In its report to Chairman Hendrie on ACRS Activities: May-August 1978; dated August 25, 1978 the Committee stated:

Dynamic Loading Combinations

The Committee has attempted on several recent occasions, including its 218th meeting, June 1-2, 1978, to encourage the Office of Nuclear Reactor Regulation to reconsider the rationale for establishing design basis loadings and loading combinations in performing safety analyses. The ACRS recommends that such a reevaluation be undertaken as soon as possible.

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DR. ISBIN: Will the venting solve this problem? Will that be an acceptable solution or not?

MR. RUSSELL: The venting is a possible solution. If they demonstrate the material compatibility of the B_4C in the spent fuel pool environment. The canning was initially put there to protect the B_4C material. Even though there has been some surveillance ongoing for the last year or so and some testing, which does not at this time indicate a problem, the Staff has not completed its review of the acceptability of B_4C material in a vented condition in the spent fuel pool. We have that under review. There are other designs which are proposing that now that we have not approved.

DR. LAWROSKI: Next topic is that by Mr. Mattson on the basis of combining seismic and other dynamic loads. How long do you estimate your presentation will take?

MR. MATTSON: I hope about 10 minutes, Mr. Chairman.

Your agenda, I think, shows something like an hour for this discussion.

I am not prepared to talk for an hour, so I hope your questions don't run for that length of time.

Back in January the Committee expressed an interest in hearing generally about the question of load combination. I appeared here in February and said that we expected the best way to come at that rather broad question was to try to write a white paper about where, how and why

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we combined loads.

I came down to talk to you in May to give you a status report on where we were on that endeavor. Time was short, so we didn't get that.

I am here to give you essentially the same thing today. The message I have, I am not sure we are coming at the problem in the most efficient manner. I am a little short on resources at this point in time. I have got a lot of activities going on in which load combinations are an important element.

I would like to pose for your consideration today that we treat those particular pieces of our work as they bear on the load combination question, rather than restructuring our work to answer your general question on load combination.

Don't expect an answer now.

What I want to do is walk through the various things going on in the Staff in the generic technical activities program, current licensing activities, topical report reviews, things of that nature, to show you where you are interacting with us now on this question, and then pause and see if we can't reach a collegial judgment that may be the way we are handling it piece by piece is equivalent, that will give us the same answers you were looking for broadly.

Before I list those pieces, I would like to respond in an oral way to the questions you asked, rather than the written way I promised a couple of months ago, to at least give

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us the same basis in terminology and hopefully the same philosophical understanding of the problem we are addressing.

The first question you asked was for us to describe the rationale by which various dynamic loads are or are not combined.

Let me speak to the policy or philosophical reasons for combining loads. As the people on the Staff talk among themselves and read documents from the past, and interpretation of general design criterion 2 as they exist today, there seem to be two reasons for combining loads.

One I will characterize as the need to provide some measure of margin to failure of equipment and structures. That is, the requirement in general design criterion 2 to combine loads appropriately, in the words of the general design criterion.

Some people say and some document support were provided to provide a qualitative measure of margin to failure.

There is another school of though that says, the second reason for combining loads. The second reason I will characterize with some shorthand words by saying people were concerned in the days that general design criterion 2 was issued about the undetected flaw causing a failure during the design earthquake, leading to the loss-of-coolant accident. That is, a concern with the possible simultaneity of events.

I would like to pause and note, simultaneity of events

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is another interesting way to come at the combined loads question. As we have looked at your question and talked among ourselves, we realize that we combine loads by combining events and sometimes we combine events by combining loads.

An example of the former, we combine events which leads us to combine at least conditions. That example would be the requirement that the equipment designed to mitigate the fuel handling accident in the auxiliary building must be safety grade equipment and the definition of safety grade means in part that it has to have seismic qualifications. So, we have combined events in that case by a rather indirect route, which leads to a combination of severe conditions for equipment. That is the design of that equipment.

On the other hand, the example where we combine loads, which, in effect, leads to a combination of events, is the LOCA, plus SSE. One might argue that the reason you combine LOCA and SSE loads is to provide margin to failure for the safety grade equipment, but as I explained earlier that leads to a presumption that, in fact, what you are doing is combining events, the seismic events and the LOCA which some people say, yes, that is the reason we required them to be combined in the beginning, in the undetected flaw argument.

