efforts:
  - survey of vessel manufacturers
  - examination of French-manufactured nozzles/boat samples
  - Prairie Island fracture mechanics analyses
  - development of UT technique
- NSPCo committed to do 70° UT ISI of nozzles:
  - Unit 1 - July 1980 outage
  - Unit 2 - February 1981 outage
- NRC saw no immediate concern related to continued operation of Prairie Island Units and concluded that W proceeding in an appropriate manner

December 12, 1979

- W transmitted letter to NRC:
  - documenting information presented at November 26 meeting
  - indicating that Rotterdam-manufactured vessels (Sequoyah Unit 1, Watts Bar Units 1 and 2, McGuire Unit 2, Catawba Unit 1) under investigation and that cladding processes/heat treatment used by CE, B&W, CB&I should preclude cracking

Late December 1979

- All customers advised of survey results/W efforts
- Decision made to inspect Watts Bar Unit 2

Early January 1980

- Watts Bar Unit 2 nozzles inspected

carrying out the conceptual design of 1000 megawatt LMFBR and 1000 megawatt LMFBR plant, and the report is due into Congress next March 31st. The DOE people tell us that they hope to submit a PSAR to NRC within a year of any Congressional go ahead that might come sometime.

Simultaneously, CRBR is moving along and in this current year I think they are spending something like $170 million and, of course, they have several hundred million already spent. In the current year, DOE has $140 million breeder technological program, including $36.5 million for LMFBR safety, and currently there is a $76 million on FFTF, which achieved initial criticality in February, and perhaps by November or thereabouts next year, should be in some sort of beneficial use.

France, in particular, is pursuing a 1200 megawatt electrical with plans to design and, perhaps, build a 1500 megawatt unit by 1985, and they may very well be marketing 1500 megawatt units by 1985.

Finally, I would comment that one might guess that there would be a 40 percent chance of change in administration after this coming fall, with consequently a 40 percent chance that the American approach LMFBR may change appreciably.

That is the technical background with the added point that NRC is not participating in any of the activities

I have mentioned here. We have stated two or three times in the past, including last February, that we support LMFBR research based on the thought perception that a lot of the current safety problems that everybody is involved with in LWRs have resulted from the fact that the safety research lagged behind reactor development.

We also put a statement in the February report that if we are thinking about importing LMFBRs, we should keep an active program in the safety and research area.

Then we come to some recommendations based upon my own personal feelings, which you may or may not agree with. We reiterate our general support of the program, and state that until a consensus is reached that we are not going to have LMFBRs.

I guess, I believe that the Commissioners really ought to put together a sound long-range research and licensing activity. I personally think they ought to try and have this on some sort of level keel that does not go up and down like a yo-yo, and destroy morale and efficiency, and so on.

I think personally the NRC should be having right now input to this input to this conceptual design study that DOE is putting together, and I personally also believe they should be participating in the CRBR work, and that it should be having some input to the DOE breeder technology program,

and to the FFTF program. I think that FFTF is in many respects a premier LMFBR development facility.

I think also personally that the NRC should try and keep up with what is going on in activities such as the licensing of these facilities. These words say both licensing and research activities. We make no effort in this paragraph to try and distinguish between the two, except to say that they are both closely related, and the people doing the activities ought to work closely together, much more closely than they were doing when we were involved in CRBR licensing.

Insofar as the specific budget level is concerned, it is hard to comment on one because there has not been one proposed, and I do not know what some of these things would cost. I guess in contrast to what I put there, I said, a level like we recommended for Fiscal Year '81, which was about $16 million, and adjusting it for inflation would bring it up to maybe $17 or something that would allow for both this licensing work that we are not doing, and for continuing research work that has been going on.

I guess I would not object if that were dropped from $17.5 to $15, or $14, or something in that area that is reasonable. I think that expenditures of that magnitude certainly are reasonable.

The total U.S. effort this year can be $615

million. I would urge funds be set up in a separate account. I personally do not endorse research as planned to cut this down to an $8 million program. I think that it can be cut still further if they do that. Even at that level, I think that it is too drastic.

I would suggest that the Commissioner put this request in the budget with the thought that not only is it needed, but if they do not put it in the likelihood is great that Congress will simply put it back in and say, "Take it from some place else." Whereas if they put it in as a specific item, the Congress may be less inclined to do that.

I have a paragraph here on some areas where we think greater emphasis should be placed, less emphasis as well. I mention two or three programs that are bearing fruit.

Chet, if you are chairing, I can turn it back to you.

MR. SIESS: Go ahead and ask for comments.

MR. CARBON: I will ask the subcommittee members, Bill, Carson, and Milt, what your thoughts are?

MR. KERR: In principle, I agree, the work should continue to be supported. I don't, at this point, know how much of a strategic position -- I technically have to recognize it may have a low priority. If we give it a high

priority, we may be ignored. Maybe we should anyway.

MR. MARK: Be ignored, or give high priority?

MR. KERR: Give it high priority.

MR. PLESSET: I don't think it make any difference what priority you put on it. It is out of our hands, really. I endorse what Max has written.

MR. SIESS: I think it is obvious what the Commission is going to do. What Congress is going to do, we have no influence.

MR. PLESSET: I think that these remarks are really directed toward Congress.

MR. SIESS: They should not be in this case.

MR. PLESSET: But they will anyway.

MR. SIESS: We can write another report to Congress.

MR. PLESSET: But they will see this one, and I endorse what you have written in detail as well as in general. I think you asked for comment.

MR. CARBON: Yes, I did.

MR. PLESSET: I think that we have to think of this being directed, really, to Congress.

MR. CARBON: I share that view. It certainly will be addressed to the Commissioners.

MR. SIESS: We get another chance at Congress.

MR. PLESSET: But the earlier the better.

MR. SIESS: If the Commission puts in zero, but we tell the Congress. Again, if you want to put in something so that we will have that to talk to the Congress about, that is also a legitimate reason.

MR. PLESSET: Right.

MR. BENDER: This report allegedly is not just a review of what should be done, but in a way it is to be sure that the Commissioners are responding to Congress.

MR. PLESSET: Right.

MR. BENDER: In that context, it is something that should be done.

MR. CARBON: Pardon?

MR. BENDER: It is being addressed to the Congressional mandate. We ought to be supportive of it, unless we want to tell the Congress that they do not know what they are doing.

MR. SIESS: They know exactly what they are doing.

MR. MOELLER: One curiosity I have on this is, why don't we have a page on fusion reactors that we should be moving faster there.

MR. SIESS: It is 30 years away. Do we need to be worrying licensing?

MR. PLESSET: It is being well guarded by DOE. That is my impression.

MR. MOELLER: There is a difference. We have a

workable breeder, they do not.

MR. CARBON: Mr. Chairman, where do we go from here?

MR. SIESS: Unless we hear comments, what you have is assumed to be the desire of the committee. I don't know of any other way to run the business, than to quit while you are ahead..

(Laughter.)

MR. SIESS: I propose some word engineering in there that we can see on the next draft.

MR. CARBON: Okay.

Shall I go on to advance converters?

MR. SIESS: You have advanced converter research.

MR. CARBON: There was a new thing put out with current draft 4.6. There was a new one that came around. It has on the front --

MR. OKRENT: I have it.

MR. CARBON: On the advanced converter research, this is gas cooled reactor work, and the current work is aimed at either Ft. St. Vrain, or at a little bit broader generic study which applied to Ft. St. Vrain as well. They are not specifically directed at it.

I spoke with Charlie Kelber this morning, and he says that about three-fourths of the current program is aimed specifically at Ft. St. Vrain licensing problems, and

about one-fourth of the program is more generic. They are spending a total this year of about $1.7 million, and three-fourth of that plus something like 10 percent for inflation would come out at a level of about $1.3 this year being spent at F. St. Vrain.

The work there is largely directed toward studies of long-term degradation of the strength of graphite techniques, some emergency cooling studies, and frequency response, power variations of this system. It seems to me that it would be quite in order for us to continue to support the licensing related work, related to the Ft. St. Vrain work.

I guess I personally do not get really very excited about supporting the non-Ft. St. Vrain portion because I do not put the gas reactors in the same category, I guess, as the LMFBR, and I would end up here personally -- again the subcommittee has not looked at this -- as proposing that we continue to support the 75 percent that currently goes toward Ft. St. Vrain, and I guess I would tend to leave out the other 25 percent.

Again, for this current year the 75 percent is something like $1.2 or $1.3 million, an the other 25 percent is $400,000, or something like that.

MR. BENDER: Would you say again what the part is that you want to cut out? What is the nature of it, again?

MR. CARBON: It is primarily work being done at Los Alamos in two areas. Generic work on the strength of the PCRV, and some CHAP-2 code work, and systems code work at Los Alamos. At the present time both of these are being decreased in magnitude in the amount of money being spent.

MR. BENDER: Okay, fine.

MR. SIESS: You had two reasons for the LMFBR. That is, you can see them down the pike not too far, and, two, that Congress is going to say something anyway, and you want it earmarked so that they willnot have to take it out of other funds.

