ORIGINAL

OFFICIAL TRANSCRIPT
PROCEEDINGS BEFORE

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

DKT/CASE NO.

TITLE SUBCOMMITTEE ON SAFETY RESEARCH PROGRAM

PLACE WASHINGTON, D. C.

DATE DECEMBER 8, 1982

PAGES 1 - 239

TR04
delete B. White

ALDERSON REPORTING

(202) 628-9300
440 FIRST STREET, N.W.
WASHINGTON, D.C. 20001

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE ON SAFETY RESEARCH PROGRAM

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

Wednesday, December 8, 1982

The Subcommittee on the Safety Research Program met, pursuant to notice, at 10:05 a.m., Chester P. Siess, Chairman of the Subcommittee, presiding.

ACRS MEMBERS PRESENT:

CHESTER P. SIESS
J. CARSON MARK
DAVID A. WARD
DAVID OKRENT
PAUL G. SHEWMON
MYER BENDER
MAX W. CARBON
DADE W. MOELLER
JEREMIAH J. RAY
HAROLD ETHRINGTON

DESIGNATED FEDERAL EMPLOYEE:
S. DURAISWAMY

ALSO PRESENT:

M. KNAPP
F. GILLESPIE
D. ODEGAARDEN
J. MURPHY
F. ARSENAULT
T. CLARK
J. ROBERTS
B. ALEXANDER
Z. ROSZTOCZY
J. WATT
MR. GOLLER
D. WILLIAMS
P. COTA

P R O C E E D I N G S

MR. SIESS: The meeting will come to order.

This is a meeting of the ACRS Subcommittee on the NRC Safety Research Program. I am Chester Siess, Subcommittee Chairman. The other members of the ACRS that are present at this time are Dave Ward, Dave Okrent, Dade Moeller and Harold Etherington. There will, I hope, be other members present sometime during the day, as indicated by the name cards set around the table.

The purpose of meeting is to discuss the NRC Safety Research Program for fiscal years '84 and '85 and to get additional information for use by the ACRS in preparing its annual report to the Congress on the research program. Time permitting, and having some material to work on, we will also discuss draft 1 of our report to Congress later today.

The meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act and the Government in the Sunshine Act. The Designated Federal Employee for the meeting is Mr. Sam Duraiswamy, who is passing out material now.

The rules for participation in the meeting were announced as part of the meeting notice in the Federal Register and, as usual, a transcript is being kept and will be made available, as stated in the Federal Register notice. Each speaker is asked to identify himself or herself when they first speak so that the reporter will get the name, and please use the microphone.

We have received no written statements from members of the public and no requests for time to make oral statements by members of the public.

The schedule for the meeting is before you. We are starting a little bit late. We were scheduled to go till about 6:15. I hope to make it a little earlier than that because I think, as you all know, we have a dinner scheduled tonight for one of our retiring members.

The theme of this meeting I think I can characterize as priorities for research. We have scheduled some comments from the user offices and the research response in terms of how those two groups view their priorities. We will have some discussion of essentially the Research Office's view of priorities as they have been expressed by the ACRS in its previous comments to the Commission on the FY 84-85 budget.

That is item 4 on the agenda, if you are trying to follow it. Actually, 4 and 5 really is a discussion following the presentation.

We have got an item on here to look at the status of the '83 budget, which the last I heard was out of the conference committee. I do not know if it has been acted upon, but we would like to know the status of it and what the significance is, because we are now into the '83 fiscal year, and obviously some of the things that happen there will affect '84-'85.

Now there are some things that are notable by their absence. The NRC's '84-'85 budget request has, of course, been submitted to the Office of Management and Budget and the members were provided with a copy of that submittal. That certainly will be referenced in Item 4 and some of the other ones.

The NRC has received back from OMB a mark on that budget request. Under the rules in the Executive department, the NRC is not permitted to discuss any actions by OMB in an open meeting, and we are not permitted to close a meeting to discuss budget matters by directive of the Federal court. So we are caught between an Executive Order that says don't discuss it publicly and a court Order that says you cannot discuss it privately.

Now I have gone on the assumption in setting up the agenda that the OMB is not likely to increase the NRC's budget request, that they are likely to decrease it -- by how much, we do not know. So we have asked the Staff, in line with this discussion of priorities, to clarify their priorities on the '84-'85 program by giving us some discussion of what would be changed, what would be taken out if they had, say, to cut the budget ten percent or fifteen percent. I think we have got five or ten here.

I would like to escalate that a little bit and say what would you take out with a ten percent cut, and what else would you take out with another five. Now that is a way of looking at priority. We could do the same thing if we had things listed in some order -- not just what they would take out, but why -- and then we would be able to discuss that.

So essentially Items 1 through 7 are priorities -- the User Office, Research, ACRS, and sort of the bottom line on '84-'85 -- what would they take out if they had less money.

The last two items are the discussion of the draft or those portions of the draft we have before us. We picked up some items in response to our plea to get some drafts in. Some of the drafts were prepared by the Staff, some have been reviewed by the Committee members, some have not, and there are some issues we can take up in the latter part of the meeting on that, depending on the time that is available.

Right now I would like to concentrate on the first seven items. Any questions about that? Would anybody like to add anything?

(No response.)

MR. SIESS: Hearing none, the first item is really Item 2 and has to do with User Office needs. We have divided that into two parts -- nuclear material safety and safeguards, and Nuclear Regulatory nuclear reactor regulations, I guess it is -- NRR. We will start with NMSS and, according to this, Mr. Knapp will lead off in presenting the NMSS research needs and the basis for that.

We have a handout that Sam just passed out to you. Mr. Knapp, do you need any help?

MR. KNAPP: I think I have a problem.

MR. SIESS: There is a great big button in there and you push it. Sam will drape you with a microphone and there is a pointer there. If we are going to see the screen, you have got to get your back to the wall over there.

MR. KNAPP: Good morning. The NMSS activities this morning are going to be discussed in three parts. NMSS, I think, as many of you know, has three divisions in it -- Waste Management, Fuel Cycle, and Safeguards.

The budget, as we understand it, for '84 and '85 are shown.

As you can see, the Waste Management Division has a line to share that budget. I will be speaking to waste management. I will be followed by speakers from Fuel Cycle and Safeguards.

(Slide.)

MR. KNAPP: Within the Division of Waste Management we have three principal technical areas of interest -- high level and low level waste and uranium recovery. This vugraph shows including the years Fiscal '82 and '83 how the resources have been distributed for contract assistance, both within the Division of Waste Management, which is administered by Waste Management personnel, and within the Office of Research.

You have the totals along this bottom line. I think one of the things to note at this point is that in general, except for something of a decrease in high level waste here, the totals are pretty well stapled throughout the interval for both offices.

One thing I would note at this time is that in general throughout the Waste Management Division was are moving to a degree from regulation development to licensing. As you know, low level has just gotten their regulation in place. Uranium recovery has had one in place for some time, and high level will be before the Commission shortly.

So our needs, as we see them, in the future will be more oriented towards licensing. I would not suggest that regulatory would be unnecessary. We are going to need help in the production of such things as reg guides. In fact, one of our priorities in the low level area is production of regulatory guides with the help of the Office of Research.

(Slide.)

MR. KNAPP: The high level program, I think several of you are aware, is divided into four technical areas -- waste form and package performance, site suitability, repository design and engineering, and performance assessment. That is where we are involved in computer codes to integrate the work of the above three areas to define whether or not a regulatory application is viable.

It is worth noting here that in high level we do not regard our research or technical assistance as being involved in the development of information or the technology necessary to build a repository. That is the job of the Department of Energy. We do feel that we have to do enough research to have the understanding necessary to independently assess an application that

DOE might bring in.

Therefore, although DOE has a massive program -- I think some $200 million -- it is necessary that we do a certain amount of independent research which will provide the information we need to deal with DOE. It is not possible for us in all areas to be able to make use of the information that they provide.

(Slide.)

MR. KNAPP: Within waste form and package performance we are concerned with the waste form itself -- the canister which contains it and the packing immediately surrounding the package. The stability and leaching processes of the waste form are of interest to us, the canister performance, both its physical strength over the operating period, which could involve a retrieval period, and the way in which it degrades over the long term, what kind of corrosion might attack it.

With respect to packing, we are interested in its chemical properties, to what extent can it remove radionuclides from ground water and prevent them from getting out into the adjacent geology, and enhance the environment to the extent that the waste in canister seats so as to promote their performance.

We are concerned about all of these areas, not independently but as an integrated problem. We would like to be confident that there are not synergisms which could cause the entire waste package to have inferior . :formance to what we might expect from an independent analysis of each of the components.

(Slide.)

MR. KNAPP: Talking about site suitability, I think this is again a time to return perhaps to the idea that we are developing an understanding necessary to independently consider an application. We want to understand the processes which are involved. We want to understand the limitations and uncertainties involved in their measurement rather than to develop the technology ourselves.

In particular here in ground water flow, we are concerned, I think, with fracture flow in both saturated and unsaturated media -- saturated media in the case of the Hanford site; unsaturated media as the likely case at this point at the Nevada test site. We do not have the understanding necessary to deal with those at this point and we are particularly interested in continuing research in those areas.

(Slide.)

MR. SIESS: Is that due to the fact that you do not know what the research needs are? Suppose somebody else has the answer? You mean you don't have the understanding. Do you mean the profession does not have it, or just NMSS does not have it?

MR. KNAPP: I would say it is my view that the profession at this time does not have it. We certainly are working with DOE. We meet with them frequently. We have got a lot of communication with them in our site characterization review. But I would not say that the understanding of fracture flow and its potential effects on both ground water time and radionuclide retardation would be considered settled or well understood by the technical community.

What we need to do here is have enough work going on that we understand what DOE brings in and we are able to independently evaluate it. I cannot really speak to the research program well, but in this case I would be talking about the work at the University of Arizona, where we are doing, I think, some pretty good work on the understanding of fracture flow and what is likely to be important.

MR. SIESS: So you want to be sure that whatever research that you have done is not being done by the same people that are doing research for DOE.

MR. KNAPP: That would certainly be our intent. Unfortunately, sometimes we learn that everyone in the world that is working on ground water flow is either working for us or DOE, and occasionally both. We try to find these things and see that there is not a conflict of interest.

MR. SIESS: Do you think there is such a thing as a conflict of interest of gaining knowledge in your objective in research? I can see a conflict of interest in applying knowledge, but the idea that there could be a conflict of interest in gaining knowledge, as a research man, I never really thought about.

MR. KNAPP: I could give you my personal philosophy about it for a while. I guess there is one thing that would trouble me. I might better say apparent conflict of interest or perceived conflict of interest.

It is my understanding that that could be a potential problem during a licensing operation. Whether the conflict of interest was present in fact or simply perceived, it could still be a problem. I think that would be my major concern. But again, this is really not something that I am in a good position to discuss.

MR. SIESS: I was listening, but I am not sure whether I heard you say the licensing process or the hearing process. Are you thinking of the hearing?

MR. KNAPP: Well, I guess I am not entirely sure what the details of the licensing process are going to look like. At this point, we expect that we will get our first application about 1987. I fully expect that there will be hearings, probably about 18 months after we receive the application. I think that is about the time the Staff will comment on it

I am sure that if it follows the procedures I expect there will be opportunity for public comment, both in formal hearings and in our formal documents, and I would expect that a perceived conflict of interest could be raised, but I am really guessing that far into the future.

MR. SIESS: Let me go back to the point of who knows or who does not know something. If you are in a situation where you within the Staff do not have the knowledge to make a certain decision but you know there is somebody out there in the world that has the knowledge, that is, the knowledge exists but you just do not have it, do you then go out with a technical assistance program rather than a research program and hire that person to provide the knowledge, whereas if nobody knows it you go out with a research program?

Is that one of your bases of deciding whether to spend your money or Research's money -- that is, technical assistance versus research?

MR. KNAPP: I do not think it would be right to say that we look at it from that perspective in Waste Management. I think that our principal basis for differentiating between research and technical assistance is -- let me see if I can come up with what might be a handy example.

In Research at the moment we are concerned about the present state of knowledge about ground water flow and fractures, radionuclide migration and fractures. We think the kind of things involved here are going to be somewhat long term. It is going to take several years to deal with and they are not ones that are amenable to bringing in a consultant or an expert and coming up with a product.

In fact, I think there is a reasonable risk that we may in fact have to settle for less than what we would really like. That, in my perspective, is the kind of work we tend to do in research.

On the other hand, immediate application, such as having known experts who have solutions available to us -- aid in such things as our current evaluation of the Hanford site characterization report -- is pretty clearly technical assistance.

So my general basis for differentiating is how immediately the results can be applied, the extent to which they be very applied work, which is a continuation of things we understand, as opposed to what kind of work is perhaps somewhat more speculative and could involve some very basic research.

MR. SIESS: That's almost exactly the distinction I was making. You said if you have got the expertise and applied it right away, you use tech assistance, but if you have questions that you think need to be answered or the technical experts do not know the answer, you go to research.

MR. KNAPP: I would say we are saying much the same thing. I guess where you caught me is I consider, candidly, both in technical assistance and in research we have some very good technical experts that know about what is known to be going on. I would consider the questions differentiating between the levels of expertise.

MR. SIESS: I was trying to differentiate somehow -- you know, you listed about the same amount of money being spent on technical assistance as on research.

MR. KNAPP: That is correct.

MR. SIESS: And not in each category -- the total. I was trying to get some idea of when you decide to spend your money and when do you decide to take it to research, and you have distinguished it pretty much on a time basis.

MR. KNAPP: I think the time and the extent to which, I might call it, perhaps, a research versus an engineered problem -- the extent to which we have a great deal of confidence that the technical problem we are attempting to address can be solved.

MR. SIESS: By somebody, not necessarily by you.

MR. KNAPP: Right.

MR. SIESS: Because you do not have the expertise or you do not have the time.

MR. KNAPP: It can be both. I would have said three years ago in the Waste Management Division it was because we did not have the expertise. We have undergone a certain amount of growth in the last three years. We have some pretty competent, experienced staff, and I would say now it is because we do not have the time.

There is also some recognition that some of our problems are bulges in the curve, if you like. It is more appropriate to solve these problems by getting the most appropriate experts from outside rather than staffing up.

The engineered part of the repository, the underground facility, is of concern to us in two aspects -- the operational phase and the post-closure phase. In the operational phase we are interested in what we call systems important to safety and retrieval. I would note here that the concept of systems important to safety is one where we are seeking results from research. That is one we would like to highlight.

Our regulatory position is that those items which we may regulate in the operation phase are those which are apt to consider to a safety hazard as a result of radionuclide releases. And an understanding of how events might occur below ground to contribute to these releases is something that is going to be pretty important to us to decide whether we can and should regulate.

That is probably going to be best determined by the risk assessment on the operational phase, and we would like very much to see work in this area emphasized to support the design portion of the high level program.

The post-closure phase, of course, we are interested in whether or not the shafts and the bore holes can be sealed, how long the seals will remain intact, when they degrade what they will degrade to, so that they may or may not be considered as significant pathways, except significant for radionuclide transport into the environment.

The area of performance post-closure is principally considering backfills and bulkheads within the actual drifts and tunnels in the underground facility to make sure that if a breach does occur it will be limited to the facility.

MR. MARK: When you talk about the barriers, I picture hot fuel in a jacket of some sort -- steel maybe, copper, maybe both -- and then I picture some backfill like slag or whatever. Where do you think of putting that boundary?

Before I get to the native rock, you say the boundary is inside that. The native rock is a thing to be discussed in itself, I imagine. Where is this boundary?

MR. KNAPP: I am happy to discuss that. I will have to digress a bit.

MR. MARK: Just tell me.

MR. KNAPP: Let me give you a different vugraph. I think it will be much easier to describe. At this time we have defined -- this is in the regulation on high level which is currently before the Commission -- excuse me, that is inaccurate. The Commission has it for information; they do not have it for action.

(Slide.)

MR. KNAPP: At the moment, the boundaries look like this (indicating). Specifically, we have two concepts, I think many of you are aware, that we would like to see containment of the waste for some minimal time. Following the containment interval, we would like to see a low release of radionuclides for as long thereafter as is reasonably achievable. I think you have seen our actual numbers in the regulation.

At this time, the boundary with respect to the waste package for containment is here. It contains exactly, I think, the things you mentioned -- the waste form itself, a container or canister surrounding the waste form, and packing immediately adjacent to it. The engineered barrier system where we are applying the release rate applies at this point (indicating) and this includes the way the regulations are currently phrased.

The rock which provides structural support for the underground facility. The intent in that terminology is to recognize that this distance, the amount we go into the rock to provide structural support, will be of an order of the size of, let's say, the pillars which provide structural support in general. So that we are not talking about a distance of one or two feet, nor are we talking about a distance of about a mile, but something intermediate, say 100 feet to about 100 meters.

MR. MARK: Dade, your Subcommittee had real concerns about the way in which some of these things were going to be confined. Are you happy with the way we have heard it described now?

MR. SIESS: Let's keep this in the context of the research program.

MR. MARK: But the research program goes to a kilometer or a foot or something.

MR. SIESS: I wanted to keep it in that context.

MR. MOELLER: I think we are -- Joe Donohue is here, if you have a moment just to get a comment from him, because he is the one on our staff who has been looking into it, who is most knowledgeable about it.

MR. MARK: Well, you had some objections.

MR. MOELLER: Yes.

MR. MARK: Have they been voiced?

MR. MOELLER: Voiced those in writing. Joe, could you respond as to whether you believe the Staff, the NRC Staff, has answered our criticism?

MR. SIESS: I do not think that -- again, can we keep this in the context of the research program? Now if this only defines one aspect of the research program versus another, I'm not sure it makes any difference.

MR. MOELLER: It does not for the research program.

MR. MARK: Well, excuse me.

MR. SIESS: Regulation is one thing, but I suppose research will go out into the atmosphere or somewhere else, and this is defining what he means by repository and design engineering.

MR. KNAPP: That is our view, that these technical questions are going to have to be addressed in one pigeonhole or another. Exactly how those are laid out is still under debate.

MR. SHEWMON: Let me run the risk of incurring his displeasure again, but do you assume there is no such thing as a dry hole in this business, even though you may put it inside of a mountain or in a salt quarry? I notice you have got ground water up there.

MR. KNAPP: Right. The regulation, as originally written, I think, in the proposed version which came out July 8 of '81 only applied to saturated media. The version which we currently have, which was given for information to the Commission, I believe to the ACRS, I believe applies to both saturated and unsaturated media.

MR. SHEWMON: Fine. Go ahead.

(Slide.)

MR. KNAPP: I would like to move on from the design vugraph to this vugraph on performance assessment. Our principal concerns at this point in performance assessment reflect the state of the program. That is, we are concerned with ground water travel time and fracture media and unsaturated media.

The difference between our concern here and that of the siting people is that they are interested in understanding the phenomena in measurement. We are interested in understanding how it can be modeled and how these models can be put into the computer codes that can be verifiable and that will make sense. I believe that is consistent with the suggestion made by the ACRS to Congress last February.

MR. MARK: Are the computer codes which you are aware of handling the situation at Okloe and explain why in 10^9 years nothing migrated more than 100 meters in a saturated medium?

MR. KNAPP: My first response would be that we on the Staff have not applied the computer codes to Okloe.

MR. MARK: Why should you not apply the one existing example of long-term fission migration, that there is any evidence for it at all?

MR. SIESS: You referred to validated codes, I thought. Is that the word you used?

MR. KNAPP: I would hesitate to say that any codes have been validated or, in the strict sense, that they could be validated, because that would require studies 10,000 years into the future.

MR. SIESS: Dr. Mark just suggested that the 2 million year time span you could use to validate a code and you said you have not thought about doing it. I was wondering what you meant by "validated", or did you say "verified."

MR. KNAPP: I presume we are all on the same wavelength as to the difference between "verified" and "validated." Given that, certainly verification is straightforward and is being done. Validation I think is more difficult. I would not consider personally that demonstrating that we could model what has happened at Okloe would constitute validatation for application to a different site or a different medium.

We are, in response to your question, funding a project -- we are not, Research is, but we have endorsed it -- a project in Australia where there is a uranium war body -- you will have to forgive me for being a little bit uncomfortable with the answers here, but I believe that there is migration of uranium and daughter products in both oxiding and reducing environments in the vicinity of the outcroppings.

We consider this as an opportunity of getting an understanding of exactly how these things migrate, understanding their influences, and see how our models work, and we will be applying it there. We are not applying it to Okloe right now.

MR. MARK: I do not know why you do not apply it to Okloe, but I am delighted to hear that you are applying it to some known situation. Okloe has the marvelous feature that you know that it was not merely saturated. It was merely full of water through millions of years of its life and nothing went anywhere.

Unless your code tells you something like that, then you ought to throw it out.

MR. SIESS: It might work for unsaturated. That is the trouble with validation. If it works, fine; if it does not work, it does not prove anything.

MR. SHEWMON: My impression is if they do not have any water, they cannot find any mechanism at all for moving it. So the saturated one is the only crap game in town, and I agree with Dr. Mark's suggestion that it would be nice to know that your code at least was not several orders of magnitude off with regard to

Oklce, even if that would in itself be an incomplete validation.

MR. MARK: It is clay, which is hard to come by. Therefore, it is rather special, but at least it had to be full of water because otherwise there would not have been any reaction.

MR. KNAPP: I understand your concern here. The only -- I would be perfectly happy to investigate the possibilities. The only difficulty with addressing it and modeling it is one of the things we are finding is there are great uncertainties. In fact, I even have the word up here in my last bullet.

There are great uncertainties with regard to radionuclide solubility and radionuclide migration. I could probably say almost in confidence now that if we picked the right values of solubility within ranges that we might have, we could predict exactly what Okloe has done.

MR. SHEWMON: That might help you to predict the unknowns. That is our basic point -- or evaluate the unknowns.

MR. KNAPP: I think your point is well taken. I would just not want to warrant that when we got the results we would not find that the uncertainties in the selection of retardation factors and solubilities would make it such that the Okloe results would fall well within the uncertainties and, therefore, I am not certain that I could say that that validates this code or this model.

We simply have an intuitively reasonable result which is consistent with the data.

MR. SHEWMON: As long as it is not flagrantly inconsistent, I think, is the concern.

MR. KNAPP: With respect to that, I think your point is well taken.

MR. SIESS: On another philosophical level I would argue if there are not any uncertainties, there is not much need for research.

One of the objectives of research is to define the uncertainties and another is to reduce them.

MR. KNAPP: I agree completely. I would just like to note two other areas of interest to us here. With respect to compliance with the draft EPA standard, which I think many of you know is a discussion of radionuclide releases to the accessible environment, we're interested in radionuclide transport, the items I just mentioned a moment ago, and scenario selection.

I've been a little loose with the terminology here. In this case I mean both a varying amount of water flowpaths that might occur and, presuming in the undisturbed case, the ways in which the repository might be disturbed such as an inadvertent bore hole. We're interested in the likelihood of these events occurring.

MR. MARK: To what extent are you making use of the absolutely detailed data that is available from Nevada on the migration of stuff from the shock 15 years ago to water sources downstream from that which are in hand?

MR. KNAPP: Quite a bit. As a matter of fact, some of the work that is going on right now at the Sandia Laboratories -- there was a paper what, a year and a half or two years ago, on that work which contrasted retardation of, what was it, ruthenium, with measurements of predictions. We are using that as a basis, among other things, to see whether or not we can make predictions.

MR. MARK: You answered my question. You are aware of the data and it is being used, and that is all I could ask.

MR. KNAPP: Yes, sir.

(Slide.)

That concludes my remarks on high level. I would like to now discuss low-level wastes. Again here, we have several areas of interest to us: site suitability, facility design, operation and monitoring, performance assessment, waste form and container performance. And as I mentioned before, one of our high priorities in research is helping developing some regulatory products, specifically some regulatory guides.

Our concern here is with the likelihood that states in some cases are going to take on the responsibility for this licensing. We want very much to provide guidance to the states that they can use in that effort.

(Slide.)

This is with respect to site suitability and low level waste, what is presently going on in research that is of interest to us and areas where we would like to see future work. In particular, we are interested in radionuclide transport and instrumentation in the unsaturated zone, simply to be able to predict how rapidly radionuclides released from the packages get past the site boundary.

(Slide.)

With respect to --

MR. MARK: Could you help me slightly? The unsaturated zone refers to what, a region in which there is no flowing water, as contrasted with the saturated zone in which there are streams of water running around?

MR. KNAPP: To be rigorous, I ought to ask a hydrologist to answer the question. The unsaturated zone, as I understand it, is an area that is not saturated. That's not quite as funny as it sounds.

I do not mean a dry location. An unsaturated zone is one where there is a certain amount of air present.

MR. MARK: Of what?

MR. KNAPP: Of air. That is to say, the voids between the rock are not filled with water. They could be 50 percent saturated and we would call it the saturated zone. This has a certain amount of merit because many people presume that the unsaturated zone means completely bone dry.

MR. MARK: That of course was the source of my question.

MR. KNAPP: Right. But the fact is, you could have in areas that are formally defined as saturated, you could have as much as 98 percent of the voids filled with water and therefore you can have transport and percolation effects to the water table and along the water table in a horizontal direction to the outside environment.

MR. MARK: Do you make any use of the fact that it's unsaturated by saying that there isn't much water, or do you say there might be some water, therefore it is equal to a saturated zone? We have to assume that the water flows as if it were saturated?

MR. KNAPP: One of the main reasons we would like to see research in that area is that I don't have an answer to that question that I'm comfortable. My expertise is in high-level, but at the Nevada test site, where we expect things will be unsaturated, at the moment I do not have an intuitive picture of what is going to happen in terms of potential radionuclide transport in the unsaturated zone that I am comfortable with.

Whether water will percolate down, whether thermal effects will cause it to move down in other patterns or what, I really don't understand what is going on in the saturated transport.

MR. MARK: I understand the problem is difficult, but if the assumption ultimately for regulatory requirements is going to be that this zone is unsaturated, but there might be an 11-inch rainfall, in consequence of which it becomes saturated, therefore we must discuss the flow as if it were saturated, then you don't need to do too much research on the unsaturated because you're going to rule it out as unreliable anyway.

MR. KNAPP: I would agree with that. I want to look to Ed Hawkins in low-level to make sure I'm not putting words in his mouth, but I think the problem that I face is I'm not sure what you've just suggested is necessarily the conservative case.

One of the reasons a couple of years ago that was put forward for not siting unsaturated zones was, at least if it were saturated you could measure the gradients present and you could measure with some confidence how much groundwater flow would occur. If the gradients were almost nil, you wouldn't have a problem.

On the other hand, an unsaturated zone, which you've suggested could very well come home if we had a good deal of rain and we had percolation effects, and then we woul have a fairly easy mechanism whereby water could go through a facility and carry radionuclides away. It is not clear to me that the presumption that the unsaturated zone was desaturated was necessarily the bounding case. That's my view on high level. We may have a different view on low level.

MR. MARK: I was thinking, of course, more of low-level.

MR. KNAPP: There are a couple of things I would like to note about this vugraph. We are presently supporting work on trench cap covers, among other things. And in our future work we have listed engineered disposal. I think that vugraph might better read, "Engineered disposal and alternatives to near-surface disposal."

Both of these items I believe are consistent with recommendations the ACRS made to Congress last February.

MR. SIESS: What you've got up there are essentially four-year programs.

MR. KNAPP: That's correct.

MR. SIESS: These things are so difficult that it's going to take four years of research to resolve things like trench cap and monitoring instrumentation?

MR. KNAPP: I think it is time that I get Ed Hawkins to answer some questions.

MR. HAWKINS: I'm Ed Hawkins with the Low-Level Waste Licensing Branch.

I think the answer to your question is that what we're doing in some of these research activities is testing some of these research ideas out over time. For instance, the trench cap cover, there have been some already constructed at the University of Arizona. We are now testing through several cycles, both in wet and dry periods, and there are also two different sites, a dry site that is now near the University of Arizona and a wet site, "wet site," which is up on Mount Lemon. We're testing some of these things to try to see how they perform.

MR. MARK: It takes four years to get a rainstorm.

MR. SIESS: It sounds like a demonstration evaluation range rather than the R&D range.

MR. HAWKINS: I'm sorry, sir, I didn't understand your question.

MR. SIESS: There's a category called research demonstration and evaluation, and it seems to me you're in the last two levels of this rather than in the first one.

MR. HAWKINS: That's probably true on most of these here. The ones that aren't, the sampling and monitoring statistics is also that sort of thing where we are trying to see some of the sampling monitoring approaches that have been used in other areas and how they've been applied to low-level waste migration and uptake.

MR. SIESS: Okay.

(Slide.)

MR. KNAPP: With respect to low-level performance assessment, you can see that several programs here are not continuing into the future. We do wish to continue work on low-level risk methodology and source terms of radioisotopes. We would also like very much to see some work done in research on stochastic modeling and transport in unsaturated flow.

I am not certain how successful stochastic modeling will be in the long run, but it's becoming increasingly clear in both high-level and low-level that the uncertainties we have mentioned earlier in determining these parameters suggest that a deterministic statement about groundwater flow is probably going to be rather difficult, and we are going to have to talk about the final analysis that devotes a great deal of attention to the ranges of uncertainty that are likely to be present.

MR. SIESS: How do you do risk methodology without stochastic modeling? You can't do risk methodology on a deterministic basis. At least, I haven't seen anybody do it.

I assume by "risk methodology" you mean probabilistic risk methodology?

MR. KNAPP: That's right. I think that the point here is that I would argue that -- well, in any case, you have a probabilistic input, an input of uncertainties to a variety of parameters. You could then deal with this uncertainty in a deterministic model, say by selecting various values for the parameters, using hypercube sampling or some other means to deal with the stochastic portion of the work.

Alternatively, there is some work that is being advocated, I believe by Lin Gilhoven at MIT, that will talk about stochastic modeling I think less from the perspective of a deterministic model of the system, for which a variety of parameters are selected, and more in terms of the actual model itself, which reflects the probabilistic nature of what goes on.

This is an area which has some interest and we think we should cover it.

MR. MARK: When you talk of risk methodology, there are several ways one might imagine. You might talk of the possibility of there being a microcurie per cubic meter of iodine-129 in some water, or you might want to go on and talk about the likelihood that someone on that account keels over. Where do you draw that line?

MR. KNAPP: Ed is going to have to tell you where he draws the line for low-level. I believe it's 25 millirem for high level at this point.

MR. MARK: You talk only of possible dose commitments, namely if this guy sits on the side of that stream and drinks water all day long he might get so much curies? You don't discuss what happens to him if he does. That's my question.

MR. KNAPP: Okay, let me address it with respect to high-level and then Ed can address it with respect to low-level.

Our current high-level charter is to determine whether or not the EPA standard can be implemented. The EPA standard, you are quite correct, does not deal with what happens to the individual. In fact, it doesn't even deal with what dose the individual is likely to see.

In their standard-making activities, EPA has set a radionuclide cumulative number of curies released over a particular interval as the standard which they would like to see met, and they have as a basis for that standard looked at the doses to individuals and made presumptions about how the doses to individuals would result in health effects.

Now, in our work in high-level we are reviewing that entire chain, that is, environmental transport, biological uptake, and health effects as a result of the uptake. We have programs going on in research to help us understand the effects of some of these radionuclides. For example, there is increased concern over neptunium over what we had a while back.

But our charter ends with respect to licensing at releases in access to the environment according to the current draft of the standard, and our work in this area considers the EPA standard and convinces ourselves that it is sufficient.

Now, on the low-level I would have to get Ed to tell you exactly what their philosophy is and how they're doing it.

MR. MARK: I am obviously uneasy about the notion of the NRC going into the effects of a given exposure. I do not think they are prepared to do so. I don't think they have the means of doing it. I don't think that anything they can do will make any sense. They might very well, and should, follow the ground of what level of microcuries might exist and might be presented to people.

To go into the health effects, it has to be the National Institute of Health or God or somebody.

MR. BENDER: I'm in favor of the latter.

(Laughter.)

MR. KNAPP: I think your point is well taken with respect to high-level.

MR. MARK: It doesn't matter if it's with respect to high-level or low-level. It's whether the NRC conceives of itself as capable into that area, which I do not believe to be the case.

MR. SIESS: Onward.

MR. KNAPP: All right.

Continuing on low-level, again we have the programs with asterisks which are continuing beyond the '82-'83 time period, and future work which we would like to see done.

Again I would note in passing that this particular project, characterizing properties of waste in containers, pays attention to the problems of chelating. They are of considerable concern to low-level and I believe they were addressed by the ACRS in their report to Congress.

MR. MOELLER: On the decontamination of waste, you have listed several items. Are you also or is anybody in the NRC looking at the criteria for the release, the research necessary to develop criteria for the release of the solutions that have been decontaminated, such as the water at Three Mile Island?

MR. KNAPP: I can't answer that myself. Perhaps Ed can.

MR. HAWKINS: Dr. Moeller, I would have to make a guess at that. I think what they are using in their criteria there is Part 20 concentration, but I'm not sure. Is that what you're referring to?

MR. MOELLER: For routine releases they can, but not for the wastes that they have decontaminated at Three Mile and are holding there.

MR. HAWKINS: The liquid wastes?

MR. MOELLER: Yes.

MR. HAWKINS: I'm afraid I can't address that. Our attention at Three Mile Island and other places has been to solidify wastes that they want to take to burial sites. That's what we've looked at.

MR. MOELLER: Thank you.

(Slide.)

MR. KNAPP: I would like to complete my discussion of the low-level program by again talking about regulatory guides. I have not listed the eight guides which we very much would like to have currently. They are not on the vugraph. Some of them include a standard format and content guide for license applications and for environmental reports, and a guide that has to do with site suitability, site selection and characterization.

The titles of the other guides is work that has been done within the Waste Management Division and could be provided if you're interested. I think the salient point is that we very strongly feel we need these regulatory products and we are hopeful for support from Research on them.

MR. SIESS: Under the present procedures, the guides have to be done by Research?

MR. KNAPP: Generally the guides, many of the guides, are done by Research. The guides are done both ways. I think it's a function of the interactions between the Program Office and Research. Generally, the Program Office is involved in the creation -- in these areas, and Ed can correct me if I'm wrong -- with Staff positions, which are then brought along and made into reg guides through Research, and I think that's the mechanism we have in mind here.

Regulatory guides have come out of the Program Office in the past.

