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PERIODIC BRIEFING BY ADVISORY COMMITTEE
ON REACTOR SAFEGUARDS

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PUBLIC MEETING

Nuclear Regulatory Commission
One White Flint North
Rockville, Maryland

Thursday, August 10, 1989

The Commission met in open session, pursuant to notice, at 2:00 p.m., Kenneth M. Carr, Chairman, presiding.

COMMISSIONERS PRESENT:

KENNETH M. CARR, Chairman of the Commission
THOMAS M. ROBERTS, Commissioner
KENNETH C. ROGERS, Commissioner
JAMES R. CURTISS, Commissioner

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STAFF AND PRESENTERS SEATED AT THE COMMISSION TABLE:

WILLIAM C. PARLER, General Counsel

FORREST J. REMICK, Chairman, ACRS

CARLYLE MICHELSON, Vice Chairman, ACRS

CHARLES J. WYLIE, ACRS

WILLIAM KERR, ACRS

JAMES C. CARROLL, ACRS

DAVID A. WARD, ACRS

HAROLD LEWIS, ACRS

IVAN CATTON, ACRS

CHESTER SEISS, ACRS

PAUL SHEWMON, ACRS

P-R-O-C-E-E-D-I-N-G-S

2:00 p.m.

CHAIRMAN CARR: Good afternoon, ladies and gentlemen.

The purpose of today's meeting is for the Advisory Committee on Reactor Safeguards to brief the Commission concerning their review of five specific matters:

NRC's Human Factors Program and initiatives;

Occupational radiation exposure of skin from hot particles;

Application of diversity in systems that use redundancy to achieve high levels of reliability;

Proposed resolution of Generic Issue 128, electrical power reliability;

And the boiling water reactor core power stability.

Copies of recent ACRS letters related to these topics are available at the entrance to the meeting room.

Do my fellow Commissioners have any opening comments?

COMMISSIONER ROGERS: No.

CHAIRMAN CARR: Doctor Remick, I want to welcome you and the other members of the Committee on

behalf of myself and my fellow Commissioners. The work performed by the ACRS is very important and your views are highly regarded by this Commission.

I might also add that this may be your last time to give us advice and you'll have to be on this side of the table and take it.

DOCTOR LEWIS: I don't think he'll stop giving you advice.

COMMISSIONER ROBERTS: But I'm not sure of our record of taking their advice.

CHAIRMAN CARR: We'll have to do something with it then.

Please proceed with your presentation.

DOCTOR REMICK: Thank you, Mr. Chairman, and I would like to take this opportunity on behalf of the Committee to congratulate you on becoming Chairman of the Commission. This is our first opportunity express those words of congratulations. The Committee looks forward to working with you and the other Commissioners in the years ahead.

CHAIRMAN CARR: Thank you.

DOCTOR REMICK: We do have five topics to discuss with you and the order that you just read is the order that we thought we would proceed, if that's acceptable.

CHAIRMAN CARR: That's fine.

DOCTOR REMICK: And the first one of those topics is our May 9th letter on human factors programs and initiatives. I am Chairman of the Subcommittee, Human Factor Subcommittee, so I'll take the lead and introduce that and then entertain questions.

I think you're aware of the fact that the ACRS for a long time has been a strong supporter of increased human factors considerations. So, we're very pleased to see that the Commission is back supporting research in that area.

One of the things we noted is there aren't many topics that are proposed, and so that one gets some useful information, it's going to take some research management concentrated attention to make sure one gets the most out of those programs.

In January, we held a subcommittee meeting with the staff on a document at that time which was called Human Factors Regulatory Research Program Plan. One of the observations of the subcommittee was that to the outside world the fact that we talk about research and technical assistance and what was proposed at that time was just to cover the human factors programs that were being under the administration of Research, this was misleading to

people, not realizing that there's a lot of technical assistance work going on in NRR and NMSS and so forth.

So, one of the recommendations of the subcommittee, you really ought to put out something that gives the total initiatives within the Agency in the area of human factors, because there are things that might be research that are done within the offices and there might be some things that really one might define as technical assistance that are done by the Office of Research. What makes them different is the length of time. If they're to be expected to be a long period of time to do it, it's done by Research. If it's a short type of effort, usually within the other offices.

While we're pleased to see that the staff apparently followed that advice in the documents we have before us gives a much better impression of the overall program within the Agency on human factors initiatives. So, we applaud the staff effort in that area.

We're also very pleased to see that NMSS is starting to consider human factors consideration in medical application of radioisotopes and in industrial radiography and those types of things. That's going to be a big job, and so one of the things we pointed

out -- they have one human factors expert now, it's conceivable that they might need more in the future.