The first does not apply to the gas cooled or anything, they are not that close, although some design work is pretty far along. The second does, because Congress has habitually put its money, or put in a requirement to do something on gas and they have had to eke it out of the budget somewhere else. Would you like to explain that second point?

MR. CARBON: Because I was inconsistent. If it makes sense to put j in --

MR. SIESS: In '81, I think that it is $3.2, and not more than $3.2 million.

MR. BUDNITZ: It is $3.7.

MR. SIESS: It is $3.7 for gas. When they say, not more than $3.7, I assume you do not have to spend $3.7.

Since they told you that you had to do something, you feel that you have to do something.

MR. BUDNITZ: We have to spend between the $3.69 and the $3.7. The way the Comptroller runs it, while that is a statutory maximum, we try to run right up to it.

MR. SIESS: You feel that you have to request --

MR. BUDNITZ: That is generally true.

MR. SIESS: You have to request reprogramming to get it down.

MR. BUDNITZ: Yes.

MR. SIESS: The Comptroller simply reads the Congressional "not more than" as an appropriation of that much. I that correct?

MR. BUDNITZ: That is an authorization.

MR. SIESS: The term "not more than" in authorization is a contention to say, this is the amount.

MR. BUDNITZ: The appropriations are never more than the authorization. If we get appropriated at $3.2, that is what we spend.

MR. SIESS: If you get appropriated zero?

MR. BUDNITZ: Then we spend zero.

MR. SIESS: That is not true.

MR. BUDNITZ: If we get appropriated really at zero, then we have to go back and ask for reprogramming. If we get appropriated something smaller than that --

MR. SIESS: Now you are getting down to my question. You have been authorized at a certain level, and appropriated zero, which we were trying to avoid, in the LMFBR --

MR. BUDNITZ: We have to reprogram to do it.

MR. SIESS: You do feel you have to do it?

MR. BUDNITZ: Yes.

MR. SIESS: Even though they did not say to do it? They said, "Don't spend more than this."

MR. BUDNITZ: We have been known to ask for reprogramming at a level slightly lower than.

MR. SIESS: The "not more than" does not mean anything. It is just a convention.

MR. BUDNITZ: Yes.

MR. SIESS: It really means just about that.

MR. FRALEY: It means that you are authorized to spend that much. You are not ordered to do it.

MR. SIESS: That is the question that I am asking. I am getting the answer, yes, we are ordered to spend it for that, or reprogram it somewhere else.

MR. FRALEY: Appropriations gives it to you for that purpose. They do not order you to spend it. But they give it to you to spend.

MR. SIESS: You are authorized to spend not more than $3.7 million. You are appropriated zero.

MR. FRALEY: Then you have to go back and ask for authority to reprogram some of the other money.

MR. SIESS: If you wanted to do it. You have to want to do it.

MR. BUDNITZ: Yes, that is right. I am saying, you had better do it.

MR. FRALEY: You wanted to do it originally, or you would not have put it in.

MR. BUDNITZ: Not necessarily. For example, in '81 we are authorized --

MR. PLESSET: I am not expecting to be a member of the House Appropriations Committee. Could we not go on?

MR. SIESS: I think that this is more important than things we have spent three hours on, Mr. Chairman. If we are going to put something in here about fast and gas, we had b ter have a clear idea of what we are doing it for, because we are going to have to report to the Commissioners on this, and somebody is going to have to explain it.

MR. PLESSET: I am overruled.

MR. SIESS: Max has admitted that he is inconsistent. I don't really care how much we put in for the one, because I think as far as the Commission's budget it is going to turn out to be zero.

MR. OKRENT: I suggest that we stay with Max's inconsistency. It is sort of a midway position that he has

taken.

MR. SIESS: Max has not said that this should be a mark. It is only on the LMFBR.

MR. CARBON: I intended to say that.

MR. SIESS: You don't think it means that. I don't know that they have any way to earmark it.

MR. CARBON: I still would have said that.

MR. MARK: How much is the national DOE program?

MR. PLESSET: It says in the first paragraph.

MR. CARBON: No. I do not really know.

MR. BENDER: It has been phased out, too.

MR. MARK: Part of Max's point has been, DOE is doing it pretty fast in the LMFBR. You don't bring up that point here.

MR. CARBON: Because they are not.

MR. MARK: Okay.

MR. SIESS: They have been putting the money into gas turbine, HTGR, and they have been putting some money into high temperature process heat gas. They just about stuffed everything on fast reactors, but it is nowhere near the LMFBR program.

MR. CARBON: It is my impression they are putting hardly anything in for it.

MR. MARK: The $1.3 is probably not even the ratio to be preserved.

MR. SIESS: Probably not. As far as something licensible coming down the pike, there is nothing in the gas area that is anywhere close.

MR. MARK: Why are we spending money on licensing expenses for Ft. St. Vrain? Does it not have a perfectly good license?

MR. SIESS: It was a demonstration type reactor, and NRC follows it.

MR. CARBON: By licensing, I did not choose a good word. But NRR is supporting this work, saying, "Gee, we have problems here," or "we may have problems. What is going to happen to Ft. St. Vrain. What will happen at 100 percent power. What will happen 15 years down the pike."

MR. SIESS: The word "licensing" does not appear in 4.6 anywhere.

MR. EBERSOLE: Did this subcommittee take up the last design that was furnished by General Dynamics on the gas cooled reactor, the economy type represented by the 25 percent Federal reduction? It was so much infinitely improved over the then commercial models, and such an improvement over the Ft. St. Vrain, it was like a Cadillac from a buggy.

I don't know how you can make any decision, Max, unless you saw these vast differences.

MR. SIESS: That is true.

MR. EBERSOLE: A 25 percent reduction in capital investment. They optimized the plant in physical processes. It just fell through because of general economics at that time, and the fact that the LWRs had a lead.

MR. SIESS: I have a couple of questions about something you said. I cannot find them right now. I will bring them up later.

We approved Max's recommendations on fast and gas. Is there any argument?

(No response.)

MR. MOELLER: In terms of the advanced converter research, I wanted to suggest -- I do not have the words -- in line 97 where you talk about containment of Ft. St. Vrain --

MR. CARBON: It is supposed to be continuation.

MR. MOELLER: I thought the plant was contained.

MR. SIESS: If you write it out, give it to Don. It will give him an extra draft.

Dr. Lawroski, you have the pleasure of giving us waste management.

MR. LAWROSKI: The committee has previously reported to Congress as well as to the Commission about the importance of getting the necessary research work done on all forms of waste that are noted here in the introduction,

the high and low radioactive wastes plus the uranium mill tailings.

When the subcommitte met with a representative of the MMSS, and the research people on June 27, it made some of the following observations about the kind of effort and level of effort. This has been pointed out in what I have written down, and Bill Kerr has given me some additions that are now included in this draft No. 3 that you have.

The subcommittee felt that it was very likely in its opinion, at least, that more exploratory requiring a lot of drilling might be necessary unless the DOE did not do as much as we think they are supposed to have been doing. Certainly, if DOE does as much as seems to be required from the way this advance notice of rulemaking on criteria for geological repositories, it would seem that NRC would not have to do as much as appeared to be planned by them.

The principal parts of the high level waste research work concerns, first, waste forms and containers. This part has been going on at a relatively modest level, and they propose to continue with that. It is important that they do this because they must be satisfied that people who claim they know how to design and fabricate the waste forms plus the rest of the waste package, the canister plus the overpack, these will require substantial effort because it is desired.

One can quarrel some that only sort of qualitatively with their target with having about a lifetime of about 1,000 years before these packages will have lost some of their integrity, and could be subjected to impact by water getting at them, and slowly releasing the contained radioactivity. By that time it should be largely very long lived efficient products.

The only item of importance is the contained transuranics. This is where they do plan to have a very large program in '82, larger in '82 than in '81, although they were obliged to cut it back some. Partly this was due, and I think we would have urged this, because they did not get anything in the FY-80 supplement, whereas they had requested $3 million.

So I think they are being realistic, and from a management standpoint a bigger jump than they had already undertaken would be difficult.

Then, a somewhat larger effort than they have been carrying out is envisioned for repository design and construction. Following this part, they envision some larger effort, that is the operation of the repository and its performance.

One place that we noted there was a large increased effort was in what is called the research on closure. It seems to me that that can be deferred.

Going back to the draft on Chapter 6, I have noted here that perhaps a moderate amount of reduction in funds could be accommodated, but only a moderate amount before you might begin to be concerned whether they can meet this schedule of having the necessary technical information to go along with what is being now requested by the President and in the IRG report, namely, going ahead with at least three different rock formations as contrasted with the early goal of initially limiting it to one.

In our discussion of how much to cut this, I would caution the fact that even if they do less of this geological drilling, it might cost still as much to do less amount of drilling because I don't know how well they have estimated their cost.

I would also wish to point out, if you don't already know, that the cost of this repository will approach that of the cost of the reactor. It comes to $1 billion that is involved. These are very approximate figures that I have seen in connection with repository concepts that are being considered for Savannah River, and Hanford, for example. This does not come cheap, especially if they were to go to something like granite which is one of the rock formations seriously being considered.