MR. SIESS: There is nothing in the rules or procedures that would prevent you from writing a guide?

MR. KNAPP: I don't believe there is any that I'm aware of, but Research might care to comment on that. The problem is, these things are so intimately linked in their production that they are created by teams of several people, on which Research and NMSS are equally represented, and it becomes a little bit difficult to say that they are a product of Research in a formal sense, in my perspective. But perhaps Research can --

MR. GILLESPIE: Frank Gillespie of Research.

The only requirement in the agency right now is that they are signed out by Research. Minogue is the only one who has the authority right now to publish a draft guide. But indeed, they originate in NMSS and NRR, and through the final editing go through our technical staff, and Minogue signs them out. But they do not need to originate with us.

MR. KNAPP: I would like to turn very briefly to the uranium recovery portion of the Waste Management Division programs. There are three areas of interest to us there: ensuring that the mill tailings pile will remain physically stable; given that that happens, minimizing the seepage and contaminant migration from the piles; and in the event that that occurs, to try to monitor the effluents and see what we can do to control them.

With respect to stabilization of tailings, we are currently concerned with rock surface designs that would cover the tailings, how they would survive after being subjected to physical and chemical attack, and vegetation that would grow over the rock covers. There are advantages and disadvantages to vegetation, obviously.

What we are interested in in the future, one of the highlights I would like to note is methods of predicting effects of long-term geomorphic processes: How can we predict what the environment is apt to do to these piles, so that we can avoid the harmful effects and perhaps take advantage of the beneficial ones. Would it be possible to locate the piles in such a way that long-term processes would tend to add to the cover over them rather than reduce it?

MR. SIESS: Those future needs are what you need answered by research, rather than technical assistance programs, is that right?

MR. KNAPP: That's correct, from my perspective. I wouldn't want to claim that we don't have a certain amount of technical assistance addressing these problems, but these are needs that we would like to see directed through research.

MR. BENDER: As long as we are on this subject, I know you have had some dialogues with Research. Do you have a feeling for the rate of accomplishment of the tasks that are being outlined here?

MR. KNAPP: I'm not quite sure what your question is.

MR. BENDER: How long will it take to get an answer to these things that you want, and how does it correlate with the money that they have got set aside?

MR. KNAPP: I can't speak to either one of those very well. George Munoley is here from Recovery.

MR. BENDER: I didn't want to limit it to uranium recovery, but just the whole schmear.

MR. KNAPP: With respect to high-level, I'll give you one of my summarization remarks right now. On high-level, and I think for the division, we are pretty comfortable with the current research budget. We are pretty comfortable with the timing in which the research projects are coming in.

I could give you some specifics about products which are being developed, which are proving useful to us. Some have been very useful in the last years and some I expect to be useful in the coming years.

MR. BENDER: I think it's enough to just say you're comfortable with it.

MR. KNAPP: We are.

MR. MARK: I'm sorry, I didn't get to see that. Could you explain just in two words what in heaven's name is referred to as "desert pavement."

MR. KNAPP: It's my understanding -- George, would you like to handle this one, or do you want to try? Be my guest.

MR. MUNOLEY: My name is George Munoley and I'm in the Licensing Recovery Branch.

What we refer to as desert pavement is in fact, over the long term you may find -- it was brought up as an example that in Peru they have those paintings. Those paintings have been on the ground, which can only be seen by extreme altitudes, have been there for a number of years.

What we sort of would like would be to get to a better understanding of how this can be achieved, how it occurs, and maybe use that to our advantage. A little more along these lines, some of the efforts in the long-term stabilization research have been investigating manmade structures that have survived for long periods of time and to try to get a better understanding, and maybe we in our designs can take advantage of these kinds of processes which we do not fully understand.

MR. MARK: Look, I can understand the fascination of wondering how things have persisted through the times that one has observed. Have you learned that there are peculiar forms of mud, and I've forgotten the technical name, that comes to be in a once-rain forest which has been cleared up and suddenly becomes totally impermeable? Having understood that, will you then make use of it or will you say, well, but it's still might rain and therefore we can't count on it?

MR. MUNOLEY: To the extent we can, we would like to. If in our evaluations of such an effect we feel that, well, we can't count on it --

MR. MARK: You say you can't count on it?

MR. MUNOLEY: If our evaluation says we can't count on it, if it will have a desert pavement effect and we can't count on it, then we can't use that in terms of our evaluation and say that we're going to count on this particular event occurring and then walk away from it forever.

If we can count on it, if we say the conditions are such that the reason this happens in Peru or whatever is such-and-such, is some sort of chemical processes, then we can use it in terms of our evaluation and say we feel there's a good possibility that this will occur and we feel comfortable using it.

It depends on how well we understand why that happens.

MR. MARK: Since I bet that you will never come to count on it, I'm not sure why you should study it to begin with.

MR. KNAPP: I would suggest that the understanding we would gain from the process, I guess from my limited perspective, would not be unlike the perspective we might gain by looking at Okloe. It's a very different process, but nonetheless if it gives us insight into what's going on I think it's something we should have enough investigation on to have an understanding of that.

(Slide.)

With respect to seepage and contaminant migration, here we are talking about the effectiveness of liners, tailing piles, dewatering and consolidation of mill tailings, and whether or not anything can be gained by nucleization of the piles and what can be done to restore groundwater quality.

One of the needs that I would like to highlight would be a coupled hydrologic-geochemical transport model for tailings, as in the other two areas of waste management. The mechanisms whereby mill tailings or high-level or low-level wastes are transported to the boundary or to the accessible environment are of considerable concern to us. We still do not understand how they are modeled.

MR. MOELLER: In the upper portion there, like A.1, effectiveness of liners, what good does it do you to look at that if you're thinking in terms of thousands of years? Or are you only thinking in terms of the length of time that a liner might last?

MR. MUNOLEY: That is purely from an operational standpoint, when it's actually operating or longer. it is purely from that standpoint, after it's drained.

MR. MOELLER: Fine, I understand.

(Slide.)

MR. KNAPP: In the area of effluent control, our current work is interim stabilization of tailings, improvement of monitoring and studies on radon exhalation. We would like to see better capability of groundwater monitoring measurement and we would like to see more work in particular in near-background measurement techniques. Here we have noise level problems. We would like to reduce the noise levels so we can get a better assessment of what is coming from the tailings.

By and large, this completes the details of the waste management presentation. I would like to make a summary remark or two, if I may.

Within the Waste Management Division, we worked pretty closely with Research over the last several years. The Research budget is somewhat different now than it was in 1979.

MR. SIESS: In which way?

MR. KNAPP: I believe you will find, particularly in high-level, it is lower than at that point. I can't tell you specifically, nut we have scrubbed down a lot of research projects. We scrubbed down a number of our own as a result of working with these folks.

I'm not going to tell you that every project we want is a top priority with them or the reverse, but I do believe that the problems we have are being dealt with pretty reasonably in inter-office discussion. We endorse this program and the budget that has been presented, and at this point we are happy with it.

MR. SIESS: Now, suppose you had to cut this program by say ten percent, to only one million dollars. What would be your lowest priority items, recognizing your prejudiced as a high-level type?

MR. KNAPP: I really cannot address that question. I would like to, but I can't give you an answer that would represent the Division this morning.

MR. SIESS: Could you do it for the high-level area?

MR. KNAPP: Probably not, being flayed when I get back from my counterparts in other areas of high-level.

MR. SIESS: Suppose some of these are longer level than others, not that they wouldn't get done but getting the answers would be pushed somewhere into the future.

MR. KNAPP: If one were to take that viewpoint, then we would place higher priorities in high-level on siting problems and I think sensitivity analysis problems. Those are currently our problems with site characteristics and what is important in the area of siting.

To the degree we're finding out those things as a result of sensitivity analyses, that would suggest that work on engineered barriers could be put at a lower priority and maybe some of the work on waste packaging.

I am a little bit leery about making any kind of a statement like that, even on my own behalf. The difficulty, for example, with waste form work -- even now, DOE is coming in with waste forms that they would like to use at West Valley. They are putting together documents on Savannah River and these things are being put in place.

I would certainly hate to wind up delaying our work on the waste package and thereby have it turn out that DOE might bring in a waste package which would simply not be sufficiently good to overcome the potential failings of a site, whether it would be Hanford or what have you. So that although our immediate application is in siting, I think that to make a decision I would have to look at the lead time on some of the other projects. I'm sorry I can't be more helpful at this time.

MR. SIESS: Any other questions for Mr. Knapp?

(No response.)

MR. SIESS: Thank you.

You said somebody else is going to present the fuel cycle, Mr. Terry? We are running behind schedule, partly because of the presentations, partly because of the questions. Let's keep in mind that this is the full Committee and questions that are more appropriate from experts in particular in the Subcommittee area we might hold back on.

(Slide.)

MR. TERRY: Good morning, my name is Glenn Terry. I'm in NMSS Fuel Cycle. I also have with me today three people who have helped me out with these difficult questions. First of all, in the transportation area, we'll have Dick Odegaarden. We'll also have Tom Clark on the advanced fuel and spent fuel licensing branch, and also, John Roberts in that same branch.

First of all, let me just show you where our priorities are, what are needs are. In the transportation modal study, fuel cycle, accident risk and assessment and the dry spent fuel storage. The secondary needs are some of the health effects and radiation protection.

(Slide)

Let's look at each one of them separately. The transportation modal study: increasing numbers of future spent fuel and high level waste shipments, the public perception of hazards from radioactive material transportation. We perceive the need to determine the adequacy of current regulations to insure that they technically and perceptually protect against high consequence accidents associated with tranport of high level materials.

From this study, we would hope to get the basis for developing new standards and guides that are necessary. These new standards and guides might be more strict or less strict depending upon what the outcome of the research might be.

MR. SIESS: What makes you think that any amount of research might change the public perception? Especially when the research deals with low probability, high consequence events in extreme cases that just scare the devil out of people no matter what the probability is.

MR. TERRY: It gives us another point on the curve.

MR. SIESS: That doesn't change anybody's perception.

MR. TERRY: Dick Odegaarden, can you address that?

MR. ODEGAARDEN: Well, I believe you will find that the questions raised essentially by the public as a whole and by the intervening groups have been concered with the extra severe credible accidents. In the past, the position taken on the standards has been that they were arbitrarily arrived at and not related to real accidents.

The standards were considered very adequate in the sense that if you build and design a package to these standards, that a reasonable amount of protection was provided to the public.

However, when you look at the standards and someone says well, you are talking about a 30-foot drop and we knew that, for instance, spent fuel travels over bridges that are higher than 30 feet, how do we know that these standards are adequate? A great deal of the effort of the public is trying to relate the 30-foot drop to things like bridge heights and things of this nature.

In the past, Sandia has done some work where they have taken a shipping cask up in a helicopter, say, at 2000 feet and dropped it onto a desert floor. And most of the damage was done to the desert floor. They have also taken and done a number of experiments with running a locomotive into a spent fuel cask; things of this nature.

So I think what we are really looking for is the correlation between the real world and the standards, and I sincerely believe that if a better job was done here, the public perception would be a lot better of the regulations. As they are now, we do not relate the accidents in the real world to things like the 30-foot drop and puncture and the fire for 30 minutes.

So I really believe that the perception of the public could be very much improved by looking at real accidents and relating these to the standards.

MR. SIESS: I understand what you are trying to do, and all I can say is lots of luck. You have to decide where you're going to stop, though, because the public goes on forever.

MR. ODEGAARDEN: That's correct. If someone doesn't want you to ship, it doesn't matter how much research you do, they will still be opposed to it.

MR. SIESS: No matter what demonstrations you make. I can think of another one.

MR. ODEGAARDEN: That's true. So someplace along the line you would reach a point of diminishing returns. I do not believe we are there yet.

MR. TERRY: Going on to our next item, dry spent fuel storage, as you are probably aware, the dry storage of spent fuel is of highest interest to the utilities these days. This is also of interest to DOE. DOE can become involved in this type of storage in the event legislation were to be passed requiring some limited government participation in the storage of fuel.

We have inhouse, I am told, six topical reports from four companies presenting designs of six different casks. We also have inhouse one request for a storage facility. Am I correct on that, John? This is John Roberts.

MR. ROBERTS: John Roberts. We do have one application in; that's with VEPCO for SERI. The six reports which are from four different firms, we have two in now and we expect the other four.

MR. SHEWMON: This is the Germans' meonite or cast iron is one example of this?

MR. ROBERTS: There are two designs from Nuclear Service. We have one report in now that is being revised. We are also expecting another report in for their Castor V model cask.

MR. SHEWMON: Is that spelled Casker?

MR. ROBERTS: No, that's spelled Castor. That's a Roman numeral V.

MR. TERRY: Since this is with us now, we do need a data base of low temperature, dry storage. We need to determine the relevance of the licensing concerns on waterlogged rods. This is just if there's a defect there; we are not sure what that defect is going to be.

MR. SIESS: What you're saying is you need research to know what questions to ask these people that are applying for a license.

MR. TERRY: I think in summation, that's

correct.

MR. CLARK: It's a matter of laying an adequate data base to assure that we have covered all the design questions as well as to preclude the possibility of having to license so conservatively that essentially you eliminate perhaps some viable method because of lack of a sufficient data base.

MR. SIESS: You're listing these as needs. Are there actual research projects that have been proposed by NMSS? Are those the 85 programs we talked about?

MR. TERRY: Yes. I would leave that to Research to get into the details o: those.

MR. SIESS: Don't get into the details at this meeting. I would like to know whether they have been responsive.

MR. ROBERTS: John has been responsive to that.

MR. ODEGAARDEN: Yes, that's correct.

MR. OKRENT: Can I come back to the transportation modal study portion of that viewgraph?

MR. SIESS: Why not?

MR. OKRENT: Earlier this morning, we were in a subcommittee meeting where people were talking about ranking issues based on both their potential risk and also, the question of what benefit you might get from expenditure. Do you have any basis for estimating what the risk is from transportation, and whether there is a significant increase in this risk from your first item, increasing numbers of future spent fuel shipments, et cetera?

MR. TERRY: I can't answer that. Dick, is there any work that has been done in Research that points to that or not so far?

MR. SIESS: The Sandia study.

MR. ODEGAARDEN: Dick Odegaarden, Transportation Branch. I am not sure that I will answer your question directly, Dr. Okrent. But the modal study would be considered a high priority in the sense that the public's perception of the standards for shipment, a number of localities, cities, counties and states, have passed a patchwork of separate regulations either designed to prevent the shipment of radioactive materials or to severely limit the shipment of radioactive materials.

The one reason I believe that cities, counties and even states have done this is because of their perception of the hazards involved. In this sense, I personally believe the modal study is important to allow the public to have a better perception of the standards and that this study shows that these standards need to be adjusted to take into account special hazards from either, say, truck or rail or other modes. Then the standards should, indeed, be adjusted.

The the increased number of shipments should not, except in the sense that if the highway traffic or rail traffic is greater or the roads are not maintained as well, the probabilities could go up or down. But basically, you are taking the number of shipments and multiplying it by a certain probability.

But I believe as the number of shipments increases, the concern for these shipments also increases, or at least that has been my perception of the public's reaction.

MR. SIESS: You haven't answered Dr. Okrent's question as to whether there is a risk and how significant it is. You talked only about the perception.

Did not the Sandia study or studies on transportation of radioactive materials evaluate the risk to the public of such transportation?

MR. ODEGAARDEN: If you're talking about NUREG-0170 --

MR. SIESS: I don't remember the number.

MR. ODEGAARDEN: Yes, the risk involved from the extra-severe credible accidents is low. It is very low. So in this sense, we believe that the shipments that are currently being made are perfectly safe.

We do believe that these regulations need to be more closely geared to the actual transportation situation in the sense that you can relate the 30-foot drop, for instance, or puncture test to what might actually take place. So you essentially have a job of a salesman in showing the public that indeed, the shipments are safe.

And if the study would show that the regulations need to be adjusted for certain special cases, then this would be one of the benefits essentially from the study.

MR. OKRENT: Well, are you trying to make this zero risk?

MR. SIESS: He just wants to make people think it is.

MR. ODEGAARDEN: You're never going to arrive at a zero risk situation. Anytime you transport a hazardous material the only way to get a zero risk is not to transport it at all. But that goes to anything, from gasoline to explosives, to anything else.

MR. SIESS: It not only reduces the risk from transportation to zero --

MR. OKRENT: If you're not going to make it zero risk, then people including yourselves will still be able to calculate some low probability sequence which involves some kind of a release. And therefore, if anyone wishes to make an issue of the fact that it is theoretically possible for some activity to be released, they can still do so. And the public perception, if it is based only on the possibility however remote, is not likely to be changed by your study or by your modifying your current standards so that you require a 60-foot drop instead of a 30-foot drop, or whatever.

I'm trying to understand a couple of things. In the first place, whether from a risk point of view the NRC thinks a change in the standards is needed; and secondly, in fact, whether the research would accomplish what it is you are trying to do.

I am not particularly impressed with the current standards in real accident conditions. All I have to do is look at half the things the NRC has in other areas and I can probably make the same statement. So that is not a particularly convincing reason for me. You know.

We had recently an accident in California where gasoline or some kind of petroleum product-carrying vehicle was involved in an accident in a tunnel, and some people were killed who were not either on the truck or, in fact, in a collision with the truck. But nevertheless, we're still shipping that material on the highways and, I suspect, through the same tunnel. There have been worse accidents involving non-radioactive materials, as you are well aware.

I am trying to understand better why research is needed in this area.

MR. SIESS: Or why it is needed by the NRC.

MR. OKRENT: Yes.

MR. SIESS: DOE might well want to do the research to help relax state and local laws, to improve the flow. Or we might be able to establish that there is less risk in transporting it than it leaving it where it is, but that wouldn't convince too many people.

MR. TERRY: Well, I disagree with what you say. There is a problem of risk assessment here.

MR. ODEGAARDEN: Let me just make one statement. The way Dr. Okrent started out with his comments was concerning reducing the risk to essentially zero. That is not what we are looking for at all. We never believe -- we'll never get there, so we are not trying to achieve an absolute zero.

What we are trying to do is we have never related the transportation accidents to the real world. We are merely trying to do that in a general way that we can blanket and put an envelope around what we consider to be the extra-severe accidents and show the public that these have been included in the standards that we are using for evaluating packages.

There will always be accidents that someone can imagine worst than what we can come up with, so we are not trying to duplicate in the sense that every conceivable accident that could be imagined we would be protecting against. That is not the point.

MR. SIESS: Dick, I think we understand your motivation. The question still remains as to what priorities should be attached to something that will not reduce the risk but only the perception of risk. That's one way of putting it.

You have to keep in mind what somebody said once; that everybody understands consequences, but most of them do not understand probabilities. If the consequences are large, they don't really care what the probablities are.

So let's go on, and we can debate this one some other time.

MR. OKRENT: By the way, do you have an estimate of how many people statistically are killed per year from the shipment of spent fuel and high level waste in accidents where the fatality had nothing to do with the cargo; just the fact that this was another vehicle on the road?

MR. SIESS: Probably a couple a year.

MR. TERRY: I don't know the numbe, but I don't know of any.

MR. SIESS: I'm sure I've read reports where the driver of a truck was killed.

MR. ODEGAARDEN: There were a couple of accidents in the past year where someone that was carrying a yoke or a waste package ran a stop light, and I think killed one or two women. There was another case just recently by Barnwell where a woman ran a stop light and the truck driver carrying an empty waste package tried to avoid the two women and he went down a side road and his truck tipped over and he was killed.

MR. SIESS: In fact, the Sandia study included transportation accidents for non-radioactive. Any increase in transportation will increase the number of accidents, and that was automatically included in the Sandia study.

MR. OKRENT: Well, I would suspect that that is by far the biggest contribution. So if you try to look at reducing the risk, well, --

MR. SIESS: Okay, let's go on.

MR. TERRY: Our next area of interest is the fuel cycle analysis risk assessment.

(Slide)

While we have confidence in our licensing procedures, there have been times when questions were asked relative to some engineering judgment used in these analyses. So to determine the soundness of these engineering judgments, there was a perceived need for looking at risk.

In 1979, the Fuel Cycle Branch developed a user need and submitted it to Research. The program that was developed is actually in two parts; the accident analysis part and the risk assessment part. Prior to performing any risk assessment in these fuel cycle facilities, since we had a feeling that there was a lot of conservatism in some of our scenarios and models and methods, we needed to define the major accident scenarios and develop realistic and verified analysis methods for predicting accident-induced releases to the atmosphere.

Out of this, we would hope to get a better insight into the fuel cycle risk and associated uncertainties, provide tools for rational and consistent safety evaluation of fuel cycle facilities design and operation, and also, to serve as the basis for assessing the adequacy of existing standards and guides and a basis for development of new standards and guides. And, of course, any of these could be more strict or less strict.

(Slide)

Last, the secondary interest lies in the health effects and radiation protection area. There are a number of programs going on in Research; some apply to fuel cycle material safety and others are keyed directly or more closely to reactors. Primarily, this is work being done in Bob Alexander's shop and would include such things as estimates of radionuclides from advance respiratory protection techniques, bioassay methodologies to include radionuclides by workers not in Bob's area, the industrial exposures.

That is all I have. I might close by saying that Research has been responsive to our needs. I wouldn't say that in some cases we couldn't use more money in some areas, but I think the mix is probably pretty good. So all in all, I think we are pretty happy with what Research has provided us with.

MR. SIESS: Any questions, gentlemen?

(No response.)

Okay, we have one more item from NMSS on safety guides.

MR. BAKER: Paul Baker. This chart depicts what we have in mind in the way of needs for research in the 84-85 time period. I think you're familiar probably with the first and last items on the list. The vital equipment determination technique project is ongoing. We propose to continue that to consider some specific items that have been identified by the staff of NMSS/NRR research that are working on this, and they need further study as to the impact of sabotage in these areas on the performance of reactors.

The last item you're probably familiar with, it's been ongoing for several years. It is the continuation of a program which has developed and now operates -- an assessment capability to determine the ability of communicated threats in the safeguards area. The initial effort was on fuel cycle facilities. The effort now is primarily on threats to reactor facilities.

The second item -- the first and last items are based upon hard requirements which have been formally issued to Research.

The second item is in preparation at the moment is being generated, and we think by '84 it will be settled and we can identify fairly clearly what we would like to see happen in human factors insofar as they impact upon safeguards.

The third and fourth items on here really go together. I don't know whether you are aware of the fact that there is a fairly intensive staff effort going on right now to study issues associated with the interaction of safeguards and safety at reactor power facilities.

There is such a program; it is being addressed by a committee which has representatives on it from the regions and from the staff; specifically, Regions I and II, NMSS, NRR and I&E, to address this area. We are not even sure that it is a problem area at the moment, but we do at the moment anticipate that out of this work -- and the report, by the way, is due in the latter part of February. It is a very active group. We anticipate that they will identify either explicitly or implicitly certain issues in this area.

We also further anticipate that we will require some support from Research in analyzing and studying these things that will be identified by this report that comes out in February. That is about the extent of it at the moment.

MR. OKRENT: What is the objective of your research on safeguards, as it is listed there? Where do you think it's all headed? What do you want to accomplish and by when and why?

MR. BAKER: Are you talking about item 1 here?

MR. OKRENT: All right, let's start with item 1.

MR. BAKER: Item 1 is one I think you're very familiar with. The staff has identified at the moment about 10 areas in a reactor facility that they believe need further study as to the importance of these items, and as to their vulnerability to sabotage as to how they would impact on the overall reactor facility. These are the ones that are being addressed.

MR. OKRENT: You're sort of giving me details. I asked you what your objective is for your research in this area.

MR. BAKER: Well, our objective in item 1 is to improve our understanding, if you please.

MR. SHEWMON: You've got 10 items. What are you going to do with your list?

MR. BAKER: They will be factored into our vital area identification program, which has been going on for quite sometime. That, in turn, impacts licensing.

MR. SHEWMON: How? Can you give us one example of a change that you'd like to see that's in the works on that? Or is it your goal to make sure that licensing protects these 10, or what?

MR. BAKER: Yes. That's true. Another thing that it impacts is our program called regulatory effectiveness review program, which is an effort to determine whether or not our regulations, guides, rules and so forth are adequate to protect the public health and safety which we are charged to do.

MR. OKRENT: How are you going to do that latter part? How are you going to do this review and decide whether it is adequate? And when are you going to do this?

MR. BAKER: They're going on right now.

MR. SIESS: What's going on right now?

MR. BAKER: The regulatory review is currently going on this week at Salem, and they have been doing it. And there is a team of people out there who are looking at that facility specifically and comparing its -- well, I guess what they're really doing is attempting to determine whether or not our existing rules and regulations are adequate to protect that facility.

MR. OKRENT: Oh, my, I must say it seems to me you are really using the English language in a different sense than I thought you were going to, because --

MR. BAKER: I've been accused of that many times.

MR. OKRENT: They have to be comparing the design against some existing regulations. This research pertains to some possible future regulations or some possible change in the design of future plants or something.

MR. BAKER: Right.

MR. OKRENT: You can't tell me that what they're doing at Salem is the same thing.

MR. BAKER: Now I think I know what you're getting at.

MR. OKRENT: Again, I asked you originally what the objective of this research was, and I don't think I've heard it.

MR. BAKER: There is another research effort which is not being funded at the moment which I guess you're referring to. I don't know. That's a program that started out in 1978 and we put 1979 dollars on it, and it did have to do with studying designs of reactor facilities so as to inhibit sabotage by an insider. Quite a bit of money has been spent on that.

I believe -- I don't know whether you remember the safeguards subcommittee or not.

MR. OKRENT: I've seen the report.

MR. BAKER: I think you had quite a briefing on that, and Sandia last spring by GE, Westinghouse and also some of the Sandia people who conducted the study. That program has undergone two phases in research. Quite a bit of money has been spent. It's been carried on with money that was put in in 1978 and 79.

The first phase, as you well know, had to do with PWRs, and they addressed the very things you're talking about; future design changes to inhibit sabotage by an insider.

That second phase --

MR. OKRENT: Excuse me, I disagree. They addressed possible design. That's different from future design changes, if I can make the distinction.

MR. BAKER: I agree with you.

MR. OKRENT: I'm still trying to find out what your objective is from the research program. In fact, I don't know how you're going to use these research reports, some of which I find to be quite interesting.

MR. BAKER: Let me continue with this very one I'm talking about. They continued into something called Phase II. They looked at existing designs and they also did a study on something called damage controls. The staff is now reviewing all of those reports. It is a review going on between NMSS and NRR in an attempt to determine which of these things should go on into a so-called Phase III. By the way, all the money has not been spent yet. There's still a little money in that program from 78-79 which they are planning to use for that. And I don't know precisely at this point how that review will come out.

There is some thinking about looking at some foreign facilities with that.

MR. OKRENT: Again, what do you feel is the objective of this research program you've just been talking about?

MR. BAKER: On a broad scale, the research program is set up to help us do a better job of safeguarding, at this stage in the game, reactor facilities. It is a continuous thing; it's not just going to stop.

MR. OKRENT: Well, let me put a question to you. There are other parts of the NRC staff that say they should proceed with trying to review current or possibly near-term applications for standard plants. Are you going to have criteria with regard to what such future standard plants should do with regard to design measures against sabotage beyond the current regulations on access control?

MR. BAKER: That is not currently in the progra, to my knowledge.

MR. OKRENT: Why not? Do you think -- should that have been an objective of your work?

MR. BAKER: Oh, it has been. We've spent $1.6 million almost -- $1.4 to be exact -- on looking at that very thing.

MR. OKRENT: Well, I don't understand your answer. You say you were looking at it but it wasn't related.

MR. BAKER: I'm sorry. I've looked at it; it's currently being reviewed by the staff. All the reports that have been generated on that are currently under staff review to determine what needs to be done more.

MR. OKRENT: What do you mean? What research needs to be done more?

MR. BAKER: Yes, sir. The so-called Phase III.

MR. OKRENT: So we could be doing research for the next 10 years, and in the meantime, people will be proposing standard plants and some other part of the staff has to review them. I'm trying to get a connection between the research program and the regulatory and licensing acitivies. Is there one?

MR. BAKER: Well, certainly. That's why we're conducting these things; to help us do a better job in the regulatory program.

MR. SIESS: When? You've had some results for several years now.

MR. BAKER: Which ones are you referring to?

MR. SIESS: The ones you are referring to; the million dollars' worth.

MR. BAKER: Those reports haven't been out several years; those reports are just now coming out. They were presented to you people last spring, I believe.

MR. OKRENT: Well, last spring Mr. Goller seemed to thin that there was enough research that had been done, that it just remained for the people to try to decide on a licensing approach to make your decisions. Is that your point of view? There is now enough research that it's just the job of the division directors to get together and decide what ought to be done?

MR. BAKER: I have to go with this program.

MR. OKRENT: I didn't understand your answer. I'm sorry.

MR. BAKER: Well, I think the management of NRC has decreed that this is the program, at least dollar-wise, that safeguards should have for 84 and 85. Are you asking me whether or not I personally agree with it? I think that's besides the point.

MR. OKRENT: I was asking whether there was enough information to make regulatory decisions.

MR. SIESS: If you spent a million and a quarter dollars and you haven't done anything with it, I would be reluctant to spend anymore until somebody decided that they had gotten their money's worth out of it.

MR. BAKER: That's what's going on right now.

MR. SIESS: You say they haven't even got a report yet.

MR. BAKER: No, I didn't say that. I said the reports are being reviewed by the staff; the reports are out.

MR. SIESS: It's been over a year since we were briefed on this. You mean they're just now getting the reports out?

MR. BAKER: The reports have been in the hands of the staff I would say maybe close to six months. I believe you were briefed last spring. Is this the same one at Sandia?

MR. SIESS: I saw reports a year before that. I saw something a year before that.

MR. BAKER: I'm not familiar with those.

MR. SIESS: Who has to do something? Is it NMSS who does this, or NRR or I&E or --

MR. BAKER: No. I think the people in NRR and the people of NMSS have agreed to review these reports jointly in an attempt to decide what additional work needs to be done in this area.

MR. OKRENT: Whose responsibility within the

NRC is it to propose requirements for new plants with regard to design measures to protect against sabotage? Is it NMSS or some other body within the NRC?

MR. BAKER: I don't believe I can answer that.

MR. O NT: Can anyone answer that?

MR. SIESS: What bothers me is he says the objective of reviewing the report is to decide whether they need more research; not whether they need to do something about plant design. If the object of doing research is to do more research, that simplifies my job a heck of a lot.

MR. BAKER: Let me clarify that just a little bit. I think in the reports that were submitted that are currently under review, several areas, many areas were identified for possible further research. We were asked --

MR. SIESS: That's always true.

MR. BAKER: Certainly. We were asked to identify those which we thought should be supported for future research.

MR. SIESS: Didn't somebody say we've paid a million dollars for this research; now we will look at how it affects the NRC's regulation and the public? Not just, does it need more research. There ought to be some answers in this where you can say this research has given us no basis for doing anything about regulation, but another two million dollars would. That's one answer I guess I would like to hear, and its justification. You can say this research has given us no basis for action, and it's extremely unlikely that anymore research will do any better, so let's quit.

But what I don't hear is anybody looking at the research results to find out whether we ought to be doing something to make plants safer, which is the object of the game. It is not to do research. The object of the game is to do something either to satisfy ourselves that they're safe enough, or to make them safer.

MR. OKRENT: I'm not even sure if we know who has that responsibility. I'm waiting to hear it.

MR. SIESS: Does anybody in this room have that responsibility? It isn't Research's responsibility to apply research.

MR. OKRENT: Research used to come in and say this is up to NMSS.

MR. BAKER: No, I did not intend to -- if I've implied this is Research's responsibility, I've misled you. All I've attempted to say is that quite a bit of study has gone on in the area that you have identified.

MR. SIESS: But it hasn't led to anything.

MR. BAKER: These studies are currently under review by the staff as to whether or not they may have an implication upon the regulatory program and also, to identify future research if that's determined as necessary.

MR. OKRENT: Well, let me address this to our hardworking subcommittee chairman. Maybe we can get somebody in from the EDO's office who could tell us what they think is the responsibility within the NRC staff for reviewing plants with regard to measures to protect against sabotage and just what they think is the required research from that point of view and what their plan of action is, and so forth and so on.

MR. WARD: Let me ask a more specific question.

MR. BAKER: Are you asking me whether or not we've currently identified research requirements to protect against future sabotage?

MR. SIESS: No. The question is regulatory requirements; not research requirements.

MR. WARD: Is the research you are doing directed toward regulatory requirements or design requirements for retrofitting existing plants, or for the design of future plants, or is there some -- I can see where there might be rather different research or regulations required. Which ones are you directing the bulk of the effort toward?

MR. BAKER: Right now, it is existing.

MR. WARD: Okay. So the aim of this research, then, is to develop regulations, policies or guides for backfitting the existing plants to improve their resistance to sabotage. Is that right?

MR. BAKER: I don't know whether we're going to backfit anything or not. I can't say. I don't know. It might be, it might be. There might be areas identified where backfitting could be justified on a cost-effective basis. I do not know the answer to that.

MR. SIESS: Okay, let's go on.

MR. BAKER: That's all I have.

MR. SIESS: Is that all? Thank you. Gentlemen, I'm going to stick more or less to the lunch schedule, if I don't make any other part of it, which says about 1:00 o'clock for lunch. We started at 10:00 o'clock.

MR. WARD: We've been sitting here without a break.

MR. SIESS: You got a break before that. We're going to continue with NRR now and what they call their Research Coordination Branch, which now has a new branch chief. There he is.

You have the floor. I won't impose any time limits on you. I'll let your stomach do that for you.

MR. ROSZTOCZY: Thank you, Mr. Chairman. As you mentioned, I'm Zoltan Rosztoczy of the Research Coordination Branch of NRR. I have with me four or five project managers who are overlooking the coordination of the programs we are going to discuss today. We are Jim Watt, Dick Williams, Bill Cleveland, and Pete Coda. They are all sitting here at the slide.

My presentation is arranged up according to the long-range research plan. The chapter numbers of the long-range research plan correspond to the task numbers on the slides. Since the first chapter of the long-range research plan and the thing starts with test 2.

(Slide.)

Under each of these items I am going to discuss briefly the regulatory activities and user needs. Then I have a number of slides on the expected accomplishments during FY '84 and '85. They are usually taken from the research plan, and I will pass over those except in some cases where they are different and I would like to point out the differences between what you have on the slides and what is in the long-range research plan.