We were also pleased to see what I would call, I think, an unprecedented emphasis in some areas of human factors research where a diverse group of research providers, we called it, are doing the work. It's not just being done within the national laboratory, but expertise from around the country, from universities, private organizations, and universities in other countries and so forth are involved. We think this is good. The point being we think the research should be done wherever the expertise is and not because it might be contractually more readily accessible at the National Laboratory. So, we applauded that.

One specific recommendation that we made, and this comes about in part from our going around to the regions and being told in the regions, at least some of them, that one of the most important considerations is selecting resident inspectors. This is a tough job. It's difficult sometimes to get highly qualified people who have experience and so forth.

So, one of our recommendations was that the staff consider a human factors research program which

would be intended to look at this question and are there ways of performing aptitude testing or are there ways of better defining the training these people should have, are there interpersonal skills that they should know about and so forth. So, that was our one specific recommendation.

I had the pleasure just a couple days ago to follow Commissioner Roberts at a meeting of the resident inspectors in Region I. I brought this up and I must admit it was not enthusiastically --

COMMISSIONER ROBERTS: What's that, it was not?

DOCTOR REMICK: It was not enthusiastically accepted.

COMMISSIONER ROBERTS: I was a good group.

DOCTOR REMICK: It was a very, very good group and I must admit you were a hard act to follow. They thought very, very much of your talk. Tom Murley was there during my presentation and so forth, so I felt very good after a couple of hours of talking to that group and I was impressed with them. But as I say, they weren't enthusiastic. They weren't against it, but they weren't quite sure what ACRS was proposing and wanted to know what's wrong. I had some difficulty being specific in that area. But it is a

recommendation.

So, with that, I would like to open up to any questions you might have of the Committee.

CHAIRMAN CARR: Commissioner Roberts?

COMMISSIONER ROBERTS: I told them that they might be seeing you in a different light the next time they saw you.

No, I have no questions.

CHAIRMAN CARR: Commissioner Rogers?

COMMISSIONER ROGERS: I wonder if you'd-- have you thought anything or talked about this whole question of the research that's going on in shift scheduling? This troubles me a little bit because I'm just not clear on what has to be done in the way of research in that area. It's a business that's been around for a long time and a lot of work has been done, a great deal published in the literature. Staff has given us some assurances that what we are doing in research really has to be done that is new. I wonder if ACRS has looked at that question at all.

DOCTOR REMICK: Not extensively, but when you say shift scheduling, are you talking about the circadian rhythm --

COMMISSIONER ROGERS: Yes.

DOCTOR REMICK: -- and also the 12 hour

versus eight hour? We have discussed with the staff from time to time -- I'm thinking back some period of time. It's certainly been in the last year. We detected what we thought was the staffs somewhat reluctance on the 12 hour shift work. But in our discussion at the meeting in January, or we had a subsequent subcommittee meeting with them, I think they said that they were not against the concept of 12 hour shifts. They did have some concerns about fatigue and so forth and thought that should be looked at.

COMMISSIONER ROGERS: Well, this research that's going on, human factors research --

DOCTOR REMICK: Yes.

COMMISSIONER ROGERS: -- in support of some kind of a position and it just isn't clear to me how much research has to be done and what the unknowns are that have to be explored here.

DOCTOR REMICK: I can't answer that. I don't know if any of my colleagues can help or not.

MR. CARROLL: I think I got the feeling from our discussions with the staff -- I'm also on the Human Factors Subcommittee -- that they were fairly well along on this. What remained to be done was to publish this in a form that the utility industry could

take advantages of it. I guess one of the staff people made the comment that we've done an awful lot of research that probably the utilities would have had to individually pay for and we think we've done a good job for the industry in that respect.

COMMISSIONER ROGERS: Well, I guess -- I don't know, it may be a question of a problem of what you define as research. It may be organizing information that's out there in the literature and rather than actually doing experiments. But I don't know, but --

DOCTOR REMICK: Commissioner Rogers, I think that's true. Much of what within the Agency is called research, if you look at it from perhaps a university standpoint, we might not call it research. It's things that need to be done. Also, the question of whether it's called research or technical assistance seems to be the question of how long is it going to take? If it's going to be a long period of time, we'll give it to research. This is what basically the staff has told us. That's how they differentiate it. But it might not be basic research that we might view from a university perspective.

COMMISSIONER ROGERS: Well, sometimes the problem is if you want an answer to something it's in

the literature someplace, but some people have felt that it costs more to go and find it than it does to go and actually reproduce the experiments or do an experiment.