So, with those two philosophical policy level reasons, we combine loads and we combine events. When we combine them, we have done various, we have accepted various ways of combining

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loads. Combining loads is a rather long way to say it, too, but we do, when we are looking at the structural capability of a piece of equipment, we are combining responses. What we have arrived at today is a position that says, when you can show a time-phasing relationship between multiple dynamic loads, you can use that time-phasing relationship in the combination of those loads, which is essentially the same thing as saying, if you have a basis for separating them you need to combine them. If you have no basis for separating the effects, and that is usually the case with rapidly varying dynamic loads when you combine the SSE and the LOCA, then you must superimpose the loads in time and decide upon a mechanism for adding the peak. One way that is clearly acceptable to us is the absolute or linear summation of the peaks.

That is, the peak responses of the equipment.

The people that proposed, and those people are numerous, most of the industry, that other methods of combination provide appropriate margin, borrowing on the words of the general design criterion 2, one such method is sum root sum of the square, SRSS.

The only proposal for the use of SRSS are those instances where a time-phasing relationship cannot be shown between the loads, or among, if they are multiple in nature, and when the loads are rapidly varying in nature.

Now, General Electric, I guess, is about one step

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ahead of everybody else in arguing the case for SRSS.

I think the last time I was here, we noted that a number of you have heard the General Electric presentations on SRSS. I will get back to that in a moment.

But it is safe to say that the arguments are not physical in nature. They are highly mathematical in nature. I think if you do as I have done, which is, go back to my somewhat advance textbooks on dynamic loads you will find that it's been traditional engineering practice for some time to say that if you have a test of how rapidly varying superimposed dynamic loads actually add on one another, then you must either use absolute summation of the peaks or make some space argument, that is, how certain do you want to be that they don't absolutely

That is the essence of the General Electric presentation as it stands today. That is, if you combine rapidly varying dynamic loads of the following nature by SRSS then there is some probability, which is the minimal analysis, which is amenable to analysis, that you will exceed the combined level by a certain amount, and it is possible to relate the exceedance to the characterized margin in structures, and derive a probability of exceeding the capability, structural capability of the equipment.

It is the essence of the GE argument.

Others have made it. Westinghouse has made it. We are not as far along in the review. Beck 's talking

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on the subject but not quite making the same argument. I will drop that discussion and come back to it in a minute.

DR. SIESS: Is that a different argument than the one for using SRSS in combining modal responses and things we do elsewhere in the process?

MR. MATTSON: I have looked at it more costly and become more sophisticated in understanding exactly what we get when we combine things that way. It is essentially the same mathematical argument. That is, randomly varying dynamic loads which you can't physically relate in time to one another.

You know, they are occurring at the same time, so what's the likelihood of exceedance of various loads, arrived at by various ways of combining them, but we do use SRSS in the way you describe.

I don't think, as I understand the history of how we got to that point for combining the modal responses that we looked at it in as much detail as we have looked at this.

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DR. SIESS: Well, it has been used in the structural field for many years now.

MR. MATTSON: Yes. We in regulation, not we in engineering.

I want to mention, there were three other questions you asked in a subsequent letter in February, having to do with the single-failure criterion and its relationship to the combination of multiple dynamic loads. We are not quite sure we understand that question, but we think you must be referring to the somewhat novel approach to the use of non-safety grade equipment to meet the single-failure criterion in the event of a main team line break outside containment. Where under the traditional approaches inside containment one would say all mitigating equipment for the loss of coolant accident must be seismically qualified, whereas outside the containment for the main steam line break, we have said the same thing.

But when you add the single-failure criterion, if the safety grade equipment is not sufficient, then you may rely upon non-safety grade equipment to perform its normal funcation. That is, assume it has survived.

That subject has been discussed at some length with you, as I understand it, a year or so ago in connection with the safety issues raised by members of the staff.

Basically, the single-failure criterion is a measure of reliability of equipment, and the combined loadings

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requirement is a requirement which speaks to the overall goodness of that equipment. So one says, this is my design basis; and the single-failure criterion, on the other hand, says, even if it is my design basis, I know that there is some unreliability of equipment, no matter what its design, and I will account for that unreliability for the single-failure criterion.

If that answers your question, fine. If not, I need some further elucidation.

Finally, the use of SRSS instead of absolute sum. I will talk in a minute about a more definitive proposal for speaking to that question.