In any case, I think the committee has recognized for a long time that the public perceives this to be a major

problem in the development of further use of nuclear energy. People have noted that there has not been a demonstrated solution for high level waste disposal, and that the work should proceed expeditiously now.

Altogether, then by way of summary of remarks during this discussion to the staff, we feel that we continued improvement in the way they are managing the development program. However, there is a major area that needs improvement, and that is in the selection of work. This is not only with respect to what work is planned to be done, and the selecting it, but also the amount of work.

Then the other part of the weakness of their management is that related to the priority. If one has to face problems of limited funding, then we will have to accommodate it either by better, more judicious selection of the work needed, and setting the priorities in regard to the scheduling of them.

We have noted that although they perform many reviews between NMSS and RES, almost entirely they done internally without much benefit from outside consulting. We have suggested that they would be considering to augment their reviews by getting consultants to assist and participate in these.

In particular, we would urge that they ask these consultants to advise them as well as possible on how much

work like the geological exploration is necessary, hopefully bearing in mind that which has already been done by DOE. There is no doubt that the NRC will have to do a substantial amount itself to convince itself, and also provide confidence to the public that there has been a professional review made of the technology that DOE will be recommending, and will be coming in for a license something in the late '80s or early '90s.

Now the low level waste -- One more thing. I am speaking now for the subcommittee, and correct me if I am mistaken. But we thought that that four-tenth of a million proposed under the RECLAMA there cannot be supported. That $400,000 is work that RES has included. It is not supported by NMSS, and it would deal with the research aimed at trying to develop predictive capability for a natural phenoma that might impact on the successful use of the geological repository.

Specifically, it has to do with being able to predict the likelihood of a vulcanism, or serious seismicity. People, at least with respect to earthquakes, have been trying to do this and without much success yet. In California, particularly, we don't think that it would be particularly appropriate. However, we must recognize that somtime maybe they might be obliged, because the public confidence would require that they say, yes, to a question

that you cannot predict.

If we have heard from some of the consultants -- beyond periods of a thousand years -- the predictions are not very good. I guess they are not very good as far as safety goes at much shorter intervals.

MR. BUDNITZ: I just wanted to comment on that. That $400,000 was the only money in the program that was not endorsed by our colleagues in NMSS. That is the only thing in the program that the guys in the program represents this kind of conceptual flexibility that they found so hard to get.

Although I admit it sounds odd, the technical defense is that we believe such issues as vulcanism are going to be used by various people in the public hearings five years hence as a means of discrediting DOE's application. While DOE is doing a little work on it, we believe we have to have the capability to review that, and that is what that is.

NMSS has said, no, they don't think so. It is a flyer. I admit it is a flyer. It is the sort of thing that does have much chance of predictive capability, but we would like it as a kind of gamble. I am not going to fight hard for it, but I want to say --

MR. LAWROSKI: As I pointed out in my draft report, we suggest that maybe the work you are doing, or are

planning to do, to develop a risk assessment methodology, maybe you could begin to apply the results early enough, and see where the proposed research work is more important. Maybe you can find priorities within that. You can do it that way, rather than do raise further the level of funding beyond the $16.3 that the EDO mark up represented.

MR. BUDNITZ: I just want to note that if in the summer of 1980 we say no to that, then you get no work in vulcanism for 1983. That is a very unfortunate part of this two-year planning.

I am not going to go way out on a limb on this. It can be raised in the context of a billion dollar program on DOE's part, and $100 million on our part over five years. We may be caught without a good defense in that one small area.

--

MR. LAWROSKI: I would appreciate that, but on the other hand over here we are interested in earthquakes of the kind that do damages at peak levels, or the interest in predicting earthquakes with respect to population safety has been near surface impact.

Nevertheless, I think at this point in time, you heard the earlier discussion yesterday and today, of the problem of funding, and we find this one hard to --

MR. MATHIS: From a tactical viewpoint, is this a good thing to leave in for the bean counters to throw out, or is it too small to be bothered with?

MR. MOELLER: My only comment was that perhaps some of your discussion could have put as a paragraph in the write-up, where you talk about the canister and the interaction. None of that is in there.

MR. LAWROSKI: I have not put in that kind of detail. I can. I tried to stay away from being too prescriptive.

Going to low level, there are two principal parts to this. One has to do with the responsibilities that NRC has with respect to getting proper packaging of low level wastes so that they can be shipped without showing signs of serious leak on the way.

The other major part has to do with providing assurance that the low-level waste locale is such that from

the standpoint of its characteristics, and proper procedures of operation, the low levels of radioactivity contained there stay there, and don't migrate away from the site.

As you know this has been a problem in at least two places already, namely, Maxie Site, and the Sheffield Site in Illinois, even though those sites had not been used for very long periods.

With the emphasis now being placed on trying to provide for regional low level burial sites, I think that it is appropriate that they spend about the kind of funding that is indicated. There is a Governors Council which has been charged by the President to try to come up with some recommended locations. There are problems impending on the amount of low level waste that the presently operating sites are willing to accept. For example, there are serious limitations being placed at Guardwell on how much waste the reactors in the East contain by way of low level waste.

Going to the next sub-element, uranium recovery, this has to do with the problem, part of which is represented by something the NRC inherited, and a problem that NRC anticipates in the future. The problem that they inherited is represented in the large number of old mills where the tailings have been the source of serious contamination problems, either with respect to water contamination, or the release of intolerable amounts of

radon from the piles.

The needs for the future with regard to that is to get the research done in a schedule so that the NRC can provide early guidance on how to operate the tailing piles of mills yet to be licensed.

MR. MATHIS: Steve, what specifically is proposed in the way of research?

MR. LAWROSKI: The research required here has to do how to demobilize the tailing piles by coverings such that the release of radon is no more than 2 microcuries per liter.

MR. MATHIS: Why don't you put the stuff back in the hole that it came from?

MR. LAWROSKI: It will not always go back into the hole. Some of the old tailings are not anywhere the near the hole because they were shipped.

MR. MATHIS: But you can do a lot of shipping for what you are going to waste here.

MR. LAWROSKI: They may not stay there. It is not like coal. Oftentimes, people say, why worry about these areas, mainly because they represent areas generally where the populations are low. Nevertheless, people have used some of these tailings because they were accessible to build homes, parks, development.

MR. MATHIS: And they are almost as bad as Grand

Central Station.

MR. RAY: Steve, you have a blank in the amount. Did you intend the $3 million that is on the table?

MR. MOELLER: A suggestion.

MR. LAWROSKI: Yes.

MR. MOELLER: Under low level waste on line 47, you end there with --

MR. SIESS: Let's don't do word engineering today.

MR. MOELLER: You don't even want a suggestion?

MR. SIESS: Unless it changes the meaning.

MR. MOELLER: No.

MR. SIESS: If it is a recommendation, write it out, give it to Dot, and it will get in the next draft.

MR. MOELLER: Okay.

MR. SIESS: There will not even be any word engineering tomorrow around the table. Any changes you want to make, editorial or otherwise, give them to Dot.

If Steve is through, are there any further comments, questions, or recommendations regarding his subcommittee recommendations?

MR. MOELLER: With Dr. Budnitz here, I was wondering if we could have sometime before he leaves a chance to ask him for what research they are considering related to our Chapter 4, specifically to the rulemaking on siting because we are trying to recommend in there that you

consider the long-term research that you need -- not long-term, but quicker than that. To consider the research that you need to support the rulemaking on siting.

MR. BUDNITZ: This is the decision unit that you are referring to. Do you see a large increase in the third line, airborne effluents, environmental impacts, a good deal of that is involved in that. Also in the last decision unit, which we call systems and reliability analsyis, the consequence analysis line, where it goes from $6 to $2.5, is substantially involved in that work. You will notice that they have cut us back, but we are probably going to get that back, I hope.

The notion here, and by the way this work is divided as follows: These are the model. This is like the Crack Code, and such, but upgraded to make it site specific and incorporate all new stuff. This work in site environmenal research is the phenoma, questions about dispersion meteorological, questions about deposition velocities, and the like. So there is a separation between phenoma and model development and analysis.

The general need is to be able to come up with much better models than now exist for understanding the site variations. There is also work elsewhere. For example, in aquatic pathways that shows a decrease, but in fact the work on the rulemaking part has increased some. On the questions

of liquid pathways, it is phenomenon analysis so that we can understand the site to site variations in that.

We have been cognizant of the siting rulemaking, of the sorts of things that we need in the shorthaul to support it, and I think that we have been fully endorsed by the Office of Standards Development that has been involved in this insofar as we have developed the program.

Again, like in the other rulemaking, we are feeling around in the dark on some of this stuff, which means that some of the budget is not delineated, but it is bigger. Part of the problem that we have in the siting rulemaking is that it liable to come along pretty fast, and '82 is going to be too late for some of that.

Bob Bornero might be able to say a few things more.