That raises a question of whether you have thought at all or have any opinions on whether it's necessary or appropriate for NRC to establish databases of research references or are there satisfactory external sources that are reasonably tapped? In other words, should we take the initiative and some kind of organization of research references, not research but research references, to make it easier to tap into the existing body of knowledge?

MR. WARD: Forrest, I'd like to comment on that.

DOCTOR REMICK: Please.

MR. WARD: I'll comment from the standpoint, at least partially, of my participation a year or two ago on the National Academy of Science panel which developed some research ideas. There, very specifically, the panel suggested to the NRC research people that there was a large body of information out there that would be applicable, but that some effort was going to be required on the part of the staff to sort it out, put it in a form that was useful for

regulatory people and also for the industry.

So, I think the panel actually categorized some areas where perhaps fresh research would be required, but many other areas where it was just a matter of making use of -- making available what's already out there.

DOCTOR REMICK: The staff did also point out a study being done at George Mason University, if I recall, which is specifically to look at the information that is available on human factors in other industries and see what of that could be applicable to the nuclear industry. I was particularly impressed with that approach and it seemed like it was something worthwhile, though I don't know the specifics of it. So, it seems to me in some areas the staff is trying to recoup some of that information that might be available without redoing it just for the nuclear industry.

COMMISSIONER ROGERS: Have you got any thoughts on what you think is appropriate for us to do in the areas of research on organization and management issues?

MR. WARD: Yes. I think that's one area where some fresh research, as well as making use of what's out there, might be available. I think it's

been very sensitive and it's something difficult to come to grips with. I think there's been a lot of reluctance to come to grips with it.

But we keep telling ourselves and each other that the residual risk from operating plants is very importantly dependent on issues of management and organization. But we somehow think that those can be resolved by kind of "seat of the pants" approaches, that we're not able to investigate these things systematically and scientifically. I think it is possible to become systematic and advance the art. I think that's going to be required.

The staff does have some programs, some very interesting programs, largely through Brookhaven National Laboratory, going on in that area. I don't know that they're going to yield any regulations. I guess I hope they don't yield directly the regulations. But I think they might turn over some rocks and make some information available to licensees that will permit them to design organization and management structures from the standpoint of minimizing risk rather than accepting traditional or haphazardly put together organization management structures.

COMMISSIONER ROGERS: I guess the key word

in my question was appropriate, what's appropriate for us to do.

DOCTOR REMICK: That's right.

COMMISSIONER ROGERS: Not what can be done so much as what's appropriate for us to do.

DOCTOR REMICK: You'll find a spectrum, I think, across the Committee. I'm one who believed very much that the organization depends on the people you have and therefore you tailor make the organization to the capabilities of the people and that you don't come up with an ideal organization structure and make people fit into it. That's my own personal view.

So I have some concerns about -- I have no problem with us doing things to better understand what works best, but it worries me very much when we go to implement and we start saying, "Thou shalt do it this way," because I'm not sure you can force fit an ideal organization on people. So, I have some reservations.

We've talked with staff about this, but they assure us that it's not their intent to impose these on individuals or utilities, but I personally have the reservations. I agree with Dave. There are things that perhaps we could learn that we could pass on that would be useful, but I don't know how much this Agency

should regulate them.

Bill, please.

DOCTOR KERR: I know as little about management as almost anybody I can think of. It seems to me that what we are interested in is not management per se, but the results of management. So, I don't think we need to encourage the use of managerial research, how one develops managerial skills.

What I do not think we have gone very far in developing is criteria for determining whether things are operating properly. We want safe plants and we are all wrestling with how one can recognize the possibility for unsafe plants before an accident happens. It would seem to me that we need to continue to concentrate on that effort.

In the construction and design, we've learned to put a lot of emphasis on equipment and construction and control of quality and the inspection of equipment, the operating phase. That's still important but there are other things that contribute. I don't think we have a good way of recognizing when an organization is operating in a way which is least likely to produce or has a low probability of producing accidents. That, it seems to me, requires some concentration of effort, whether one calls it

research or investigation or whatever. But that is the area that I think we should continue to emphasize.

COMMISSIONER ROGERS: Do you think there are those measures that one might find from some kind of research would be different for a management of a nuclear power plant from management of an automobile factory or something of that sort?

DOCTOR KERR: I plead not the Fifth, but ignorance. I don't know. I wish I knew.