A related question is why we assume that the primary system fails during a seismic event. That is, we combine LOCA and seismic, but that other category 1 equipment functions. I think the best answer I can give to that I have just spoken to. That is, that dichotomy in the logic people say has been recognized from the beginning, but it is the very dichotomy that is the reason for combining in some people's minds. That is the undetected flaw in the otherwise seismically designed and capable equipment.

And, of course, the weakness to that is, if there is an undetected flaw in one piece of equipment, why isn't there in multiple pieces of equipment? And the answer from a deterministic standpoint is, one flaw is far enough, although

you won't see that written down anywhere.

MR. BENDER: If it is all right to deal with it in one system but no in another -- you are arguing you are going to be concerned about it in the mechanical systems but not in the electrical systems?

DR. SIESS: Deterministic rather than a random flaw.

MR. MATTSON: I was thinking of it differently. I was thinking of it mechanical versus mechanical.

MR. BENDER: If you qualify the electrical systems seismically, you don't assume that it fails. You don't hold the same argument when you do it mechanically.

MR. MATTSON: Yes. The basic reason underlying that is that the failure of the mechanical equipment in the primary system leads directly to the loss of coolant accident, whereas the failure of the electrical equipment because of the undetected flaw does not lead directly to the loss of coolant accident.

MR. BENDER: I can hardly accept --

MR. MATTSON: That is the traditional argument for that dichotomy. Whether or not it stands the test in today's light, that is another question.

You asked the rationale. The rationale is, we have been able to restructure, as we have been able to -- is along those lines.

DR. SIESS: You put the flaw where you think it will

do the most harm in the system that will cause the LOCA.

MR. MATTSON: Yes.

DR. SIESS: But you really haven't examined the whole system to see whether that is truly the place it will do the most harm.

MR. MATTSON: That is true also. Judgment, made some years ago and carried through, through the years without testing.

Let me briefly list some of the related staff activities in which the question of load combinations is an important part and tell you what is going on and when you will begin to see that work.

Probably the most important and near-term related areas is generica technical activity A(2), which has to do with asymmetric loads for pressurized water reactors. You have seen that task action plan some months ago. To refresh your memory, it is the North Anna asymmetric loads problem that you have seen addressed, or will soon, on Diablo Canyon, on Hatch, on other pressurized water reactors.

Hatch is not a pressurized water reactor. It is a boiling water reactor. In the Hatch review within the last several months we have shown that there can be an external asymmetric load question due to a break in the cavity, causing an overturning moment on the vessel. That question was addressed on the Hatch docket.

It has not reached you yet, because the SER is just being printed. I will call your attention to that when it comes down here.

A(2), treating the asymmetric loads question, has as a part of it the question of, how do you combine the SSE loads and the asymmetric blowdown load within the cavity? We have applied our interim requirements in that required for plants now in the licensing process. That is, absolute summation of the peaks for those pieces of equipment that don't pass that test, or meet that criterion.

The applicant can do an SRSS calculation and then demonstrate margins of failures for each component, component by component, essentially what we have been doing over the last year.

Now, the generic task action plan is scheduled to be completed in about two years. That includes a lot of reanalysis for operating plants and the approval of a number of generic models for use in the CP and OL licensing process.

One of the important first decisions to be made in that task action plan is, what methods will we use to combine rapidly varying dynamic load, SSE plus asymmetric cavity loads? There has been a joint task force formed between the Division of Operating Reactors and the Division of Reactor Safety, a task force of about five people, representing structural design expertise and equipment design expertise.

They are due to finish their work around mid-July, and one would expect it to be reported and available for discussion and consideration by management and you all perhaps in August.

Now, I want to move from that generic piece of work to another --

DR. ISBIN: Were you inferring these were in-house?

MR. MATTSON: All in-house. General Electric came to us in a related but separate generic activity for which we have no category A number at about midwinter, to tell us of a major reanalysis program at the General Electric Company for all of the Mark II and Mark III facilities.

This reanalysis was designed to demonstrate that although the equipment in the Mark IIs and Mark IIIs was within the scope of GE, supply had not been designed to accommodate certain feedback loads from the pressure suppression pool through the rest of the structure in the facility, feedback loads arriving with SRV loads or with LOCA loads, that even when those feedback loads were concerned, the structural capability met appropriate regulatory criteria.

It's a major, thorough-going reanalysis by General Electric which is under way now for the lead Mark II plant, Shoreham, Zimmer, LaSalle, WPPSS, and will eventually turn to the Mark III plants as they come back in for the operating license review.