MR. BORNERO: I would just like to add to that that during FY-80 we were able to get ahold of some resources from NRR, and we had sort of a task force of the siting, NRR standards, and research, and there is activity going on right now to do the data development for siting trade-offs, demographic modeling, and so forth.

At your convenience, if you wanted a briefing on that, we could provide it.

MR. MOELLER: Thank you.

It is being done, obviously, in several decision units, and hopefully it is being well coordinated.

MR. BUDNITZ: It is significantly better coordinated than the stuff on the degraded core, but I must say that it is not well coordinated yet. First off because we do not have the sort of target in the agency's program to shoot at that is well-defined, and secondly because lacking that we have not put our own act together.

I want to plead a little guilty to the fact that we are not as well together there as we should be, but I think that the groups in SAFER Division, where the phenomena are studied, and Bob Bornero's group, where the models will be put together, are working closely enough together that it is not going to be a problem.

Bob is nodding. I think that it will be in decent shape. There are only three or four guys, actually.

MR. SIESS: Are you satisfied, Dave?

MR. MOELLER: Yes.

MR. OKRENT: Actually, there are some topics that came out of the recommendations of the task force that are not covered by the general areas you defined.

MR. BUDNITZ: That is right.

MR. OKRENT: I just wanted to note that.

MR. BUDNITZ: Yes, but there we also have a little bit going on, for example, questions about demography I will site just one so we can get a feeling for it. We are looking at the whole question about changes in demography

due to the presence of a big reactor complex in a small rural area that would modify the demography over a decade or two, and that sort of thing.

MR. SIESS: Who has got the next one?

MR. MARK: Chapter 7, safeguards and fuel cycle safety.

It took me sometime to come up with what we should call the unit. I concluded, and I am not sure if I am right about that, first we would have what we used to think under safeguards as one block. All the safeguards are there. The rest of the unit is all of those situations where materials are handled but not covered under the waste management, mining, and operating reactors. The rest of the unit is therefore everything else for handling of materials.

MR. BUDNITZ: It is called, Safeguards, Fuel Cycle Safety, and the Garbage Can.

(Laughter.)

MR. KARL: I tried to write a sentence which said that, but it needs word engineering which I will trust Chet to do. It is totally incomprehensible, the first one.

MR. SIESS: I thought it was appropriate.

MR. KARL: I call attention in the introduction to a thing that I think has a little more point here than some of the other factors, and that is that this ignoring reprocessing situations and breeder reactors. All of the

things discussed here are going to have to be done again when it is decided that you might have plutonium in the waste fuel, etc.

I don't make any argument about it, but it does belong here to realize that.

Looking at the safeguards package alone, which is items (a), (b), and (c) on the sub-element list, I have merely identified in the first go-round the main items expected to be included as work under those sub-elements, saying what they would be.

I have said that the items in item 7(c), in my view at least, but I say in the committee's view, are of lower priority than 7(a) and (b). I think that view is shared by NMS, and that worried me because it was my thought they held a position they might want to explore the opposite position. It may be that I understood parts of that sub-element less than the others, anyway.

They have to do with trying to think of scenarios that might occur in a sabotage or death situation, and what you might afterwards, but there are only $400,000 in this sub-element anyway.

I put in the summary the statement with respect to the extent with support that whole package. I will mention that now. There is no much difference between the EDO and the request except in the distribution. The two totals are

$4.9 and $5.2, and I merely comment that this is about $5 million, and that the work should continue at about that level.

I call attention again to the fact that it is very hard for me at least to compare priority of this kind of work with the priority of the work on cracking, or something else having to do with an operating reactor from the point of view of risk reduction. But it is an important area. I also say that what is proposed is in the low range of acceptability, and it should not be reduced much.

MR. MOELLER: Which one was that?

MR. KARL: It is the whole package (a), (b), (c), and it is the first paragraph of the summary. If that does not fit the pattern, we can always move it around.

To go back to the other items, unless Dave or Steve would rather. They have taken up these rather disparate elements, none of which are particularly large. Again, it is said here what is comprised under that sub-element. Steve who wrote this recommends funding of this research, which I of course again repeat in the summary.

Decommissioning, no debate between EDO and RES, and it is said here that we support that work, which isn't really very much. But it is hard to argue for more than they have put in.

The transportation has been cut down from past years, which seems right. Yet, there is some work on-going, and a little bit needed, more for debate with the State of New York people, perhaps, than for any other reason.

On effluent control, that section is a little bit more difficult, less straightforward than a previous section in one of Dave's chapters which sounds as if it has almost the same title, but they are not quite the same. Here I think we are looking at the effects of tornadoes that might disrupt coder systems, and things of that kind, which are a little away from the normal attempt to conduct that waste system properly.

The work proposed is at least generally supported, although attention has been called to possible amalgamation of some headings which appear in different places, which would look better if they were all one program.

The byproduct safety, nobody, least of all not I, knows what it means even though I wrote this paragraph. It is a new program where they look at tedium and I don't know what else, and risk watches. There was a breakdown which may not have been the proper thing to read from, but from which this paragraph is written.

It looks to me at least as if the first thing they ought to do is to look at all the byproducts needed to be looked at, and put them in some priority order from the

point of view of risk. That particular item was cut out of the PPPG Program, and the measuring of how much radioactivity there was was left in, and I thought it sounded upside down.

MR. BUDNITZ: I want to make two points. First, you are right, and that was odd. Second, you have written byproduct safety, and it is not. It is product safety. These are products that have radioactive material in them. It is product safety.

MR. MARK: We were told that it was byproducts. I will change the title, if you like.

MR. BUDNITZ: You can leave it as byproducts, but you know what the notion is anyway.

MR. MARK: It is the stuff that used to be in downtown Tucson, and so forth?

MR. BUDNITZ: Yes. Let's not argue about the definition. You know what it is. It is the smoke detectors, the stuff that the Bureau of Rad Health regulates in part.

MR. MARK: We will change the title to read Product Safety just like yours, but maybe use the word byproducts in the text.

MR. BUDNITZ: Yes.

MR. SIESS: We were told at the first meeting that that was an error, and it should be byproducts.

MR. BUDNITZ: Whatever you do, the message is in there.

MR. MARK: Occupational safety, which Dave provided does overlap with the occupational section in an earlier deciosion unit.

MR. BUDNITZ: This is not related.

MR. MARK: Excuse me. This is protection of workers against occupational doses by various regulatory strategies like crud, and so on.

It is a program that was cut in the PPPG listing, and has stayed cut both by EDO and RES. It is an important area, and I would wonder why it was not a little bigger this year. I assume that you can redistribute it in the decision unit. It does not seem worthwhile to get into an argument here because the amount at issue is only two or three hundred thousands.

MR. BUDNITZ: We have some regulatory authority and that is intended to fill in some blanks.

MR. MARK: The bottom line, then, is a paragraph which says tht we support at above the existing ongoing level, and that is the $4.9 or $5.2 the work on safeguards. We prefer the RES request for the rest of the decision unit which are these assorted items. The decision unit should be supported.

MR. OKRENT: I have one question of the staff.

Under Physical Protection in '82, the way it reads in this long document, I can't tell whether there is something in here that would be looking at how might you design future plans to reduce the chance of successful sabotage. I am talking about LWRs. It does not seem to be in there; is it?

MR. BUDNITZ: I really thought that there was something in there about that, but I really don't know what it is.

MR. MARK: There has been a design study already completed.

MR. BUDNITZ: I thought that there was some follow on to it, small. But I don't know.

MR. OKRENT: It seems to me that that is a research area, and not an easy one.

MR. BUDNITZ: As Carson said, there was some work on that. It was conceptual in nature. I thought that there was a little bit of follow on on there, but I can't recall. It might be in '81, and not in '82. I just don't have the number. If you would like to add some words in there that that is of continuing interest, that is fine.

MR. MARK: Sort of war games, graph theory studies which worried me and other people last year and the year before in the then immediate plans, were thought to have been finished before we got to 1982, and that the results of those would be more in the field rather than on-going.

MR. OKRENT: It is a complex problem, and one that is perhaps related to this thing where they are going to rank vital areas, but it is by no means the same problem. I think, in fact, they should try to do research to see if there is something that represents possibly a real improvement, certainly considering internal access. I don't want to say, only internal access, but certainly considering internal access.

MR. MARK: It has not been totally ignored, Dave. Some of the work has been done before.

MR. OKRENT: I would prefer to see us recommend that some of the work under physical protection in 1982 be addressed at this point myself. I am not proposing an increase in the budget, but that it be part of the FY-82 work, because I can't read it in what is here.

MR. PLESSET: We have an obligation for another session to begin very shortly. After we finish Sequoyah, and this involves Chet, do you want to come back after that and do Chapter 8, or do it in the morning?

MR. SIESS: How long do you think you are going to take on Sequoyah?

MR. PLESSET: I have no idea. You tell me.

MR. SIESS: I will estimate two and a half hours.

MR. PLESSET: Then I doubt that we should do Chapter 8 tonight. We have only one chapter left.