MR. WARD: No, I think there's some very real differences. I mean I think the great difficulty with nuclear power is that there is not direct, usable feedback from experience to tell you how well you're doing, as far as the safety of nuclear power plants is concerned. We just don't have the major accidents that must be avoided. So, we're not getting daily, weekly, yearly experience that one does in an automobile factory or something else. So, to the extent that we don't have that, there are some differences that have to be taken into account.

CHAIRMAN CARR: Well, we can't afford to make a mistake to learn from in this business.

DOCTOR KERR: Yes, I think that's the difference.

MR. WARD: Yes, that's it.

COMMISSIONER ROGERS: The data that you get, you don't like it when you have it. I mean it's --

Fine, thank you.

CHAIRMAN CARR: Commissioner Curtiss?

COMMISSIONER CURTISS: I don't have any questions.

CHAIRMAN CARR: I don't have any questions, but I have a comment on your aptitude testing for inspectors. My experience is in the Medical Research Laboratory New London and Submarines has, to my knowledge, for 40 years been trying to sort out from the input to the submarine school over the lifetime of the career what makes good submariners and they're still working on that problem. So, I'm not sure we can figure out what makes good inspectors either.

DOCTOR LEWIS: Because they're all good.

CHAIRMAN CARR: I think it's a function of background and training and interest and that kind of thing. So, you get some surprises when you try to make judgments along that line.

It's the same problem with management decisions. As you say, good people can make most any organization work and, conversely, the wrong people can screw up most any organization. So, it's a tough job.

All right, we can proceed then.

DOCTOR REMICK: All right. The second topic then is the occupational radiation exposure of skin from hot particles. This is an area -- at the time of the letter I think we had strong differences with the staff in some respects. But I think we have some good news and I'd like to turn that over to Jay Carroll, who is Subcommittee Chairman.

MR. CARROLL: Thank you, Forrest.

By way of background, I guess for the last several years there's been a general consensus in the nuclear industry that existing 10 CFR 20 limits for skin exposures which are designed for exposure of large areas of the skin were overly conservative for hot particles, which we started to see as we got more sensitive radiation detection equipment into the nuclear plants.

The staff's ultimate plan is to revise Part 20 to have specific regulations dealing with hot particles. But this probably a two to three year process. In the interim, the staff has proposed an interim standard to be used in taking enforcement action in those instances where hot particles cause exposure to individuals in the plants. So, it's this interim standard that we're considering today.

I don't know how much of our letter we need to repeat. I guess our recommendation was that the staff's proposal for an interim standard seemed to have some problems and we could therefore not endorse it. We recommended that staff senior management take an active role in affecting a timely resolution of the remaining outstanding issues with NCRP so that their report could be published and the staff could then proceed to revise this interim standard to be based on the NCRP report.

When I mention senior management in that context, it seemed to us that there were a lot of differences in what ought to be done here between research and NRR and at least some of the health physicists out in the regions. That seemed to be a problem and I guess that all comes together at the EDO level. So that's what we had in mind when we recommended that senior management get involved in the issue.

Since our letter, I guess there have been several things that have occurred that would be of interest to you. On July 20th, the staff and NUMARC met and it seemed to us that there was somewhat of a disconnect between the two organizations at the time they made their presentations to our subcommittee and

our full committee. Out of that meeting there was agreement that there's a need for more direct discussions between the two entities and this should lead to an improved working relationship. I think that's very good.

On July 27th, EPRI sponsored a meeting in Richland, Washington that brought together EPRI and their consultants, NUMARC, industry representatives, one of the members of the NCRP Subcommittee on Hot Particles. Very significantly, EPRI paid to have John Hopewell, who is the permanent U.K. researcher in this area come over so everybody could talk to John Hopewell in one place. NRC Research and Research's consultant, John Baum of Brookhaven, were there. I thought it was a very useful meeting because it got a lot of issues out on the table.

EPRI also presented the work of their pig studies that are being done up at Hanford, which tended to support the NCRP recommendations.

I guess one of the most significant statements that was made in my mind was Bill Roesh of NCRP, who's been involved in their activities for close to 40 years and is one of the old grey beards in the rad. protection field, stating that he believed the recommendation that they put forth would ensure

that a worker who had a hot particle exposure wouldn't know it happened to him unless he had a microscope. But that was really basically what they were trying to protect against.

But if you listen to all the experts and scientists and so forth, you almost need a rosetta stone to interpret what they're telling you.

The staff met with Warren Sinclair of NCRP recently and got a commitment from Warren, who is President of NCRP, that their final report on this subject would be published by the end of September and would presumably address the concerns the staff raised in reviewing that draft report. He also indicated that their recommendations would continue to be as they were a year plus ago.