GE's proposal -- and we have essentially agreed with

the proposal -- is that we not look simply at the method of combining loads to adjudge the appropriateness of the conservatism in the dynamic capability of the facility. That is, we ought to look at some of the other assumptions that go into the overall analysis.

That gives us a way of putting in context the conservatism required for the load combination method with some other important parameters: the method for calculating a mass and energy release; the method for calculating the cavity pressure, caviry pressure distribution, the load acceptance criteria, that is faulted or emergency criteria under the ASME code, and the definition of SRV loads.

That one is worth pausing on. GE has proposed, and we are proceeding with, a review of a method for demonstrating the time phase relationship of the dynamic loads occurring within the pressure suppression pool. That is something that will be occurring over a year or two-year period consistent with the Shoreham, LaSalle, WPPSS reviews.

It is important to know it is going on. It is also important to recognize, if you try to adjudge conservatism overall, there's some of those pieces of conservatism that are far out in time relative to positions people would like to make on SRSS.

For example, if you wait for GE to decide the question for Mark IIs and IIIs, then I don't have an answer

for the asymmetric loads question, which has some higher urgency to it because of its effect on operating plants.

An added dimension to the GE program for reanalysis of the Mark IIs and Mark IIIs, we usually think combining of loads is an important consideration for the SSE and the big LOCA and that we are dealing with very low-probability, low-risk phenomena. In the GE reanalysis we have a little bit different wrinkle. That wrinkle is, the SRV loads plus the OBE loads, safety relief valve, plus the operating basis earthquake when combined have difficulty meeting the upset conditions for the ASME code. So there

So there is a considerable bone of contention between the staff now and GE on the method of combination of SRV and OBE loads and the acceptance criteria for those loads.

Another related generic activity is the topical report --

DR. ISBIN: You mean these arguments carry over to the Mark I?

MR. MATTSON: The answer is, in most people's judgment at this time, no. In other wrods, the couplings between the Mark I pressure suppression design and the rest of the system is not as tight a coupling. It is not as rigid a system.

Jim, do you want to say more about that question?

MR. ISRAEL: No.

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DR. ISBIN: This was a point Bridenbough made some time ago. I thought it was answered in the negative.

MR. MATTSON: I am answered it negative, too. We have a little information on the nature-appeared cause of the feedback loads and a little better information from GE than we had in the past about the hangars, snubbers, the systems that are of concern in the Mark 2, Mark 3 system and there are good arguments for why the coupling, being fought as direct and rigid in the Mark 1 System, isn't lead to the same difficult.

DR. LAWROSKI: Any comment relative to the Diablo Canyon Plant?

MR. MATTSON: What we have done there is to apply the interim approach which we feel we have a very defensible basis of safety for. We might have some difficulty defend it's the most efficient and cost effective way to proceed, but absolute summation was required in the case of Diablo Canyon for the combining of the SSE and LOCA lode.

Asymmetric lodes were treated in some detail, a la North Anna, with approved Westinghouse evaluation models and independent audit calculations using our own computer codes within the staff.

MR. BEND: Do you suppose you will ever write down these bases so someone can look at them in a collective way and try to make some sense out of them? Because most of what I heard today is just verbage. It didn't really address the

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question. I suggest there is no logic to what you have done up to now, you are inventing logic.

MR. MATTSON: No. I think it says there was logic, that it was written down then. It's a little bit difficult because it wasn't written down to resurrect it. We think we can resurrect it. As we do it, some of it appears to be overly conservative and arbitrary and there are efforts ongoing to put reason and rationale into what we do.

My message is, there are so many activities ongoing that if I try to overlay yet another one, I haven't the resources to handle it. I would prefer to go on with the current approaches under the Generic Technical Activities Program, related matters in the Generic Task A24 on environmental qualification on Class 1E Electrical Equipment, where we are looking at sequential versus simultaneous testing of electrical equipment. Are there differences, are there failure mechanisms that we don't see with our sequential testing, to be concerned about the combined events?

MR. BEND: I think you are hiding a sentimental question behind a maze of detail. You ought to go back and start thinking about the logic more, rather than doing this infinitum perfect of detailed computations than you still can't match up the logic because they attack the problems in umpteen different ways, with upmteen different people and a total bill of system evaluation would encompass a lot.