Then the third part of each of these items is a slide on comments that again I am going to discuss with you.

MR. SIESS: Okay, you were going to in effect assume we have read the long-range research plan?

MR. ROSZTOCZY: That's correct.

MR. SIESS: Which is not in a general sense a very good assumption, but I think it's one you should make in the interest of time. And I believe that the people who have a particular interest in a particular area probably have read the long-range research plan in that area.

MR. OKRENT: Which long-range research plan?

MR. SIESS: The long-range research plan.

MR. BENDER: I think it's a draft you're talking about, isn't it?

MR. SIESS: He will be talking about the long-range research plan, '84-'88, draft, November.

MR. ROSZTOCZY: This is the November draft that has been presented.

MR. SIESS: It's the one we jocularly refer to as the short one. Okay.

MR. ROSZTOCZY: The other slides, the ones which mention the expected accomplishments, those are there for your convenience. If in the process you have questions on them, I will be happy to stop and discuss any of those you might have questions on.

So let's start with the first item, which is plant aging. The number of operating plants has increased during the past years. Also, these plants are getting older and older, so we are running into more and more questions and problem areas which relate to the actual aging of the equipment.

Correspondingly, we expect to see more research being done in these areas. We also expect that the research program will keep an eye open and identify also possible aging mechanisms that are not presently known or are not presently accounted for in the regulatory activities.

They also expect to comment on the appropriateness of the regulatory requirements and the present regulatory practices. We would expect that the research program will make recommendations on methods for examination, testing and evaluation to show compliance with the existing aging requirements. These are the basic goals that we've put forward for this part of the program.

MR. SIESS: What do you mean by aging environments?

MR. ROSZTOCZY: Depending on which equipment or which part of the reactor system we are talking about, we have various requirements. For example, steam generator tubes, we have certain requirements that if they degrade below a certain level then you have to plug them or you have to replace them or you have to replace the steam generator.

As part of the program, when they're examining a steam generator that has actually been removed from a plant and they are looking at actually removed tubes to see whether there is any type of degradation, and whether the way we are presently measuring the degradations and showing they are not exceeding the specified limits are appropriate.

MR. SIESS: Now, what advantage would you take of the fact that plants are actually aging and the things we should be worried about are actually already showing up at increased rates of LER's in certain areas or something? Is this part of the program, to look at actual experience?

We have plants 10 or 12 years old. We've got 20 year old plants.

MR. ROSZTOCZY: Yes, it's part of the program to find out what is happening in the existing plants. It's also part of the program that some of the actual research work is being done on equipment which has been removed from them.

For example, in the steam generator case, one of the steam generators which has been removed from the Surrey plant is the one that is being examined and that is a major part of the research program in that area.

MR. SIESS: Am I right that they tried to do something with Shipping Port and couldn't get any cooperation?

MR. ROSZTOCZY: I'm not familiar with that case. Maybe Research can comment on that later today.

MR. SIESS: That's the oldest plant that is now being decommissioned.

MR. ROSZTOCZY: I cannot comment on it, but maybe just one comment is that Shipping Port design-wise is probably further removed from current plants than, for example, Surrey would be or any of the other power plants.

MR. RAY: A question. Will your aging phenomena include the effect of radiation?

MR. ROSZTOCZY: Yes.

MR. RAY: Radiation, temperatures, pressures and so on?

MR. ROSZTOCZY: Yes. For different components the emphasis might be on different parameters, but all of those are included.

The program itself consists basically of five portions. The first item is on reactor vessels, the second one is on steam generator, the third one is on piping systems, the fourth is elect ical and mechanical components, equipment like pumps, valves and so on. The last part of it is examination of known nondestructive testing and various processes that can be used for this.

These are generally the programs that Research is planning to include in the Research Branch for all of these areas. We have only one comment. The comment relates to the aging of the equipment. There is a separate research program on equipment qualification, and we see a certain amount of overlap between the aging part here for the equipment and the equipment qualification program.

We feel that it would probably be better handled if the aging of the equipment is considered under the equipment qualification research program, as opposed to being put in here.

MR. SIESS: The thing that puts the equipment into a different category is its active; all the other things you've got in this category are passive components?

MR. ROSZTOCZY: Yes. There's probably a difference in the thinking to handle it under the equipment. The main difference, the equipment is required to be qualified by testing before you even put it into the plant. So there is a testing process being followed when you qualify the equipment, and one step in the testing process is to actually put the age on the equipment, testing it on a seismic table, or testing it on an open environment. So this is a very integral part of the qualification testing for those pieces.

MR. SIESS: Because it is active, because I can think of the piping in the reactor vessel as being qualified by test, too.

MR. ROSZTOCZY: The other difference about testing is size. Most that we are handling in the equipment area are relatively small in size. So it is possible to put them in a tank and test them under a local environment. Other components like vessels and piping and so on are not susceptible for those types of testing.

So my discussion on the first item; unless the Committee has some questions on some of the actual program items, then I would like to move to the next one.

MR. SIESS: Do you have an idea as we go through about how large the program is on aging in '84-'85? Research doesn't pull it out the same way, do they?

MR. GILLESPIE: We've got it on the computer this way, but I didn't bring it with me.

MR. SIESS: That's all right.

MR. RAY: Are we permitted to talk?

MR. GILLESPIE: About $20 million.

MR. SIESS: We can talk about anything on the budget that was submitted to the OMB.

MR. GILLESPIE: We can add -- we're talking about numbers that add up to $209 million, which was what was originally submitted to OMB.

MR. SIESS: We can talk about the original submittal.

MR. GILLESPIE: About $20 million.

MR. SIESS: It gets spread over some decision units.

MR. GILLESPIE: This is fundamentally about 50 percent of Guy Arlotto's work in hearing technology. He had a budget of about a total of $20 million.

MR. OKRENT: I have two questions. I was reading an article on the plane coming in yesterday and it mentioned that in the area of testing for products that people might consume, in other words foods or things like this, or be exposed to, one of the principal testing laboratories in fact had been doing a less than perfect job, in fact what you might call an unacceptable kind of job, and this may have ramifications for a variety of things because it was a laboratory that serviced a lot of the industry.

Is there anything in what you do that somehow postulates this condition and asks yourself whether there is any kind of research or whatever requirement that is relevant? This is something I had in another area of technology, a non-trivial.

MR. ROSZTOCZY: Yes, there's an opportunity as part of the programs to do that type of thing. Let me give the same example I brought up a minute ago, the steam generator. Look at the Surrey steam generator. That's been tested and examined in operation, and based on the actual testing that was performed decisions were made which tubes should be plugged in that steam generator and which ones do not need to be plugged.

Then it operated for a further amount of time. Now, by removing the steam generator and looking through, what did you find in the actually removed steam generator, the testing techniques that were used during operation to select out which tubes needed to be plugged or not are checked, in essence.

So whenever there's an opportunity to do a checking on this, yes, we try to do that.

MR. OKRENT: I can think of certain types of testing that are done that give you a chance to learn from experience until it is needed in anger, as it were. Let me leave it as a thought for the moment.

There is another thing that has occurred. It's my impression that in one of the countries abroad they found that a lot of electrical cabling which was installed, actually, because of some modification in the manufacturing process, what they ordinarily thought might have been there aged much earlier, much more quickly than one would have anticipated.

Is there any kind of research-related thing that enters into this sort of thing?

MR. ROSZTOCZY: On the equipment part, yes. We have something which is called a verification testing process, when we pick up some equipment that has already been tested by the industry and they found it acceptable, and then we contract with somebody like Sandia Laboratory to take this very same equipment and perform the equivalent of the test that the industry has used and tests that satisfy the current requirement, to see what kind of results do they get.

Up to now, I think a number of cases when we tested it, we ended up with somewhat different results than what the industry came up with, and this usually resulted in a study and evaluation to see what caused the differences. Quite often the resolution is that, even though the standards defined many requirements for the qualification testing process, there are still many other decisions that the testing laboratory had to make in the process and if some of those are not made correctly you might come up with the wrong results.

They are also issuing more detailed guidance and regulatory guides in some areas which bring attention to those areas where these types of difficulties have been observed in the past.

MR. OKRENT: I guess I was raising the question a little differently, then, from the research point of view. It is conceivable to me that if you are interested in some particular insulation, maintaining its electrical insulating capability, that there are some kinds of things which are not rigidly controlled by the specs, that might seem okay to the manufacturer and in fact might represent an improvement in how he makes it or whatever, and to him in fact it might look like they should automatically pass the same test that was already passed and need not be requalified.

That is the sort of thing that might result from people thinking in a research atmosphere the same way that copper embrittles, welds which have been irradiated. Let me just leave it as a thought.

MR. ROSZTOCZY: We have seen many examples of those where the manufacturer believed that based on available information and previous testing, that it should pass a certain test. Then it was tested and it failed the test. They learned from it, and took corrective actions.

MR. RAY: May I ask you a question, Zoltan? These comments bring it to mind. A while back, we were visiting in Sandia to see the lab testing and so on. As a result of our detailed questioning, it surfaced that frequently when an organization like Sandia needs samples of equipment, off the shelf items, as it were, to make tests and expose them to aging phenomena and so on, temperature, pressure, and so on, they get problems getting these samples from the manufacturer, because he feels that his commercial interest might be threatened if adverse results come out of these tests.

Is this fairly prevalent, as you understand it? And is there any way that those tests might be expedited by influencing or trying to influence the manufacturers and make samples available?

MR. ROSZTOCZY: You are correct that on a number of occasions we run into some difficulty in updating samples for the manufacturers. The reasons, however, given were of a different nature. The manufacturers are concerned that if we test their equipment and then we publish a report on it, that now in a sense we duplicated the work that they have done, and now their commercial interest is hurt by this.

Let me give you an example. It is not necessarily manufacturers. Sometimes somebody manufactures a given equipment and another organization buys this equipment from them. It is an unqualified equipment at that time. The second organization will spend the money to qualify. Then he sells it at a higher price.

Now, if we take this equipment, the same equipment, and we test it and publish a report on it, then nobody is going to buy it from him. Everybody will go back to the original manufacturer, and will say, oh, the NRC already tested it. We know it is all right. So the money that he invested in the qualification of the equipment would be lost.

The way to get around it, there are some ways how one can prevent this from happening, and we have been working with our legal department very closely during the past year, and Sandia, including lawyers from Sandia, to work out the details of how to handle this so that nobody's commercial interest is hurt, and at the same time we get the equipment, and the information we obtain will be available to the public.

Let me move, then, to the next item, which is pressurized thermal shock. In pressurized water reactors, some transients and accidents can result in an overcooling, and if at the same time the vessel is under pressure or has been repressurized, then the combined thermal stresses and pressure stresses can propagate flaws in the vessel material, provided the fracture resistance of the vessel material is low.

The fracture resistance of vessels changes with age, so as they get older, they become more embrittled, and flaw growth is more likely. We have recently completed a Commission paper on this subject. There was a meeting with the Commissioners a few days ago. I believe the meeting is going to continue tomorrow, where the Staff recommendations are being presented to the Commission, and we will hear the final decision on this.

The Staff basically in this paper recommended to the Commission a screening criteria on the temperature, 270 degrees for axial welds and 300 degrees for circumferential welds. The Staff also proposed a method of how you can estimate the RTNDT temperature and obtain these values.

Our findings so far show that most plants could avoid reaching the screening criteria values if they would institute flux reduction programs in the very near future. This is an area where they have to take actions far ahead of the time where they would reach these levels and they could protect from that.

Last, by completing our work on the position paper, we found there are a number of areas where there is need for additional research. These are basically four areas.

(Slide.)

MR. ROSZTOCZY: One of them is to provide additional confirmatory pressurized thermal shock information. This is the type of information you have seen on the aging program, and we are obtaining those under that program.

The second part is to decrease the uncertainty of the current analysis. We found there are large uncertainties. And the third part is to apply this analysis to typical plants one B&W plant, one Westinghouse plant, and one Combustion Engineering plant. And the fourth item is to investigate the alternatives for the reduction of the results associated with pressurized thermal shock. So, these programs will be ongoing in these four basic areas.

(Slide.)

MR. ROSZTOCZY: Once we have this information, we expect to give that feedback in the licensing process and use it on the future evaluation of the operating plant vessels. The expected accomplishments are again listed on the following page. Let me just take the last bullet from the expected accomplishments, which relates to various risk reductions of alternatives.

(Slide.)

MR. ROSZTOCZY: Under that one, we are expecting measures like improved instrumentation and control system, heating the emergency core coolant, heating the emergency feedwater, changing the fuel loading schemes. This would reduce the irradiation to the vessel and possible in situ annealing of the reactor vessel.

Let me comment on one recommendation that the Committee made last summer in connection with this program. You recommended that the merits of pressure reduction as a corrective action should also be investigated. It is the intent of this program to consider pressure reduction as one of the alternatives, and investigate it along those lines.

That completes my discussion on pressurized thermal shock. Are there any questions on this?

(No response.)

MR. ROSZTOCZY: Let me go on to the next task, which is equipment qualification.

(Slide.)

MR. ROSZTOCZY: Guidance for equipment qualification of electrical equipment has been developed by NRR back in 1979, and the Commission order was issued in 1980 that required the operating plants to re-evaluate the qualification of the safety-related equipment. A new rule is presently being proposed, and it is in management review, and that is a revision to Regulatory Guide 189, which is under management review.

Based on the Commission order, each of the operating plants have performed an evaluation of the qualifications and submitted in a report to the NRC, and then we found that some of the information we are looking for was available in the SRP, some was missing, so the ACRS asked for additional information, and a supplement for each plant is going to be issued in the near future. This, however, only covers the electrical equipment.

For mechanical equipment qualification and for seismic qualification, guidance, what we presently have is the guidance given in the standard review plan and the various industry standards referenced in the standard review plan. An advance notice of rulemaking covering mechanical equipment and seismic qualification is presently being prepared, and it is scheduled for issuance, I think, next year.

With the present state of the equipment qualification program, we do see a definite need for additional research in this area, and those are shown in the following slide.

(Slide.)

MR. ROSZTOCZY: We feel that synergistic effects and accelerated aging methods require some additional work and some additional study. We are recommending performance of independent verification tests, the ones I mentioned a few minutes ago. We are also asking for some tests to identify failure modes of various equipment, and to update fragility data that then could be used for probabilistic risk assessment studies.

Every time, when we are putting forth a new requirement, we always evaluate the cost benefit aspects of these. When we have been doing our work on equipment qualification, we found that the presently available risk assessment methods were not appropriate to evaluate the cost benefit effects of equipment qualification. We have been asking for some changes and improvements in the methods, and we expect that when those are available, we will be doing some cost benefit evaluation of the cost benefit issue.

Finally, we are looking for a decrease in the uncertainties in the current qualification methods. The expected accomplishments are listed on the next slide. I will skip that one and then go to the comment slide.

(Slide.)

MR. ROSZTOCZY: We have three comments in this area. The first one is that NRR is recommending a somewhat less elaborate program for equipment qualification research than is presently shown in your long-range research plan. However, we are asking for an acceleration of the program.

For example, in order for us to use the information that is coming out from the electrical equipment qualification program in the ongoing work, we would need to see information not later than 1984. We would ask Research if they could accelerate this schedule.

The second comment is that the equipment qualification program plan which describes the entire equipment qualification program is still under management review. There have been some discussions only recently. The indication is that there will probably be some changes in this program. Those changes could affect some of the research program being done in support of equipment qualification.

So, as soon as a decision is made on those changes, they should be factored into the research program.

Finally, the comment that I mentioned earlier, that there is a certain overlap between this program and the aging program in terms of equipment. These could obviously be combined and performed along those lines.

MR. SIESS: Zoltan, suppose an accelerated schedule on the equipment qualification program ended up costing more money. What would you suggest be taken out to provide those funds?

MR. ROSZTOCZY: This is exactly what is presently being considered under the overall equipment qualification program. They are asking for electrical equipment to be accelerated, and it is a possibility that there will be some changes in maybe other parts of the equipment qualification program that would compensate for it.

MR. SIESS: Something like that, you only look at one program, you don't say, well, let's speed this program up and cut another program back, or is the negotiation done within the framework of one program?

MR. ROSZTOCZY: We are doing both. Usually, we start within the framework of one program, and see if there are limitations in terms of manpower or available support. Then what would be the parts within this program that maybe we can either defer or we can go ahead without it? And then separate from that, we also look at the overall picture for the program. The priorities in the overall programs have been spelled out in a memorandum that was sent from Mr. Denton to Mr. Minogue dated March 25th of this year.

If you wish, at the end of my presentation, I can go back to that and just give you a brief summary of which programs were singled out as the high priority items which were in the lower priority area, and which ones were put into a third group that is called programs that possibly could be handled by the industry as opposed to being handled by NRC.

MR. SIESS: I seem to remember that memo. It may be worthwhile to look at it.

MR. ROSZTOCZY: That completes my discussion on equipment qualification.

MR. SIESS: The next item is the severe

accident research program. We have been reviewing that quite extensively in Research and within NRR. I believe you have been in on all the meetings, haven't you?

MR. ROSZTOCZY: It is currently under review, especially the research portion of it. There are three meetings scheduled with the appropriate ACRS subcommittee, one this month, one in January, one in February. It is being done kind of jointly by the ACRS, RES, and NRR.

MR. SIESS: We have had about three already. I wonder if we couldn't just skip to the comments part on that, because I don't see what we could cover on the severe accident research plan that hasn't been or won't be covered in the subcommittee meetings.

MR. ROSZTOCZY: It is our intent to cover the same information I have here in the upcoming meeting in somewhat more detail with the other subcommittee members.

MR. SIESS: So really looking at your comments, there is not an awful lot to be added at all.

MR. ROSZTOCZY: No. If I can say just briefly, what we are expecting to do under the severe accident program is to perform probabilistic risk assessment studies for selected plants. There are four typical plants which represent a different design that we are going to do these studies first for.

The studies intend to use up to date methodology and up to date data, including collecting together new information that is available. Based on these studies, we expect to find out how much risk is associated with severe accidents, where does the risk come from, from what initiating event, from what failure modes, and so on. Then we intend to study possible improvement, how one could reduce the risk, and based on that, make recommendations for severe accident requirements, and the goal is to have those available by the end of 1984.

MR. SIESS: Are these PRA's being done by Research or NRR?

MR. ROSZTOCZY: They will be done by Research.

MR. SIESS: They will probably be done by a contractor and be paid for out of the Research money.

MR. ROSZTOCZY: That's correct. So that is the basic approach, and you can find more details in the handouts. The comments are more along the line I already mentioned, that we are having these ongoing meetings in the next three months. We are bringing attention that it is a very broad program. This is probably the largest individual program in the research plan. This is running on the order, I think, of $50 million a year. Because it is very broad, it has many subtasks and goes in many different directions, and we intend to look closely at the research in those areas.

One general comment is that even though we are planning to make a decision, an early decision on the severe accident requirements in 1984, we do see a continuation of the severe accident research program beyond that time. We also feel that the work done up to '84 will probably be the one that is going to tell us what areas of the ones which are the most cost effective for more research, and the second phase of the severe accident research program should heavily depend on the outcome of the first phase.

MR. SIESS: If that doesn't continue beyond '84, it will be a milestone at the NRC.

(Slide.)

MR. ROSZTOCZY: Let me then move to the following item, which is Task 6 in the slides. This is the loss of coolant accident and transient analysis. Back approximately nine years ago, when Appendix K was issued, then the available information was limited in some areas, and as a result of that, we had to include some artificial requirements in Appendix K.

Also, we included some restrictions on the calculational methods and the use of data which we find now does not permit the use of new information as it becomes available. We have to emphasize that these problems exist only in certain areas of Appendix K. In most areas of Appendix K, when new information becomes available, it can be used, but in some restrictive areas it cannot.

Consequently, we are considering a rulemaking on Appendix K in terms of revising the Appendix K rule. In connection with any revision one has to answer the question of whether the new rule or the rule with the revisions is sufficient. When Appendix K was issued, it was considered to be very conservative. In order to do this, one has to evaluate the uncertainties with the new proposed methods, the uncertainties associated with the data we are using, and assess this and compare it against some required margin.

We are also finding that the Babcock and Wilcox design, the PWR design is, as we all knew, somewhat different from the others, and it makes a difference in the prediction and calculation of loss of coolant accident. Most of the tests done for the pressurized water reactor times up to now has been done in a manner which was more representative of the Westinghouse and Combustion design. This is an area where some additional tests are needed. So, we are going to collect the information for the B&W design.

MR. WARD: Soltan, let me ask you a question. With regard to Appendix K changes, we just heard at a subcommittee meeting last week a rather extensive program that one vendor, General Electric, has in developing some proposals for what they think is a considerable improvement to an Appendix K type of requirement which would permit probably more efficient operation of existing reactors and perhaps more efficient designs of any future cores or reactors.

There seems to be a lot of incentive for the owners or through them the vendors to do this sort of research on their own. What sort of research is the agency doing? What is the need for research by the agency along this line?

MR. ROSZTOCZY: A very large portion of the research in this area has been done by the NRC or with NRC support. The reason is that this is a rather expensive area of research. The largest program, of course, had been the LOFT program. An actual nuclear reactor has been tested under loss of coolant conditions. The others are like Semiscale tests, which are a scaled down version.

MR. WARD: But I am trying to make a distinction between the research which has gone on to justify the existing Appendix K, and that research is all pretty well finished, as I understand it. Now there is an effort, and I think an appropriate effort, to change the requirements of Appendix K reflecting a better understanding of the LOCA and of the ECCS systems.

It seems to me that the incentive for that is going to come from, as I said, from the owners, and from the vendors.

MR. ROSZTOCZY: There are no two research programs. It is the same research. The research which has been done to a large extent but is still ongoing for the purpose you described is the one that the vendors are using. They are using the information that was obtained from this research, pulling it out and applying it to their design to see what it means for their specific design, and they are making changes in their loss of coolant calculational methods based on this new information.

So, we are talking about the same research program, and a large portion of it is already done. A lot of it is under way, and it is expected to go on for a number of years.

MR. WARD: Does the NRC see its responsibility in funding this research so that they can better understand proposals that the owners' groups or vendors will be coming up with, or does the NRC see it as a regulatory responsibility to essentially relax Appendix K requirements?

MR. SIESS: What research are you talking about, Dave? What project?

MR. ROSZTOCZY: Let me throw in -- I am sorry.

MR. WARD: I am talking about research such as Semiscale, and there is some research at -- on boiling water reactor systems that is being funded jointly.

MR. SIESS: Let me throw in an example. For the pressurized water reactors, to see how the ECCS water would penetrate into the bottom of the vessel, because we thought it could flood the core, was not known at the time when Appendix K was enacted. In the same way, the amount of water that would penetrate through the boiling water reactor core prior to reflooding again was not known. There was just not enough information and data.

Because these were not available, some requirements were put forth in Appendix K.

MR. SIESS: Zoltan, he is not talking about what has been done. We are talking about the FY '84-'85 research program. I think the question is, what is the justification in your mind for continuing the work in Semiscale, for example, and FIST?

MR. OKRENT: And for the NRC to pay for it.

MR. ROSZTOCZY: The justification for this research was --

MR. SIESS: Not was.

MR. ROSZTOCZY: Was and is. The justification for the research is, there were these missing parts from the loss of coolant accident which made it very difficult for a regulatory agency to specify what needed to be done and to put forth the criteria. This research was initiated to fill these gaps. The justification is still the same. There is no change in the justification. Once you have performed the research and the information becomes available, is publicly available to everyone, it is expected to be used in the various people's evaluation for the loss of coolant accident. When they use it in some areas, it shows some penalty; in some areas, it shows a better result than they had for their approximate bounding calculations that we had before.

Usually when they find a benefit from it, they change their method. They come to us and they ask for approval.

MR. WARD: Let me put it this way. The

research that has gone on for the last several years and which I believe we will both agree is winding down was to show that the requirements of Appendix K were adequate to protect the public health and safety against a large break LOCA. Okay.

Now, does the agency feel that there is still research, that they haven't yet shown that the Appendix K requirements are appropriate, and more is needed for that, or does the agency feel that it is its role to relax the requirements to permit more reactor operation of existing reactors and perhaps more efficient design of new reactors?

MR. ROSZTOCZY: It is a modification of the first statement. The agency feels that completing the research that was started for that purpose needs to be done. It ought to be completed. It simply has not been completed yet. We are not starting anything new in this area. We are simply completing the research started many years ago.

MR. SIESS: You are still validating large LOCA codes.

MR. ROSZTOCZY: That is a portion.

MR. WATT: Jim Watt.

There has been a transition to a need for realistic codes. That is part of this question of revising Appendix K. Basically, we have pretty well demonstrated that our evaluation models are conservative and we have a preponderance of research results that confirm that, but now, as a result of Three Mile and the emphasis on procedures and realism, now we want to go toward -- or at least some of us view it as this, that we want to go to a more realistic analysis, and we want to consider the use of best estimate codes for licensing purposes.

This will be a major step. I think this is what we are going into. We have a lot of information, but we have not looked at it in terms of does it do any more than demonstrate the conservatism of what we have agreed to. Now we need to look at it and see how far could we go and remain conservative.

I think this is the type of comment that you are looking for. The Semiscale, FIST, the LOFT experiments are being used and looked at with best estimate codes. They are providing a certain level of information relative to this, but I think the critical thing is, where do we go from there? That is what is going to be considered in this revision of Appendix K.

MR. SIESS: Are you satisfied, Dave?

MR. WARD: Well, not quite, I don't think. I am still not clear -- I mean, overall I think the program to use best estimate codes and develop an understanding of LOCA and ECCS effectiveness is a wonderful, great effort. My question is, is there an NRC responsibility, should there be an NRC responsibility for funding that effort? Is the effort here to assure that the health and safety of the public is being protected? Or is the effort to permit more efficient generation of electricity?

MR. ROSZTOCZY: The goal is, as far as we are concerned, is to protect the public health and safety, and this is done to be sure that the existing Appendix K requirements are appropriate in view of a much larger knowledge that is available now than was available before. That is the goal of the research program. That is what was being done before, and that is why it is supported by NRC.

MR. WARD: So you are saying that you are still not sure that the Appendix K requirements are adequate.

MR. ROSZTOCZY: Yes, we had that question, and that is why we went into the research program.

MR. WARD: Where do you stand today on that question?

MR. ROSZTOCZY: I would say in relative terms that we are probably 80 percent complete and 20 percent is still coming.

MR. WARD: And is wrapping up that remaining 20 percent the total purpose of the program that is being funded in 1984 and '85?

MR. SIESS: No. A lot of it is natural circulation transients.

MR. WARD: Well, Appendix K is --

MR. ROSZTOCZY: You have to be careful. This program we are discussing here is loss of coolant accident and transients and other accidents, but the loss of coolant part, I believe, basically is for that purpose.

MR. SIESS: Why don't you put the expected accomplishment slide up there?

MR. ETHERINGTON: It seems to me, though --

MR. SIESS: The first three items are essentially Appendix K type items, aren't they? And then after that everything else is --

MR. ROSZTOCZY: You have to flip two sides. This is the slide on expected accomplishments in '84 and '85. The first item is very important for pressurized thermal shock. It predicts how fast you would be cooling down the vessel. The second one is one of those items which started with Appendix K, and it is not complete yet. The third one is the same thing. That is an Appendix K item, and it is not completed yet.

The following ones are not LOCA's.

MR. SIESS: Then at the top of the next page you have some cleanup on LOFT which is sort of independent.

MR. ROSZTOCZY: It is really putting into use some of the information that has been obtained.

MR. SIESS: Put the next one up, because it does have a LOFT item on it, refill/reflood.

MR. ROSZTOCZY: Yes, and that is a large item in the budget.

MR. SIESS: Is that LOFT test?

MR. ROSZTOCZY: No, that's 2D/3D, 2D/3D tests, and those are basically reflood tests for a large facility. This shows where we are today. We have run these type of tests on a small scale. This is a large-scale three-dimensional facility to confirm the information that we obtained during the last five or six years on smaller-scale experiments can be either directly used or some recirculation can be used for large reactors.

MR. OKRENT: Can I ask --

MR. SIESS: Does that help you, Dave?

MR. WARD: Harold had a question.

MR. OKRENT: Is it your opinion that there are areas with regard to LOCA where Appendix K may be significantly inadequate?

MR. SIESS: Taken as a whole or as a particular part?

MR. ROSZTOCZY: If you are using the word "inadequate" in the sense that it doesn't represent --

MR. OKRENT: I'm using it with regard to

protecting the public health and safety.

MR. ROSZTOCZY: Up to now our findings confirm that along those lines Appendix K probably gives an appropriate amount of margin. If you look at individual pieces, then you find that some artificialities in the calculation just do not happen that way, and it kind of puts you in the wrong direction.

MR. OKRENT: I'm just trying to understand at the moment if there are places where the Staff thinks that Appendix K may be inadequate to protect the health and safety of the public.

MR. SIESS: Try answering yes or no.

MR. ROSZTOCZY: Let me hear the question again, so I know what it is.

MR. OKRENT: Are there areas of Appendix K which the Staff thinks has inadequacies with regard to protecting the public health and safety.

MR. ROSZTOCZY: No.

MR. OKRENT: If you're doing research, it must be for a reason other than that there is a concern that you're not protecting the health and safety of the public, correct?

MR. ROSZTOCZY: It is done for the purpose of confirming that, that we understand the physical behavior that was not available originally.

MR. OKRENT: But the outcome of the research in fact is that you gain an additional understanding and that it is used in part to improve the efficiency of operation. Mr. Ward was asking in a sense if the major purpose or use of the research is to improve the efficiency of the operation of the plant, should the NRC be doing it.

Let me give you an example from another field of regulation. I think the people who regulate the possible adverse health effects of new chemicals and so forth have developed a technique for looking for carcinogenicity or something like this. I suspect the industry could argue, this is not necessarily a best estimate method. They could say that most of the time it is conservative.

Well, the Food and Drug Administration could say, well, we need a big research program to confirm that we are being conservative, and of course in the process let's say that we can confirm that most of the time, and the industry could then take advantage of what they had learned to say, well, let's use this other method which lets us do something we couldn't do before.

That isn't the way, as far as I can tell, it is being run there. I guess we are trying to see at what point the NRC has done enough with regard to protecting the public health and safety.

MR. ROSZTOCZY: I think we are dissecting this in quite a bit of detail, but I think the answer is relatively simple and straightforward. We are doing it because we want confirmation that what we required from the industry is appropriate, and as long as it is confirmed we are happy. If we find out that it was wrong, what we required, then we will make changes. At the same time, the industry needs pretty much the same data for the other purpose, so they would be doing it for the other purpose.

In some cases it's a cooperative program, where we pay for it partially, they pay for it partially; we use it for our purpose, they use it for their purpose.

MR. OKRENT: Well, if I was going to look over the field of things that would affect light water reactor safety and ask myself, where is the NRC Staff relatively confident that what they are requiring is protecting the public health and safety, where do the PRA's that are being done get that answer, and where should the NRC Staff, if they do not, have nagging doubts about the uncertainties -- they should have them -- and where the PRA's suggest that these are places where risk does arise, LOCA would not be one of the areas where you have large uncertainties and where the PRA's are contributing risks due to the uncertainties.

If there's a risk from a LOCA, it's because the probability of a small LOCA, let's say, may be large and the reliability of the systems that you're requiring right now is not as good as what the British are going to require if they build one, and so forth. So I am not swayed particularly by your statement that we want to confirm our requirements. I think that logic is not being pursued in any uniform way.

MR. ROSZTOCZY: Let me comment on that --

MR. SIESS: Gentlemen, I think we might benefit from thinking about this over lunch. It is an interesting issue, and I will apologize for running ten minutes past our break time for lunch and I'll make up for it by asking you to be back here at 2:00 o'clock and we'll continue this discussion.

(Whereupon, at 1:10 p.m., the meeting was recessed, to reconvene at 2:00 p.m. the same day.)

AFTERNOON SESSION

MR. SIESS: Dave Ward wanted to continue that discussion on ECCS when he gets back from the other meeting about 3:00.

MR. OKRENT: Good.

MR. SIESS: Zoltan. Where is he? Tell him, don't be afraid, come on back in.

(General laughter.)

MR. SIESS: The meeting will come to order.

Our forces are somewhat depleted. There is another meeting going on, maybe a couple of them. One, I think, will be over at 3:00, and the other at 4:00, if you believe that. Mr. Ward is out, and he would like to continue the discussion on ECCS when he gets back about 3:00 o'clock, so let's go on to advanced reactors.

And since Dr. Carbon is not here, we will depend on other people on that, although I suppose I am supposed to say something about that, too.

(Slide.)

MR. SIESS: I might mention that since Dr. Plesset has returned to the Committee, Mr. Ward will be taking over as chairman of his ECCS Subcommittee. So no member has an idle interest in anything. I just wanted to be sure that his interest was explained.

MR. ROSZTOCZY: Yes.

MR. OKRENT: I wouldn't touch it with a ten-foot pole.

(General laughter.)

MR. ROSZTOCZY: May I start with Task Number 7, which is advanced reactors? This is basically two parts. One part of the program is supporting the fact breeder reactor program, and the other one is the gas-cooled reactor program.

In terms of the fast breeders, the Clinch River Breeder Reactor is presently under review, and technical support is needed for the performance of the licensing review for this. The major portion of the fast breeder reactor program is now directed toward the Clinch River program. The type of items that we need information on in FY '84, '85 time frame are decay heat removal by natural convection, assessment of energetics of a core disruptive accident, and coolability of the core debris under a core disruptive accident condition, and consequences of complete loss of off-site power and on-site power, and also, we need some additional work on the definition of the source term, the radiological source term.

A second part of this breeder program is the development of generic design criteria and regulatory standards for the liquid metal breeder reactors. So a certain amount of work is going on in that direction.

(Slide.)

MR. ROSZTOCZY: In terms of the gas-cooled reactors, our main concern is relative to the technical support for the Fort St. Vrain plant. As you know, it has been operating for a number of years. We do endorse the current program. However, there have been some re-evaluations of the plant beyond the presently available fuel. Should they make a decision to cease operation at the end of the presently available fuel supply, then we will re-evaluate our research program in this area and make appropriate changes.