In discussing this with staff people yesterday, I'm told that they would expect to then have a new draft of the interim standard available for internal review within the staff by November of 1989. Hopefully we can get this very troublesome issue behind us.

DOCTOR REMICK: I think, Mr. Chairman, this is an area that I might add to what Jay said. From time to time I know I've asked the question, is there a role for ACRS any longer? Does the Commission need

it, does the nation need it? I think this is an example of the type of thing that this Committee does serve when basically sound technical people are at loggerheads and nothing is moving. Sometimes the Committee getting involved in speaking out and encouraging gets people back together and that's a good example of that.

CHAIRMAN CARR: Questions, Commissioner Roberts?

Commissioner Rogers?

COMMISSIONER ROGERS: No.

CHAIRMAN CARR: Commissioner Curtiss?

COMMISSIONER CURTISS: No.

CHAIRMAN CARR: Well, I think you're absolutely right. This issue has been around too long and personally I voiced my displeasure at not having it behind us. It seems it's taken too long to get it there. I've heard the same thing you've heard, that the NCRP plans to have their final statement out in September and the staff is going to have their draft out for review in November and I would encourage my staff to speed that review up so that the Commission can act on it this year and get it finalized and get it behind us and take it off the books.

Fine. The next item.

DOCTOR REMICK: The next item then relates to our letter of June 14th to you on the subject of reliability and diversity of equipment. Doctor Kerr is the Subcommittee Chairman, so I'd ask him to summarize that.

DOCTOR KERR: I don't think it's news to anyone here that in order to achieve the high reliability that is required in some of the systems that are a part of the safety protection of nuclear power plants that one uses a number of subsystems, each of which is capable of performing a function that is needed in tandem in such a way that if one fails there are still one or more left to continue to perform the function. One gets this increase in reliability by the use of redundancy if the subsystems are indeed independent one of the other.

In effect, that means that the likelihood of failure of more than one of the systems in a short interval is much less than the failure of any one system alone. The independence to achieve this increased reliability is a very important feature. The designer and the operator must strive to achieve that independence in a variety of ways. It will occur if there is some external influence that produces simultaneous failure or nearly simultaneous failure of

two subsystems, or if there is something about the subsystems or the equipments themselves that tends to produce simultaneous failure.

For that reason, there are situations in which one uses diversity. That is the individual subsystems are deliberately chosen to be different one from the other, even though the function performed may be the same. Because of this consideration there are situations in which one insists on diverse subsystems to make up the total system. The ultimate goal, however, is always reliability. There are situations in which this diversity may not contribute to total system reliability.

The issue under discussion at this subcommittee meeting and subsequent meeting of the Committee was whether one should always insist on diversity almost as if it were an end in itself, or whether in an effort to achieve reliability there might be situations, and indeed some of us felt that there almost certainly would be situations, in which diversity might not be a good idea.

What we were seeing was that there should be an open mind on this issue and that in a particular situation such as the SCRAM system in reactors where one is trying to achieve a very high reliability, one

should look carefully to ascertain that indeed the introduction of diversity will increase reliability rather than perhaps having the opposite effect.

I think that's as much as I need to say about that. I would ask any of my colleagues to add to it or we'll have to try to respond to questions.

DOCTOR LEWIS: No, I think you've said it very well, Bill. The point is that this is really not a unique problem within the regulatory system. If one finds a philosophical solution to a problem, and in many cases diversity is a philosophical solution to the problem of protection against unforeseen, unknown, common cause failures, you have different things. Sometimes it takes on a life of its own and people forget why they're doing that.

Bill was more polite than I would be. He didn't mention the particular case that incensed us, but it was one in which a circuit board required a two diverse circuit boards which turned out to be identical but had different manufacturers stamps on them. But they were otherwise functionally and, at component level, identical. These were defined as diverse because they were different in one respect, the manufacturers stamp was different on the two of them.

Now, it's certainly true that sometimes there can be a failure specific to a plant and you achieve a little bit of extra protection by getting something from another manufacturer, but it's a small effect. And yet at the regulatory level there tends often to be not very much judgment exercised about what you're buying for your diversity. Once you've decided that you require diversity, then it's a dichotomy, a bimodal decision. Either you've done it or you haven't done it. If you haven't done it, you don't pass. If you have done it, you do pass. It was that sort of thing that raised our hackles, or some of our hackles a little bit.

It's hard to know what the solution is other than to say, do better, do good or be more thoughtful about why you're requiring things. But it's an endemic problem.

CHAIRMAN CARR: Commissioner Rogers, any comments?