MR. MATTSON: I hear what you are saying, but I am not so sure I understand exactly what you are proposing. Can't you turn that into a proposal, how would you do it?

MR. BEND: I am suggesting you go back and look at the basis on which you are deciding what things can cause a system to fail and the logic associated with arguments that say in one case the earthquakes will not, for example, cause something to fail. In another case, causing the item to fail when both are seismically qualified.

There is just no logic to that. Unless you are going to assume that the earthquake is going to fail everything whether it's qualified or not or you are going to assume if the item had been qualified for an earthquake, it wouldn't fail under those conditions.

I just can't see dealing with it in two different ways. I don't care what the piece of hardware is. It seems to me that that is what you are doing. You are going through all this effort to qualify equipment seismically, then you are sayi-, there are some equipment will still fail seismically.

If that is the case, a-l of it will and you might as well eliminate the qualifications. I am only using that as an example. I think there are dozens of other cases that are similar that you are following and consequently we are getting a lot of computations with numbers in them that we can't relate to any kind of behavior situation.

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MR. SCHWEIL: The same argument could be used for the primary system piping. It's again designed for temperature and pressure and designed not to fail. but we postulate failure.

This is a defense in depth philosophy. It's not mechanism. It just provides some additional margin.

MR. BEND: If that is the logic, it's all right, but I don't believe it is.

DR. SIESS: It seems to me the problem has to be broken down into two parts.

The first question is when or whether you combine lodes or events or phenomena. That is the one we got into, combining LOCA and earthquakes, and it's philosophical in some degree, judgement in others, it may not be logical and it may be approachable on a probabilistic basis.

The other problem, once you have decided to combine things, what procedures, what calculations do you make to do it. That is your combining dynamic lodes et cetera. And what stresses do you allow. Again, that is probabilistic. If you are going to combine two things, you usually allow a higher stress level, and so forth.

There are two separate problems; when do you do it, whether you do it, and if you do it.

Now, I would like to add one more comment. One reason you favor combining lodes was to provide a qualitative measure of margin to failure, or to provide margin to failure.

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That is probably the poorest reason you can come up with because it will inevitably lead to widely varying margins of failure.

MR. MATTSON: Within a plant or between plants?

DR. SIESS: Within a plant, because you have some portions of some elements of the system that may not be stressed at all by one of the two phenomena, in which case, you have no margin by combining them.

You have other elements that are stressed equally by the two phenomena, in which you have a significant margin and the margin will vary from place to place, just because one element is affected by LOCA, but not by earthquake or vice versa.

MR. MATTSON: I agree with you. I understand that. It is in today's life, a mere way of producing margin.

DR. SIESS: You said qualitative, and it is. There is a margin ranging from say zero to two or something of that odds that you don't -- you know what it is.

There are better ways of doing that to evaluate it.

MR. MATTSON: You suggest there should be a probabilistic approach as to whether or not to combine.

We have some elements of that approach in the reactor safety study.

DR. SIESS: This is also a probabilistic approach. ASME Section 3, Division 2, the more areas you combine, the

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more the lodc cycle.

MR. SIHWEIL: It's not qualitative.

MR. MATTSON: That is the second question. I thought you were suggesting we ought to go to the first question, that is whether and where and the probabilistic approach here.

Is there some basis using reactor safety methods, perhaps, or say what you get from the combined event is sufficiently small that they needn't be combined, make that decision, then go to the next question.

How do you provide margin to failure and to come to that margin by a more rational, uniform method, that is, a place to all

DR. SIESS: I don't think some of the things are quantifiable. If you consider LOCA and earthquakes as independent variables, independent phenomena, it's still not zero probability. They would occur simultaneously, but I think it's also clear that a LOCA is somewhat more likely to occur in the presence of an earthquake than it is in the absence of an earthquake.

If we assume that we assume higher allowable stresses, if you wish, because we are trying to balance the risk, it's done very crudely now.

MR. BENDER: I am concerned about the emphasis put on the earthquake causing event associated with the LOCA as they apply to pressurized systems, and excluding that phenomenon

from occurring in anything else which is the way you do it now.

You say the pressurized system is the most vulnerable. That is not likely to be the case. I think you really ought to go and do without suggesting, consider the whether and when and then work out methods.

It seems to me you are doing the reverse.

DR. SIESS: Your point, mine, is they are combining lodes in some parts and not in others.