There is also an effort under this program to develop generic design criteria for gas-cooled reactors. We do not see any applications in the near future for the licensing of gas-cooled reactors, but somewhere further down the line there is always the possibility.

MR. SIESS: I would sort of think it looks about as likely now as the CRBR does.

MR. OKRENT: Would you put the previous one back on?

(Slide.)

MR. OKRENT: What did you have in mind with regard to the research in the definition of radiological source term?

MR. ROSZTOCZY: I believe that addresses the subject of what source term should be used in the evaluation of the fast breeder reactor in the licensing process. As you know, we are in the process of re-evaluating the source term for the breeder reactor. We believe there will be some changes in this, and similarly, an evaluation of the source term for the fast breeders will have an influence in the evaluation of the fast breeder performance.

MR. OKRENT: That is it.

MR. ROSZTOCZY: That is it.

MR. OKRENT: Okay.

(Slide.)

MR. ROSZTOCZY: The next slide shows the various areas where technical support is needed in the gas-cooled reactor area. This includes fuel particle integrity during heatup accidents, fission product plate-out and lift-off following accidents, evaluation of severe accidents for the Fort St. Vrain plant, application of human factors to the Fort St. Vrain plant, development of a high temperature gas reactor safety handbook, work on graphite failure criteria and failure mechanisms, and testing of flow mixing and natural convection.

MR. SIESS: Zoltan, I perceive what is at least an apparent difference between NRR's stated needs in the gas-cooled area and Research's stated objectives. I say apparent because I think the actual work needs both. But according to what Research has said, the Fort St. Vrain support work is essentially to be completed in '83, and that the '84, '85 program is aimed pretty much at a future gas-cooled.

I realize they say that partly that is because of what Congress has told them to do. I saw your list of needs which essentially are these things up here, and Research's response to it, which, as I read it, said, yes, most of these things will be included in our program looking toward the future. Can I conclude that NRR is satisfied that the Fort St. Vrain needs are satisfied?

MR. ROSZTOCZY: We are satisfied that the ongoing program addresses the Fort St. Vrain needs. It is our understanding that some of these, especially the ones shown on the slide, even though they are ongoing, will be running into 1984.

MR. SIESS: And I assume that in deciding on this particular list of needs, that this has been done without the benefit of a risk assessment as to how important these are compared with one Fort St. Vrain running and 80 lightwater reactors running. This is deterministically looked at?

MR. ROSZTOCZY: Yes. These are deterministically looked at, if you wish. These arose from some of the problems that have been observed from the operation of the plant, and arose from the review of the safety evaluation of the plants in some areas where lack of information made the review more difficult.

MR. SIESS: Most of these have not arisen during the operation. Most of these are based on postulated accidents. Plate-out lift-off is certainly an accident condition. Severe accidents are accidents. What kind of human factors were made for Fort St. Vrain?

MR. ROSZTOCZY: We were doing such work for the gas-cooled reactors. The question then is, is this applicable to Fort St. Vrain, or do you have to factor in the other items? For instance, emergency operating procedures for the reactors are developed in a certain way, and the plant itself, we have a certain way. Fort St. Vrain is a different type of plant, and one has to be careful before just directly applying the same information.

MR. SIESS: It seems to me that one difference would be that Fort St. Vrain doesn't react nearly as fast, and this doesn't have a significant difference in human factors.

MR. ROSZTOCZY: That's correct.

MR. SIESS: You want time to think before you act.

MR. ROSZTOCZY: Correct.

MR. SIESS: Since Fort St. Vrain would be -- This would be of interest in writing procedures, the fact that you have allowed them an STA to an hour instead of a half-hour, something like that? I don't know if that is human factors or not, but how does an HTGR safety handbook relate to Fort St. Vrain?

MR. ROSZTOCZY: Pete, would you like to address that question?

MR. WILLIAMS: Maybe I should answer that. Pete Williams.

I had better answer that, because I believe I am mostly the author of this concept. The safety handbook really, I think, has two missions. In terms of licensing, we have often thought that a document such as one that would contain perhaps analysis methods, basic data, an index to available supporting documents on Fort St. Vrain would be handy in I&E response centers.

In the same sense, we also think it would be good to collect all of the worthwhile work, important work that has been done over the years in developing background for fast reactors in some sort of a document. It would be not only a record of what was done, but it could be very useful in the event that gas-cooled reactors do undergo development.

MR. SIESS: We don't have a handbook for light/water reactors.

MR. WILLIAMS: Not that I know of.

MR. SIESS: And your feeling is that most people that would have to deal with these things are much more familiar with water reactors than they are with gas-cooled?

MR. WILLIAMS: There have been some instances in the response center where Fort St. Vrain will phone in an incident and the checklist has not been appropriate.

MR. SIESS: I can imagine. Okay. I understand.

MR. OKRENT: Could you put back the one on LMFBR's, please?

MR. ROSZTOCZY: Most certainly.

(General laughter.)

MR. OKRENT: That is a limited set of topics. Is it limited by the situation that those are the only topics, or that there is a limited amount of money, and these seem to be the highest priority ones, or some other limitation?

MR. ROSZTOCZY: Basically, what this slide shows is that work is going in two areas. One of them is the Clinch River area, and the other one is the generic question of liquid metal breeder reactors.

MR. OKRENT: Let's just look at Clinch River for the moment.

MR. ROSZTOCZY: For Clinch River, these are the items -- these are the tasks we expect to complete in the FY '84, '85 time frame. So there are other tests completed earlier, like '83, and there will be some beyond this.

MR. SIESS: If you had all the money you wanted, would you add something to that?

MR. ROSZTOCZY: I think the answer to that has to be yes. If we would have no limitations on our support, I am sure there would be some other things we would like to see done.

MR. SIESS: Would you like to name one?

MR. ROSZTOCZY: I can not name you anything offhand. We would have to discuss it with our task leader people and see what they would like to have included. One item I am aware of is, they would like to move faster on some of these. The present schedule for the research program is somewhat slower than they would prefer to see, so acceleration of the program would definitely be one of the considerations.

MR. SIESS: Let's see. Moving faster means spending more money for the year. Does it also mean spending the same money total?

MR. ROSZTOCZY: Spending the same money total, but spending it earlier and getting the results earlier.

MR. SIESS: That is the theory, anyway.

MR. ROSZTOCZY: Yes.

MR. OKRENT: Let's see. Assuming you had an accident in which the core debris gets out of the vessel, Clinch River has a fairly complex set of processes involved in maintaining the radioactivity within some kind of a boundary for a suitable length of time. There is no research that NRR feels is needed in that area? I don't quite see it on your list.

MR. ROSZTOCZY: That is the second bullet on there, the Clinch River program. The second portion of that second bullet which says coolability of the core debris.

MR. OKRENT: I am sorry. There are things that are important quite apart from the coolability. Coolability has a very specific meaning, and I am talking about various things that make it into your containment, condensables, non-condensables, heat, aerosols, whatever, and how the containment will perform, the secondary containment.

MR. ROSZTOCZY: That would be all under the source term. That means all the way to release outside of containment.

MR. OKRENT: Source term, at least as it has been used in the discussion that we have had with the licensing people, is sort of an artificial kind of a source term that you put into a containment building that you assume is going to be there, so that the leakage under that postulated set of conditions is sufficiently small that you don't exceed 10 CFR Part 100 or something.

So, I hear you, but I don't think you are answering the question.

MR. ROSZTOCZY: I am using the source term in a much broader sense on this slide, so any research in terms of how much is released from the debris, how is it transported within the containment, how much is plated out, how much would be released if there is any opening in the containment, that would be found under that part.

MR. OKRENT: But on light/water reactors, we have a rather large program just on hydrogen. Now, is that source term? No, it is a separate thing. Source term does not encompass the threat to containment integrity. Let's say hydrogen or whatever. So I repeat. It seems to me that in the items you have identified, and the way you discuss them, I still do not see whether or not NRR thinks there are no questions that need research or what with regard to -- and I am only using this as a for example, containment function or loss of function given a core disruptive accident.

MR. ROSZTOCZY: That we moved through fast. On the severe accident research program, the equivalent of this was done for the light/water reactors. It was cut into three areas, cooling the core or core debris, release of hydrogen, and the source term.

Here in the fast breeder reactor program two of those are there; the hydrogen is missing. I am not aware that we are doing hydrogen work in this area separately, but the other two are included in the program and will be considered.

MR. OKRENT: I am just trying to understand whether NRR has really thought through its needs for CRBR, and in identifying a program it has found that these are the important ones, and dismissed the other or just has not systematically in fact examined this in a depth equivalent to what it is now doing for LWR's.

There are other things I could pose. I am not sure whether Reg. Guide 1.97 directly is applicable. If not, well, what does one want for the CRBR?

MR. ROSZTOCZY: The Clinch River Breeder office within NRR has directly worked with Research to work out what are the most important items in the research program that should proceed. They looked at systematically what these things are. As I mentioned earlier, I think one action with the gas-cooled that includes some items that will be completed prior to 1984 includes some which are going beyond '85.

These are the ones which are expected to be completed in the '84, '85 time frame.

MR. OKRENT: See, that is the second time you said that, and I do not find that a suitable answer, because the question is, what should you have completed in the '84, '85 time frame, not what you expect to be completed. If the two are synonymous, fine. But it is not at all clear to me that these two are synonymous. So that is what I was trying to suggest by one or two small examples.

MR. ROSZTOCZY: They are synonymous within that one comment that the program office would like to see some of these programs proceed faster, but based on the present availability of people and money, this is the speed that is suggested or has been proposed to go with. I am not aware of any item not being in the program that we are asking for.

MR. OKRENT: I don't understand that statement, but I won't pursue it.

MR. ROSZTOCZY: There is one additional comment on the breeder reactors. The present long-range research plan includes on the breeder reactors a probabilistic risk assessment study to be performed for CRBR by the NRC. The Committee, ACRS, has also recommended that we perform such a study. It is our present position that we do not recommend going forth with such a study at the present time.

The applicant is performing a probabilistic risk assessment study for Clinch River. It will take a number of years before the study is done. As we are progressing with it, they are showing us the results of their accomplishments, and those are being reviewed by the NRC. Whenever we find something in the process that we think should be included and was not included by the applicant, then we ask them to include it.

By doing so, we believe that this one study will take care of whatever is needed to be accomplished by the probabilistic risk assessment, and there does not appear to be a need to duplicate this study in-house with NRC funds.

MR. SIESS: Okay.

MR. OKRENT: Let's just note that silence is not equivalent to consent.

MR. SIESS: It's noted.

(Slide.)

MR. ROSZTOCZY: That completes that part. The next is risk analysis. Probabilistic risk assessment typically is used for three different purposes. One is to estimate the overall public risk; the second is to evaluate the relative importance of various initiating events or various design features; and the third one is to review some portions of the design and operation of nuclear power plants.

There are many PRA's which are available from the previously conducted programs. Some of these are the ones coming from the reactor safety study, the RSSMAP study, and the interim reliability evaluation program.

These PRA's throughout the years have varied somewhat in scope and depth and also in quality. There are certain areas that were not covered or certain areas where the PRA's were not complete. These are initiating events, many external events were not included, treatment of common mode failures, human factors from both aspects, the aspect of an aggravation from an accident as well as mitigation of an accident, systems interactions and the assessment of uncertainties.

(Slide.)

We feel that an improved, updated methodology is needed that should address these shortcomings, and we propose appropriate treatment of these items which may be dependent on the use of a given PRA study.

(Slide.)

The next few slides spell out in some detail what we expect to accomplish in fiscal year '84 and '85. Let me skip those and go to comments.

(Slide.)

We have recently prepared a memo from NRR to Research, dated November 30, 1982, that spelled out NRR's research needs on PRA methodology, and we are working with RES to generate a program plan for PRA methodology development research. We expect this plan will be completed by March of 1983.

MR. SIESS: November 30th? We have not seen that yet, I take it?

MR. ROSZTOCZY: That is possible. You probably have not seen it yet. Have you seen it, Frank?

MR. GILLESPIE: The final doesn't appear to have shown up.

MR. ROSZTOCZY: It was signed off on November 30th and it was signed off by Mr. Minogue, and we'll see the Committee gets copies in the near future.

MR. OKRENT: Could you make it in the very near future, because we have a Subcommittee meeting a week from today.

MR. ROSZTOCZY: I have a copy with me.

MR. OKRENT: That would be very near.

MR. SIESS: We have a Xerox machine next door. We'll take care of it.

MR. OKRENT: Could I ask a small question, just to find out whether you agree with the statement that I read in something that I guess is called the Commission's budget request, Office of Management and Budget. Under the area on risk analysis and talking about common cause failure mechanisms such as fire and flood, it says: "Recent and current research on floods has reinforced the conviction that internally generated floods pose a greater threat to plant safety than external floods."

Do you agree with that statement?

MR. ROSZTOCZY: I would not consider myself an expert on externally generated floods, but based on my knowledge and my understanding, yes.

MR. OKRENT: Is there some place I could look to know what the basis is for this conviction?

MR. ROSZTOCZY: Would anyone from the Staff like to comment on that?

MR. MURPHY: Joe Murphy.

The -- at least one study ongoing has found the internal floods to be very significant, from what we hear. That's the NSAC Oconee study. Obviously there are great uncertainties in the external floods, but because of the warning times and the low probability of the events, we believe the internal floods dominate. I can't point you to an exact reference on the subject, however.

MR. OKRENT: Well, I have not seen any Oconee PRA and I do not know whether it is internal or external flooding that is a problem there. But I do recall that on each recent case where I have asked the Staff, have they looked at internal floods, they've said, yes, we've reviewed it and it's all right.

I know that back in the early to mid-seventies, after the Quad Cities flooding incident, the Staff supposedly had each plant look at internally caused floods and there were some changes made as a result of this. So I am trying to understand what the basis for this early strong general conclusion or conviction is.

Some of the SEP plants we've looked at have an externally caused flooding event, posing a real problem. And I think I can rattle off two or three where it is holding up completion of review, and the number isn't all that small for the likelihood, and there are uncertainty bands around it and they don't even always have a lot of time.

So this is something sent to OMB. Maybe they are nontechnical or something, I don't know. But I would like to understand the basis for this. Furthermore, I would like to know what kind of research it is you need to do with regard to internally caused floods. Is it research or is it a self-examination by each licensee that is needed?

If you have this conviction, wouldn't it be that you send a letter out to all the licensees, we have this conviction, please review your plant, tell us if you are okay; if not, what you're going to do.

MR. ROSZTOCZY: We have sent out such a letter after Three Mile Island, which asked them to establish the flood levels to check what equipment would be under flood, for example --

MR. OKRENT: In the containment?

MR. ROSZTOCZY: Yes.

MR. OKRENT: I assume it's not the research people you are talking about here.

MR. ROSZTOCZY: There have been somewhat similar requests in terms of equipment qualification for safety-related equipment outside of containment. So if you have any cubicles or something that you could flood, then what would be the result.

MR. OKRENT: The one thing I read recently was on Shoreham. One of the independent review groups suggested that maybe internally caused flooding was an important risk contributor. That was followed up by a Staff memo saying, no, no, we don't agree with this. We have a factor of, what is it, 30 less likelihood of internal flooding being a cause of core melt.

So I am trying to understand this statement.

MR. ROSZTOCZY: It is the purpose of this program to develop the capability that one could address that question, one could ask the question, what would be the consequence in terms of risk if you flood a certain part of the plant.

MR. OKRENT: What kind of research is needed? Is there some new methodology that doesn't exist?

MR. ROSZTOCZY: There are two things that are needed. One is, you have to build it into your PRA analysis. If it is not broken down to sufficient detail or certain steps or certain decision points are not in it, you cannot account for it. So you have to do that modification.

The second thing you need is you need the failure fragility data which goes with the equipment that would be flooded under these conditions and applicable for the flooding circumstance for the flooding condition.

MR. OKRENT: Are you telling me, for example, pick Lowe & Garrick or SAI or any of the other groups who will do a PRA for a utility, could not now take a specific plant and do an internal flooding analysis to find out -- and come up with estimates of the likelihood of flooding?

MR. ROSZTOCZY: They haven't done it yet. Nobody has done it.

MR. OKRENT: I'm sorry, I think they have.

MR. ROSZTOCZY: Well, with the exception that maybe Oconee addressed it to some extent. I haven't seen that one. But in general, nobody has went to the extent yet to include flooding as a parameter and collect together the information of how does this affect the plant in a flooded condition.

MR. OKRENT: I'm sorry. What do you mean by behave under flooding conditions?

MR. ROSZTOCZY: If you have a certain piece of equipment, let's say a valve and a valve operator, let's say this will be flooded as a result of an external or internal flood, is it going to function under these circumstances? What is the probability that it will function, is not the same as the probability of the same equipment without the flood.

Right now all the PRA studies are using one probability, the one which is the appropriate one in normal operation, and they do not change this when the equipment gets under water.

MR. OKRENT: Are you suggesting that the NRC research program ascertain the functionability for all of the various kinds of equipment that might be flooded under various postulated internal flooding events for all the LWR's? Just what is it you're proposing the NRC research program do? Now I'm really curious.

MR. ROSZTOCZY: Maybe the best would be if you go back and go through these slides, because these are kind of a summary of the memo that I referred to earlier.

To answer directly your question, what we are proposing is to look at and see what accident parameters are essential for representing equipment behavior under accident conditions. For example, you might come up with that you need three parameters, you need temperature, you need radiation, and maybe flooding as critical parameters to represent the accident.

Then there is a fair amount of information available from ongoing and previously performed equipment qualification tests on the failure of this equipment under those conditions in terms of those parameters. Like those which are sensitive to temperature, we have some data where they pass, we have some data where they failed. And one could put together a fragility curve from this.

If you have that information, then you are in the position to perform this analysis. It is suggested that as part of this program we collect together the available information on equipment failure.

MR. OKRENT: I'm not sure what you think the NRC's responsibility is. If you think some of the plants have too high a risk as a result of internal flooding, why is it not the applicant's job to show that if he thinks some equipment can run after it's flooded, to do that thing?

MR. ROSZTOCZY: We fully agree with you. Once we arrive at the point that we are certain that a certain type of plant, certain design, are representing a sizeable risk in a given area, then it would be left to the licensee to do the appropriate work.

What we are doing here really is to provide a method to evaluate the severe accident and show where the risk is coming from. If what we find is the risk is coming from equipment being flooded, that is a major contributor to risk and that would tell us to go after certain plants and bring this to their attention and require them to meet certain requirements. If we find that this is a very small contributor, then we would not do it.

So this is to provide the methods to perform some typical studies and based on that identify the relative weak points or the areas where drastic improvements can begin.

MR. MURPHY: I think what we really need to do is integrate what analysis we need to move into the PRA. We're talking about the risk analysis of this portion to come up with an integrated way of handling the common cause failure from flooding into the system modeling that goes on as part of the PRA. This has been attempted to a limited scope in some of the industry PRA's, and we feel it is possible to be more comprehensive and more accurate and to reduce uncertainties in the process.

MR. SIESS: Did you say it's limited to scope or limited to the PRA? I thought the only PRA's that were considering external events were industry work?

MR. MURPHY: That's correct.

MR. SIESS: You want it more thorough?

MR. MURPHY: Yes.

MR. SIESS: Shall we go on, Dave?

MR. OKRENT: I just wanted to note that the Shoreham PRA included flooding, and it was Future Sources Associates that provided them their estimate of this. And the Staff more recently has said they disagree with what Future Sources Associates did, and they and they would be a factor of 40 or more smaller, I believe, and so forth.

So I am still a little bit at a loss to know what it is that is -- what the research is that's being proposed. A little while ago we heard on CRBR the Staff doesn't have to do one PRA on a fast reactor; we will learn by looking over the shoulder of somebody else who is doing it and suggest here and there that they add this or that, that will be enough, even though we don't have one under our belt, whereas on light water reactors, where they have a great many, research is needed.

MR. SIESS: Staff made the point about Shoreham that this was very sensitive to the maintenance procedures for the plant, which would not just be type specific but utility specific. And I think they also raised a question about the operator action, which was a procedural type thing, which would suggest that there is not much you can do generically to look at some of these things if the uncertainties are utility specific.

Now, in general I would say that whether that's a disagreement, that's an area for research. But the nature of this disagreement was that it was plant specific or utility specific, which you cannot solve with any generic program.

MR. OKRENT: I want to be clear. It is not that I'm saying one should not look at internal flooding. I was trying to make sure that it was being looked at for each of the recent cases. I am at the moment trying to understand the Staff conviction I quoted, and also just what research they think ought to be done on the internal flooding.

MR. SIESS: I don't see how you can generalize on the relative contribution of internal and external flooding, since external really is all over the map depending on where the plant is located, and the Staff has claimed that internal is specific to the owner-operator.

Okay, onward.

(Slide.)

MR. ROSZTOCZY: Would you like me to go

through this program or go to the next one?

MR. OKRENT: I read the vugraph. It didn't help me.

MR. SIESS: Okay. Let's see, are we still on risk?

MR. ROSZTOCZY: This completes the risk.

MR. SIESS: The next item is human factors, and I think I would like to propose that we skip it, for two reasons. One is that Dave Ward is not here and the other is that this again has been reviewed by the Subcommittee. I am not sure whether they are through with their review, but if they are not it should be better done by a Subcommittee.

Now, what I think I would like to check is your comments showing any significant areas of dissatisfaction with the research program. You do state that you don't think some of it is going to be there soon enough to make severe accident decisions. There is another statement, let's see -- on your second page, Zoltan, you have a comment that, "Division of Human Factors Safety concurs in the long-range review plan, except for overemphasis on seismic event as a precursor for severe stress."

Would you explain that?

MR. ROSZTOCZY: Apparently the research

emphasizes seismic events as being -- besides affecting the equipment, at the same time has a certain effect on the operators themselves, and as such contributes to further development of the accident. And our human factors people feel that the present version of the long-range research plan is somewhat overemphasizing this aspect.

It's not that they disagree. They feel that there is this effect, but they feel it's overemphasized.

MR. WILLIAMS: I would like to go --

MR. SIESS: Let me clarify my question. That comment appears under task 9, human factors. Now, under task 11, external events, on the third page, under that is expected accomplishments in '84 and '85, and one of the expected accomplishments is information on mechanisms, times and consequences of operator incapacitation resulting from external events.

Are those related in any way, and if so does NRR feel the same about both?

MR. ROSZTOCZY: The one you're reading on there, task 11, is a lot broader in that it is not limited to anything like a seismic event, but it would include other things, for example transportation accident and gas being released and so on.

MR. SIESS: But it says "operator" there. That could mean a truck driver?

MR. ROSZTOCZY: It's the effect of gas on the operator in the plant.

MR. SIESS: You mean chlorine or something like that?

MR. ROSZTOCZY: Yes.

MR. SIESS: I thought that was designed out.

MR. OKRENT: I am really skeptical.

MR. SIESS: We've been asking every plant I've seen for the last ten years whether they had their control room protected against gases or that sort of stuff.

MR. ROSZTOCZY: Under 11, the question is all external events. So look at external events and see how that could affect the operator.

MR. SIESS: Yes, but I can think of gas, I can think of floods, tornadoes, earthquakes.

MR. ROSZTOCZY: Yes, that's correct.

MR. SIESS: Those are all considered. Gas is considered now. I guess I don't understand. And if you say earthquakes are not important, because that's what you just mentioned, that you think it's overemphasized --

MR. WILLIAMS: Maybe I can help a little bit.

I think I wrote that statement there. I was paraphrasing --

MR. SIESS: Which one did you write?

MR. WILLIAMS: That earthquakes could be overemphasized. What the Division of Human Factors meant is, they are very anxious to do research on how stress affects operator actions, all kinds of stress; and that a good example of the kind of stress would be earthquakes. But they don't want to single that out as a special stimulant for stress.

MR. OKRENT: Well, right now I think there has been no research on what might be the problem in the control room given an earthquake. Correct me if I'm wrong. There has been nothing specifically in there. So if it's been overemphasized, zero amount has been overemphasized.

MR. WILLIAMS: I'm sure they don't really mean that, but I'm sure they also want to consider other stress sources equally.

MR. OKRENT: I might note in passing that in a trip report prepared by Mr. Richardson, I believe it was, covering a trip to Japan, he mentioned that one of the reasons that the Japanese employed a seismic scram on nuclear reactors was that their experience was that following an earthquake at fossil fuel plants the operators tended to make many errors, and they were trying to, presumably, reduce --

MR. SIESS: If they do that in Japan, what do you think would happen at Zion?

MR. OKRENT: There is a large chance for error. I just note that in passing, in view of your comment about overemphasis and the degree of emphasis that it's had up to now.

MR. SIESS: I was going to say, it's quite a different problem between the East Coast and the West Coast, and you just killed that one, Dave.

MR. MOELLER: Well, on the earlier comment about the reactions of the operators to chlorine, are you looking at this in view of lack of faith in control room habitability following a release outdoors?

MR. ROSZTOCZY: Yes. The purpose of the program would be to look at all external events, including this, and see which one of these is a significantly high contributor to the risk, so that we can either establish some regulations or study them further.

MR. MOELLER: Well, for each plant and each control room and human factors reactions and so forth, do you go through a sequence -- not necessarily you, but does the NRC Staff go through a sequence -- of looking at the maximum -- and I'm using the wrong word, but some design basis tornado, flood, et cetera, hurricane, for that particular plant and see what impact it would have upon the control room and the functioning of the air systems?

MR. ROSZTOCZY: Yes. In general, it's being looked at for what effect it would have on the entire plant, including the control room, as well as the plant itself.

MR. MOELLER: One other question. In all of the research you have here I see nothing, although I guess I can see something coming close; management and organization -- I was looking -- right now you're going through a rulemaking on the staffing of control rooms. Do you see any research needs on that? Are you doing anything? Do you have anything in mind in the next couple of years to help answer those questions? Because what I came out of the full committee meeting last month with, the primary impression I came out with was that we really don't have all of the information we need to make decisions in this area.

So, I am looking for the research.

MR. ROSZTOCZY: Within, again, the limitation of the FY84 timeframe, there are those two items that are listed under the organization and human factors.

MR. MOELLER: Are those performance evaluation standards? What does that mean for the people?

MR. ROSZTOCZY: To generate standards that you would use to evaluate the performance of a management organization.

MR. RAY: Well, isn't there a program, a research item somewhere on task analyses?

MR. WILLIAMS: Yes.

MR. RAY: It seems to me that was mentioned in the Human Factors Subcommittee.

MR. WILLIAMS: Yes.

MR. RAY: So we skipped human factors. Then I guess it's listed in there, isn't it?

MR. GILLESPIE: That's listed in Human Factors Operator Task Analysis, maintenance operators, task analysis. What they're doing, how well they're doing, what training they have to do it. Yes.

MR. RAY: And some of the consultants, particularly in the human factors subcommittee meeting, felt that those results should be available before that rulemaking was pushed.

MR. MOELLER: Okay.

MR. WILLIAMS: That's why they're not listed there. Many of these task analysis programs are in progress or, in some cases, have been completed. They have done a lot of good work.

MR. SIESS: Dave?

MR. OKRENT: Does the staff feel that they currently are in a satisfactory position, and don't need any further research with regard to their ability to ascertain whether an operator is sufficiently good from all points of view that are relevant?

MR. ROSZTOCZY: No. We do feel there is need for additional research.

MR. OKRENT: And do you think you've requested the right kind?

MR. ROSZTOCZY: Yes.

MR. OKRENT: What would you say is the single most important area where you think more research is needed in that regard?

MR. ROSZTOCZY: I'm not in a position to answer that, but there is a program plan on human factors which has been developed very recently. I think it's in the process of being close to being issued. That addresses these issues and puts them into some perspective, so I can lead you directly to that or I could respond to a specific question.

MR. OKRENT: Does the staff think it's in a position to ascertain whether the operating staff know their plant sufficiently well to be given the responsibility for running it?

MR. ROSZTOCZY: Yes.

MR. OKRENT: You don't think you need research on that.

MR. ROSZTOCZY: Right.

MR. OKRENT: Do you think you are in a position to identify what constitutes the necessary capability in the technical supporting group of the licensing organization, or do you need research in that area before you can establish rules or requirements?

MR. ROSZTOCZY: Rules or requirements on the technical supporting staff?

MR. OKRENT: Yes.

MR. ROSZTOCZY: I do not believe that we asked for research in that area but I would have to check on that.

MR. OKRENT: If you don't ask for research that presumably means you know enough here to deal with the matter, or what?

MR. ROSZTOCZY: That we either have enough or it's not a high priority item.

MR. OKRENT: Do you know which of those two it is?

MR. ROSZTOCZY: No, I don't.

MR. OKRENT: Maybe you could find out. Sam, could you follow up on that?

Just one other question. My recollection -- and I may be wrong in this regard so correct me; I won't be embarrassed -- my recollection is that I didn't see any emphasis on what I would call online diagnostic methods. For example, the staff is anxious to have an SPDS but I don't recall seeing a lot of safety parameters.

MR. SIESS: Analyzer.

MR. OKRENT: That's something that is likely to be done at a national lab. It is not something that is likely to be available to the operator in the control room. I don't recall seeing any emphasis, or maybe even mention of, research on what some people call disturbance analysis assistance, which means something that would be online in the control room that might be able to tell the operator what is going on.

A simple example of the service analysis system would tell him that he is saturated and not subcooled, but that's a small piece of the overall plant performance. But that's one little corner. Did I miss it?

MR. ROSZTOCZY: I'm not aware of any in this timeframe.

MR. OKRENT: Does the staff think it's unimportant or what?

MR. ROSZTOCZY: Let us check on that, too.

MR. OKRENT: Okay.

MR. SIESS: Okay, where are we?

(Slide)

MR. ROSZTOCZY: Well, Mr. Chairman, you suggested that we skip human factors.

MR. SIESS: I think so. I think we've got a subcommittee working on that.

MR. ROSZTOCZY: Okay. Then we should go to task 10 which is instrumentation and control. We have two unresolved safety issues in this area; A-47 and A-49. A-47 addresses the control systems involvement in plant safety and A-49 is the pressurized thermal shock that we discussed earlier.

In addition to that, the general design criteria permit a graded approach to the safety function. In other words, this requires that equipment should be qualified according to the safety functions. Up to now, the NRC has basically required that they either have to be qualified or they don't, but we do not have different degrees of qualification. We believe that is needed, and further research should be done in this area to try to establish different degrees of safety-related equipment.

A third area that we are interested in is that digital computers seem to be coming into use more and and possibly will play a bigger role in the future, so we need some research in this area in terms of evaluating the usefulness in the developments in the use of these.

We also have an update of regulatory guides in the instrumentation area and some of the research is being done for the purpose of providing information for those regulatory guides.

MR. SIESS: Zultan, if I look at all of the structures, systems and components of a plant, will the average level of qualification be raised or lowered by a graded approach?

MR. ROSZTOCZY: The graded approach would have the presently-qualified equipment most probably staying the same as it is. It would establish a second level of qualification; a lower level, a less demanding level of qualification and put other equipment into that area.

There is also the possibility that some equipment from the presently more demanding qualification would be degraded to the other ones. It's possible that there would be some in that category.

I think the largest accomplishment would be to have other equipment, like control equipment which presently does not have any qualification requirement, to meet some less restrictive requirements.

MR. SIESS: So it won't raise the average level of qualification, since you really don't know how good that equipment is that you don't have a requirement on.

MR. ROSZTOCZY: For most important equipment, it will probably not change anything. For the next group of equipment it would raise both the requirements and the quality.

MR. SIESS: Are you sure it will raise the quality?

MR. ROSZTOCZY: It would raise the quality in the respect. But if somebody has equipment in that category that was of a lower quality than required, then it would have to be upgraded. So if a given plant today purchases equipment that in such a way it already meets it, it would not raise the quality. If another plant, plant X, did not buy it, then it would result in an upgrading.

MR. SIESS: My point was they don't just automatically go to low quality equipment because it's not "safety-related." Most plants have a desire to have fairly decent stuff in their plant, even though you don't require it.

MR. ROSZTOCZY: In general, yes. However, if you send out a purchase order without specifying certain req_rements for the equipment, then despite the attitude you described, you might end up with something that would not withstand a certain condition.

MR. SIESS: And you might not.

MR. ROSZTOCZY: Yes.

MR. OKRENT: Could you tell me what you think of the research which has been initiated to develop a graded approach?

MR. ROSZTOCZY: They are looking at the various equipment coming into nuclear plants and seeing what equipment should meet some kind of a requirement for what purpose and what those requirements should be.

MR. OKRENT: How are they taking this look?

MR. SIESS: What is the basis for the "should" risk assessment?

MR. ROSZTOCZY: The basis for the "should" of either reliance on that equipment under some circumstances like certain equipment that it would be very helpful to have in case of an accident, like at Three Mile Island. Some of the equipment that was used; in fact, the main cooling method that was used, is not the so-called safety-related cooling method.

So they are looking at equipment that would be useful, very handy to have in the case of a special circumstance like an accident.

The other way is to see what equipment could interfere with the plant operation.

MR. OKRENT: Is this a technical assistance program, or is this in the Office of Research?

MR. ROSZTOCZY: I believe it's in the Office of Research. Jim would like to add something.

MR. WATT: There has been a task initiated to address Class 2E equipment. Now, there is some discussion on whether 2E actually covers the spectrum or is a singular element.

MR. SIESS: Does 2E exist right now?

MR. WATT: No. I will just correct myself. Reg Guide 1.97 actually does a little of this in that it has Category 1 which is equivalent to Class 1E, and then Category 2 which might satisfy most of the requirements for 1E except the redundancy or perhaps not being on a vital bus. In other words, the equipment might be seismically qualified but it might not satisfy the other requirements of class 1E.

MR. OKRENT: You say there is a task? Could you tell me in a minute just what the approach is? I still can't quite tell whether people are going to sort of just sit in a room and use engineering judgment, or there is going to be some kind of a particular analysis as to what --

MR. SIESS: Are you going to qualify for the OBE instead of for the SSE? Give us a hint as to how you're going to decide which equipment, and how do you decide how good it has to be? Or, I hate to say reliable because nobody has introduced that word, but how reliable it has to be.

MR. WATT: I am afraid I will only say I am reporting its existence. My speculation would only add to the confusion that's already there.

MR. SIESS: Does this project already exist?

MR. WATT: Yes.

MR. SIESS: Frank, is this in FY83? Is this in the FY83 budget?