MR. SIESS: Mr. Chairman, I estimate that we could easily spend an hour on the next chapter. Tomorrow we will have to go back over some things we have deferred today, Dave's rewriting of severe accidents, and look back at some things in earlier sections, review the totals, and then spend as much time as you want to spend trying to assign priorities. This all has to be done fairly early because if we are going to do anything with priorities, there will have to be some words put down somewhere, and either somebody is going to have to put them down, or I am going to have to put them down, and that does not get done at three o'clock.

So I would figure that we have two hours on the agenda for tomorrow, but I think that it will take us about four hours to finish it up.

MR. PLESSET: Bornero wants to know, should he stay?

MR. SIESS: I am here until we quit at four o'clock tomorrow.

MR. PLESSET: What is the pleasure, to come back and do Chapter 8 after Sequoyah?

MR. MATHIS: Either after or before.

MR. PLESSET: No, not before. I will not have those people wait any more. They have waited all day.

MR. MATHIS: Then let's do it after.

MR. PLESSET: Let's take a ten minute recess, and

then we will go to Sequoyah.

MR. BUDNITZ: Mr. Chairman, I would like to ask another question.

MR. PLESSET: Yes.

MR. BUDNITZ: If you do Chapter 8 after Sequoyah tonight, then tomorrow you will be doing the priorities, and the like. Will it be necessary for me or someone to be here for that?

MR. SIESS: Not unless you want to defend yourself.

MR. BUDNITZ: I am not thinking about that as much as in order to answer questions and the like.

MR. PLESSET: I don't think you need to be there for that.

MR. BUDNITZ: In that case, Bob will stay, and he is nodding, and we will not come tomorrow.

MR. PLESSET: Fine.

MR. BUDNITZ: In which case I have a 20 second comment that I would like to make.

I am leaving the agency in August, so I will not be appearing before you again, at least not in my official capacity. I want to say that it has been one heck of a good two years being here with you, guys, and I appreciate it.

(Applause.)

MR. PLESSET: We will take a ten minute break.

(Short break was taken.)

MR. PLESSET: We are going to hold this to an hour, and I am sure that nobody is going to be too terribly upset at that.

I think we left the applicant with a question. Dave, do you have a question for the applicant?

MR. OKRENT: I would suggest that the applicant really give the rest of his presentation, and then I assume that might take 10 or 15 minutes, and then maybe hear what the staff may wish to say on what he said, and that would take 10 or 15 minutes, and then that would leave 30 minutes for qestions from the committee. At the end of an hour, maybe we will be finished before then, or maybe we will need 10 more minutes.

MR. PLESSET: Let me go to the applicant, hopefully for a 30 minute or so completion of the presentation.

MR. MILLS: Dr. Plesset, I believe that we can complete our presentation in much less time than 30 minutes, and that will give you additional time for questions.

We will ask Mr. Dintworth to go ahead with his presentation, and he has a good feeling for time.

MR. DINTWORTH: Mr. Chairman, you are correct, I did not finish this morning. I made my conclusion, but I had to leave out some in the middle, Dr. Okrent, because of the time limitation. We did do the whole presentation for

the subcommittee the other day.

I will pick up now on slide 4 in the handout information you were given this morning. As I mentioned earlier this morning, we had three different types of systems, the first of which was then in containment. We used filter vented containment as of one of the concepts that we looked at, additional containment, and then couple containment. These were the three types of vented containment we looked at.

On filter vented containment, we had contracts with separate contractors to do concept studies of each of these in the two month period of February and March of this year. We found out as a result of our studies that we felt as far as hydrogen control is concerned -- My comments on filter vented containment are limited just to that, hydrogen control, and not other accident scenarios where you might be able to show more advantages for this concept.

But for hydrogen, we found it not effective for rapid pressure transits. We found that the estimated dose in the local population zones could be in excess of 900 rems. We felt that there are many, or some essential features of the filter vented containment concept that are demonstrated.

We had questions with regard to things in the path, the burning of the hydrogen, cooling after the burn of

the hydrogen, the release of particles if you have an explosion in part of the flow path that you are not desiring to occur.

There is a high potential for unnecessary bypass of the containment based on the ability of the operator to vent the containment if he so desires. Operator decisions to vent would bother us a little bit, and then there is the very high initial cost, and moderate O&M costs to this concept.

MR. OKRENT: Excuse me, could I ask to understand. On item 2, what assumptions are made when you get 900 rems, is it just the noble gas, or a combination of meteorology. Could you be a little more explicit?

MR. DINTWORTH: I don't have the detail for that with me. I can provide the actual calculations to you that we use. If my recollection serves me, it was the noble gases of the actual model of meteorology around the site that released. I am not sure and we will be glad to provide it to you.

MR. OKRENT: If you could provide the detailed study, that would serve the same purpose.

With regard to item 1, where it says, "Not effective for rapid pressure transient," that again makes some kind of an assumption. If you were to turn it on at one time, for example, suppose hydrogen were building up

over a period of an hour, or you name, and you did not turn this on until just before the burning which took place in a period of seconds, or if it went on automatically during the transient, you would need a very large vent area. It would be impactical, I think.

On the hand, if you envisaged a situation where you were concerned that the combination of pressure in the containment plus burning could lead to an overpressure, in other words if you had some steam pressure or something there already, and you now used this to drop pressure before the burning so that the pressure at the beginning of combustion is lower, and therefore at the end, then it is not so clear to me that the vented filter containment does not give you some means of reduction.

I am not urging it on you, but I am trying to unde-stand what that statement means.

MR. DINTWORTH: I will ask Dr. Wang Lau of Task Force on Degraded Core Cooling to respond to this.

MR. LAU: Wang Lau, TVA.

Dr. Okrent, what you said, your statements are absolutely correct. One of the factors that bothered us in all the vented containment, whether it is vented to a couple containment, or vented to an additional containment, there is a common factor that bothered us, and that is, if you vent before you have too much hydrogen built up, you are in

essence reducing the oxygen content in the containment. Therefore, for the additional amount of hydrogen you add to the containment, you are building up the hydrogen volume fraction a lot faster than you would have if you did not vent. It is a very important consideration because we believe that if you do that you have a tendency of increasing the hydrogen relative concentration.

MR. OKRENT: It is true that you have things going both ways, but in the end the energy that you have put in will be dependent upon how much hydrogen burns, and the pressures, and more complicated things will depend on what the initial state was.

I was just trying to understand whether conclusion 1 was generally applicable, independent of when you started venting, or whether you meant in terms of a system that sort of opened at the time of the burning.

MR. MILLS: I think that I can answer that very quickly. We assume zero atmospheric pressure in the containment at the time of the hydrogen burn. We had already taken advantage of the filter vented containment, or the ice condenser, or containment sprays to lower the pressure at the time that the burn began.

Taking that assumption, the burns and the pressure that we saw could build up in ice condenser containment we felt that this filter vented containment was not effective

for those rapid pressure burn.

MR. OKRENT: I agree, if you burn a mixture, you may well get pressure as high as your design pressure.

MR. LAWROSKI: I thought, too, that what he was concerned about was that if you got the concentrations of hydrogen in a higher range, you would be faced with a more probable detonation type burn than the kind of burn that had been in their assumptions. I believe you are more likely to get a detonation if you have several more --

MR. DINTWORTH: You have no control over the situation.

MR. OKRENT: I am only trying to understand what the meaning of the sentence is, or the phrase.

MR. MARK: This may be part of it. You have a 10 percent hydrogen mixture. Enough hydrogen comes through to give you 10 percent. That is giving you all of the 1.5 psi driving gas. So if you open the vent, nothing happens, and yet if you burn that it will give you 28 psi or 30. You don't have a hydrogen pressure to drive a vent.

MR. OKRENT: That I understand, but there is frequently some steam pressure in many of the events, not all. It depends.

MR. MARK: One can make a lot of assumptions about the steam, is it there or isn't.

MR. OKRENT: I understand the basis for the

calculation. Thank you.

MR. DINTWORTH: We have committed here, and made note that we will send Dr. Okrent the information on the statement on i m 2.

MR. MOELLER: In all of these you are assuming complete core melt, is that the idea, all volatile and all gaseous radio nuclides are released inside containment?

MR. DINTWORTH: We have assumed that the total available inventory of nuclides would be available for release if you had a rupture containment.

MR. MOELLER: Then on the 900 rem dose, again, throughout the LPZ, at what elevation was this released, if it is a filter vented containment is it through a stack of any sort?

MR. DINWORTH: It is a stack. I don't remember the height. It seems to me like it is higher than the containment building.

MR. EBERSOLE: George, you said total. You meant WAS 740 for this release?

MR. DINWORTH: Yes, I believe so. We can confirm that, too, but that will show up in what we are going to send.

MR. EBERSOLE: Yes.

MR. OKRENT: I was a little surprised by the number because I did not think that that ordinarily got that

large a dose in WASH 1400 until they got something worse than a category 6 event.

MR. MOELLER: How far out is the LPZ, what is the radius?