MR. BENDER: Without any reason.

DR. SIESS: This is illogical by any argument. I don't think it can be justified probabilistically.

MR. MATTSON: I am not sure yet that I understand what your problem is there.

MR. BENDER: If you assume that an earthquake causes LOCA's, then it's all right to combine the earthquake and the LOCA lode, but that says, for example, that the piping must fail because of the earthquake in order to have the LOCA.

But since you qualified the pipe and not so it wouldn't fail in earthquakes, you have to argue that that is not going to happen. But let me accept the argument that the earthquake --

DR. SIESS: Not that, but lower the probability.

MR. BENDER: All right. Let's accept the argument that the earthquake will cause the LOCA in spite of the fact that you qualify it. Why don't I say that about all of the

electrical system which is equally qualifiable. There is a lot more of it, and I know a lot less about it.

DR. SIESS: Of course, it also has single failure so it's reliability may be sufficient --

MR. BENDER: If there is anything that lead to failures, it's earthquakes. Whatever causes one, will cause them all.

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MR. ETHERINGTON: How much effort is being given, how much attention is being given to criteria for failure? Are you considering those low cycles? When you add extreme forces do you consider restricting any behavior or do you allow for stretches beyond the elastic limit and the effect on the frequency which would again tend to diminish the peaks?

MR. MATTSON: We allow for demonstration beyond the elastic range if it can be allowed component by component.

MR. KNIGHT: If I phase out suddenly, my apologies. I am good for about 10 or 15 words with my present throat condition.

If I understand the thrust of the question, it would be how much consideration do you give to physical realities when postulating these breaks, and I guess my direct answer is none.

MR. ETHERINGTON: Then you are extremely conservative.

MR. KNIGHT: I would agree with that entirely.

MR. ETHERINGTON: Why is this?

MR. KNIGHT: I think we are just now getting into the realm of reality, if you will. We have perhaps the best document in house right now from Westinghouse -- that -- including essentially a fracture mechanicsapproach, I think that is probably the way most people try to get at this

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question, looking at, again, once again, this is not unique, it was done in the past but not done too well. Looking at the size of the flaw, that would be necessary, the size of undetected flaw that would be necessary to give you failure with any reasonable probability, given the loadings that you would see under an SSE, we just received that about a month ago. We are just starting to look at it. We have asked the people at Brookhaven to look at it also. We feel it would be a relatively sensitive issue, were we to hang our hat on that, we would like to have as broad a base of consensus as possible.

MR. ETHERINGTON: I am glad to hear that, because I think this is as important as a question of combining loads.

DR. SEISS: Am I correct that in the Diablo Canyon probablistic study they looked at the probability of earthquake LOCA combination, that the earthquake could cause a LOCA, and also looked at the probabilities that the earthquake could disable other parts of the system including electrical? Did they cover that?

MR. SIHWEIL: You know, the single failure criterion requires --

DR. SEISS: I am talking about the Diablo Canyon probablistic study that didn't postulate any single failures.

MR. SIHWEIL: I am not aware of that.

MR. KNIGHT: I am not certain about the electrical

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portion. I just finished mentioned this Westinghouse --

DR. SEISS: It took the scenarios all the way through. It didn't stop with LOCA and assume probalistic failure They did a complete study right down to contaiment isolation, et cetera. It must have involved electrical systems.

MR. KNIGHT: It must have.

DR. SEISSL: Did WASH 1400 do that? Did it factor the earthquake into every step?

MR. MATTSON: The way it was cashed out, it showed it was not a significant contributor to the risk and was dismissed. There was a considerable amount of work since then.

DR. SEISS: Am I not correct that the research program to quantify seismic margins will be looking at all aspects of this, or will it simply look at seismic margins and so-called structure limits?

MR. MATTSON: I think there is a debate at the moment between the NRR staff and research staff as to exactly what that perhaps is looking at.

MR. KNIGHT: There is a debate. I met with a group yesterday. The senior advisory group on that program meets again the middle of June, I guess. As currently proposed I think we will probably follow through -- well, it is a very broad program. I believe the intent here would be to say bridge the gap left in the WASH 1400 studies, to look explicitly at the earthquake from a risk standpoint, following

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it all the way through to radiological releases.

DR. SEISS: All the mitigating factors and effects on them.