MR. GILLESPIE: It's under instrumentation and control. We're trying to locate what it comes under because it is not a familiar topic.

MR. OKRENT: You see, it's not what I recall from prior discussions of the approach, that research was talking to the unresolved safety issue.

MR. SIESS: I suggest staff could find the project if it exists.

MR. GILLESPIE: It does not appear to exist in our 84 budget.

MR. RAY: Zultan? I don't have a clear idea of the reasons for the graded approach. Your second bullet says that GDC-1 indicates that structures, systems and components should satisfy quality standards consistent with the safety functions to be performed.

Today, a system that performs safety functions is graded safety grade, isn't it? It's classified as such?

MR. ROSZTOCZY: The equipment and systems which are essential for the safe handling of the plant --

MR. RAY: Are graded safety?

MR. ROSZTOCZY: Are safety graded and those would be the 1E category.

MR. RAY: Now, what are you going to do? Do you anticipate that you will downgrade some of those because of the gradation that is going to come out of this development?

MR. ROSZTOCZY: That is not the main goal.

MR. RAY: You're still going to hold that Class 1E?

MR. ROSZTOCZY: Yes. And then establish a second category, 2E.

MR. RAY: In between control and 1E? Is that what you're talking about; something in between?

MR. ROSZTOCZY: Right now we have class 1E and then we don't have anything else.

MR. RAY: The rest can be classified as control.

MR. ROSZTOCZY: The rest can be anything. This would establish a second category. It would specify what equipment would fall into the second category and would specify what are the requirements for those equipment which are in the second category. Typically, control equipment would fall into the second category.

MR. RAY: I see, it's equipment that is not graded now 1E.

MR. ROSZTOCZY: right.

MR. RAY: I wonder if the approach here, from a research viewpoint, will involve significant looks at systems interactions. Is that what you're talking about here, to indicate a need for an in-between grade or a higher grade of control?

MR. ROSZTOCZY: That will play some role in the deciding of which equipment would fall into this category.

MR. RAY: So research would be analytical studies, then.

MR. ROSZTOCZY: Well, one of the major portions would be to establish what should be the criteria for this equipment.

MR. RAY: Yes, but the criteria must come out of some kind of a study or be arbitrarily pulled from the air on the basis of engineering judgment, and in a consultation like Dr. Okrent outlined a while ago.

MR. ROSZTOCZY: This is not new. It was raised a number of years ago. Various people have been working on it. It's my understanding that it has been considered as a possibility under IEEE standards also, in the same way it has been raised within the staff many years ago but it never came to a resolution because there was not enough information to say this is what the criteria should be, these are the reasons for it, this is the equipment that would fall in there.

So the present approach is to, through the research program, provide the means in terms of manpower and funding to look at this problem and bring it to a resolution.

MR. GILLESPIE: We wrote it in the research program, but we don't have the people here to explain what he had in mind when he wrote it in.

MR. GOELLER: But where it is indicated it would be limited to instruments, control and systems. We would not include structures or other components.

MR. SIESS: Where are we?

MR. ROSZTOCZY: We're at 10, instrumentation and control.

MR. SIESS: All right. We're forgetting item 11, and before somebody starts asking questions, this does not include seismic; right?

MR. ROSZTOCZY: We have a separate program on seismic. Task 11 discusses external events. There are various external events. Some of them are called man-related external events and the other ones are outside external events.

Examples of the man related are like gas or aerosol release from accident or man-related events; dispersion of vapor clouds; and, for example, an aircraft impact on a plant. These have not been looked at systematically recently. We feel that there is a need to look at them and see how important these are and how much more, if any, needs to be done in these various areas.

I'm sorry I have to say that does include some seismic events because there is the seismic test listed under this one.

MR. SIESS: Somebody told me a while back that the probability of a small aircraft crashing on a given site was something like 10^{-5} per year. Do you know anything about that?

MR. ROSZTOCZY: Usually, when a plant is licensed, this is one of the issues being looked at, especially if the plant is close to an airport.

MR. SIESS: This wasn't close to an airport, and it was a small aircraft, not a commercial aircraft.

MR. ROSZTOCZY: I would think that the probability strongly depends on whether it's close to an airport or not. I don't know where the 10^{-5} came from.

MR. SIESS: You continue to misunderstand what I said. I was told that the probability of a small aircraft crashing on any plant -- that is, any area in the United States, including this room -- was 10^{-5} per year.

MR. ROSZTOCZY: I do not know where that number came from.

MR. SIESS: That's background. That is probably a little higher than the probablity of a tornado or a turbine missile.

MR. OKRENT: It's probably less dangerous than a tornado.

MR. SIESS: Not less dangerous than a tornado missile.

MR. OKRENT: In other words, if you were unprotected for a tornado --

MR. SIESS: Missile. Well, I am still trying to get somebody to find out what the number is. I was told it is being used in other countries and was applied here. But go ahead.

MR. MOELLER: Well, in terms of external events, I recall that forest fires have been evaluated. But has the smoke, say, a dense cloud of smoke impacting upon a control room, is that commonly evaluated?

MR. ROSZTOCZY: I am not aware of that being evaluated. It would probably be looked at under this program and see if it needs to be evaluated.

MR. MOELLER: But I don't see the words mentioned anywhere -- fires, meaning off-site fires. You mention vapor clouds. Would that include smoke from a fire?

MR. ROSZTOCZY: I assume it would include smoke.

MR. RAY: I think I'm lost in left field. When the staff reviews the adequacy of the ventilation in a control room, don't they review the effectiveness of the type of filters they use for that? And isn't filtration of smoke and that sort of thing out of the air exhausted into the control room, isn't that considered?

MR. ROSZTOCZY: I'm not sure to what extent, what size of a fire is being considered. I'm sure it is being considered for a fire on the site type of thing, but not if you have a forest fire which covers a whole area.

MR. RAY: Your concern is more the capacity of the ventilating system and its filtration.

MR. ROSZTOCZY: Yes.

MR. RAY: And whether or not it is effective for that kind of thing.

MR. ROSZTOCZY: It is, in a sense, if you compare it to earthquakes, and we have certain earthquakes that we design to, and then when we evaluate the risk then we go out to earthquakes far beyond this which have very low probabilities to occur. We see what will be the consequences.

I think we see here that those systems are designed to handle certain fires, but they could be either a much lower probability --

MR. RAY: It's the function of the system.

MR. ROSZTOCZY: Yes.

MR. MOELLER: As I recall, HEPA filters, for example, cannot handle too much smoke. I could be wrong, but it seems I remember that.

MR. ROSZTOCZY: Among the natural phenomena, the seismic event would be considered. Also, flooding, maximum probable flooding and high winds.

(Slide)

The expected accomplishments are shown on the next two slides, and I'm going to skip those and go to the comments.

We have nothing more to add to this, so I have no comment slide on that.

MR. OKRENT: By the way, if the NRC were asked to reduce its research budget by 5 percent, 10 percent, 15 percent, 20 percent, and NRR were given the choice as to where to recommend the cuts be made with no restrictions, just based on what they thought was best for reactor safety, where would they recommend cuts be made, and how, in FY '84-'85?

MR. ROSZTOCZY: We have not done any detailed analysis recently. The best source for this is the Denton to Minogue memo I referenced earlier, which kind of prioritizes these items. I intend to come back to that as soon as I finish these tasks and sum them up. If you have additional questions, maybe that would be the best time to respond to them.

MR. SIESS: Okay.

(Slide.)

MR. ROSZTOCZY: I move on to Item 12 then, which is radiation protection and health effects. We find one area here where there is a need for additional research. This one is the low energy neutron dose. It is our understanding that the present monitoring and detection doesn't pick up low energy neutrons, and therefore it is not included in the monitoring like the other items.

MR. MOELLER: As I recall, the subcommittee had a question, not on the need for this research, but the coordination with DOE, because we heard when DOE reported quite an extensive program which sounded very similar to what the NRC was doing.

MR. ROSZTOCZY: Yes. As you see on our comments, and I just put that slide on.

(Slide.)

MR. ROSZTOCZY: You can find a number of other items in the research program that I did not mention in my first slide, and our feeling is that some of the research programs may be not needed, and in view of possible cuts, this is maybe an area that is ripe for that.

MR. SIESS: Let me understand what these two sheets mean. The first one indicates what you think you need. The second one is things Research is doing that you didn't ask for, and you don't think you need, you don't think they need to do?

MR. ROSZTOCZY: Are you talking specifically about Task 12?

MR. SIESS: Yes.

MR. ROSZTOCZY: The first one indicates the area, and it shows only one area where we think there is a need to perform research in this time frame. The others are comments on some other items which appear presently in the long-range research plan.

MR. SIESS: They didn't get there through NRR. They got there through somebody else? Either Research put them in on their own initiative, or they came from NMSS, or I&E, or Congress?

MR. ROSZTOCZY: Yes. In some cases, I don't know the history specifically. In some cases, it could have come from NRR years ago, and our thinking on it is somewhat different today than it was maybe back years ago when it was researched.

MR. SIESS: I intend to ask Research something like that, and I just wanted to get it clear.

MR. MOELLER: Does yout third bullet on proposed research to improve dose reduction, did you write this before the GAO came out with their report, or after? And if so, does the GAO report influence you in any way?

MR. ROSZTOCZY: Do we know the answer to that, Phil?

MR. COTA: No. This last comment was made independently of the GAO report. Phil Cota.

MR. MOELLER: Does the GAO report have any impact on you?

MR. COTA: I haven't seen the report myself.

MR. MOELLER: Do you plan to obtain a copy and read it?

MR. ROSZTOCZY: Could we ask for a clarification of what GAO report?

MR. MOELLER: Okay. The GAO issued a report just recently. It was released -- well, in a November, 1982, issue of Nuclear News, it stated that it had just been released, and they made a number of recommendations and discussed extensively the increase in collective occupational radiation doses at nuclear power plants.

In other words, they summarized the situation and made recommendations concerning it.

MR. ROSZTOCZY: Thank you very much. As you note from the slide, our comment on this item is that we are not saying there is no need for work in this area, but we feel that this is one of those areas that maybe more appropriately would be done by the industry as opposed to being done by the NRC.

MR. SIESS: Doesn't DOE have something in this area?

MR. ROSZTOCZY: I am sure they have some programs, yes. Maybe the proper statement would be that it would be more appropriately done by other government agencies.

MR. SIESS: Does NRC have health requirements that require some changes? It seems to me right now everybody is meeting the requirements of the law, aren't they?

MR. ROSZTOCZY: Yes.

MR. SIESS: And what you are saying is, as long as they meet the requirements of the law, that is fine?

MR. ROSZTOCZY: Yes.

MR. SIESS: You could encourage research on this by lowering your requirements. That might also shut some plants down.

MR. GOELLER: Does that philosophy that you just espoused, Zoltan, is that your own, or is that NRR's?

MR. ROSZTOCZY: Which philosophy?

MR. GOELLER: That as long as they meet the law, that is sufficient, and implicit in that, I interpret that to say that ALARA is not to be furthered by regulatory efforts.

MR. ROSZTOCZY: It is my understanding that as long as they meet the requirement, especially in terms of individual dosimetry, that is appropriate as far as individuals are concerned. As far as the policy of an organization is concerned, they are supposed to limit it to as low as achievable.

MR. SIESS: Individuals can get up to five rem, but they like to keep the total man rem -- ALARA applies to the total, not the individual.

MR. ROSZTOCZY: Yes.

MR. SIESS: I hadn't thought about it that way.

MR. MOELLER: I don't know that I follow the conversation, because as the GAO report points out, if you try to keep individual worker doses down, you increase the collective dose.

MR. SIESS: He was saying his understanding was that as long as the individuals met the requirement, that was okay, if they work right up to the limit, but ALARA applied to the totals.

MR. MOELLER: I am not sure. In the middle bullet --

MR. SIESS: You are right. If you try to keep individuals down and use more people and less well trained --

MR. MOELLER: That is what the GAO report pointed out. In the middle bullet, does not a certain amount of the work on radio nuclide pathway research, isn't it applicable to waste disposal facilities? I mean, I don't understand the statement.

MR. SIESS: That is NMSS. This is NRR speaking.

MR. MOELLER: And they don't regulate any waste disposal facilities?

MR. SIESS: I don't know.

MR. MOELLER: Who regulates them?

MR. SIESS: NMSS.

MR. WARD: NMSS.

MR. SIESS: And I&E. They are getting a parochial viewpoint. That is all on that item, Dade. Is there anything else you wanted to ask?

MR. MOELLER: No. We had very good subcommittee meetings, several of them, and we are in pretty good shape.

MR. SIESS: Did you hear the same stuff at the subcommittee meeting?

MR. MOELLER: In a different manner, but yes. We spent two two-day subcommittee meetings, not all on this subject, but we heard a good report, and yes, we covered what was discussed here.

MR. SIESS: Okay.

MR. ROSZTOCZY: The last section we are dealing with is Chapter 14 of the report, and that has a number of subitems under it. I would like to comment on three of those. One of them is fire protection. The fire protection area, there is some work undergoing at the present time. We expect to be through by 1983, and we do not foresee additional work on that beyond the '84, '85 area.

The second item is decommissioning. Under this program, there have been a number of reports generated which were written by Battelle Northwest. These are presently being reviewed by the Staff, and we have some comments in that area. We feel that there is a need for a Regulatory Guide for decommissioning surveys, so there is some additional work going on to establish the background information needed to write that guide.

MR. SIESS: What is the name of Task 14 that has so many odd subdivisions?

MR. ROSZTOCZY: I am not sure what the title is, but it probably means everything left out.

MR. GILLESPIE: It is the topical program.

MR. RAY: I think you have left things out of this exhibit, too. I see a 14.5 and it has nothing to do with fire.

MR. SIESS: It is only addressing three items, and two of them he does not have a sheet on.

MR. RAY: Okay. I missed your point.

MR. MOELLER: One major question we had in the subcommittee meeting on decommissioning was the lack by NRC to address the extensive quantities of waste, low-level waste, maybe some high-level, that will be generated as a result of decommissioning, and where you are going to put them, and that is totally then NMSS?

MR. ROSZTOCZY: I think that would fall into that area. Our area would be of establishing any requirement that must be met before a site could be made publicly available.

MR. MOELLER: Fine. Okay. Thank you.

MR. ROSZTOCZY: And then the last item is seismic analysis, which is 14.5, and I do have some slides on that.

(Slide.)

MR. ROSZTOCZY: The NRR needs in terms of the seismic area has been identified in a memo that was issued in April of 1982, and the ACRS has reviewed and looked at these needs in the past, and I believe the ACRS has endorsed them. We have requested the development of a seismic program plan in the longer term for the seismic work, and this one is presently being developed.

As a matter of fact, we have just received a draft of this yesterday from RES, and we will be working together with RES to develop this into a program on the seismic program plan. This SSMRP program, it was one of the ACRS recommendations that this should include a program on boiling water reactors, and we are including some work on boiling water reactors.

In terms of the long-range --

MR. SIESS: Can I ask a question? You say you coordinated it with the PRA methodology program. From something I read, it seems now that the objective of SSMRP is to develop a simplified PRA methodology to take account of effects of seismic PRA's. I also got the impression that there will be, whatever is developed from the Zion study would really only be applicable to pressurized water reactors, and what you do on the BWR thing will then extend that applicability to boiling water reactors. Is that correct, that if you only had what they were doing, your methodology would only be applicable to the PWR's?

MR. ROSZTOCZY: We started out to work on the PWR's first, and we were going to go to the boilers second. Somewhere along the line, in our discussion with RES, we took the position that they should complete the PWR part and spend as much on the boiling water reactor parts as the rest of the program permits. So, it is our expectation that the PWR will be completed, including providing a simplified methodology that could be used in PRA's, and it is our understanding that some of the boiling water reactor work will also be done.

Based on the experience that we gained with the pressurized water reactors, I think we probably will find a way of how to use the boiling water.

MR. SIESS: I agree with you, but that doesn't answer my question. Originally, the SSMRP had something to do with determining seismic margins.

MR. ROSZTOCZY: Yes.

MR. SIESS: And when it looked like all it was going to do was look at the seismic margins for Zion, which was a PWR, we thought that, gee, you ought to look at a BWR. The seismic margins might be different in a BWR. I am not sure they would be, but there wasn't any reason to expect them to be the same.

Now that the objective is not to look at the seismic margins, but to develop a simplified PRA methodology, is there still reason to believe that the methodology would be different for a BWR than it would for a PWR?

MR. ROSZTOCZY: Yes. There are differences between them.

MR. SIESS: Differences that would make the methdologies different?

MR. ROSZTOCZY: Yes.

MR. SIESS: Maybe I don't understand what methodology means.

MR. ROSZTOCZY: When you develop your --

MR. SIESS: You have got fragilities. You have got components. And you are going to guess at the fragilities anyway, whether it is a BWR or a PWR. The earthquake, the structures, the uncertainties, the way they have to be treated are the same.

MR. SHAO: This is Larry Shao. On SSMRP, Livermore has developed a complete methodology for calculating seismic risk. This should be applicable for both PWR's and BWR's, but now, after this methodology has been developed, we are developing a simplified methodology. Right now we are developing a simplified methodology for the PWR.

The simplified methodology for the PWR and BWR may be different because essentially the simplified methodology had to cut down the number of cut sets. For instance, for the complicated methodology, there were four cut sets for the Zion analysis. We wanted to reduce the amount of these sets. But for the BWR and PWR, how we cut down may be quite different for the simplified methodology.

MR. SIESS: I understand that, Larry. Thank you. Are you sure that BWR versus PWR, the only likely difference is, they wouldn't be similar differences between, say, a B&W plant and a Westinghouse plant?

MR. SHAO: There may be some differences there, too. There is some possibility that there may be some differences in the B&W and the CE plant, but the methodology should be applicable to all plants.

MR. SIESS: I understand. Thank you.

MR. OKRENT: Well, one of the things I would question is that it is a complete methodology. I don't think you really meant that, did you?

MR. SIESS: Compared to simplified, it is complete. I am not sure how simplified simplified is going to be.

MR. ROSZTOCZY: Let me continue, then, with the long-term research needs in this area. This includes the generation of different experimental data, validated and improved methods, and we have urged Research to work closely with other governments who are also having significant programs in the seismic area to coordinate our work with them and try to obtain as much information as possible from ongoing foreign research.

The expected accomplishments in '84 and '85 are simplified seismic risk methodology, recommendations of alternatives to the use of peak ground acceleration as an input parameter, benchmarking of soil structure interaction and structural response analysis techniques, and benchmarking of computer codes for buckling analysis of steel containments.

The comments we have to offer is one I mentioned earlier.

(Slide.)

MR. ROSZTOCZY: We are working together with RES to generate the program plan for the seismic research area, and we expect to complete that early next year. That completes this portion of the presentation.

Let me move now to this Harold Denton memo dated December 5th, 1982, to Robert Minogue, which comments on the long-range research plan.

Among other things, it indicated some of the priorities.

MR. SIESS: What was the date on that?

MR. ROSZTOCZY: March 25, 1982.

MR. SIESS: This is just PRA.

MR. ROSZTOCZY: The other one, what was a recent memo on user needs for probabilistic risk assessment methodology, I gave a copy to this gentleman.

MR. SIESS: We have it.

MR. DURAISWAMY: Could I have a copy of it?

MR. SIESS: You are going to start with your low priority items and answer Dr. Okrent's question? His question was, what would you take out? That is where you start.

MR. ROSZTOCZY: The way they are arranged here, there are three groups. There are the high priority items, six items there. Then there are low priority items which are maybe four or five. And then there are items which may be more appropriately done by the industry, and there are a few, three items under that.

MR. SIESS: Do you want to hear the whole list, Dave?

MR. OKRENT: You are the chairman.

MR. SIESS: Okay. Let's start with the low priority items.

MR. ROSZTOCZY: The low priority items are in general those where the research is being performed to confirm licensing practices. Included in this one are research related to occupational ALARA, including base treatment and reduction, contamination and dose estimation.

MR. SIESS: That is all?

MR. ROSZTOCZY: Let me continue. It also includes some research being done toward the application of new sites and for reactors beyond Clinch River and

Fort St. Vrain, and that is it.

Now, the other group that you could call low priority, this is a group which may be our candidates for the industry as opposed to the NRC. In this category, we have development of research such as non-destructive testing techniques to meet NRC acceptance criteria, qualification of research, such as qualification testing techniques to meet the NRC assistance criteria, demonstration research such as demonstration of decommissioning and fuel development techniques.

Those are the low priorities.

MR. SIESS: I suspect if you took all of those out, you wouldn't get up to Dr. Okrent's 20 percent.

MR. OKRENT: You wouldn't get up to my 5 percent, because you are not doing very much on advanced reactors beyond Fort St. Vrain and CRBR in the current budget for '84 and '85. And I don't think you have --

MR. SIESS: ALARA.

MR. OKRENT: -- huge amounts in those others. So I guess I would like to repeat my question. If you had to save 5 percent, 10 percent, 15 percent, 20 percent of the proposed '84 and '85 budget, where would NRR propose to make the savings?

MR. ROSZTOCZY: We would use the same

principles that you heard here in the listing of these, and look at the research programs in the other areas, and see what subtask could be cut out based on these principles, like when it is only confirmatory to something we are doing, or so on, those would be the subject for this, but we have not done it, and I cannot give you a list saying, these are the subtasks we would cut out from the various programs.

MR. OKRENT: Is that a fair question for next month? Mr. Siess has meetings every month.

MR. SIESS: We are going to hear the Research Staff give us maybe 5, 10, and 15 percent levels. You could stick around and argue with them a little bit later.

MR. OKRENT: Okay.

MR. SIESS: Now, I am going to call that part concluded, but we still have Item Task 6, that Mr. Ward and, I think, Dr. Okrent were pursuing before lunch, and I hope we can keep this reasonably short. We still have a fair amount of stuff to hear from Frank Gillespie.

MR. MOELLER: Mr. Chairman, I would like a minute. I find it interesting that occupational doses are put in a very low priority when one reviews the record and sees that the collective doses are increasing at these nuclear power plants at 20 to 30 or more percent per year. It doesn't take anyone too much thought to figure out that if you do not address it this year, you are going to have to address it next year or the year thereafter.

MR. SIESS: Well, somebody will stop backfitting.

MR. MOELLER: Well, I also find it interesting because every time the NRC orders a backfit, one of the predominant considerations is what occupational dose will this entail, and we see in a GAO report that unskilled workers are being used to do jobs that should be done by skilled workers, and why is this being done? It is being done because of the high occupational doses.

So that is my 60-second speech.

MR. SIESS: Okay. One of the days.

MR. WARD: Okay. I know we don't want to spend too much time on this, but this LOCA research remains a big hump. It is a large ticket item. That is what my question is about. What is the NRR's perception of the appropriateness of continued large LOCA research being funded by the NRC?

Now, as I understand the situation, the Appendix K was written several years ago to provide protection for the public against the risk of large break LOCA's in nuclear power plants, and although the requirements of Appendix K were thought to be cons rvative, the agency believed that it had to do confirmatory research to show that indeed the requirements were conservative.

Now, my understanding is, this research has largely been completed, and really, in relationship to other risks of power plants, it has probably been shown as well as it needs to be shown that the Appendix K requirements are conservative.

Now, there is a need for other related research that perhaps needs to be better understood for some regulations for small break LOCA's and dealing with transients, and that seems to me to be a proper function of NRC research, to explore those areas, to see if there is a need for regulations or guides or policies or something being developed for controlling small break LOCA's and transients.

But it seems to me that the work that needs to be done on large break LOCA's is no longer safety-related, but it is work to justify getting out from under the burden of the big, large conservatisms inherent in the application of Appendix K criteria.

My question is, is it really appropriate for the NRC to be funding that sort of research, or is it funding it because it feels so bad about laying these big old conservatisms on the industry that you ought to help the industry to get out of it?

MR. ROSZTOCZY: Yes. The NRC many years ago, back in the Appendix K days, started a relatively large sized research program. The purpose of that was to evaluate the appropriateness of Appendix K and to fill those gaps where information was not available, and this was shown through the hearings which preceded Appendix K.

This program has proceeded and provided a large amount of information by now. That information overall confirms the approach that was taken by Appendix K. It indicates maybe conservatisms in some areas and demonstrates certain phenomena that were not known when Appendix K was established.

Nevertheless, in view of all of this, Appendix K is sufficient in terms of public safety. However, this program has not yet been completed. We are in the phase-down portion of this program, but it is not finished yet. The question then is that in view of that, that the information that has been brought up to date, does this more or less justify the approach that was taken?

The justification is to terminate abruptly the program that we developed, and what we are executing, or is it to finish it and complete it?

It is our view that it should be completed. There have been some surprises in some of the earlier portions of the program. It is not out of the question that there will be some surprises in the later portion of the program also. It is our goal and purpose that if we find in the information that is coming out of the research anything that would indicate that some part of the system or something is unsafe in connection with the large LOCA, then we will take appropriate action.

It is also our goal that when this research information is in hand, if we find that some part of the regulation as it stands is overly restrictive, then to change that also, and we expect to do so when it becomes obvious. We think this can best be done if the program is completed and all the information is on the table so we can make an overall assessment of whether any relaxation of Appendix K is appropriate.

To that extent, we believe that the government has the responsibility, and to spend the government dollars on this research is appropriate. There are, however, quite often questions raised of what else might happen with this information. We do believe, and we hope that this information that has been generated on government programs, that this information will be used by the industry, and it will be used by those who have ECCS evaluation models, and they are going to improve their models through the use of this information.

MR. SIESS: Did you understand that?

(General laughter.)

MR. WARD: I think that is as far as we are going to get.

MR. SIESS: Does the other Dave want to try?

MR. WATT: The funding has been significantly reduced. It is a LOFT consortium now, for instance. The funding went from $45 million a year to ten or fifteen.

MR. SIESS: Eighty-four or '85, I will admit it has been reduced, but '83, the number has gone up a ways.

MR. WATT: And the emphasis on tests are not on large LOCA, but are on small breaks and transients.

MR. BENDER: As I understood it, the LOFT people were willing to provide information on what those tests could be used for. Have we gotten their recommendations?

MR. ROSZTOCZY: They have made recommendations along the lines, and one of the tests we discussed earlier today was, they would put together in a summary type of form what information came out from the LOFT program and how that could be used in the safety evaluation of plants.

MR. BENDER: Are you saying that is something for next year?

MR. ROSZTOCZY: I believe it will be completed in '84.

MR. BEACH: Yes, that is correct.

MR. WATT: But the future experimental program is outlined now. I don't think it is finalized yet. I think it is seven tests over the next three years, beginning with L2-6, which will be on fuel failure.

MR. BENDER: I am not persuaded that we have to wait until next year to get that in. It looks to me like they've got a test program in mind, and they have been running one for some time, and we ought to be able to have that now, a statement as to what the information can and will be used for.

MR. WATT: There are many test results that will come out of LOFT. This program that was mentioned was one of reviewing those and combining them into a smaller quantity, which is more directed toward the identified needs of licensees.

MR. ROSZTOCZY: Dr. Bender --

MR. BENDER: I heard that, but I am not persuaded by the response. The data has been coming out right along, and I just have some -- it bothers me that we have to wait until all the data is out to figure out what it is going to be used for. It just seems to me that that should have been an ongoing process.

MR. ROSZTOCZY: Dr. Bender, that is exactly what it has been. Throughout the years, as new information became available, it was published. It was almost always published in records form. These records were widely distributed, and those reports usually discussed what was learned and how it might affect the safety evaluation of plants. But there is such a large number of these reports that have accumulated throughout the years that right now anyone would be hard pressed to try to look at these and find out altogether what was learned from LOFT and how it was used, because we have asked for, in addition to having these publications produced as we went along, we have asked for summary reports to pool all of this together, and that is the summary report that will be generated in 1984.

MR. OKRENT: I wonder if anyone can identify a specific result that is worth $10 million.

MR. ROSZTOCZY: Ten million dollars? Well, that depends on how you mention the $10 million.

MR. OKRENT: In terms of reducing risk. If we went through generically and tried to find out if we had this information --

MR. SIESS: Gentlemen, I think we have gone about as far as we can today. Thank you, Zoltan.

Gentlemen, may I have your attention for a minute? We have got two categories of items left on the agenda. Research has a lot of things to talk to us about, about three hours' worth, and we don't have three hours. The item about doing the draft report was pure fiction, as far as I was concerned. I didn't even expect to have drafts, although we do have a number of drafts prepared by staff and some of the committee members. We will devote a few minutes to that if we can find it, but next month will be our major thrust on that.

When I made out the agenda and the times on it, I did not realize we had a dinner engagement at 6:45, and I was counting on having another hour on here.

MR. GILLESPIE: Research will endeavor to be brief.

MR. SIESS: Yes. We are going to have a break. I wanted to give you something to come back for.

(General laughter.)

MR. SIESS: Frank Gillespie is going to do most of the stuff on research, and he will keep it brief, if we will permit him. Remember that we will have a chance next month to go over some of this again with writing as a major objective. We think we can make some kind of an arrangement for Bob Minogue next month to explain the exact state of the budget. It will take a closed meeting, but we will try to find a way to close some of the meeting so that he can talk to us and not end up in jail.

We will get as far as we can, and again, I do plan to st p shortly thereafter.

MR. OKRENT: He won't go to jail. It will be Sam.

MR. SIESS: We will put it on the lawyer some way.

Let's take ten minutes now.

(Whereupon, a brief recess was taken.)

MR. SIESS: Okay, Mr. Gillespie has the floor and we'll have him for the next couple of hours at least.

MR. GILLESPIE: Okay. Let me tell you, we've got representatives from each division here, and in all cases but one a division director to answer specific questions as we go through the recommendations.

We cannot talk about numbers. We are going through at least one iteration right now with OMB. They have come back with a mark. We have come back with a comment. And therefore, until the President presents his budget January 19th to the Congress, that information has been barred.

We will try to give you a sense of the office priorities, which were reasonably rapidly established last week as a result of the OMB mark, and in commenting on our return I will give you sizeable pieces to give you a sense where particular chunks of money would come from. Either Minogue or Ross are endeavoring to come in January, when we will supply you in writing with them the exact mark and where it's coming from.

Right now, Bob Minogue spent last week at Livermore, he is going to Oak Ridge this week, and he is going to try to get to PNL in Idaho before he meets with you again. It's almost a FIN by FIN go-over of the entire program to come up with the details of exactly how any reductions might be taken.

Let me dispense with the easy thing first. This year's appropriation bill, the FY '83 appropriations bill, has cleared the Committee in the Senate. It's on the floor for a floor vote. It is in line for a floor vote.

In the House, the appropriations bill has cleared the Bevel Committee, but it is with the Rules Committee. It has not been acted on in any way by the Rules Committee. It's waiting in line and has to go through the Rules Committee before it hits the House floor. There is reasonable doubt that that may not occur by December 15th or December 17th, when Congress chooses to adjourn, and we will be under a continuing resolution going into next year, which means our appropriations bill dies and it goes back to square one and starts in Committee again all over because it's a new Congress.

MR. SIESS: The one that just went through was the authorization for '82?

MR. GILLESPIE: That's the '82-'83 authorization, and that hasn't made it yet. So under our continuing resolution now and anticipated continuing resolution in another week, no new projects will be started and we are strictly funding old projects. In general, that means old FIN numbers. So it's continuations of last year's work.

Overall, since you have seen the '83 numbers last in June we were here, there has been a $3.6 million reduction and we have not distributed that reduction across the decision units yet.

MR. SIESS: '83?

MR. GILLESPIE: '83 total has been reduced by $3.6 million. The exact distribution of that has not been worked out yet, only because, since we haven't been allowed to start new programs, there has not been an immediate press to do that.

MR. SIESS: What was the '83 total?

MR. GILLESPIE: $185.2 million.

Now, the '83 distribution, when we do finally get a bill which will allow us to put new money out, and any DEO money could be greatly affected by what we go to Congress within in '84. There could be a significant impact back into '83 and redirection of funds, holding of the money for some projects, deferral of some projects for another year. The implications of our final '84 mark could be brought back into '83 also.

Now, we have never come and responded, although you have our written response to your comments, or you have our comments on your comments on our budget.

MR. SIESS: We'll get our comments and your comments on our comments.

MR. GILLESPIE: For brevity, I'm not going to use a lot of vugraphs. I'm not going to use any unless I get pressed into it.

I will say that we do have a significant negotiation going on. Your first comment in your report in the budget recommendations was you recommended no change in the total budget. Depending on the result of negotiation, that comment in itself may change, I would think or hope.

Going on to the next, more specific comment, you had recommended a $1.5 million increase for decision unit two, facility operation and safeguards, a half a million dollars for the program on seismic effects in the control room, as discussed in Section 2.5. NRR earlier called this an overemphasis, but we have shifted the half a million down to do that. That was done in the budget that went forward to OMB.

You also requested a million dollars for research and to design against sabotage, which I won't go into any more. Our general position this morning is we are waiting for the safety-safeguards interface task force to come through. NMSS has basically put a hold on concurring as a program area manager for, I guess, reactor security contracts until the results of that task force are in.

Ron Haines, the regional administrator in Region I, is the administrator of that task force. RES is an observer at the meetings and is not, or at least originally was not, invited to participate.

MR. OKRENT: What is the task force suppose to do, do you know?

MR. GILLESPIE: They were established as a result of the Insider Rule going to the EDO -- Carl, did you want to comment on that? I was just going to briefly --

MR. GOLLER: That was established by the EDO in response to a memo from the Chairman in which the Chairman expressed a concern about the possibility of current safeguards, physical security type requirements and the implementation thereof at nuclear power plants on the safety of plants. As indicated in his letter, his concern was the result in particular of plant visits that he and one or more other Commissioners had made to plants, in which they had had a personal opportunity to observe the physical security activities at plants. And he simply asked for a review of any possible unnecessary or unacceptable interaction of that kind that is ongoing.

One of the important aspects of that is the Insider Rule, which incidentally was just on the verge of being submitted to the Commission when that letter came forward from the Chairman. That was then held in abeyance pending a review by this task force, and a recommendation on that Insider Rule package to the Commission will be one of the first actions of that task force.

MR. OKRENT: Okay. That is related to a specific aspect of the sabotage and to a rule that the Staff was considering with regard to access.

MR. GILLESPIE: Yes, vital area designations.

MR. OKRENT: How about the rest of the sabotage question?