MR. DINTWORTH: I believe that this is the dose that would be received in the first two hours with the meteorological conditions that existed, and I don't know what those are.

MR. MOELLER: Is this a mile, or two, or five?

MR. DINWORTH: It is three miles of the plant.

MR. MOELLER: Okay.

MR. DINTWORTH: This will be confirmed again with the information that has been requested here.

Are there any other questions on the filter vented containment?

If not, essentially item 1 on the additional containment. The additional containment would be just that, providing additional containment volume in another pressure vessel or building adjacent to the existing containment building.

The same trouble about handling effectively the rapid transients. We do find that it would minimize the radiation release to the public. We find it has high initial cost and O&M cost. But the main thing that we found that we did not like about it was that it is effective for

handling the rapid pressure transients which you cannot control.

MR. EBERSOLE: George, before you leave the filtered containment, was that a wet filter, including submerged bubbling of the gases, or just an additional filter?

MR. DINTWORTH: For the detail of that design, I will again turn to Dr. Lau.

MR. LAU: The filter vented containment we evaluated is basically the UCLA filter containment. There is no water in the flow path. Basically, it is a big sandbox, about 100 feet by 200 by another 100 feet or so, with sand and gravel in it to absorb the heat and the particulate.

MR. EBERSOLE: It is a dry filter.

MR. LAU: Basically, there are two boxes. The first box is a sandbox thing with a heat sink and moisture sink to take out the steam pressure, and also between sand trays you have some provision for burning off the hydrogen. Then downstream you have the conventional charcoal and paper.

MR. EBERSOLE: Thank you.

MR. OKRENT: That would lead to an assumption that all the noble gases are released, and anything else?

MR. LAU: I believe that that is what our

dosilogical people assume in the conventional way. In the packet that we are going to send, we will have those details.

MR. OKRENT: Considering rapid pressure transients, is there any suppression that occurs due to the presence of the high spray section, in your opinion, and the ice condenser, and is that not an important feature?

MR. DINTWORTH: I will defer to Dave Gayser of Westinghouse.

MR. GAYSER: If your burns are located in the lower compartment, there is a substantial mitigating effect of the ice, assuming that there is ice there, and in the small break types of transients that would be a very significant mitigating feature.

If your burn occurs in the upper compartment, at the types of concentrations that we are talking about here, then the ice is not effective in supressing the magnitude of the pressure that results from the burn.

MR. DINTWORTH: Are there any other questions on the filter?

MR. EBERSOLE: This dose sounds so high, let me ask you, did this include the stripping effect of your sprays and the absorption in the ice? Did you take advantage of the fission products?

MR. DINTWORTH: We did not take advantage of the

ice, as Dave just said, because we have to assume the worse situation.

MR. EBERSOLE: I don't mean in the context of reducing the pulse, but grabbing fission products and keeping them in the containment?

MR. DINTWORTH: We did not see that there would be any benefit of the ice or the spray to prevent the release of noble gases.

MR. EBERSOLE: All right.

MR. DINTWORTH: That is wat the 900 rems is based on.

MR. EBERSOLE: Okay. Thank you.

MR. OKRENT: Of course, the question that one would have to ask oneself is, does the gas released go with the physical situation, but by that kind of gas release are you in a different kind of a situation with regard to what the core does? You haven't only hydrogen burn concerns.

MR. DINTWORTH: As I said, we did assume that all the noble gases were in the containment, and therefore they were driven out with the driving force of the hydrogen burn. But you could come up with other physical scenarios.

MR. OKRENT: What I am getting at is, to get the core damaged to the point where all the noble gas is out of the fuel, the fuel all has to be pretty hot.

MR. DINTWORTH: Yes.

January 31, 1980

- W transmitted letter to NRC
  - documenting results of Watts Bar Unit 2 inspection - no underclad cracking

Early February 1980

- Decision made to inspect one Sequoyah Unit 1 nozzle
- Sequoyah Unit 1 nozzle inspected - reheat cracking found

February 22, 1980

- NRC/W/TVA Meeting
- Results of Watts Bar Unit 2 nozzles and Sequoyah Unit 1 nozzle inspections presented
- NRC required inspection of other Sequoyah Unit 1 nozzles
- NRC stated that all Rotterdam-manufactured nozzles should be inspected
- NRC concern related to satisfying ASME Code Section XI acceptance criteria

Late February 1980

Other Sequoyah Unit 1 nozzles inspected - underclad cracking found

- Acceptability of all indications in terms of Section XI criteria demonstrated
- NRC granted Sequoyah Unit 1 5% Operating License (February 28, 1980)

Mid-March 1980

- NRC requested detailed information about cladding process/heat treatment used in fabrication of North Anna Unit 2 nozzles in order to perform an independent evaluation (NOTE: North Anna Unit 2 vessel manufactured by Rotterdam, nozzles clad by Sulzer.)
- Virginia Electric and Power Company committed to inspect North Anna Unit 2
- NRC inquired about condition of Salem Unit 2 nozzles (NOTE: Salem Unit 2 vessel manufactured by CE.)
- Public Service Electric & Gas Company committed to inspect Salem Unit 2

TVA RELIABILITY STUDIES

A) SYSTEMS INTERACTION METHODOLOGY APPLICATIONS PROGRAM

B) REACTOR SAFETY STUDY METHODOLOGY APPLICATIONS PROGRAM

C) AUXILIARY FEEDWATER SYSTEM RELIABILITY EVALUATION

D) PLANT FULL SCALE SAFETY AND AVAILABILITY ANALYSIS

SYSTEMS INTERACTION METHODOLOGY APPLICATIONS PROGRAM

SUMMARY

- AN OBJECTIVE WAS TO DEVELOP A METHODOLOGY INDEPENDENT OF THE STANDARD REVIEW PLAN (SRP) FOR IDENTIFYING AND EVALUATING SYSTEMS INTERACTIONS IN LIGHT WATER REACTOR COMMERCIAL POWER PLANTS

- WATTS BAR NUCLEAR PLANT (WBNP) WAS CHOSEN AS THE EXEMPLARY FACILITY FOR DEMONSTRATING THE METHODOLOGY

- ALTHOUGH IT WAS NOT THE PURPOSE OF THIS STUDY TO JUDGE WBNP, IT WAS CONCLUDED THAT THE FACILITY IS GENERALLY WELL PROTECTED AGAINST INTERACTIONS CONSIDERED WITHIN THE SCOPE OF THIS STUDY

SYSTEMS INTERACTION METHODOLOGY APPLICATIONS PROGRAM

OVERVIEW

OBJECTIVE

- DEMONSTRATION OF METHODOLOGY

METHOD

- IDENTIFICATION OF COMMONALITIES EXISTING AT WBNP THROUGH EXAMINATION OF FAULT TREES
- DETERMINATION OF POTENTIALLY INTERACTIVE CUT SETS WITH 3 OR LESS INDEPENDENT FAILURES
- REVIEW AND ASSESSMENT OF POTENTIAL INTERACTIONS

LIMITATIONS

- RCPB MITIGATING SYSTEMS WERE NOT MODELED
- FAULT TREES WERE DEVELOPED FOR ANSI N18.2 CONDITION I AND II OCCURRENCES ONLY
- FUNCTIONS RELATING TO THE CONSEQUENCES OF RELEASE OF RADIOACTIVITY WERE NOT MODELED
- FIRE, EARTHQUAKE, HURRICANES, TORNADOES, FLOOD, SABOTAGE EXCLUDED

SPECIFIC ANALYSIS

DATA OBTAINED ON ALL COMPONENTS WHICH APPEAR IN CUT SETS

LINKING CHARACTERISTICS

- AC POWER - TRAINS A AND B
- DC POWER - TRAINS A AND B
- ACTUATION - INPUTS AND OUTPUTS TO AUTOMATIC CONTROL CIRCUITS
- LUBRICATION - INTERNAL AND EXTERNAL
- COOLING
- HYDRAULIC
- COMPRESSED AIR
- LOCATION - ROOMS, PIPE CHASES, GENERAL AREAS

REACTOR SAFETY STUDY
METHODOLOGY APPLICATIONS PROGRAM

OVERVIEW

OBJECTIVE

- DETERMINATION OF DOMINANT ACCIDENT SEQUENCES

METHOD

- SYSTEM EVENT TREES CONSTRUCTED FOR WASH-1400 INITIATING EVENTS
- SIMPLIFIED FAULT TREES DEVELOPED FOR MITIGATING SYSTEMS

RESULTS

- ICE CONDENSER PLANTS HAVE DIFFERENT DOMINANT ACCIDENT SEQUENCES
- RISK IS SIMILAR TO LARGER DRY CONTAINMENT PLANTS

SEQUOYAH AUXILIARY FEEDWATER SYSTEM
RELIABILITY EVALUATION

SUMMARY

Kaman Sciences Corporation was contracted by the Tennessee Valley Authority to conduct a reliability evaluation of the Sequoyah Unit #1 Nuclear Power Plant Auxiliary Feedwater System (AFS). Kaman employed the GO computerized event tree methodology to perform the analyses.