MR. MATTSON: I think I can characterize the debate a bit better. Reactor safety study folks in research want to come at it from the risk assessment view entirely. The proposal we made was to include that view, but to go beyond that and look at the dynamic capability, if you will, of the equipment, the energy absorption capability, not just -- keep it within the elastic range and everybody is okay.

DR. SEISS: This could well answer Mr. Bender's question. Would the increased unreliability of electrical component due to the existence of an earthquake contribute significantly to risk as compared to decreased reliability of mechanical components?

MR. BENDER: In the WASH 1400 study in assessing reliability, they gave -- they showed no loss of reliability due to earthquakes if the equipment had been seismically qualified. That was the fundamental premise in it. What I am saying is, if that amount holds in one place it holds everywhere else.

DR. SEISS: In Diablo Canyon, for example, you could assume there was no failure if the earthquake did not exceed that for which it was qualified and it was a complete failure if it did exceed it. Or you could put a tail on the lower end and say that there are going to be some defects in the equipment

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and so forth so an earthquake even less than the one qualified could cause a failure. It's sort of a gopher proposition.

MR. KNIGHT: It gets quickly into a difficult area, that is the so-called fergility testing, how much above some qualification level can you take a typical piece of equipment or classes of equipment and still not have failure.

MR. BENDER: All I am saying is, an elctrical circuit breaker has the same structural problems of any other structure, and if you are going to qualify seismically to survive an earthquake you are making the same argument you are making when you say the support structure for a piece of pipe survives.

MR. MATTSON: I think there is a difference in those two arguments. One is an internal pressure containing component, rigidly constrained, and the other is a piece of electrical equipment hung on a wall.

MR. BENDER: Look at the history of the recent earthquake in Los Angeles and see what failed. You will find out the electrical equipment was the thing that was the real problem.

MR. MATTSON: But non-electrical equipment designed, review, tested to survive that earthquake. The pressure component has the same character. We know the probability of its failure and the consequences of its failure, the consequences are serious, probability is raised by the earthquake, therefore we go the extra step, defense in depth, because

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it's a direct cause of the loss of collant accident. Where the electrical equipment, designed not to fail, if it fails, doesn't cause a LOCA.

MR. BENDER: If I have to rely on the diesel generators and on the circulating equipment to remove the heat, then I have to deal with the matter of whether the power supplied to them are there.

MR. MATTSON: But the diesel generator is outside of this question because it sees no LOCA load.

MR. BENDER: But it sees the earthquake load. The piping wouldn't fail under the earthquake either if it's seismically qualified, you tell me, but still you are adding the loads as if you were.

DR. LAWROSKI: The Chair would appreciate it if you let Mr. Bender have the last word, Mr. Mattson.

MR. MATTSON: One possible alternative way to come at this problem is for there to be a subcommittee or perhaps a full committee interest in that research program.

DR. SEISS: Which one?

MR. MATTSON: To which you referred.

DR. SEISS: There is a great deal of interest.

DR. LAWROSKI: Gentlemen, we have a couple more items to be taken up yet before we recess for lunch.

DR. SEISS: We will be discussing that research program.

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MR. MATTSON: I am caught on how to respond to you most specifically. I sympathize with your concern, I understand the margin, I understand the uniformity of the margin it provides, but it's generally conservative and it can be generally met and I have the resources to license cases and to solve other safety problems, and I don't have the resources to overlay this project on top of them.

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MR. BENDER: I think I am not sure the added conservatism you are providing does much.

DR. LAWROSKI: It gives you one more opportunity --

MR. MATTSON: I am looking for constructive suggestions from you all as to how to go about it better.

DR. LAWROSKI: Thank you, Roger.

We have two more items. One, could we --

Is Mr. Woodruff here now?

MR. WOODRUFF: Yes.

DR. LAWROSKI: Can we have a few minutes summary of the incident relative to the Met tower at Skagit?

MR. WOODRUFF: Roger Woodruff from Inspection and Enforcement.

Last Monday evening about 7:30 the meteorological at Skagit collapsed. It damaged the instrument shack and took out a power line.

The Applicant advised us that the cause of collapse was due to loosening of 4 turnbuckles in the guy wire, the 4 guy wires on one side of the tower.

As you know, an LWA has not been issued for that reactor. There are no security measures at the site other than a caretaker who resides, maintains the residence there. The caretaker was not there at the time of the incident. He is under investigation by the Skagit County sheriff.

The FBI has been notified, the City of Seattle,