MR. GILLESPIE: As I understand it, the entire program has been basically put on hold until this Committee -- until this task force report is in, and then it will be looked at in total.

MR. GOLLER: To the extent that is involved with any possible or actual impact on safety, it comes under that task force's charter.

MR. OKRENT: I see. Well, I wonder if I could explore a couple of points related to sabotage for a minute or two. In the discussion that the Staff had with the Commission on the last ACRS report, it seemed that the Staff didn't in part agree with some of the things that the report attributed to the Staff, and Mr. Minogue did not seem to think that the Staff had anywhere indicated that the existing program was limited by funding limitations and priorities.

I just wanted to -- in case that was the situation or may still be the situation, I will call your attention to page 21 of the attachment to the memo from Minogue to Fraley, subject, "262nd Meeting of the ACRS," on which there's a handwritten date, May 27, 1982, which specifically says this is the concern to which this has been addressed. So there was in fact a statement in writing by the Staff that there was such a limitation.

The other part of this is, one gets the impression from reading the RES response dated August 11, 1982, from Minogue to Shewmon, that RES feels that somehow the work they are doing on safety implementation and control systems and on systems interactions in a general way, whatever that is, because I don't quite know what that is, has a strong bearing on whatever it is they might do in the area of design against sabotage. And that is also the way the comment from the

Staff to the Commissioners themselves went.

I would like to understand better what it is the Staff thinks is involved in these programs that bears on this question, why it is a vital part of this question if it is, when you would get it resolved, and how, if it is a vital part, and so forth. Because as I say, both in the comments of the Commissioners and what you sent to us, you seem to suggest that somehow this was the next place where efforts should be placed and in the meantime you didn't see what else should be done, sort of.

I hope I am not paraphrasing it incorrectly, but I have the documents here if you want to look at them, if you don't have them handy.

MR. GILLESPIE: No, that's true, that's what we said. We did not intend to imply that that was everything that should be done now. We had two things we were looking at, and one is, the funding limitation is, we've got a fixed pot of money. So everything is funding limited, in that if you do more in one place you have to do less someplace else.

No one is telling us or has told us specifically, do not spend money on this thing you've proposed. We have not necessarily proposed a large program in this area.

Our position is that the common cause failure --

MR. OKRENT: The statement is, you are limited -- I couldn't tell what you were just saying.

MR. GILLESPIE: It's not limited by funding in that we were told, you will only spend X number of dollars on safeguards. We were not told that. We were given an office -- we have an office budget. We have a fixed amount of money. If we spend it on safeguards -- it is a judgment call. What do we spend it on? If we spend it on safeguards we don't spend it on something else.

So it is not fair to say that it is not limited by funding. Everything we do is somehow limited by the ultimate pile of money that we have.

MR. OKRENT: But that statement hasn't been made on each item. It was made on the specific item.

MR. GOLLER: If I could try, I think the approach or the philosophy that Mr. Minogue has expressed is that if components, equipment or systems are damaged or fail or become inoperational for any reason, including sabotage, that is only one possible cause. So that for those programs such as the safety implications of control rooms, where the consequences of failures are being investigated in general and generic terms, that has a feedback to safeguards and sabotage.

If a control system fails due to sabotage or for whatever reason, it doesn't care why this has happened. The only thing that is important is that it has consequences. To that extent, these other programs have a feedback into the safeguards concerns and will be considered by the people that are cognizant on safeguards.

MR. OKRENT: I don't want to be harsh, but I find that as unconvincing as about -- you know, everything has some impact on safety and might be involved in sabotage. You have made no direct connection.

In fact, from what I know of the program in research on controls, which is in an early stage, it does not really bear in any important way on any of the sabotage considerations that I have seen in the reports that have been developed or the kinds of things you think about. It is sort of almost -- I hate to say it -- a red herring, in my opinion.

The same goes in the area of systems interaction. The kind of things you are looking for in the area of systems interaction might truly, if you learn about it, jog your memory and say, gee, that was something we missed when we were trying to look at how a guy might sabotage a plant. But it doesn't bear any important relationship to the kinds of things that you yourself and your contractors have studied up to now.

MR. SIESS: Do they need more research on designing in sabotage or do they need to start using what they've got?

MR. OKRENT: I don't know, but what they said was, what we are doing in this area of systems interaction and safety aspects of control rooms, this is important to our sabotage consideration; we have to do this next before we do other things. That is the thing that for the moment I find a little bit unbelievable.

They've put out some good reports, by the way. I think the studies have been done already. I think the past program has not been unproductive. I'm trying to find out where it's going.

MR. SIESS: It seems to me it's possible that the Staff doesn't think you ought to try to design to prevent sabotage, but they've never said that. I haven't seen any indication that they are using the research results to see if you can do it.

MR. GOLLER: There has been research done which addresses specifically that question. It came up with conclusions and recommendations. Those have been --

MR. SIESS: Recommendations to whom?

MR. GOLLER: To the NRC.

MR. SIESS: Has the NRC done anything with them?

MR. GOLLER: That is, the Office of Research has transmitted those to the licensing organization. It is their responsibility to make decisions on the extent to which those recommendations might be implemented, either on existing plants or on new plants, and there is a big difference between the two. There have been studies done, different studies done on each of those two kinds, existing plants and new plants. A separate set of -- although related, a separate set of recommendations were developed.

MR. SIESS: I can't tell from our report. It says, "The Staff states that budget constraints have limited the extent to which they are developing new regulatory policy." Would "they" in that case be NRR or Research? You were quoting from something in this from Minogue.

MR. GOLLER: That would be Research.

MR. OKRENT: But they were also the Office of Standards, if I understand correctly.

MR. SIESS: That's right. Carl just said it's up to NRR.

MR. OKRENT: If you're supposed to develop this, you tell me, because sometimes they say NMSS has the ball.

MR. GILLESPIE: I don't want to get into a finger-pointing game with NMSS. We have transmitted various results to NMSS. NMSS is assigned as the program area manager for safeguards. They are assigned in writing and in the PPG responsibility for putting down what the safeguards policy is for the agency.

MR. SIESS: We talked to them this morning and didn't get anywhere.

MR. GILLESPIE: Any standard rule change which we write first has to have their concurrence. If we get a nonconcurrence on it, every one of them can sit over there in writing. If we get a nonconcurrence, in general it's not done.

MR. OKRENT: I think we need research on how the NRC is organized.

MR. SIESS: Right now I'm not in favor of doing any more research until somebody is willing to use it.

MR. GILLESPIE: And in fact, NMSS stated this morning that they're studying the current information to decide what they would like to do next. Research has earmarked about $300,000 for the sabotage design-related research in '84. Now, whether that does anything or actually gets initiated will greatly depend on our interactions with the NMSS.

MR. SIESS: I think we're finding out where the catch is in this thing.

Okay, let's go on.

MR. GILLESPIE: You recommended the elimination of the experimental program on atmospheric dispersion. Basically, our response back said we intended to finish that in '83, in late '83, and as a minimum early '84.

MR. SIESS: You've got $3.6 million to get rid of in '83.

MR. GILLESPIE: I don't know that our schedule has changed any, and the general indication is there is not $.9 million in there to reduce from atmospheric dispersion right now in '84. So as a result of that comment, no change was made to the budget.

MR. SIESS: What are you reading from, Frank?

MR. GILLESPIE: My handwritten notes and your comments.

MR. SIESS: I'm looking at your response.

MR. GILLESPIE: Yes, our response. I summarized our response to that.

MR. SIESS: Just for me to follow, tell me what section you're on.

MR. BENDER: Is there any money in there in '84?

MR. GILLESPIE: Frank, is there anything at all in there now in '84, meteorology, atmospheric dispersion?

MR. ARSENAULT: I believe there is approximately -- at present there is approximately $400,000 to $500,000 in there, which is directed primarily at using the data we generated earlier.

MR. GILLESPIE: When I go through the prioritization and next month when you see the numbers, this may affect your recommendation significantly.

D was a recommended increase of $3 million for risk analysis. I guess our real comment back was that we feel that we are doing what needs to be done and we feel our disagreement is more over the rate that it is being done at. That is what we discussed with the Commission, and the Commission had your notes and they had our recommendation and they decided to go with ours.

MR. OKRENT: That brings up a point, Mr. Chairman. It seems to me -- Mr. Chairman, it seems to me that it might be worth your thinking about whether, when the Staff interacts with the Commission with regard to what the ACRS has recommended in a report on safety research -- whether it's the one to the Congress or the one to the Commission doesn't matter, really -- whether the current procedure and the way the discussion proceeds is from our point of view one that has adequately had the benefit of whatever reasoning the ACRS had behind its recommendations, because our recommendations remain pretty cryptic. Sometimes we write a paragraph, but --

MR. SHEWMON: But never inscrutable, I hope.

MR. SIESS: Close to it. Sometimes I don't even know what they mean.

(Laughter.)

MR. SIESS: Next month, Dave, we've got something worked out where we are going to get our advice to the Commission in a lot earlier. We haven't gotten all the details worked out, but the Commission wants it earlier so that there can be more interaction, more chance to explain and discuss.

In the past we've waited until everything went to the Commission and we got that in a week before they had to make the decision. And all of that discussion we had a couple of months ago was trying to get that on an earlier schedule, and that will help.

MR. OKRENT: Let me come back to this

discussion I just had on sabotage. If you look at the transcript, which I happen to have, of that part of the discussion between the Staff and the Commission, the points Mr. Minogue raised were what we think would be done, is this business on control systems, and there was nobody there who could raise the question, is that really what you should do or so forth. And I guess nobody working in the Office of Research was going to question what Mr. Minogue was saying, so there weren't going to be two points of view coming in that way.

MR. SIESS: Now, we've got a problem, because our recommendations tend to be somewhat condensed. The Staff gets to talk to the Commission. We get their response back in writing, but we don't have a chance to say, no, you misunderstood us.

MR. OKRENT: Or, what the Staff told you you should disregard.

MR. SIESS: Yes. And all I can say is that next year we have a system that is going to get something to the Commission earlier, and if we can figure out some way of getting some interaction I think everybody would be happier. We are working on it, as you may recall.

MR. OKRENT: It seems to me either we ought to do something where there is a better chance for the

Commission knowing what we thought was important and way, or we ought to devote less effort than we are. This still is a lot of effort and I'm trying to do a cost-benefit balance in my mind.

MR. SIESS: I think we took a step last year that will help. We got our report to the Commission much shorter and tried to only address the areas of disagreement. If we can continue to do that, but expand discussion on the areas where we have concern, it will open the way and we will get it to them earlier.

Now, just how the Commission can interact with the Committee or with individual members we have not worked out. But there is no reason we cannot have a meeting with the Commission after we get something to them. They want more chance for interaction. That is what inspired it.

We talked about that new schedule. Is it in writing?

MR. DURASWAIMY: Yes.

MR. GILLESPIE: We've got it. I guess our basic commitment is we will have the budget to the ACRS and the other offices for review a month earlier than normal. So our budget, at the same time we would give it to the EDO, would be submitted here in May. That was deliberately the Chairman's desire to have more time to review it, to get a more complete report from the ACRS.

MR. SIESS: And since it is the Chairman's budget, the principal interaction can be with the Chairman, which sort of simplifies things a little bit. I think we know what we're trying to do. I think I'm in 100 percent agreement with Dave. Maybe we can be more scrutable, at least on items that have been in there for three years.

The next item -- where are we?

MR. GILLESPIE: On E. There is going to be more discussion. The damaged fuel work is part of the severe accident plan, and the next meeting is December 22nd. It was reduced by the Commission.

MR. SIESS: The 21st, isn't it?

MR. GILLESPIE: Yes.

MR. SIESS: I hope it is, because that's when I'm going to be here.

MR. GILLESPIE: The $500,000 went to seismic design. We recommended an increase of one million dollars for advanced reactors to aid in the development of a regulatory position for post-CRBR LMFBRs. We agreed with this and the Commission has -- we sent a position to the Commission and their silence on that position was taken as a silent affirmation that it was all right to do it.

So in 1984, we anticipate having in the budget a million dollars for post-CRBR LMFBR work and the establishment of licensing criteria.

MR. SIESS: It wasn't in 84; it was in 85.

MR. GILLESPIE: We have it in 84.

MR. SIESS: It wasn't added, though.

MR. GILLESPIE: It wasn't added, but we will do it with what is there. It's not going to be all CRBR work.

The Commission's position that we threw up before saying we couldn't do it has been dispelled, and now we can do it. It is not added funds; it is shifting of the focus of a million dollars.

MR. GILLESPIE: You recommended a million dollar increase in waste management. Our response back was summarized. We wrote back that we thought funds were sufficient at this time, but we will basically remain flexible if NMSS comes to us with a severe research need. We are continuing to talk back and forth with NMSS. The staffs are working very closely together, and there is general agreement on our position within the staff.

MR. SIESS: These were the programs that were taken out.

MR. GILLESPIE: Earlier.

MR. SIESS: Yes. Now this morning, NMSS said they were reasonably satisfied with what they've got.

MR. GILLESPIE: Yes. Something with NMSS on waste management, their budget is about equal to ours. And the perception we are taking, at least in the future, is if we're going to examine our budget, then as an office we have to look at what they are doing and make a judgment on the whole realm of waste management work and compare that to other work we are doing.

So it is definitely integrated in our minds with the TA budget of NMSS, which is about equal. It's about $11 million. It's about equal to our research budget.

One thing I would like to mention. On the LMFBR licensing criteria, we are talking to EPRI. The industry was doing some work in this area and they approached us last week to join them in a jointly-funded program. So we are at least initiating talks with them and that may start this year.

What they were talking about is working on or participating in the industry program on doing a generic LMFBR risk assessment with NRC and DOE and EPRI participating.

Our 83 participation would probably be towards the end of the year and would not be in the million dollar range, but it would be the start of cooperation with them.

In fiscal 85, although this is an 84-85 bill, we do have to go through another appropriations cycle in 85. The Commission acknowledged all of your recommendations for 85 and increased our budget everywhere you said it should be increased for exactly the same amount. And that is still reflected in our 85 budget mark.

NOw, if there are no technical questions for the division members, -- Goeller left. We still have Frank Arsenault here, Joe Murphy is here representing Bernero, and Larry Shao is representing Arlotto. Basically, our budget -- the minor shift, I might say, of a half a million dollars remained exactly as you had seen it in June without significant change.

MR. SIESS: I guess I have a question for Larry. On the containment leakage research -- and I use that term advisedly -- there is a big chunk of money going into containment shall capacity. I'll use that term. You know what I mean. Which I think, at least in the foreseeable future, is probably essential. We have got to get the right questions answered, or even the right questions asked better.

There was some money in 83 for penetration research, and some in 85, but there was nothing in the budget in 84 for work on penetrations. Now, the concern is leakage of the containment and I don't really care where it leaks. And I just still have this gut feeling that it's a lot more likely to leak in one of those things that goes through it than it is for a solid steel and concrete section.

Have you got any idea how you can get the

money to keep the penetration stuff going through 84
rather than have it stop and start up again?

MR. SHAO: Based on your comment, I thought we had a program continuing all the way through. I thought we had money in 84.

MR. SIESS: The budget doesn't show anything for 84 in the figures that I have looked at. The structural staff says they hope to get it somewhere, and I am just wondering how committed you are to getting something on that penetration stuff.

MR. SHAO: We will look it over again. Maybe we should put more into the penetration thing.

MR. SIESS: That would be a last resort. But I think it depends a lot on where the containment is, because some of the questions tie together.

But I think if I had my druthers and I had to cut back some or slow the containment stuff down, I'd do that.

MR. SHAO: I personally believe penetrations are a very important area. One thing we can do is either look at the continuing money or look at the construction money.

MR. SIESS: The containment thing is like two and a half million dollars a year for five years. That is as far out as the budget goes. I don't know whether it goes beyond that or not.

If it turns out that the containment is not a major part of the problem, I would hate to wait too long to find out. I would like to see the penetration stuff moving along fast enough to find out just which is important or if they are equally important to get a balanced program going.

MR. SHAO: I will talk to Dennis about that and get back to you.

MR. SIESS: It's not an awful lot of money, but money is tight.

MR. GILLESPIE: Let me get down to the money is tight problem.

I had originally -- Minogue really wanted to cancel this meeting today because of the significance of our current negotiations with OMB. I did agree with Chet that I would run down -- we did prepare a recomment and the specific terms they could get without feeling they had to compromise or having contractors calling me up tomorrow, given this is an open meeting, saying we are going to cut your program.

Just a brief word on how we came to the priorities. Let me take it in pieces. On the low end of the priorities scale, which would cover $11 to $12 million, given the question that if you were to reduce my budget by $11 or $12 million, the things that would be reviewed and looked at with the most skeptical view would be the fuel cycle research. In general, the research and support of NMSS.

This represents work in reactor and facility engineering, a little work in facility operations, and a couple of million dollars in risk analysis. So the first thing we would be looking at would be fuel cycle non-reactor work materials kinds of things. That, in our minds, would represent something up in the range of $11 to $12 million of our current work. Oh, excuse me, that goes up to $8 million.

The second category is going to be waste management. The exact distribution within waste management would need to be worked out with NMSS. We would look at it as a pool of resources between their money and our money and whatever falls out, period. So fuel cycle and waste management would be about $11 million.

The next item to be severely looked at would be items dealing with siting of new plants. That has been severely reduced in the past. Further reductions are to be anticipated there.

The next place that would be looked at --

MR. OKRENT: How much money is there?

MR. GILLESPIE: The total in there is a million and a half.

MR. OKRENT: Okay.

MR. SIESS: Really what you are saying is that non-reactor --

MR. GILLESPIE: You're shaking your head, Frank.

MR. ARSENAULT: I would just point out that the siting subelement, which contains one and a half million dollars, has projects in it that are relevant to operating facilities.

MR. GILLESPIE: That's true, the socio-economic --

MR. SIESS: What you're saying is you start from the other end, which is not what we asked you to do, and your priorities are operating reactors. That's the PPG guidance.

MR. GILLESPIE: Our first priority is operating reactors, and what I am doing is starting from the low end and working up.

MR. SIESS: Non-reactor stuff and then you're taking out non-operating.

MR. GILLESPIE: Non-operating reactor and then operating. That would raise me up to about $14 million.

The next thing that would be looked at, given the kind of arrangement we are operating at, would be the regulatory analysis function which is currently under Bernero.

MR. SIESS: You had about $11 million before siting. Are you going to get $3 million out of siting?

MR. GILLESPIE: There's $11 million; then I've got -- siting and health-related. Siting and health-related issues. NRR said some things this morning like they didn't like what we were doing in a couple of areas. Depending on the mood of whether we're looking to build up or cut down, I'm sure their comments will be taken in those areas very literally.

The next -- that will get me up to about $14 to $15 million, at which point we really start getting into operational reactor-oriented programs.

The next item -- the last item on the reactor end would be a very hard look at the human factors program that we have underway. What is really research and the research program; what is technical assistance; what would NRR pick up under the technical assistance program, and it would be a joint negotiation working with NRR on what in total between the two of our offices would be done and what would not be done.

Now, they have about a $5 million budget in this area on technical assistance, and we really do have a belief -- Minogue has a belief that many of the projects in human factors are kind of in the grey area, whether it's technical assistance or whether it's research. Some of them are fairly short turnaround items.

MR. WARD: I don't understand that. You're not talking about -- you're strictly looking at the research budget as a separate entity as if the rest of the budget wouldn't be reduced by a similar amount?

MR. SIESS: That's what we're asking him?

MR. GILLESPIE: Yes.

MR. WARD: Is that specific?

MR. GILLESPIE: Yes.

MR. WARD: Okay, if you all say so.

(Laughter.)

MR. WARD: I bet it isn't.

MR. GILLESPIE: My words will make more sense when you get the charts after we get the word from the Executive Branch and they have digested our recomment. I'm not trying to be illusive but I have to be illusive.

MR. SIESS: To stay out of jail.

MR. GILLESPIE: In the human factors, we're looking at the total TA research budget, and the questions between Carl Volmer and Hugh Thompson are if there's a reduction of resources out of this total pool indirectly, indirectly NRR might not take a dollar cut, but there may be a swap-off of projects to make sure the highest priority things continue to get done, given that we got cut and they did not.

MR. WARD: Okay. How long is it going to take you to get down to confirmatory research on large break LOCA? Where's that at?

(Laughter.)

MR. GILLESPIE: That in particular is under negotiations between NRC and OMB, and I just can't talk about that. That was a particular question raised between the two organizations.

MR. BENDER: There's a sentence or two there.

MR. GILLESPIE: Also, LOFT I can't discuss at this time.

As a topical area, it is in negotiations.

MR. OKRENT: You mentioned something called regulatory analysis.

MR. GILLESPIE: Yes.

MR. OKRENT: Remind me what is in that thing, again.

(Laughter.)

MR. GILLESPIE: I was hoping no one would ask that.

MR. OKRENT: It's not in my little write-up here.

MR. SIESS: Where did you mention it in the list you're going over?

MR. GILLESPIE: I think I threw that in.

MR. WARD: He said it, not to be interrupted.

MR. GILLESPIE: Regulatory analysis covers -- they will, in the long run. It's a new branch; it's one of the three branches Bernero ended up with when he organized it down from four branches. They have a systematic and periodic review of the regulations. Their responsibilities include prioritizing the research program on a risk basis.

MR. WARD: Generic issues?

MR. GILLESPIE: Yes. Keeping track of rulemaking, writing and publishing the long-range research plans. Joe?

MR. SIESS: I wonder how much money we could save if we didn't have that long-range research plan.

MR. WARD: Have they provided input to this categorization you are giving us now?

MR. GILLESPIE: Oh --

MR. WARD: If not, I guess we ought to cut them.

(Laughter.)

MR. GILLESPIE: They had not matured but they are attempting. The long-range plan this year is a set of data sheets out to the division directors to get back in. And the final go-around of this -- in fact, this is consistent with what their first cut was. The answer is yes, it is consistent, but no, they weren't involved.

MR. SIESS: See actually, the Commission has said the top priority is operating reactors. Whether that is risk-based or good judgment and common sense I don't know, but at least we are making some use of the PPG.

MR. OKRENT: Okay, that's enough on that for now. That gives me a vague idea.

MR. GILLESPIE: That would get us up in total to about $15 or $16 million. We would probably take several million dollars out of equipment, and anything above, about $17 million is going to be severe accident work; accident evaluation, mitigation, the source term work and cutting into advanced reactors, which is the Bassett responsibility. It's all vested in one division and we are looking at it as one pot of money.

Arlotto's work, the decision was made funamentally not to cut into the engineering work on operating reactors. We would not be cutting into aging equipment qualification. We would not anticipate taking anything away from containment.

As a reverse priority, that is really as specific as I can get for about $17 million, and anything above that we really start getting into -- it would go into severe fuel work.

MR. SIESS: $17 is a little under 10 percent.

MR. GILLESPIE: What would come out of this severe fuel work will be greatly dependent on the adjustments made in the severe accident plan.

MR. SHEWMON: And what will determine that?

MR. SIESS: PBF is what?

MR. GILLESPIE: PBF, NRR, ACRR.

MR. SIESS: PBF is all or nothing? It just costs so much to run it?

MR. GILLESPIE: We've made a commitment on PBF that we will not run it in 84 unless we get foreign funding for it. Our 84 budget does have $4 1/2 million in it for PBF. It takes about $16 million a year to run it. We can't get foreign funding for the rest; the money just runs out.

MR. SHEWMON: Four million will cover your commitments for cleanup for one year?

MR. GILLESPIE: No, that doesn't include any commitments for cleanup. That hasn't been negotiated yet. That is strictly test program.

MR. SHEWMON: Let me ask the question again. There would not be a program, but you do have four million in the budget.

MR. GILLESPIE: Yes.

MR. SHEWMON: If you didn't have a program, you'd be committed to cleanup.

MR. GILLESPIE: That four million dollars would then be diverted to --

MR. SHEWMON: That would be about what you would spend for cleanup?

MR. GILLESPIE: Yes. Once you get the fuel out, you can almost spent as much or as little as you want, depending on how fast you want to clean it up. So yes is the answer.

MR. OKRENT: I would guess that that is not an expensive facility to mothball, and if you mothballed it and decided three years later you wanted to run some other kinds of experiments in it, it would not be the same sort of thing as trying to get the right kind of a crew and all of the kinds of instrumentation --

MR. SIESS: For LOFT, too.

MR. GILLESPIE: It's a more fundamental facility than LOFT. For some small amount we could maintain chemistry and keep the facility in a condition --

MR. OKRENT: TREET could come over and do experiments.

MR. GILLESPIE: Yes, but that four million dollars would be used to either do that or decommission it or terminate the program. Chet, that is really as much as I can say.

We are attempting, if we are forced to face any severe cuts, to take as much as possible in the non-operating reactor areas. We do not anticipate they will give us more than we asked for, so there will be no growth.

MR. SIESS: The advanced reactor stuff didn't get mentioned anywhere there. That is sort of untouchable right now?

MR. GILLESPIE: The advanced reactor -- what had been negotiated with NRR has been reduced by a million dollars because we went the other way and said that a million dollars of that would be for LMFBR work. That is why the advanced reactor stuff wasn't touched. It goes down in 84 anyway to 9.5; two and a half of that is based on congressional commitments, so there is not really --

MR. SIESS: And there are six on CRBR.

MR. GILLESPIE: And as I said, anything of about $8 million would come out of accident mitigation with loss of coolant and LOFT being treated separately.

MR. SIESS: Gentlemen, more questions for Frank while you've got him? He will be back next month, he'll have somebody with him.

MR. GILLESPIE: Yes, it will either be Ross or Minogue ready to talk specifics. Right now, they are still going over a thin list and what should be cut, what will we leave. We're waiting for OMB to come back with their recomment granting or denying it. Anyone who says they know when OMB will come back with their final word is only guessing, so I will not guess. Before January 19th when the President goes to Congress.

MR. WARD: Maybe Sam got it, but on the human factors program you said there could be some shuffling between research and technical assistance programs.

MR. GILLESPIE: Right.

MR. WARD: What is the net delta savings or whatever reduction? I don't think you mentioned that, or I guess I couldn't hear.

MR. GILLESPIE: I kind of lumped it in with the other stuff deliberately.

MR. WARD: You'll have a handle on that?

MR. DURAISWAMY: Yes.

MR. GILLESPIE: I have attempted to discuss this as much as I can with Sam, and there is some fuel cycle work there. That would be a definite cut. The rest is really kind of nebulous. We have our ideas and Minogue is going to visit the labs before any final decisions are made. That's why he's going to Oak Ridge and PNL.

I apologize for having to be so general.

MR. SIESS: That's all right, Frank.

MR. GILLESPIE: It's very awkward and I think you will see what I mean when you see the final charts.

MR. SIESS: It might even be better this way at this stage, anyway, to get the broader picture.

MR. BENDER: I think you've told us about as much as we could have expected, and maybe more.

MR. SIESS: Now you're spoiling our dinner completely. Is there anything else?

(No response).

MR. SIESS: Gentlemen, Sam has passed out to you the drafts that we have. I frankly think the time to go through these afternoon on any basis whatsoever is counter-productive. Some of them are going to get revised by members. The drafts are the staff's drafts and we will have a meeting next month. In the meantime, I hope people will start going through them.

I would like to offer a suggestion. Some of the stuff we put in Part I, and we've got some material in that category now. I think we might tighten up the report to Congress if some of that could be moved back into the Part II and mentioned much more succinctly and with more emphasis if it really affects the budget in Part I. But that is something we can take care of next month.

I think we are going to have some things to say to the Congress about the budget that we do not want to dilute by too much introductory material.

Now, what is missing in Part I will be the section to summarize our recommendations and so forth. So be prepared for that next month. Take this with you and see that the other members get copies tomorrow and Friday, and I think we will manage to have a meeting on the Wednesday preceding the next general meeting, without any planned conflicts. And I hope without any unplanned conflicts.

We have done very well today. We have finished up in a blaze of glory here with a lot of members present. Dade?

MR. MOELLER: It doesn't apply specifically to 84 and 85, but I was reading the comments from Ms. Bouquard on LOFT. Is that the correct pronunciation of the Congresswoman from Tennessee, I guess?

MR. GILLESPIE: Yes.

MR. MOELLER: On the long-range research plan, and I found her comments quite interesting and to the point. Have you people gone through all of those?

MR. SIESS: These are the ones that came out of her committee meeting?

MR. MOELLER: Yes.

MR. GILLESPIE: We have a written reply going back that should be circulating between the Commissioners now. She sent us a letter asking for our reply in writing, and we itemized each of the recommendations.

MR. MOELLER: And if, indeed -- of course, the committee and many others, you and many others testified, so I assumed --

MR. SIESS: We testified, too.

MR. MOELLER: Right. That it could represent -- a proper digest of all of these comments could represent a very good critique.

MR. SIESS: They responded to them. Didn't you?

MR. GILLESPIE: The response is in draft. It's going around the Commissioners now. When it gets their concurrence, then they will send it over under the Chairman's signature.

MR. SIESS: You're getting a lot of good

advice these days. I'm surprised the program isn't a lot better than it is.

(Laughter.)

MR. GILLESPIE: Thirty percent of their comments, though, were on the long-range plan.

MR. MOELLER: Yes.

MR. SIESS: That was the old long-range plan.

MR. GILLESPIE: Yes. And the new long-range plan should be reflective of what their comments were.

MR. SIESS: Anything else, gentlemen? Sam had something to say. The staff would appreciate any comments we have on the long-range plan, although I don't think we're committed to giving any formally.

MR. GILLESPIE: Right. The only commitment is on our part and we will supply it to you, and then the commitment on your part is if you want to tell us something, you can.

MR. SIESS: So we will remind you gentlemen, that if you have any comments on the long-range plan you can provide them to the committee, and we will transmit them to the staff. They will come as input, but we're not going to try to get a committee position on the long-range plan. I think Dade has already sent some in.

MR. DURAISWAMY: Yes.

MR. GILLESPIE: Which were more -- you handed me a copy of that -- it was more telling than you had thought because one of the comments was that many dates appeared that the work would be done --

MR. MOELLER: Right.

MR. GILLESPIE: -- after. Which at least means that having the dates in there is better than it was before because we can get a comment saying that we weren't doing it soon enough. So that was actually a very meaningful comment back to the people that were writing it.

MR. MOELLER: And particularly, I found that if you could, at the beginning of each subject area or subelement, tell us what you've accomplished up to this point, some little listing of the accomplishments to date, then we would sort of know where we go from here.

MR. SIESS: That's in the budget area.

MR. GILLESPIE: Yes. The only reason that was not in there, why we decided not to put a background in was sheer volume. What we were hoping to keep short has already expanded.

Let me just bring it up. That was a telling comment to us because we never had dates in specifically enough for people to comment that way on it.

MR. SIESS: Gentlemen, we ought to have by January 5th --

MR. DURAISWAMY: January 5th is the meeting.

MR. SIESS: That's the meeting we're going to have on this, and we cannot wait until January 4th to have draft 2 of this report. Draft 1 is what I almost called draft 0. So those of you who have responsibilities for chapter sections, et cetera, the deadline is set for draft 2 and the materials that were sent out to you for December 19th. And that is a pretty real deadline because that is just before the Christmas holidays and if they're not in then, we will not have much to look at on January 5th.

MR. SHEWMON: Sam doesn't celebrate Christmas, do you, Sam?

MR. DURAISWAMY: No, I don't.

MR. SIESS: But I only have one section to write. My daughter is going to be away for Christmas, so we're celebrating on the last day of Chanukah.

Gentlemen, the meeting is adjourned. Thank you.

(Whereupon, at 5:22 p.m., the subcommittee meeting was adjourned.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

____

in the matter of: ACRS/Subcommittee on Safety Research Program

Date of Proceeding: December 8, 1982

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.