Results indicate that the probability of successfully starting the auxiliary feedwater system upon demand and providing adequate water flow and pressure to at least two out of four steam generators is 0.99999 where the initiating event is both feedwater pumps tripped. In event of loss of offsite power (blackout) with diesel generators and battery back-up available the AFS start-up success probability is 0.99997. Other excursions were also evaluated.

The analysis revealed that there are no first order faults in the Sequoyah AFS for the initiating event both feedwater pumps tripped. A total of 116 second order faults were identified for this case. The largest contribution of unavailability resulting from a pair of faults is 10^{-7}. Most second order fault sets contribute to start-up unavailability on the order of 10^{-10}.

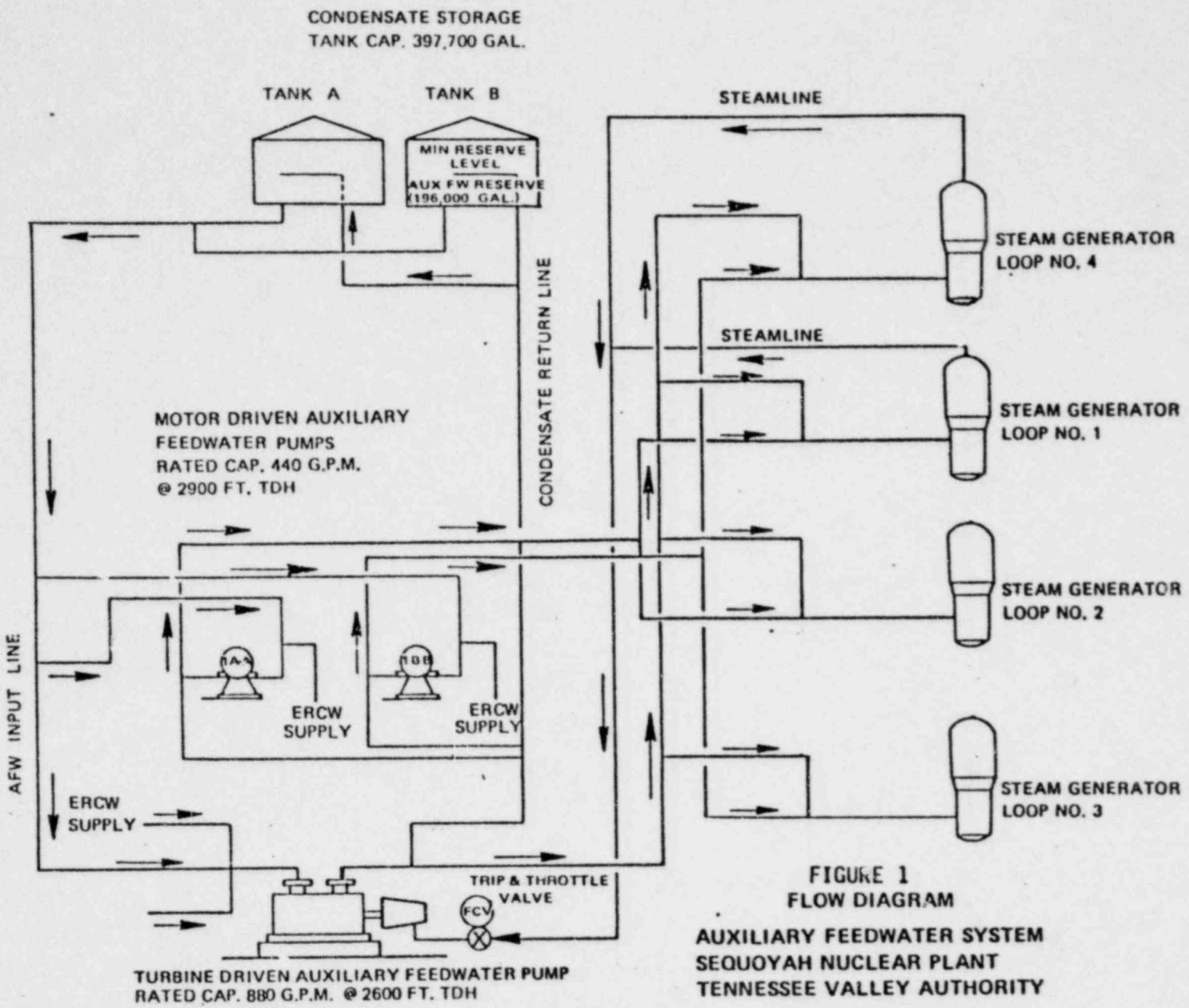


FIGURE 1
FLOW DIAGRAM
AUXILIARY FEEDWATER SYSTEM
SEQUOYAH NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY

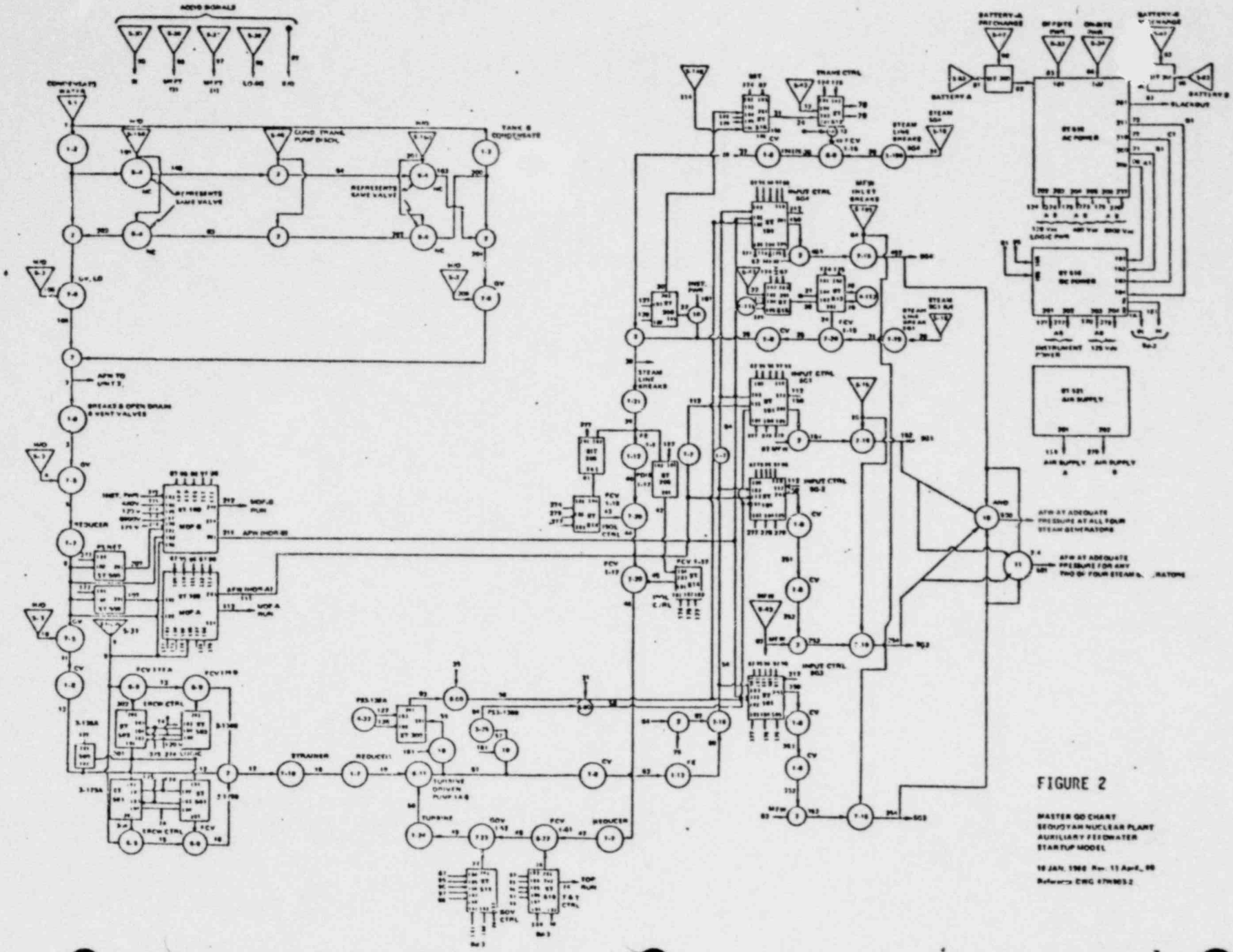


FIGURE 2

MASTER QD CHART
SEQUOYAH NUCLEAR PLANT
AUXILIARY FEEDWATER
STARTUP MODEL

10 JAN. 1986 Rev. 11 April, 88
Reference DWG 47W853-2

SEQUOYAH NUCLEAR PLANT
FULL SCALE SAFETY AND AVAILABILITY ANALYSIS

OBJECTIVE: To develop two plant models, one to assess plant safety and one to evaluate plant availability

METHOD GO methodology developed by Kaman Sciences Corporation with funding from EPRI