COMMISSIONER ROGERS: Well, just that the point of your letter, it seemed to me, was the key one, that reliability -- and as Professor Kerr has said, reliability is the objective, diversity is not the objective, not unless you're in the business of selling things it is. Then you might want to have a

market for your product and argue for diversity. But otherwise, it's the reliability that's the key that we're after. This is just one way to get there and to focus on that as an ultimate good in its own right certainly seems to be misplaced.

But certainly the notion of redundancy without diversity is also a sensible view. You could have just backup systems that could be identical and we do that in some instances.

DOCTOR LEWIS: There are very few airplanes with a prop engine on one side and a jet engine on the other side.

COMMISSIONER ROGERS: At least they're not supposed to operate that way.

DOCTOR KERR: The letter discussed what's the effect of aging on the possibility of common mode of failure. The point that we were trying to make here was that, at least for liability theory as usually interpreted, there is a region of component of light during which one expects the failures to be at random and then there is a region, a wear-out region in which one expects more clustering. If one operates and if one has enough experience so that one can define with confidence the random region, then aging shouldn't have any effect on common mode of failure.

One removes or replaces the component. So, we felt that there was a possibility of some misunderstanding in this particular arena.

COMMISSIONER ROGERS: I guess you don't have a solution for us though, other than to just raise the issue and think about it.

DOCTOR LEWIS: I have a solution, but it's not a practical one. You didn't say it had to be practical.

CHAIRMAN CARR: You mean common sense?

DOCTOR LEWIS: Common sense is so common. No, the subject of how to interpret rules with wisdom in the support of reliability and safety is not a simple one. The question of diversity and redundancy and that sort of thing is really not the only place it's come up. It's come up in the question of how much in service testing there should be, is a classic place. All through that, I at least have a sense that there is a well developed, if you'll forgive me, theory of reliability. Books are written about it. Professors teach courses in it. In other words, it's a legitimate human endeavor.

I have a sense that there's not enough use of that body of knowledge within the NRC. If you were to ask me to quantify that, I would surrender

instantly. But it shows up in places of which this is one.

CHAIRMAN CARR: Commissioner Curtiss?

Well, I certainly agree and I'm glad, Doctor Lewis, you cleared up the specific because when I read the comment I must admit it looked like motherhood to me and I thought, "Well, there must be something behind that that's not apparent on the face of it because it's obviously good statement." I see what you mean.

DOCTOR LEWIS: But you're not coming out against motherhood.

CHAIRMAN CARR: Not today. Not in this forum. And your point about -- I think you're supporting what we're trying to get everybody toward reliability centered maintenance where if you know it's going to fail you fix it first or replace it first and then you don't have to consider that in your dual mode of failure. I certainly agree with that too.

There are a few components which -- it seems there are fewer everyday that we can't replace, but what you can't replace, obviously, you've got to take into consideration.

Next item.

DOCTOR REMICK: All right. The next one is the proposed resolution of Generic Issue 128, electric power systems reliability and our subcommittee chairman is Charles Wylie. So, I'll turn it over to Charles.

MR. WYLIE: Thank you, Mr. Chairman.

Our letter of June 14 on this subject, the Generic Issue 128, gives our comments and recommendations on the subject. As a matter of background, Generic Issue 128 is an integration of three separate issues, namely Generic Issue 48 on limiting conditions for operations for Class 1E vital instrumentation buses. It deals with a safety concern that some operating nuclear plants do not have administrative controls or technical specifications governing operational restrictions for their vital buses and associated inverters. It may result in the failure of the plant safety systems to perform their function then they're required.

Generic Issue 49 pertains to the interlocks and limiting conditions operations for Class 1E tie breakers. Again, the concern is that administrative controls and technical specifications governing the operation or restrictions do not exist which may result in the buses being interconnected through tie

breakers which may be left closed by mistake. If left closed, the tie breakers can compromise the independence of the redundant safety-related buses and in some cases may prevent the emergency diesel generators from supplying emergency power when needed.

Generic Issue A-30 concerns the adequacy of safety-related DC power supplies and it deals with a concern that some plants may not have adequate provisions for monitoring, maintaining, testing to assure that the DC power supplies are available and capable of performing their safety functions when they're needed.

The staff's proposed resolution to Generic Issue 128 is to issue two separate generic letters with related information requests to inform the licensees of the concerns and to obtain information for the staff to assess whether necessary actions have been taken to resolve these concerns.

The ACRS concluded that the staff's proposed resolution would probably improve the reliability of the electrical systems. However, we viewed the staff's proposed resolution as a continuation of the fragmented approach to resolving safety issues rather than an integrated approach.