Jane N. Beach

Official Reporter (Typed)

Jane N. Beach

Official Reporter (Signature)

NMSS

PROGRAM OFFICE ACTIVITIES

AND

RESEARCH NEEDS

NMSS/WM/KNAPP

12/8/82

T1

NMSS RESEARCH SUMMARY

	FY84	FY85
WASTE MANAGEMENT	11.9	12.3
FUEL CYCLE	3.8	5.6
SAFEGUARDS	1.0	2.0
TOTAL	16.7	19.9

DIVISION OF WASTE MANAGEMENT

	FY82	FY83	FY84	FY85
HIGH LEVEL WASTE	7,863	6,300	6,300	6,000
LOW LEVEL WASTE	2,332	2,350	2,150	1,775
URANIUM RECOVERY*	1,287	1,600	1,580	1,420
SUBTOTAL	11,482	10,250	10,030	9,195

OFFICE OF RESEARCH

	FY82	FY83	FY84	FY85
HIGH LEVEL WASTE	5,470	5,248	5,420	5,750
LOW LEVEL WASTE	3,780	4,122	4,130	4,200
URANIUM RECOVERY	2,450	2,730	2,350	2,350
SUBTOTAL	11,700	12,100	11,900	12,300
NRC PROGRAM TOTAL	23,582	22,350	21,930	21,495

*INCLUDES REGIONALIZED RESOURCES

NMSS/WM/KNAPP

12/8/82

AREAS OF RESEARCH - HIGH LEVEL WASTE

WASTE FORM AND PACKAGE PERFORMANCE

SITE SUITABILITY

REPOSITORY DESIGN AND ENGINEERING

PERFORMANCE ASSESSMENT

WASTE FORM AND PACKAGE PERFORMANCE

- WASTE FORM PERFORMANCE
  - STABILITY
  - LEACHING PROCESS
- CANISTER PERFORMANCE
  - OPERATING PERIOD PERFORMANCE
  - LONG TERM DEGRADATION
- PACKING PERFORMANCE
  - ION EXCHANGE CAPABILITIES
  - DEGRADATION
  - MECHANICAL STABILITY

SITE SUITABILITY

- GROUNDWATER FLOW
  - PROCESSES
  - MEASUREMENT
- GEOCHEMISTRY
  - PROCESSES
  - MEASUREMENT
- GEOLOGIC STABILITY
  - PROCESSES
  - MEASUREMENT

REPOSITORY DESIGN AND ENGINEERING

- OPERATIONAL PHASE
  - SYSTEMS IMPORTANT TO SAFETY
  - RETRIEVAL
- POST-CLOSURE PHASE
  - SHAFT & BOREHOLE SEALS
  - ENGINEERING BARRIER PERFORMANCE

PERFORMANCE ASSESSMENT

- GROUNDWATER TRAVEL TIME
  - FRACTURED MEDIA
  - UNSATURATED MEDIA
- COMPLIANCE WITH DRAFT EPA STANDARD
  - RADIONUCLIDE TRANSPORT
  - SCENARIO SELECTION
- SENSITIVITY AND UNCERTAINTY ANALYSES

AREAS OF RESEARCH - LOW LEVEL WASTE

- Licensing
  - Site Suitability
  - Facility Design, Operation and Monitoring
  - Performance Assessment
  - Waste Form and Container Performance
- Regulatory Development
  - Standards Development

SITE SUITABILITY

PRESENT SUPPORT (FY82, 83)

UNSATURATED ZONE HYDROLOGY

*RADIONUCLIDE TRANSPORT IN SATURATED ZONE

*CHEMICAL CHARACTERISTICS OF MIGRATING RADIONUCLIDES

FUTURE SUPPORT (FY84, 85)

RADIONUCLIDE TRANSPORT IN UNSATURATED ZONE

INSTRUMENTATION FOR UNSATURATED ZONE

SITE STABILIZATION AND CLOSURE METHODS

*CONTINUING IN FY84, 85

FACILITY DESIGN, OPERATION AND MONITORING

PRESENT SUPPORT (FY82, 83)

- * TRENCH CAP COVERS
- * MONITORING INSTRUMENTATION
- * SAMPLING AND MONITORING STATISTICS
- * BIOLOGICAL MONITORING

FUTURE SUPPORT (FY84, 85)

ENGINEERED DISPOSAL

*CONTINUING IN FY84, 85

PERFORMANCE ASSESSMENT

PRESENT SUPPORT (FY82, 83)

- ATMOSPHERIC DISPERSION
- BIO-UPTAKE
- BIOENVIRONMENTAL PATHWAY
- *LLW RISK METHODOLOGY
- *SOURCE TERMS OF RADIOISOTOPES

FUGURE SUPPORT (FY84, 85)

- STOCHASTIC MODELING OF FLOW AND TRANSPORT IN UNSATURATED FLOW
- STOCHASTIC MODELING OF FLOW AND TRANSPORT IN SATURATED FLOW

*CONTINUING IN FY84, 85

WASTE FORM AND CONTAINER PERFORMANCE

PRESENT SUPPORT (FY82, 83)

*CHARACTERIZING PROPERTIES OF WASTES AND CONTAINERS

CHARACTERIZING TMI-TYPE WASTES AND SOLIDIFICATION PROCESSES

IN-PLANT SOLIDIFICATION

CHARACTERIZING PROPERTIES OF VOLUME-REDUCED WASTES

*CHARACTERIZING PROPERTIES OF SOLIDIFIED DECONTAMINATION WASTES

*DECONTAMINATION IMPACTS ON WASTE SOLIDIFICATION AND DISPOSAL

FUTURE SUPPORT (FY84, 85)

CHARACTERIZING NON-FUEL CYCLE WASTES AND IMMOBILIZATION PROCEDURES

CHARACTERIZATION AND LONG-TERM PERFORMANCE OF HIGH-INTEGRITY CONTAINERS

TREATMENT OF CHEMICAL AGENTS IN LLW

*CONTINUING IN FY84, 85

STANDARDS DEVELOPMENT

PRESENT SUPPORT (FY82, 83)

*REGULATORY GUIDES

FUTURE SUPPORT (FY84, 85)

*CONTINUING IN FY84, 85

AREAS OF RESEARCH - URANIUM RECOVERY

ASSURE LONG TERM STABILITY OF RECLAIMED TAILINGS

MINIMIZE SEEPAGE AND CONTAMINANT MIGRATION

MONITOR AND CONTROL EFFLUENTS

LONG TERM STABILIZATION OF RECLAIMED TAILINGS

A) PRESENT INVESTIGATIONS

1. Design of rock covers
2. Survivability of rock cover material
3. Vegetation

B) FUTURE NEEDS

1. Methods for predicting effects of long term geomorphic processes
2. Geometry of rock/soil cover design to minimize scour and flow effects
3. Investigation of phenomena leading to desert pavement effects (stable and forms)

NMSS/WM/KNAPP

12/8/82

MINIMIZE SEEPAGE AND CONTAMINANT MIGRATION

A) PRESENT INVESTIGATIONS

1. Effectiveness of liners
2. Dewatering/consolidation
3. Neutralization/restoration

B) FUTURE NEEDS

1. Verified coupled hydrologic/geochemical transport model for tailings/well field contaminants
2. Sand/slime segregation and bottom liner strategies for seepage reduction
3. Quantification of soil heterogeneities affecting retardation
4. Groundwater restoration techniques

EFFLUENT CONTROL AND MONITORING

A) PRESENT INVESTIGATIONS

1. Interim stabilization of tailings
2. Improvement of monitoring measurements and sampling methodologies
3. Radon exhalation

B) FUTURE NEEDS

1. More effective groundwater monitoring/measurement capability
2. Near-background measurement techniques
3. Practical instrumentation for measuring off-site tailings contamination

NRR RESEARCH NEEDS AND REASONS FOR SUCH NEEDS

PRESENTED AT THE DECEMBER 8, 1982 MEETING

OF THE ACRS SUBCOMMITTEE ON SAFETY RESEARCH PROGRAM

BY ZOLTAN R. ROSZTOCZY

TASK 2, PLANT AGING

REGULATORY ACTIVITIES AND USERS NEEDS

- THE INCREASING NUMBER OF OPERATING PLANTS AND THE ADVANCING AGE OF THESE PLANTS BRINGS ATTENTION TO PLANT AGING. AGING CHARACTERISTICS OF STRUCTURES AND COMPONENTS WERE ONLY PARTIALLY KNOWN AND REVIEWED AT TIME OF LICENSING. AN UPDATE IN LIGHT OF PRESENT KNOWLEDGE IS NEEDED.

- IDENTIFY TYPICAL STRUCTURES AND COMPONENTS WHICH ARE SUSCEPTIBLE TO AGING. IDENTIFY AGING MECHANISMS.

- REVIEW CURRENT REGULATORY PRACTICE WITH RESPECT TO AGING REQUIREMENTS. RECOMMEND, IF NEEDED, UPDATED AGING REQUIREMENTS

- RECOMMEND METHODS OF EXAMINATION, TESTING AND EVALUATION TO BE USED TO SHOW COMPLIANCE WITH AGING REQUIREMENTS

EXPECTED ACCOMPLISHMENTS

- REACTOR VESSELS

  - A UNIFIED ELASTIC AND ELASTIC-PLASTIC FRACTURE MECHANICS ANALYSIS PROCEDURE FOR LICENSING EVALUATIONS OF PRESSURIZED THERMAL SHOCK IN PLANTS (FY 1984).

  - EMBRITTLEMENT AND ANNEALING DATA FOR VESSELS BEING REVIEWED UNDER THE SYSTEMATIC EVALUATION PROGRAM FOR LICENSING DECISIONS (FY 1984).

  - COMPLETION OF BENCHMARKS FOR MEASURING AND PREDICTING FLUENCE AND EMBRITTLEMENT USING REACTOR VESSEL SURVEILLANCE CAPSULES (FY 1984).

  - ESTABLISHMENT OF ASTM STANDARD ON CRACK ARREST TESTING SPECIMEN (FY 1985).

  - CONFIRMATION OF K_{Ic} CURVE FOR PRESENT PRACTICE STEELS IN ASME SECTION XI (FY 1985).

- Validation, by large-scale tests, of unified fracture mechanics methodology for licensing evaluation of pressurized thermal shock (FY 1985).

- Proposed licensing criteria and standards for in situ annealing of commercial reactor vessels (FY 1985).

- STEAM GENERATORS

  - Validation of results by current and advanced NDE by examination of removed tubes (FY 1984).

  - Validation of models for licensing evaluation and prediction of stress corrosion cracking (FY 1984).

  - Engineering data on new technologies for controlling coolant chemical impurities (FY 1984).

- Correlation of remaining tube integrity with NDE to validate regulatory guide inservice inspection (ISI) plans and tube plugging criteria (FY 1985).

- Demonstration of generator cleaning and decontamination as basis for action on licensing applications (FY 1985).

PIPING

- Pipe cracking predictive models, proposed fixes, and weld repair criteria evaluated, and development of regulatory positions and licensing criteria (FY 1984).

- Initial findings on toughness of cast stainless steels transmitted to NRR for use in evaluating pipe cracking incidents (FY 1984).

- Regulatory positions and licensing criteria proposed for repair welding and repair of stainless steels (FY 1985).

- Experimental validation for elastic-plastic fracture mechanics analyses completed for use in developing position on leak before break (FY 1985).

- ELECTRICAL & MECHANICAL COMPONENTS - SEE TASK 4
- NONDESTRUCTIVE EXAMINATION
  - CRITERIA FOR NEW LICENSING POSITION ON USE OF ACOUSTIC EMISSION (AE) FOR LEAK DETECTION IN HYDROTESTS (FY 1984).
  - RECOMMENDATIONS FOR IMPROVEMENT OF ASME B&PV CODE, SECTION XI REQUIREMENTS FOR ULTRASONIC INSPECTION OF VESSEL PLATE AND FORGING, FOR ELECTROMAGNETIC METHODS FOR THROUGH-WELD AND STAINLESS STEEL INSPECTION, AND FOR MULTIFREQUENCY EDDY CURRENT TESTING OF STEAM GENERATOR TUBES (FY 1984).
  - CODE ACCEPTANCE OF CONTINUOUS AE MONITORING FOR CRACKS AND VALIDATION LEAK MONITORING BY AE FOR LICENSING USE WHERE CONVENTIONAL METHODS CANNOT BE USED (FY 1985).
  - VALIDATION OF IMPROVED SAFT-UT DETECTION AND EVALUATION METHOD IN FIELD TESTS TO OBTAIN ACCURATE FLAW DATA FOR LICENSING DECISIONS ON THICK SECTIONS, WELDS, AND MULTIMETAL JOINTS (FY 1985).

COMMENTS

- Aging of equipment can more appropriately handled under Task 4, Equipment Qualification.

TASK 3, PRESSURIZED THERMAL SHOCK

REGULATORY ACTIVITIES AND USER NEEDS

- IN PWR-S TRANSIENTS AND ACCIDENTS CAN RESULT IN SEVERE OVERCOOLING OF THE REACTOR VESSEL CONCURRENT WITH REPRESSURIZATION. THE COMBINED THERMAL AND PRESSURE STRESSES COULD CAUSE PROPAGATION OF SMALL FLAWS IN LOW FRACTURE RESISTANCE VESSELS.

- OVERCOOLING OF THE REACTOR VESSEL MAY BE CAUSED BY (1) SECONDARY SYSTEM UPSETS, OR (2) EXCESIVE EMERGENCY CORE COOLANT.

- BASED ON RISK CONSIDERATIONS THE STAFF RECOMMENDED AN RT_{NDT} SCREENING CRITERION - 270°F FOR AXIAL WELDS, AND 300°F FOR CIRCUMFERENTIAL WELDS.

- STAFF PROPOSED CONSERVATIVE METHOD OF ESTIMATING RT_{NDT}. PRESENTED, ALSO, AN OUTLINE OF THE PLANT SPECIFIC SAFETY EVALUATIONS PROPOSED TO BE FURNISHED.

- THE ONGOING PROGRAM TO IMPROVE PROCEDURES AND OPERATOR TRAINING SHOULD CONTINUE.

- MOST PLANTS CAN AVOID REACHING THE SCREENING CRITERION THROUGHOUT THEIR SERVICE LIFE BY TIMELY IMPLEMENTATION OF FLUX REDUCTION PROGRAMS.

- INDUSTRY AND NRC PROGRAMS ARE NEEDED TO:
  - PROVIDE ADDITIONAL CONFIRMATORY PTS INFORMATION
  - DECREASE THE UNCERTAINTY OF CURRENT ANALYSES
  - APPLY THE ANALYSIS TO A B&W, W AND CE PLANT
  - INVESTIGATE THE ALTERNATIVES TO REDUCE PTS RISK

- THESE PROGRAMS SHOULD IMPROVE THE STAFF'S CAPABILITY FOR INDEPENDENT AUDITS AND ASSESSMENT OF LICENSEE EVALUATIONS.

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

- Improved fracture mechanics methodology will be developed under Task 2, including a data base on fracture toughness and crack arrest toughness of irradiated vessel steel and weld metal and improvements in neutron dosimetry and vessel surveillance

- Development of TRAC and RELAP-5 models of representative plants for use in licensing audit calculations (FY 83 and 84)

- Calculation of the temperature and pressure of reactor coolant in the downcomer for use in vessel integrity calculations in the PRA (FY 83 and 84)

- Perform a PRA study to predict the likelyhood of vessel failure due to PTS for Oconee 1, Calvert Cliffs 1 and H.B. Robinson.

- Estimation of the likelihood of reactor vessel failure and the corresponding risk to the public; identification of important sequences, uncertainties, operator actions, and control features;

COMPARISON OF RISK-REDUCTION EFFECTIVENESS OF ALTERNATIVE CORRECTIVE MEASURES, LIKE IMPROVED INSTRUMENTATION AND CONTROL SYSTEMS, HEATING THE ECC AND EMERGENCY FEEDWATER, CHANGING FUEL-LOADING SCHEMES; AND IN SITU ANNEALING OF THE REACTOR VESSEL (FY 84)

COMMENTS

- ACRS RECOMMENDED AN EXAMINATION OF THE MERITS OF PRESSURE REDUCTION AS A CORRECTIVE MEASURE TO AVOID PTS. IT IS THE INTENT OF THIS PROGRAM TO CONSIDER PRESSURE REDUCTION AS ONE OF THE CORRECTIVE ACTIONS.

TASK 4, EQUIPMENT QUALIFICATION

REGULATORY ACTIVITIES AND USERS NEEDS

- GUIDANCE FOR QUALIFICATION OF ELECTRICAL EQUIPMENT WAS DEVELOPED IN 1979 (NUREG-0588, DOR GUIDELINES) A RULE (§ 50.49) AND A REVISION TO REGULATORY GUIDE 1.89 WERE ISSUED FOR PUBLIC COMMENT IN EARLY 1982.

- THE REVIEW OF ELECTRICAL EQUIPMENT QUALIFICATION IN OPERATING PLANTS IS UNDERWAY. SER'S WERE ISSUED.

- GUIDANCE PROVIDED ON MECHANICAL EQUIPMENT QUALIFICATION AND ON SEISMIC AND DYNAMIC QUALIFICATION IS LIMITED TO THE SRP AND IDUSTRY STANDARDS REFERENCED IN THE SRP.

- AN ADVANCED NOTICE OF RULEMAKING COVERING MECHANICAL EQUIPMENT QUALIFICATION AND SEISMIC AND DYNAMIC QUALIFICATION IS IN PREPARATION. A COST-BENEFIT STUDY ON SEISMIC QUALIFICATION IS UNDERWAY.

- Industry and NRC programs are needed to :
  - Investigate synergestic effects and accelerated aging methods.
  - Perform independent verification tests
  - Identify failure modes and provide fragility data for PRA studies
  - Perform realistic cost-benefit analysis
  - Decrease the uncertainty of current qualification methods

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

- Evaluation of the effects of aging, radiation dose rate, chemical environment and synergism to polymers (FY 84)
- Validate accelerated aging and accident simulation methods by examining and testing components removed from nuclear plants (FY 85)
- Determination of failure modes and fragility limits of Electrical Penetrations under accident conditions (FY 84)
- Assessment of the equipment qualification testing methods and sequences (IEEE std. 323) (FY 84)
- Assessment of methodologies given in the standards for the qualification of electric cables and penetrations, motors and electric valves (FY 85)
- Evaluation of criteria to extrapolate pump and valve qualification test results from one size component to another (FY 84)

COMMENTS

- NRR RECOMMENDS A LESS ELABORATE RESEARCH PROGRAM ON EQUIPMENT QUALIFICATION WITH AN ACCELERATED SCHEDULE. FOR EXAMPLE, THE INFORMATION GENERATED ON ELECTRICAL EQUIPMENT QUALIFICATION SHOULD BE AVAILABLE BY THE END OF 1984 IN ORDER TO BE USED IN OUR ONGOING PROGRAM.

- THE EQUIPMENT QUALIFICATION PROGRAM PLAN IS PRESENTLY UNDER MANAGEMENT REVIEW. CHANGES ARE ANTICIPATED ESPECIALLY IN THE MECHANICAL EQUIPMENT QUALIFICATION AND SEISMIC QUALIFICATION PORTIONS OF THE PROGRAM. WHEN THE PROGRAM PLAN IS FINALIZED, THE RESEARCH PROGRAM WILL BE ADJUSTED TO REFLECT THE CHANGES.

- THE PRESENTLY PROPOSED PROGRAM ON COMPONENT AGING OVERLAPS THE AGING PART OF THE EQUIPMENT QUALIFICATION PROGRAM.

TASK 5, SEVERE ACCIDENTS

REGULATORY ACTIVITIES AND USERS NEEDS

- RISK ASSESSMENT STUDIES PERFORMED UP TO DATE INDICATE THAT SEVERE ACCIDENTS ARE THE MAIN CONTRIBUTORS TO PUBLIC RISK.
- THE STAFF RECOMMENDED SEVERE ACCIDENT RULEMAKINGS ON SPECIFIC STANDARD PLANT DESIGNS AND REGULATORY DECISIONS ON CLASSES OF EXISTING REACTORS (SECY-82-1B). PROPOSED SCHEDULE: CE AND GE IN FY 84; WESTINGHOUSE IN FY 85
- AN INTERIM RULE RELATED TO HYDROGEN CONTROL HAS BEEN ISSUED IN TWO PARTS: A FINAL RULE (12-2-81) AND A PROPOSED RULE (12-23-81)
- A RULE WAS ISSUED ON 12-15-82 FOR PENDING CP APPLICATIONS WHICH AMONG OTHER THINGS PROVIDES FOR INCREASED PROTECTION FROM SEVERE ACCIDENTS

- A SAFETY GOAL POLICY STATEMENT HAS BEEN PUBLISHED FOR PUBLIC COMMENT.

- INDUSTRY AND NRC PROGRAMS ARE NEEDED FOR:

  - UPDATING OF PRA METHODOLOGY AND DATA BASE FOR SEVERE ACCIDENT ANALYSIS (SEE ALSO TASK 8)

  - ANALYSIS OF TYPICAL PLANT DESIGNS

  - IDENTIFICATION OF PLANT RISK REDUCTION POTENTIAL: ACCIDENT PREVENTION; ACCIDENT MANAGEMENT, CONSEQUENCE MITIGATION

  - DEVELOPING REGULATORY REQUIREMENTS ON SEVERE ACCIDENTS AND GUIDANCE FOR THE EVALUATION OF SEVERE ACCIDENTS.

  - DECREASING THE UNCERTAINTY OF CURRENT ANALYSES.

- A REGULATORY DECISION ON SEVERE ACCIDENTS IS TARGETED FOR 1984. GOAL: DECIDE WHETHER TO ADD OR MODIFY PRINCIPAL DESIGN FEATURES AND OPERATING GUIDES AND PROCEDURES OF OPERATING PLANTS.

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

A.) ACCIDENT SEQUENCES AND PROBABILITIES

- ADAPT THE UPDATED PRA METHODOLOGY DEVELOPED UNDER TASK 8 FOR USE IN SEVERE ACCIDENT ANALYSIS. CHECK COMPLETENESS OF INITIATING EVENTS, TREATMENT OF HUMAN FACTORS AND COMMON MODE FAILURES (FY 84)

- USE THE COMPUTER CODES DEVELOPED OR IMPROVED UNDER SUB TASK B TO ANALYZE SEVERE ACCIDENT SEQUENCES IN SUPPORT OF SEVERE ACCIDENT PRA STUDIES (FY 84).

- DEVELOP A COMPUTER CODE (MELCOR) WHICH PERMITS DIRECT ASSESSMENT OF THE ENTIRE COURSE OF A SEVERE ACCIDENT (FY 85).

- DEVELOP THE DATA BASE NEEDED FOR SEVERE ACCIDENT PRA STUDIES, INCLUDING INITIATING EVENT AND FAILURE PROBABILITIES, PROBABILITIES OF OPERATOR ACTION, PREDICTION OF ACCIDENT ENVIRONMENTS, SYSTEM AND EQUIPMENT FRAGILITY DATA, CONTAINMENT FAILURE PROBABILITIES, SO ON (FY 84).

B.) PHENOMENALOGICAL GENERIC ISSUE

- ASSES THE BEHAVIOR OF DEMAGED FUEL IN THE 2200°F TO 500°F TEMPERATURE RANGE. DETERMINE THE FISSION PRODUCT AND HYDROGEN RELEASE AND TRANSPORT KINETICS. DETERMINE COOLABILITY LIMITS IN VARIOUS STAGES AND CONFIGURATIONS OF CORE DAMAGE (FY 84).

- PERFORM MULTI-EFFECT IN-PILE FUEL DAMAGE TESTS TO PROVIDE SCOPING DATA ON THE GOVERNING PHENOMENA. (FY 84).

- PERFORM SEPARATE EFFECT EXPERIMENTS ON THE GOVERNING PHENOMENA TO FURNISH A DATA BASE FOR MODEL DEVELOPMENT AND ASSESSMENT (FY 84 AND 85)

- CONDUCT AN INDEPENDENT EXAMINATION OF THE TMI-2 CORE TO OBTAIN BENCHMARK DATA (FY 84).

- DEVELOP COMPUTER CODES FOR DETERMINING COOLABILITY LIMITS AND COOLING REQUIREMENTS OF DAMAGED CORES AT VARIOUS STAGES OF DEGRADATION (FY 84 AND 85).

- DEVELOP COMPUTER CODES FOR PREDICTING CONTAINMENT PRESSURE HISTORIES DERIVING AND FOLLOWING HYDROGEN COMBUSTION (FY 84 AND 85).

- Develop methods of predicting the response and test the survivability of equipment in a hydrogen burn environment (FY 84)

- Obtain data on the consequences of high temperature core fuel debris interaction with (1) the vessel cavity concrete basemat; (2) water present in the cavity or introduced later to the cavity; and (3) mitigating structures and devices (FY 84).

- Use the information obtained above to update and verify existing computer codes. Where needed, develop new models. (FY 84)

- Develop and verify simplified computational models, suitable for use in risk analyses, which adequately represent containment failure modes (containment structural failure, failure of containment at major penetrations, failure of electrical penetrations, faulty valve operation) and performance under severe accident loading (FY 84).

- Apply the knowledge gained under this subtask to the severe accident PRA analysis (FY 84) c.) SOURCE TERM

- Develop experimental data base and verified models for predicting the release, deposition and transport behavior of radionuclides under severe accident conditions (FY 84).
- Conduct experiments on fission product chemistry and on the behavior of aerorols in a conducing steam atmosphere (FY 84).
- Conduct large scale fission product and aerosol transport tests (Marviken) (FY 85).
- Utilize the information obtained from the in-pile fuel damage tests on fission product release to determine the kinetics and quantities of fission product release and depalation (FY 85).
- Develop models for fission product release during core-melt interaction with concrete (FY 84)
- Use the information obtained above to improve and verify fission product and aerosol transport codes (FY 84 and 85).

D.) RISK REDUCTION ALTERNATIVES

- IDENTIFY ALTERNATIVE DESIGN AND OPERATING OPTIONS. PERFORM ANALYSES FOR THE SYSTEMATIC EVALUATION OF THE COSTS AND BENEFITS OF ALTERNATIVE CONCEPTS FOR REACTOR DESIGN AND OPERATION.

- STUDY VARIOUS OPTIONS FOR THE PREVENTION AND MITIGATION OF MITIGATION OF HYDROGEN COMBUSTION, INCLUDING OXYGEN DEPLETION, PRE AND POST-ACCIDENT INERTING, AND HIGH POINT VENTING (FY 84).

- PREDICT THE EXTENT OF REMOVAL EFFECTIVENESS AND DEPLETION OF AEROSOLS AND OTHER FISSION PRODUCTS BY ENGINEERED SAFETY FEATURES (SUPPRESSION POOLS, ICE CONDENSERS, FILTRATION SYSTEMS, CONTAINMENT SPRAYS SO ON) IN REDUCING THE POTENTIAL FISSION PRODUCT ESCAPE FROM CONTAINMENT.

- INVESTIGATE IMPROVEMENTS IN CONTAINMENT DESIGN UNDER BOTH, STATIC AND DYNAMIC PRESSURE LOADS (FY 84).

- EVALUATE VARIOUS OPERATOR ACTIONS WITH RESPECT TO ACCIDENT PREVENTION, MANAGEMENT OF SEVERE ACCIDENTS AND MITIGATION OF THE CONSEQUENCES OF SEVERE ACCIDENTS.

E.) INTEGRATION OF PROGRAM ELEMENTS

- USING THE INFORMATION DEVELOPED UNDER THE VARIOUS PROGRAM ELEMENTS UPDATE AND COMPLETE EXISTING PRA STUDIES FOR FOUR TYPICAL PLANTS (PWR LARGE DRY CONTAINMENT, PWR ICE CONTAINMENT, BWR MARK I CONTAINMENT AND BWR MARK III CONTAINMENT) (FY 84).

- IF THE UPDATING OF THE 4 TYPICAL PLANTS IS SUCCESSFUL, UPDATE THE OTHER 9 EXISTING PRA STUDIES FOR SEVERE ACCIDENTS (FY 84).

- EVALUATE THE UNCERTAINTIES ASSOCIATED WITH SEVERE ACCIDENT RISK ANALYSIS (FY 84).

- PRESENT THE RESULTS OF THE SEVERE ACCIDENT RESEARCH PROGRAM IN TERMS OF:

  - RISK ASSOCIATED WITH SEVERE ACCIDENTS
  - MAIN CONTRIBUTORS TO SEVERE ACCIDENT RISK
  - PLANT RISK REDUCTION POTENTIAL
  - RECOMMENDATION FOR REGULATORY REQUIREMENTS ON SEVERE ACCIDENTS

COMMENTS

- THE SEVERE ACCIDENT RESEARCH PROGRAM IS PRESENTLY UNDER REVIEW BY ACRS, RES AND NRR.—THREE MEETINGS HAVE BEEN SCHEDULED WITH THE ACRS SUBCOMMITTEE.

- THE SEVERE ACCIDENT RESEARCH PROGRAM IS RATHER BROAD, IT INTERFACES WITH MANY OTHER PROGRAMS AND HAS MANY SUBTASKS. GOOD COORDINATION AMONG THE TASKS AND WITH OTHER PROGRAMS IS ESSENTIAL.

- BASED ON THE PROGRAM OUTLINED ABOVE WE EXPECT A REGULATORY DECISSION ON SEVERE ACCIDENTS BY 1984. THE SEVERE ACCIDENT RESEARCH PROGRAM, HOWEVER, IS EXPECTED TO CONTINUE BEYOND 1984. THE CONTINUATION OF THE PROGRAM SHOULD, TO A LARGE EXTENT, DEPEND ON THE RESULTS OF THE FIRST PHASE OF THE PROGRAM AND ON THE ENSUING REGULATORY DECISIONS.

TASK 6, LOCA AND TRANSIENT ANALYSIS

REGULATORY ACTIVITIES AND USER NEEDS

- WHEN APPENDIX K WAS ISSUED NINE YEARS AGO, DUE TO THE LACK OF APPROPRIATE CALCULATINAL MODELS AND SUPPORTING EXPERIMENTAL EVIDENCE, IT INCLUDED (1) A FEW ARTIFICIAL REQUIREMENTS AND (2) A FEW RESTRICTIONS THAT PREVENT THE USE OF NEW INFORMATION. A REVISION OF APPENDIX K IS PRESENTLY BEING PLANNED. SOME OF THE SUPPORTING INFORMATION IS NOW AVAILABLE, SOME ARE STILL UNDER DEVELOPMENT.

- WHEN APPENDIX K WAS ISSUED IT WAS JUDGED TO BE SUFFICIAETLY CONSERVATIVE. ANY RELAXATION OF THE APPENDIX K REQUIREMENTS MUST BE ACCOMPANIED BY AN EVALUATION OF THE UNCERTAINTIES OF THE NEW PROPOSED METHOD AND AN ASSESMENT OF THE SUFFICIENCY OF THE REQUIRED MARGIN.

- THE B & W PWR DESIGN IN SOME WHAT UNIQUE DUE TO THE STEAM GENERATOR DESIGN. IT HAS ITS OWN NATURAL CIRCULATION CHARACTERISTICS, AND BEHAVES DIFFERENTLY UNDER SMALL BREAK LOCA CONDITIONS OR FOLLOWING A STEAM GENERATOR TUBE RUPTURE. ONLY LIMITED INFORMATION IS AVAILABLE FOR THIS DESIGN.

- FOR MANY YEARS THE LOCA WAS IN THE CENTER OF ATTENTION OTHER POSTULATED EVENTS RECEIVED LESS ATTENTION. INFORMATION IS NEEDED TO EVALUATE AND VERIFY THE METHODS AND DATA USED FOR THE EVALUATION OF OTHER EVENTS LIKE STEAM GENERATOR TUBE RUPTURE, PRESSURIZED THERMAL SHOCK, STEAM LINE BREAK AND ATWS.

- CONTINUATION OF THE LOCA AND TRANSIENT ANALYSIS PROGRAM IS NEEDED

  - TO COMPLETE THE DATA BASE FOR LOCA ANALYSIS
  - REDUCE THE UNCERTAINTY OF LOCA CALCULATIONS
  - ASSESS THE UNIQUE FEATURES OF THE B & W DESIGN
  - PROVIDE RELYABLE METHODS TO EVALUATE OTHER TRANSIENTS AND ACCIDENTS
  - PROVIDE INFORMATION FOR THE SEVERE ACCIDENT PROGRAM

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

- DEVELOPMENT OF A DOWNCOMER FLUID MIXING MODEL AND A PRESSURE VESSEL FLUID HEAT TRANSFER MODEL. BOTH MODELS WILL BE VERIFIED BY EXPERIMENTAL DATA (FY 84)
- DEVELOPMENT OF A POST-CHF HEAT TRANSFER MODEL (FY 85)
- EXPERIMENTAL DATA ON FLOW BLOCKAGE AND FLOW DIVERSION DUE TO FUEL SWELLING AND RUPTURE (FY 85)
- EXPERIMENTAL DATA ON STEAM GENERATOR TUBE RUPTURE AND STEAM LINE BREAK TO EVALUATE METHODS CURRENTLY USED FOR PLANT SAFETY EVALUATION, PREPARATION OF EMERGENCY OPERATING PROCEDURES AND OPERATOR TRAINING.
- EXPERIMENTAL DATA ON BWR BEHAVIOR UNDER NATURAL CIRCULATION AND UNDER ACCIDENT CONDITIONS (LOSS OF FEEDWATER, TURBINE TRIP, INTERMEDIATE BREAKS) (FY 85)

- Assessment of information obtained from the LOFT program, including post irradiation examination of fuel bundles, application of LOFT results to various safety issues (FY 85)

- Large scale experimental data on the thermo hydraulic behavior of emergency core coolant during the refill and reflood phases of a LOCA (vessel flow distribution, ECC by pass) (FY 85 and 86)

- Completion of the development of the final version of the TRAC code (FY 84)

- Development of a prototype PWR plant analyzer. The analyzer should run faster than real time, should display plant parameters on terminal controls and should permit user interaction with the calculations, if desired

TASK 7, ADVANCED REACTORS

FAST-BREEDER REACTORS

- The construction permit application of CRBR is under review. Technical support is needed in FY 84 and 85 for the resolution of the following licensing issues:

  - Decay heat removal by natural correction (FY 85)
  - Assessment of the energetics of a core disruptive accident and coolability of the core debris (FY 85)
  - Consequences of complete loss of off site and onsite power (FY 84)
  - Definition of radiological source term (FY 84)

- Development of generic design criteria and regulatory standards for the licensing of LMFBRs as a long-range objective.

GAS-COOLED REACTORS

- NRR'S PRINCIPAL CONSERN IN THE GAS-COOLED REACTOR PROGRAM IS FSV TECHNICAL SUPPORT.

- NRR ENDORSES THE CURRENT FSV SUPPORT PROGRAM, BUT WILL REEVALUATE NEEDS IF OPERATIONS ARE FORECAST TO BE DISCONTINUED AFTER CURRENT FUEL SUPPLIES ARE EXPENDED

- NRR ENDORSES DEVELOPMENT OF GENERIC DESIGN CRITERIA AND REGULATORY STANDARDS FOR THE LICENSING OF HTGRS AS A LONG-RANGE OBJECTIVE.

- Technical support is needed for the resolution of the following issues:

  - Fuel particle integrity during heat up accidents
  - Fission product plate-out and lift-off
  - Evaluation of severe accidents for FSV
  - Application of human factors research for FSV
  - Development of a HTGR safety handbook
  - Graphite failure criteria and failure mechanics
  - Testing of flow mixing and natural connection

TASK 8, RISK ANALYSIS

REGULATORY ACTIVITIES AND USERS NEED

- PROBABILISTIC RISK ASSESSMENT (PRA) IS USED FOR:
  - ESTIMATING PUBLIC RISK (SAFETY GOAL)
  - EVALUATING THE RELATIVE IMPORTANCE OF VARIOUS INITIATING EVENTS AND DESIGN FEATURES
  - REVIEWING DESIGN AND OPERATION OF NUCLEAR POWER PLANTS
- MANY PRAS OF U.S. REACTORS HAVE BEEN MADE.
  - REACTOR SAFETY STUDY (RSS)
  - RSS METHODOLOGY APPLICATION PROGRAM
  - INTERIM RELIABILITY EVALUATION PROGRAM
  - INDUSTRY STUDIES

- PRAs varied in scope, depth and quality. Available PRAs are incomplete in the following areas:

  - Initiating events (External events, PTS)
  - Treatment of common mode failures.
  - Human factors from the aspects of both accident aggrevation and mitigation
  - System interactions
  - Assessment of uncertainties

- An improved PRA methodology is needed. It should be complete relative to the above shortcomings. It should be based on current knowledge (source term, core damage, equipment failures, containment failure etc.)