MANPOWER
KSC = 80 man-months
TVA = 30 man-months

SCHEDULE
Phase 1 July 1, 1980 - Dec. 31, 1980
Phase 2 Jan. 1, 1981 - Dec. 31, 1981

SCOPE

Phase 1
- Simplified plant model
- Detailed plant models of selected systems (Electrical Power, Central Air, Reactor Protection, Safety Injection, Main Steam, Main Feedwater)
- Preliminary safety and availability assessments

Phase 2
- Expansion of simplified model
- Data collection
- Final safety and availability assessments
- Incorporation of operator, test, and maintenance actions
- Determination of critical components
- Investigation of abnormal scenarios

SUMMARY

- HYDROGEN STUDIED ABOUT NINE MONTHS
- SEQUOYAH CAN WITHSTAND SUBSTANTIAL AMOUNTS OF HYDROGEN ABOVE DESIGN BASIS
- SIGNIFICANT MODIFICATIONS HAVE BEEN OR ARE BEING INCLUDED TO REDUCE POTENTIAL FOR DEGRADING EVENTS
- LIMITED RISK ASSESSMENT SHOWS SEQUOYAH COMPARABLE TO THE WASH 1400 STUDY REFERENCE PLANT
- PROPOSED CONCEPTS FOR RESOLUTION OF HYDROGEN ISSUE EVALUATED
- INTERIM DISTRIBUTED IGNITION SYSTEM CHOSEN FOR IMPLEMENTATION AT SEQUOYAH. DEVELOPMENT WORK ON CONTROLLED IGNITION IS PROCEEDING FOR FINAL IMPLEMENTATION AT SEQUOYAH. HALON SUPPRESSION IS ALSO BEING STUDIED.

SLIDE 2

CAPABILITY OF THE SEQUOYAH CONTAINMENT

- MINIMUM CONTAINMENT PRESSURE CAPABILITY

  YIELD – 33 PSIG
  ULTIMATE – 42.5 PSIG

- VOLUME – 1.2×10^6 FT^3

- CONTAINMENT CAPABILITY TO WITHSTAND HYDROGEN COMBUSTION

  ASSUMPTIONS:

  - BURN IS INSTANTANEOUS AND COMPLETE
  - BURN IS ADIABATIC
  - NO RADIATIVE TRANSFER

  RESULT:

  - SEQUOYAH CAN WITHSTAND A HYDROGEN BURN EQUIVALENT TO APPROXIMATELY 25 PERCENT METAL-WATER REACTION (USING ULTIMATE STRENGTH OF MATERIALS)

SLIDE 3

CONCEPTS STUDIED FOR MITIGATION, CONTROL, OR PREVENTION OF CONSEQUENCES FROM HYDROGEN

- MITIGATE THE CONSEQUENCES OF HYDROGEN BURNING
  - VENTED CONTAINMENT:
    1. FILTERED
    2. ADDITIONAL
    3. COUPLED
- CONTROL COMBUSTION
  - CONTROLLED IGNITION SOURCES
- PREVENT COMBUSTION
  1. INERT CONTAINMENT WITH NITROGEN
  2. SUPPRESS COMBUSTION WITH HALON

CONCEPTS – ASSESSMENT

- VENTED CONTAINMENT

FILTERED

1. NOT EFFECTIVE FOR RAPID PRESSURE TRASIENTS
2. ESTIMATED DOSE IN LOW POPULATION ZONE IS IN EXCESS OF 900 REM
3. SOME ESSENTIAL FEATURES NOT DEMONSTRATED
4. POTENTIAL FOR UNNECESSARY BYPASS OF CONTAINMENT
5. HIGH INITIAL COST, MODERATE O/M COST

ADDITIONAL CONTAINMENT

1. NOT EFFECTIVE FOR RAPID PRESSURE TRANSIENTS
2. MINIMIZED RADIATION RELEASE TO THE PUBLIC (VESSEL LEAKAGE ONLY)
3. VERY HIGH INITIAL COST, LOW O/M COST

SLIDE 5

CONCEPTS – ASSESSMENT (CONT.)

COUPLED CONTAINMENT

1. NOT EFFECTIVE FOR RAPID PRESSURE TRANSIENTS
2. POTENTIAL FOR DEGRADING SAFETY OF SECOND UNIT
3. LARGE OPERATIONAL PENALTY FOR SECOND UNIT
4. MINIMIZED RADIATION RELEASE TO THE PUBLIC

SLIDE 6

CONCEPTS – ASSESSMENT (CONT.)

– CONTROL COMBUSTION

IGNITION SOURCES

1. HIGH POTENTIAL FOR EFFECTIVENESS DURING MOST ACCIDENTS LEADING TO CLAD OXIDATION
2. NO EFFECT ON PLANT OPERATION
3. TECHNICAL DEVELOPMENT REQUIRED
4. REQUIRE LOCAL HYDROGEN MONITORING
5. MODERATE INITIAL COST, LOW O/M COST

CONCEPTS – ASSESSMENT (CONT.)

- CONCEPTS WHICH PREVENT COMBUSTION

  NITROGEN INERTING

  1. EFFECTIVE IN PREVENTING HYDROGEN COMBUSTION
  2. LARGELY A PASSIVE SYSTEM
  3. DIFFICULT BACKFIT TO ICE CONDENSER
  4. OPERATIONALLY PROHIBITIVE BECAUSE OF FREQUENT MAINTENANCE NEEDED ON ICE CONDENSER AND OTHER CONTAINMENT SYSTEMS
  5. SIGNIFICANT POTENTIAL FOR DEGRADED SAFETY THROUGH REDUCED MAINTENANCE OF EQUIPMENT
  6. INCREASED LOSS OF ICE
  7. HIGH INITIAL COST, EXTREMELY HIGH O/M COST

CONCEPTS – ASSESSMENT (CONT.)

HALON SUPPRESSANT

1. POTENTIALLY EFFECTIVE IN PREVENTING HYDROGEN COMBUSTION
2. NO OPERATIONAL EFFECTS WITH NORMAL PRECAUTIONS
3. MODERATE HAZARD TO PERSONNEL
4. TECHNICAL FEASIBILITY NOT DEMONSTRATED
5. DECOMPOSITION PRODUCTS MAY PRODUCE SEVERE CONSEQUENCES
6. ACTIVE POST ACCIDENT WITH SHORT BUT REASONABLE TIME TO MANUALLY ACTIVATE
7. HIGH INITIAL COST, LOW O/M COST

RESULTS AND CONCLUSIONS

- MOST PROMISING CONCEPTS FOR HYDROGEN CONTROL SELECTED FOR A RIGOROUS DEVELOPMENT PROGRAM ARE:

  1. IGNITION SOURCES

  2. HALON SUPPRESSION

- SIGNIFICANT IMPROVEMENT IN PHYSICAL MODELS AND COMPUTER CODES ARE NEEDED

- FILTERED VENTED CONTAINMENT IS UNACCEPTABLE FROM RELEASED DOSE

- INERTING IS NOT FEASIBLE FOR AN ICE CONDENSER CONTAINMENT

- RISK AT SEQUOYAH COMPARABLE TO WASH 1400 REFERENCE PLANT

PROGRAM FOR DEALING WITH DEGRADED CORE CONDITIONS

- WE HAVE ORGANIZED AN EIGHT-MAN FULL TIME TASK FORCE FOR DESIGN AND DEVELOPMENT WORK ON DEGRADED CORE ACCIDENTS.

- WE ARE IMPLEMENTING IMMEDIATELY THE DESIGN AND INSTALLATION OF AN INTERIM DISTRIBUTED IGNITION SYSTEM (PHASE 1) TO BE OPERATIONAL WITHIN TWO TO THREE MONTHS.

- WE ARE IMPLEMENTING IMMEDIATELY DEVELOPMENT WORK TO UPGRADE THE INTERIM DISTRIBUTED IGNITION SYSTEM (PHASE 2) AS IMPROVED ASPECTS OF THE SYSTEM CAN BE DEVELOPED.

- WE WILL COMPLETE A LONG-TERM STUDY AND DEVELOPMENT EFFECT FOR CONTROLLED IGNITION SYSTEMS WHICH WILL LEAD TO BACKFITTING THE PHASE 1 & 2 SYSTEMS, IF NEEDED. (PHASE 3) THE LENGTH OF THE STUDY SHOULD BE APPROXIMATELY TWO YEARS.

- WE ARE IMPLEMENTING IMMEDIATELY A DEVELOPMENT EFFORT TO UNDERSTAND THE POTENTIAL NEGATIVE ASPECTS OF HALON AS A HYDROGEN BURN SUPPRESSION.

slide 11

Degraded Core Task Force Program

Major Tasks

1. Controlled Ignition
2. Halon
3. Risk Assessment
4. Core Behavior, Hydrogen Generation and Transport
5. Hydrogen Burning and Containment Responses
6. Containment Integrity
7. Equipment Environmental Qualifications
8. Radiation Dose Code
9. Hydride Converter, Fogging, and Others
10. Rulemaking and State of the Art