The concerns raised by the particular

generic issues are highly plant specific, have interrelationships among themselves as well as a number of other generic issues and unresolved safety issues. It was our opinion that a more efficient and effective approach to the resolution on the issues could be accomplished by including them in an integrated approach such as the ISAP or the IPE programs.

Therefore, we recommended that the resolution of Generic Issue 128 be implemented through the Individual Plant Examination Program, along with an assessment of the associated risk reductions.

CHAIRMAN CARR: Any comment, Commissioner?

COMMISSIONER ROBERTS: Well, if I remember what we've witnessed over a period of time, this isn't the only generic issue you think ought to be done through the IPE, right?

MR. WYLIE: That's correct.

COMMISSIONER ROBERTS: I happen to agree with that. That's all I have.

CHAIRMAN CARR: Commissioner Rogers?

COMMISSIONER ROGERS: Well, just on that issue though, what does that really mean? The IPEs are -- some of them haven't even begun yet, I think.

MR. WYLIE: Yes, that concerns us.

COMMISSIONER ROGERS: And so, what do you do when you turn up something like this? Do you stick it in a pile and wait until an IPE turns up and then you say, "This should be part of your IPE. Look at this"? I mean in practical terms, how do you deal with issues once they've been flagged as an issue of some sort? It's a question of priority, of course, but if there is sufficient basis for being a bit concerned about it, what do you do with it in integrating? How do you do that? Do you wait until it's part of it and force it into the IPE program or what? I'm just trying to get a feeling about how you see this.

MR. CARROLL: My answer to that would be that you put out a generic letter describing this as an issue that certain licensees may have --

COMMISSIONER ROGERS: A disconnect from the "what did you do about it" question.

MR. CARROLL: Yes, and that we expect you to address this in your IPE and here are the concerns the Commission has about this issue.

COMMISSIONER ROGERS: But you wouldn't object to that, though. You don't see any problem in that, getting a letter out, sort of a notice.

DOCTOR REMICK: Notify people, yes. But no imposing it ahead. You're establishing a priority

when you impose upon them and, "It must be done by this and this date." It might not be more important than the other things they have on their plate.

COMMISSIONER ROGERS: Yes.

DOCTOR REMICK: I think Doctor Kerr wishes to respond.

DOCTOR KERR: I was simply going to say that inevitably the power plant is the total system and there are a lot of interactions among the various subsystems. If you pick one out to concentrate on it, you may miss these interactions. This is why a number of us, I think, feel the IPE approach is important. It should encourage people to look at the total system.

MR. CARROLL: I think one of the other things that troubled me in listening to the staff's presentation was -- part of it was the fact that it isn't in somebody's tech. specs, therefore we can't prove to ourselves whether they have a problem or not. Therefore, we're going to ask them a bunch of questions. That's a burden on the resources of a utility. I think the other way is a much cleaner way to get the answer the staff wants, namely the IPE process.

DOCTOR REMICK: Doctor Seiss would like to

provide a response.

DOCTOR SEISS: Commissioner Rogers, I don't remember the exact wording of the letter, but in Mr. Wylie's oral remarks he offered you two alternatives to integrate this. One was the IPE, which only comes along once in a lifetime, I hope. But the other was ISAP. ISAP is a perfectly good way of integrating items that come up this month, next year, two or three years later.

DOCTOR REMICK: Along that line, I don't know if you had an opportunity to read a letter that came into the staff from Northeast Utilities about their response to IPE and ISAP. We thought that was a particular interesting response from one licensee, particularly stressing the importance of the ISAP program to them. You were sent copies, and so it's worthwhile reading, I think. It's an interesting response.

Anything else on --

COMMISSIONER ROGERS: I guess really the issue when all is said and done though is setting up a whole set of new priorities piecemeal, one by one. It's not getting the information out or calling people's attention to the issue, but then raising it to a new level of priority without looking at all the

other things that have to be dealt with.

DOCTOR REMICK: That's it exactly.

COMMISSIONER ROGERS: Yes.

MR. WYLIE: In the past, in regard to USI on the black and decay heat removal, we ran into the same type of situation where independently these were coming out without regard to the others.

DOCTOR REMICK: One can understand it from the staff's side. They work on these things very diligently over a period of time and finally see some resolution and so forth and you want to see some action and their recommendation is action. But somehow there needs to be some coherence and some perspective put to these things rather than just one coming out a week on different issues and so forth.

DOCTOR KERR: And some of these generic issues were probably identified by the ACRS.

DOCTOR REMICK: Yes, I'm sure they were.