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

- Evaluate all potentially significant initiating events (external and internal). Select those which are significant contributors to public risk. Assemble a data base for all significant initiating events (FY 84)

- Develop improved PRA models capable of predicting in-plant fission product transport and deposition using latest experimental data on accident phenomenology (FY 84 and 85)

- Perform a systematic identification and evaluation of principal reactor accident sequences (FY 84)

- Incorporate equipment performance in accident environment into the PRA methodology. Develop simple methods for predicting environmental parameters. Collect fragility data on equipment performance in accident environment (FY 84)

- Incorporate human factors research results into the PRA methodology (FY 84)

- Incorporate the results of the seismic safety margin research program into PRA methodology (FY 85)

- Develop a better treatment for identification and quantification of dependent failures. Include dependent failures either by explicit modeling in the fault trees or by parametric modeling (FY 84)

- Evaluate the uncertainties of PRA methods and the supporting data base. Make recommendation for future research aimed at reducing the above uncertainties.

- In cooperation with other research program (like SARP) perform sample calculation to demonstrate the capabilities of the improved PRA methodology.

- Organize and coordinate NRC's activities on PRA method development and data collection, such that the above goals can be accomplished in a timely manner with minimum expenditures and minimal duplication.

COMMENTS —

- A memo on NRR research needs in PRA methodology has been prepared recently (Nov. 30, 1982)

- A program plan for PRA methodology research will be developed jointly by RES and NRR by March, 1983.

TASK 9, HUMAN FACTORS

REGULATORY ACTIVITIES AND USER NEEDS

- HUMAN FACTORS PROGRAM PLAN SUBMITTED TO THE COMMISSION IN NOVEMBER, WILL BE PRESENTED IN DECEMBER

- NRR USER NEED ON PRA METHODOLOGY DEVELOPMENT (11-30-82) REQUESTS IMPROVED CONSIDERATION OF HUMAN FACTORS IN BOTH ACCIDENT AGGRAVATION AND MITIGATION.

- NRR REQUESTED RES TO DETERMINE OPPORTUNITIES FOR AND LIMITATION OF MANAGEMENT STRATEGIES FOR SEVERE ACCIDENTS FROM HUMAN FACTORS STANDPOINT.

- DHFS CONCURS IN LRRP EXCEPT FOR OVER-EMPHASIS ON SEISMIC EVENT AS A PRECURSOR FOR SEVERE STRESS

- DHFS REQUESTS A NEW PROGRAM TO DEVELOP "OBJECTIVE MEASURES OF INDIVIDUAL OPERATOR AND CREW PERFORMANCE IN NUCLEAR POWER PLANT OPERATION". THIS IS NEEDED TO DETERMINE EFFECTIVENESS OF HUMAN FACTOR IMPROVEMENTS SUCH AS CONTROL ROOM DESIGN AND CREW TRAINING

EXPECTED ACCOMPLISHMENTS IN FY 84-85

- HUMAN FACTORS ENGINEERING

  - COMPREHENSIVE DATA BASE REFLECTING THE OPERATOR AND CREW BEHAVIOR IN A VARIETY OF PLANT EVOLUTIONS AND ACCIDENT SEQUENCES (1984)

- LICENSEE PERSONNEL QUALIFICATIONS

  - USING THE SYSTEMS APPROACH TO TRAINING (SAT), CRITERIA SELECTION OF MALFUNCTIONS THAT SHOULD BE MODELED IN NUCLEAR PLANT TRAINING SIMULATORS (1984)

  - EMPIRICAL DATA ON NUCLEAR POWER PLANT OPERATOR PERFORMANCE FROM TRAINING SIMULATOR EXPERIMENTS (1985)

- MANAGEMENT AND ORGANIZATION

  - PERFORMANCE EVALUATION STANDARDS FOR OPERATING AND NEAR-OPERATING PLANTS (1984)

- Performance enhancement guidelines for operating and near-operating plants and evaluation standards for plants undergoing startup (1985)

- PLANT PROCEDURES

  - Methodologies for evaluating generic emergency operating procedure guidelines and operating, maintenance and testing procedures for PWRS and BWRS (1984)

  - Adaptation of computer-based analysis technique for assessment of nuclear power plant procedures presentation based on qualification and abilities of the plant personnel (1984-85)

- HUMAN RELIABILITY

  - Prototype human reliability data bank (1984)

- Human error probability data from operating plants, training simulators, and expert judgement to support selected human reliability analysis (1984)

- Validated computer-based performance model for developing human error data adequate to support selected human reliability analysis (1985)

COMMENTS

MUCH OF THE INFORMATION TO BE GENERATED WILL RELATE TO ACCIDENT MANAGEMENT STRATEGIES FOR SEVERE ACCIDENTS. HOWEVER, SIGNIFICANT PORTIONS OF THIS INFORMATION WILL NOT BE AVAILABLE TO INFLUENCE SEVERE ACCIDENT DECISIONS SCHEDULED FOR EARLY 1984.

TASK 10, INSTRUMENTATION AND CONTROL

REGULATORY ACTIVITIES AND USER NEEDS

- SAFETY INPLICATIONS OF CONTROLS IS AN UNRESOLVED SAFETY ISSUE (A-47). THE RESEARCH PROGRAM IS SUPPLEMENTAL TO BOTH A-47 AND A-49, "PRESSURIZED THERMAL SHOCK."

- GDC 1, INDICATES THAT STRUCTURES SYSTEMS AND COMPONENTS SHOULD SATISFY QUALITY STANDARDS CONSISTENT WITH THE SAFETY FUNCTIONS TO BE PERFORMED. RESEARCH TO DEVELOP A GRADED APPROACH HAS BEEN INITIATED TO SUPPORT PROPOSED REGULATORY GUIDES.

- PROGRAMMABLE DIGITAL COMPUTERS ARE SEEN AS HAVING A USEFUL SAFETY FUNCTION. RESEARCH IS BEING SUPPORTED TO PROVIDE NRR WITH INFORMATION TO SUPPORT EXPECTED LICENSING ACTIONS.

- UPDATE OF VARIOUS REGULATORY GUIDES RELATED TO INSTRUMENTATION AND CONTROL.

EXPECTED ACCOMPLISHMENTS IN FY84 AND FY85

- DEVELOPMENTS TO AUGMENT FAILURE MODES AND EFFECTS ANALYSIS (FMEA) FOR CONTROL SYSTEMS (1984)

- CONTRIBUTIONS TO RESOLUTION OF A-47, "SAFETY IMPLICATIONS OF CONTROLS" (1984)

- CATEGORY 2E FOR EQUIPMENT QUALIFICATION REQUIREMENTS (1985)

- CRITERIA FOR LICENSING EVALUATION OF DIGITAL COMPUTERS (1986)

COMMENTS

- A GRADED APPROACH TO EQUIPMENT QUALIFICATION REQUIREMENTS IS SEEN AS A LONG OVERDUE CONTRIBUTION TO THE LICENSING PROCESS. IT SHOULD PROVIDE MUCH NEEDED CLARIFICATION OF PLANT REQUIREMENTS WITH SIGNIFICANT SAFETY AND ECONOMIC IMPLICATIONS.

TASK 11, EXTERNAL EVENTS

REGULATORY ACTIVITIES AND USER NEEDS

- GASES OR AEROSOLS RELEASED FROM EXTERNAL MAN-RELATED EVENTS COULD ENTER SPACES CONTAINING SAFEY-RELATED EQUIPMENT. LITTLE IS KNOWN REGARDING THE THREAT TO OPERATION OF THIS EQUIPMENT THROUGH CORROSION, CONDUCTION, OR COMBUSTION.

- DISPERSION OF VAPOR CLOUDS IS NOT WELL ENOUGH UNDERSTOOD TO ASSESS THE RISK FROM OFFSITE RELEASES.

- AFFECT OF EXTERNAL MAN-RELATED EVENTS ON PLANT SAFETY THROUGH EFFECT ON PLANT OPERATOR IS NOT WELL UNDERSTOOD.

- UNCERTAINTIES EXIST IN METHODS USED TO ESTIMATE CONSEQUENCES OF IMPACT BY EXPLOSION-GENERATED MISSILES OR AIRCRAFT.

- INFORMATION ON SEISMIC SOURCE ZONES IN THE EASTERN UNITED STATES IS NEEDED.

- An information base is needed for development of means for interpreting high-frequency; high-acceleration earthquake records for use in licensing decisions.

- Methodology is needed for estimating probabilities of extreme floods including the probable maximum flood, so that margins of safety can be assessed.

- Estimates are needed of probabilities of extreme windspeeds for use in PRA's.

EXPECTED ACCOMPLISHMENTS IN FY 84 AND 85

- INFORMATION ON ADVERSE EFFECTS ON SAFETY RELATED EQUIPMENT OF GASES OR AERSOLS FROM EXTERNAL EVENTS.
- INFORMATION ON DISPERSION OF VAPOR CLOUDS FROM OFFSITE RELEASES.
- INFORMATION ON MECHANISMS, TIMES, AND CONSEQUENCES OF OPERATOR INCAPACITATION RESULTING FROM EXTERNAL EVENTS.
- REFINED METHODS FOR ANALYZING IMPACTS OF AIRCRAFT OR EXPLOSION-GENERATED MISSILES.
- AN ASSESSMENT OF THE MARGINS OF SAFETY WITH RESPECT TO EXTREME METEOROLOGICAL PHENOMENA.

TASK 12, RADIATION PROTECTION AND HEALTH EFFECTS

- REGULATORY ACTIVITIES AND USER NEEDS

- THE ABILITY TO MONITOR LOW-ENERGY NEUTRON DOSE IS CURRENTLY LACKING. ADDITIONAL RESEARCH IS NEEDED IN THIS AREA.

COMMENTS

- RES PROPOSED EXPERIMENTAL RESEARCH ON HEALTH EFFECTS OF RADIATION. WE DO NOT QUESTION THE NEED FOR BETTER UNDERSTANDING OF HEALTH EFFECTS, BUT WE QUESTION THE VALUE OF THE RESEARCH PROPOSED. IT IS NOT OBVIOUS THAT THE RESEARCH RESULTS WOULD PERMIT SUFFICIENT REDUCTION IN UNDERTAINTIES IN THE HEALTH EFFECTS OF LOW LEVEL RADIATION TO IMPROVE RULEMAKING AND LICENSING DECISIONS.

- IN VIEW OF THE LACK OF NEW REACTOR APPLICATION ON THE HORIZON, WE QUESTION THE NEED FOR THE RADIONUCLIDE PATHWAY RESEARCH PROPOSED BY RES.

- RESEARCH PROPOSED BY RES TO IMPROVE DOSE-REDUCTION AND HEALTH-PHYSICS-MEASUREMENT TECHNIQUEST SHOULD BE CLOSELY COORDINATED WITH INDUSTRY TO AVOID DUPLICATION OF EFFORT. THE GOAL IS FOR NRC TO ESTABLISH HEALTH AND SAFETY REQUIREMENTS AND FOR INDUSTRY TO DEVELOP COST-EFFECTIVE MEANS TO MEET THESE REQUIREMENTS.

TASK 14.5 SEISMIC ANALYSIS

REGULATORY ACTIVITIES AND USER NEEDS

- NRR USER NEEDS (BOTH SHORT AND LONG TERM) IDENTIFIED IN APRIL 1982 MEMO ACRS HAS ENDORSED THIS DOCUMENT.
- SSMRP WILL DO BWR STUDY AND BE COORDINATED WITH PRA METHODOLOGY DEVELOPMENT PROGRAM. (NOVEMBER 30 MEMO).
- LONG TERM RESEARCH NEEDS EMPHASIZE:
  - RECOGNITION OF SSRMRP'S PROJECTED ACCOMPLISHMENTS, LIMITATIONS AND TERMINATION DATE OF SEPTEMBER 30, 1984.
  - USE OF EXPERIMENTAL DATA TO DEVELOP AND VALIDATE IMPROVED METHODOLOGY
  - DEVELOPMENT OF COOPERATIVE AGREEMENTS WITH INDUSTRY, OTHER GOVERNMENT AGENCIES, AND FOREIGN GOVERNMENTS.

EXPECTED ACCOMPLISHMENTS IN 1984 AND 1985

- SIMPLIFIED SEISMIC RISK METHODOLOGY (1984)
- RECOMMENDATIONS OF ALTERNATIVES TO THE USE OF PEAK GROUND ACCELERATION AS ON INPUT PARAMETER (1984)
- BENCHMARKING OF SOIL-STRUCTURE INTERACTION AND STRUCTURAL RESPONSE ANALYSIS TECHNIQUES (1935)
- BENCHMARKING OF COMPUTER CODES FOR BUCKLING ANALYSIS OF STEEL CONTAINMENTS (1985)

COMMENTS

RES'S LONG TERM PROGRAM PLAN IS IN DRAFT FORMAT AND SHOULD BE AVAILABLE FOR NRR REVIEW SHORTLY.

FUEL CYCLE LICENSING NEEDS

PRIMARY NEEDS

- Transportation Modal Study
- Fuel Cycle Accident Analysis and Risk Assessment
- Dry Spent Fuel Storage

SECONDARY NEEDS

- Health Effects and Radiation Protection

T4

PRIMARY NEEDS

- Transportation Modal Study
  - Increasing numbers of future spent fuel and high-level waste shipments
  - Public perception of hazards from radioactive material transportation
  - Non traceability between current standards and real accident conditions
  - Basis for development of new standards and guides

- Dry Spent Fuel Storage
  - Data base for regulation of low temperature ($<250^{\circ}$ C) dry storage
  - Determine whether relevant licensing concerns exist on the performance of water-logged rods

PRIMARY NEEDS (CONTINUED)

- Fuel Accident Analysis and Risk Assessment

  Accident Analysis

  - Prior to performing risk assessment in FC facilities, need to define major accident scenarios and to develop improved, realistic and verified analysis methods for predicting accident induced releases to the atmosphere

  Risk Assessment

  - Better insight into fuel cycle risks and associated uncertainties
  - Provide tools for rational and consistent safety evaluation of FC facility design and operation
  - Basis for assessing the adequacy of existing standards and guides
  - Basis for development of new standards and guides

SECONDARY NEEDS

- Health Effects and Radiation Protection
  - Number of RES studies, some apply to FCMS others keyed to Reactors

SAFEGUARDS RESEARCH

	PROJECT	FY84	FY85
Reactor SG Licen-ing			
o Protect Against Sabotage by Insider	Vital Equipment Determination Techniques	350	350
o Respond to Sabotage Event	SG Aspects of Human Factors Research	200	200
o Decrease Possible Adverse Impact of Safeguards on Safety	Safety/Safeguards Interface Studies	100	400
o New Safeguards Concepts for Sabotage Protection		250	950
Reactor and Fuel Cycle Safeguards Licensing			
o Respond to Threats	Communicated Threat Assessment Research	100	100
	TOTAL	1000	2000

T5

MAR 25 1982

MEMORANDUM FOR: Robert B. Minogue, Director
Office of Nuclear Regulatory Research

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

SUBJECT: DRAFT LONG RANGE RESEARCH PLAN FY84-88
(LRRP)

This memorandum provides NRR's comments on the draft RES Long Range Research Plan for FY84-88.

The program of research outlined in the LRRP is generally responsive to NRR needs, but the plan would be more useful if it included crosswalks, by problem areas, and if resource estimates were available as foreseen in the Dircks February 3, 1982, memo. Before I can endorse the plan in accordance with the procedures in that memo, I will need to know the approximate level of effort proposed for the various portions of the plan to make cost effectiveness judgments and to assist in refining priorities.

We have reviewed the problem areas of concern to NRR that could benefit from research early in the FY 84-88 time frame, and have identified the following high priority areas:

1. Human Factors research directed toward identifying and developing the scientific basis for licensing requirements and criteria, consistent with the Commission's PPG of 1982.

2. Code validation research to maintain the best-estimate models up to date through such programs as Semiscale, FIST, and separate effects programs.

3. Degraded core accident research, including prevention and mitigation, to support or confirm the staff regulatory actions applied to operating reactors, plants in the staff review process, and new plant applications. See my memorandum dated Feb. 24, 1982 regarding draft NUREG-0900.

2 4. Research into aging of plant structures, systems, and components, including material degradation, valve behavior, flaw detection, maintenance, and inservice inspection.

T12

OFFICE							
SURNAME							
DATE							

5. Risk and reliability methodology development and scenario reassessments, based upon various events that could lead to degraded core conditions, as identified by degraded core research, extreme external phenomenon research, and experience with operating reactors. Risk and reliability methodology should also be applied to identify more clearly the classification of structures, systems and components important to safety.

6. Extreme external phenomena research to the degree necessary to supply reasonable confirmation of staff positions established in applying the NRC safety goal.

B. The following areas have lower priorities in NRR, but should be pursued as resources permit:

1. Research performed to confirm licensing practices. Those tasks in response to operating experience concerns should be given highest consideration.

2. Research related to occupational ALARA, including waste treatment and reduction, decontamination, and dose estimation.

C. Research directed toward applications for new sites and for advance reactors beyond CRBR and FT. St. Vrain, has a low apparent priority at present, since new applications are not expected in the near future. However, in order that the staff will be prepared for interest in advanced reactor designs, we reiterate our request in the 1983-87 LRRP comments that you include a small program identifying the areas where present regulations need to be augmented for future advanced plants and acceptance criteria need to be established.

In a period when budgets are being seriously reduced, we strongly support your efforts toward increased use of joint participation with other agencies and industry and your reviews of the major research programs to assure their usefulness to NRC.

D. Many of the research activities described in the LRRP would appear to be candidates for the industry or agencies other than NRC. Examples are:

1. Developmental research such as non-destructive testing techniques to meet NRC acceptance criteria.

OFFICE ▸							
SURNAME ▸							
DATE ▸							

R. B. Minogue

2. Qualification research, such as qualification testing techniques to meet NRC acceptance criteria.

3. Demonstration research such as demonstration of decommissioning and fuel development techniques.

Additional more detailed comments on the draft LRRP document are provided in the enclosure.

Original Signed by
H. R. Denton

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

DISTRIBUTION COPIES:
Central Files
RSCB r/f
GKnighton
PCota
FSchroeder
SHanauer
HDenton
ECase
RMattson
RVollmer
DEisenhut
HThompson
JFunches

Note: See previous concurrences.*

TMI:PO	CRBR:PO	DST:GP:AD	DST:DIR	PPAS:DIR
BSnyder*	PCheck*	FSchroeder*	SHanauer*	JFunches*
3/19/82	3/19/82	3/18/82	3/18/82	3/17/82

DST:RSCB	DSI:DIR	DE:DIR	DL:DIR	DHFS:DIR	NRR	NRR
PCota:jd*	RJMattson*	RVollmer*	DEisenhut*	HThompson*	ECase*	HDenton*
3/15/82	3/17/82	3/18/82	3/19/82	3/17/82	3/23/82	3/25/82

OFFICE ▶						
SURNAME ▶						
DATE ▶						

OFFICIAL RECORD COPY

DETAILED COMMENTS ON
DRAFT LONG-RANGE RESEARCH
PROGRAM FY 84-88

GENERAL COMMENTS:

1. Resource information is needed for NRR evaluation due to the importance of level of effort in judging cost effectiveness of programs.

2. A summary chapter (and charts) would be helpful in presenting such a large program.

3. The plan should make clear that the NRC PPG 1982 guidance will be followed for consolidation and coordination of programs with industry and other agencies and elimination of marginal programs.

2.0 LOCA AND TRANSIENT

2.1.5 Semiscale

B&W owners groups are performing analysis to evaluate a number of NRC concerns about plant characteristics under off design conditions. Semiscale 2x4 configuration designs are being prepared. If NRC concerns are not resolved by analysis, a joint NRC-industry venture will be pursued.

2.4.5 Code Development and Application

An important point to be raised in this area is that the system codes developed in support of NRR's licensing needs should be user-convenient and should be compatible with different computers. This requirement should be identified in the LRRP.

The need to establish accuracy goals for various calculations should be included to assure that our limited resources are applied only to significant improvements in code accuracy.

4.0 ACCIDENT EVALUATION AND MITIGATION

NRR comments on this area were provided in a memorandum from Denton to Minogue, subject: Initial Review of Nuclear Plant Severe Accident Research Plan (Draft NUREG 0900) dated February 4, 1982. This LWR work should peak in about FY 85 and should drop off to a relatively low level of confirmatory effort by FY 87.

5.0 ADVANCED REACTORS

As directed by the memorandum from Dircks to Minogue and Denton, dated September 24, 1981, the NRR/RES working group recently completed plans for short term research needed for CRBR construction permit licensing. During the course of the CP review we propose the working group also identify that additional longer term research needed for the CRBR operating license. At this time we do not anticipate a need for LMFBR research other than that related to CRBR. Consequently we intend to defer comment on details of the proposed long term LMFBR research program until the NRR/RES working group has completed the plan for CRBR research. We believe that will allow ample time for planning the needed programs in sufficient detail to meet the licensing objectives.

6.0 REACTOR AND FACILITY ENGINEERING

6.1 Mechanical Systems and Components

Mechanical Components

The LRRP should be revised to include research programs in the following specific problem areas in mechanical engineering:

(a) Reactor Internals Confirmatory Dynamic Analyses for BWRs and PWRs
(b) Jet Loads Due To Up-Stream Flow Limiting Effects
(c) Confirmatory Impedance Tests for Essential Piping
(d) High Temperature Effects on Mechanical Components Design
(e) Thermal Shock Effects to Reactor Internals Mechanical Design
(f) Flow Transient and Structural Response Monitoring for Essential Piping

4

Based upon NRR's Equipment Qualification Program, we would expect to phase out the mechanical equipment testing by the end of FY 1987. The LRRP should be modified to identify the availability of results and associate them with the objectives and major milestones of the Equipment Qualification Program Plan.

6.2 Seismic Design Research

4

Based upon NRR's Equipment Qualification Program, we would expect to phase out the Seismic/Dynamic testing program by the end of FY 1987. The LRRP should be consistent with these plans.

6.3 Structures

Experience with an increasing number of structural reviews of nuclear power plant applications suggests the need for standard problems, code benchmarking and development of audit capability to identify the adequacy of the applicant's analysis and design. This need has been identified through staff structural audit of various nuclear power plant designs at the offices of the respective architect and engineers. If new CP applications are anticipated in the FY 84-88 time span, the development of an interactive structural hardware and software system capable of analyzing Category I structures is needed to provide a tool whereby the Structural Engineering Branch can ensure that the structural analyses used by the applicants are correct and that they are being used correctly

6.3.5.2 Safety Of Plant Structures

We agree with the general statements in the LRRP describing the Safety of Plant Structures Program, but the program description should be expanded to include the following:

(a) Review and develop as needed, methods for characterizing loads from earthquakes, flooding, and tornadoes, including the relationship between probability of occurrence, load magnitude, load duration, and other factors which would significantly affect plant response.

(b) Clarify the status of studies on seismic loadings, flooding loadings, and tornado loadings.

The study on load combinations for design of structures considers probabilistically the combination of loads, on a structure, of extreme environmental phenomena, postulated accidents, and normal plant operation. Failure mechanisms are also considered probabilistically.

The LRRP should include an expanded description of the Benchmarking of Containment Pressure Response, so we can determine whether the project meets our needs.

Modeling of soil-structure interaction (SSI) is one of the major problems confronting seismic design and analysis. Research efforts have produced many analytical methods, and disagreements among different methods have been commonly seen. As none of these methods have been benchmarked, data need to be obtained and benchmarking standard problems need to be established.

In the area of geotechnical engineering, specific mention should be made of a need for research with other agencies and the industry on seismically induced lateral movements in embankments. Many nuclear power plants have safety-related facilities founded on dams or embankments. Seismically induced lateral movements have a significant impact to the safety of these facilities. Currently, Newmark's procedure is used to estimate the amount of seismically induced lateral movement. However, a recent report by Franklin and Chang indicates that Newmark's procedure underestimates actual movements. Research is needed to develop a new procedure or to modify Newmark's procedure for estimating seismically induced lateral movements.

6.7 Decommissioning

The Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, November 1980 (NUREG-0586) dismisses entombment as a decommisioning alternative for nuclear reactors because of the long half-lives of certain radioisotopes, such as ^{59}Ni and ^{94}Nb, which accumulate as activation products in the reactor vessel and internals. It has not been established, however, what the residual risk from entombment would be and whether the total net reduction in risk achieved by employing another decommissioning method would be worth the additional costs involved. This work in support of the rulemaking should be included in the LRRP if consistent with the completion of the rulemaking.

6.8 Effluent Control and Chemical Systems

The draft LRRP indicates that the planned FY 83 program includes an evaluation of the continuation of the source term measurement program for additional BWR's, i.e., obtain measurements at more than one BWR. NRR believes that consideration of more than the one unit in 1982 is necessary to provide adequate measurements. It may require two additional BWR's to provide this representative data, thus extending the program into 1984 or later. The results are needed to update NUREG-016, "Calculation of Releases of Radioactive Material in Gaseous and Liquid Effluents from Boiling Water Reactors." Once NUREG-016 is revised, the models used by NRR to calculate radiological effluent source terms for PWR's and BWR's would both be realistic, since they would have been developed from actual experience.

6.9 Qualification of Electrical Equipment

d Based upon NRR's Equipment Qualification Program, we would expect to phase out the electrical equipment testing by the end of FY 84. The LRRP should be consistent with these plans.

7.3 Occupational Protection

Because of the aging of operating reactors accompanied by buildup of radioactivity in the primary system, and the need to keep occupational radiation doses ALARA, plants may require decontamination of their primary systems. RES should include in the FY 84-88 LRRP efforts to closely monitor industry research on the effectiveness and cost of alternative methods for decontamination. This information is necessary for the staff to assess applicant occupational ALARA designs and programs.

9.0 Siting and Environment

9.1 Siting and Environmental Impact

Although relatively low in priority due to new CP application inactivity, the following areas of research should be identified in the long range plan to assure their recognition at the appropriate time.

1) Research on the effects of hazardous chemical releases upon plant equipment.

2) A sensitivity analysis of electricity demand forecasts on our licensing process. Effort is also needed for the maintenance of the ORNL computer model and data base, which is their used for on call computing of use-specific demand projections.

9.2 Earth Sciences

There are several areas of research, the priority of which should be established by their direct application to the current operating plant concerns. These should be specifically acknowledged in the LLRP. These areas are as follows:

Seismology and Geology

1) The Ramapo Fault Zone, in which the Indian Point NPP is located, is subject to frequent, low level seismicity with only a suggestion of a linear trend of epicenters. Recent research indicates two types of faults within the zone, one of which may be related to the seismicity. Detailed research may result in typing the seismicity of these faults. This would be of great significance for the siting of nuclear facilities in the eastern U.S. where it has not been possible to tie earthquakes to particular structures. A test line should be run, using seismic reflection techniques, to determine the feasiblity of determining the geometry of the faults to see if they continue steeply at depth or change to shallow dip. If the signals are clear enough, the program should be extended to include at least two more lines across the Triassic basin. Earthquake monitoring should continue.

2) Nuclear power plants in the Western U.S. are often located in proximity to earthquake-generating faults. In these cases an estimate of the potential earthquake magnitude is needed as one parameter used to develop the seismic design input. The development of fault parameter-earthquake magnitude relationships is a rapidly evolving field.

3) The procedures of site specific response spectra have been used to determine the seismic design input for some nuclear power plants. Very often suites of appropriate site specific records are too few or not available. Simplified techniques for the estimation of site specific spectra from peak or other ground motion parameters are needed.

4) Most nuclear power plants are sited east of the Rocky Mountains. Profound differences in attenuation with those areas in the Western U.S. where data are available make ground motion estimation difficult. It is also becoming apparent that differences in attenuation exist for different parts of the Central and Eastern U. S. Effort is needed to develop regionalized attenuation models for ground motion at different frequencies for different parts of the Central and Eastern U.S. that conform with both theory and available data. Compare and contrast these models with Western U.S. models for relationships. Determine the uncertainty associated with these models.

5) The staff has initiated the use of site specific spectra based upon 50th and 84th percentile of suites of response spectra associated with a given magnitude, distance, and site condition range. An initial study done by LLL should be expanded, taking into account new data and sensitivity evaluations. RES should initiate a project to develop representative site specific spectra for given site magnitude and distance conditions based upon a collection and evaluation of all existing data.

In the area of geotechnical engineering, specific mention should be made of a need for research with other agencies and the industry on seismically induced lateral movements in embankments. Many nuclear power plants have safety-related facilities founded on dams or embankments. Seismically induced lateral movements have a significant impact to the safety of these faciities. Currently, Newmark's procedure is used to estimate the amount of seismically induced lateral movement. However, a recent report by Franklin and Chang indicates that Newmark's procedure underestimates actual movements. Research is needed to develop a new procedure or to modify Newmark's procedure for estimating seismically induced lateral movements.

Health Effects

Coordination with the appropriate agencies is needed to insure that the controversy over the dosimetry for Japanese A-Bomb survivors is adequately investigated and resolved to the point where NRC can use realistic risk estimates. Reference: Memorandum dated June 30, 1981, from G. Beebe, Public Health Service, to D. Frederickson, subject: "Dosimetry for Japanese A-Bomb Survivors".

10. Systems and Reliability Analysis

This section appears to be a very ambitious program and as such does not suggest any clear indication of relaxation in effort through FY 88. There are areas of proposed RES work that, under limited resources, may be reduced through building on IREP/NREP studies rather than performing new independent studies. Some of these areas that may be reduced in effort are the proposed MARK II BWR assessment, the CRBR IREP-like study, and the IREP study for demonstration of PRA application to standard plant designs. We believe that these programs could be more cost effective building on the Limerick MARK II study by Philadelphia Electric, the CRBR update by DOE, and the GESSAR study by GE based upon the NREP procedures.

There is concern about the need for a complete WASH-1400 update. Updating may be accomplished more cost effectively through selective modification. Recognizing that our knowledge of human error, multiple-failure consideration, and extreme-external-phenomena are continually improving, selective modification may be a superior approach.

COMMISSION PAPER
ON FOREIGN DEVELOPMENTS OF INTEREST TO NRC

IN RESPONSE TO DIRECTION PROVIDED BY THE COMMISSION TO THE STAFF IN A MEMORANDUM FROM SAMUEL J. CHILK TO WILLIAM J. DIRCKS ON AUGUST 13, 1982 THE STAFF, UNDER THE DIRECTION OF JAMES R. SHEA, DIRECTOR, OFFICE OF INTERNATIONAL PROGRAMS, HAS CONDUCTED A STUDY THAT ADDRESSES AGENCY-WIDE PROBLEMS IN COVERING FOREIGN DEVELOPMENTS OF INTEREST TO NRC.

BASED ON THIS STUDY, THE FOLLOWING RECOMMENDATIONS ARE IN THE PROCESS OF BEING SUBMITTED TO THE COMMISSION FOR THEIR CONSIDERATION:

1. PROCEDURES WILL BE ESTABLISHED FOR THE ROUTINE REVIEW AND UTILIZATION OF FOREIGN SAFETY INFORMATION IN NRC'S REGULATORY PROCESS.

2. NRC STAFF WILL BE REQUIRED TO PREPARE TRIP REPORTS FOR ALL FOREIGN VISITS AND WRITE SUMMARIES OF ALL DOMESTIC MEETINGS WITH FOREIGN PERSONNEL.

3. CENTRALIZATION AND AUTOMATION OF FOREIGN DOCUMENTATION RECEIVED BY NRC TO IMPROVE THE DISTRIBUTION AND UTILIZATION OF NUCLEAR REACTOR SAFETY INFORMATION GENERATED BY OTHERS.

STATUS: COMMISSION PAPER IS CIRCULATING AMONG THE VARIOUS OFFICES CONCERNED AND WILL SOON BE SENT TO THE COMMISSION FOR THEIR REVIEW. RES CONCURS WITH ABOVE RECOMMENDATIONS.

OFFICE OF NUCLEAR REGULATORY RESEARCH

MAJOR INTERNATIONAL COOPERATIVE AGREEMENTS

AUSTRIA	LOFT PROGRAM
BELGIUM	NUCLEAR SAFETY RESEARCH COOPERATION
FRANCE	GENERAL REACTOR SAFETY RESEARCH AGREEMENT; IN PILE FUEL TESTS, STEAM GENERATOR PROJECT, LOFT NUCLEAR QUALIFICATION OF POLYMER BASE MATERIALS, LMFBR (UNDER NEGOTIATION)
GERMANY	GENERAL REACTOR SAFETY RESEARCH AGREEMENT; 2D-3D REFILL/REFLOOD PROGRAM, LOFT, LMFBR FUEL DISRUPTION EXPERIMENTS, PBF AND HSST
JAPAN	GENERAL REACTOR SAFETY RESEARCH AGREEMENT; 2D-3D REFILL/REFLOOD PROGRAM, LOFT, PBF-NSRR, DEBRIS-BED COOLABILITY STUDIES, SIMMER CALCULATIONS OF FAST REACTOR ACCIDENTS
NETHERLANDS	LOFT, HEAVY SECTION STAINLESS STEEL TECHNOLOGY (HSST), AEROSOL RELEASE AND TRANSPORT RESEARCH, ZIRCALOY FUEL CLADDING COLLAPSE STUDIES
SWEDEN	GENERAL REACTOR SAFETY RESEARCH AGREEMENT; AEROSOL BEHAVIOR AND FILTER SYSTEMS PERFORMANCE RELATED TO VENTED CONTAINMENT SYSTEMS
SWITZERLAND	LOFT PROGRAM AND THE ECCS-REFLOOD PROGRAM, HSST
UNITED KINGDOM	GENERAL REACTOR SAFETY RESEARCH AGREEMENT, LOCA SIMULATION FUEL DISRUPTION EXPERIMENTS, AEROSOL RELEASE AND TRANSPORT, HSST CORE DEBRIS CONTROL STUDIES, PROBABILISTIC RISK ASSESSMENT AND EVALUATION

NORDIC GROUP (DENMARK, FINLAND NORWAY AND SWEDEN)	LOFT PROGRAM COOPERATION, HSST/PBF AND NORDICS GROUP WATER REACTOR SAFETY RESEARCH PROGRAMS
COMMISSION OF THE EUROPEAN COMMUNITIES	GENERAL REACTOR SAFETY RESEARCH AGREEMENT
HALDEN REACTOR PROJECT	AUSTRIA, DENMARK, FINLAND, GERMANY, ITALY, JAPAN, NETHERLANDS, NORWAY, SWEDEN, UK