MR. WYLIE: Well, I don't think we disagreed that they're real concerns.

CHAIRMAN CARR: No, the problem exists.

MR. WYLIE: Yes, the problem exists.

CHAIRMAN CARR: I guess my personal opinion is we're approaching them all rather piecemeal instead of going ahead and requiring a Level 3 PRA and getting

it over with. Inch up on them one at a time.

Any other comments?

Next item.

DOCTOR REMICK: Okay. The fifth item was boiling water reactor core power stability and it is our letter dated June 14th also. Doctor Kerr is subcommittee chairman and also David Ward had a related subcommittee. I turn it over to those two.

DOCTOR KERR: I don't think there's much to be said about that because I don't think there is any significant disagreement between the staff and our view on what should be done. We have no concern about a serious immediate problem. Indeed, I think it's a consensus that the problem is real only if one gets an ATWS because if you get the oscillation and can make the reactor go subcritical, it eliminates it. There doesn't seem to be any disagreement about that. It's only when you may have a critical reactor and continue to oscillate that you may have problems.

The difficulty arises because that phenomenon is not well described yet. I don't think there is a computer code or an analytical approach that permits one to predict the behavior that can occur in the variety of situations from which the oscillation might start with confidence. Even though

it's a low probability event that you'll get that at the same time you have an ATWS, it's sort of in the realm of the unknown. If one did somehow get very large oscillations, it could be serious.

We think it ought to be investigated, but at a reasonable pace and the staff seems to agree with that approach. So, I have nothing further to say.

DOCTOR REMICK: Dave?

MR. WYLIE: No, I have nothing to add.

CHAIRMAN CARR: Any questions?

COMMISSIONER ROGERS: Well, yes. There's a comment in your letter, "We're disappointed, given many years that BWRs have been operating in this country, with the present limited state of knowledge and inadequacy of existing analytical tools."

Just not being an expert in this field, I'm disappointed too. I wonder why that is the case or if it is the case. Is it that nobody has ever done this or looked at situations that can lead to things of this sort or that somebody did it but somehow it got lost long ago in the archives?

I've heard some comments from people when they heard about the LaSalle incident that, "Well, that's nothing new. We knew about that years ago."

DOCTOR REMICK: Correct.

COMMISSIONER ROGERS: And yet it seemed to be new to other people in the business and it certainly was new to the operators in that plant. I wonder whether there is an additional issue almost relating to what we were talking about in the human factors business, that somebody has looked at the thing but somehow it was a long time ago and they've left the business or retired or whatever and we haven't gotten that into contemporary thinking or actions.

DOCTOR KERR: I think I can add a little bit to this, Commissioner Rogers. Engineers, at least, tend to like to treat linear systems. The early work on this oscillation, which was observed I think almost when the first one of these things was constructed to treat it as a linear system and one can at least predict the oscillation using a linear system. One does not necessarily, and indeed I think one cannot get the amplitude of the oscillations very well.

It's a tough problem because in order to treat it one has to include spacial distribution. You can't treat it as a point problem and it's also a very non-linear problem. Those two things make it tough to describe and tough to solve the problem.

As experience has developed, it is

recognized that while the linear approach will give you a fairly good idea of when the oscillation will start --

COMMISSIONER ROGERS: Onset conditions.

DOCTOR KERR: -- it doesn't permit you to describe the amplitude of the oscillations, nor does it give you a very good idea of the effect of some of the initial conditions on that amplitude. One has to go to the non-linear distributed system in order to get that. It's a difficult problem.

COMMISSIONER ROGERS: But are you saying that a collection of items such as this out there that one could detect the possibility of using linear analyses that nobody has bothered to pick up and really do in a non-linear way to see how serious they are in terms of amplitude and so on and so forth?

DOCTOR KERR: There have been efforts to treat various parts of the problem. I don't think there exists -- as far as I know, there does not exist a satisfactory or complete solution of the things that probably one should know.

CHAIRMAN CARR: Is this in a too hard slot? Is that what you're saying?

COMMISSIONER ROGERS: Well, no incentive maybe. People are not afraid to tackle hard problems

if somebody's really interested.

DOCTOR REMICK: I think the need was known. Perhaps it was satisfactory until a problem develops. It has stirred interest. Certainly I know of some universities that are working on the problem and others. So, I don't think it's an insolvable type of situation.

DOCTOR LEWIS: Well, you know, there's a level at which it is insoluble because you're talking about three dimensional, unsteady, hydrodynamics, multi-phased. You know, that's insoluble for a long time to come. The question is narrowing down the universe to the point at which you're willing to do things and the normal way you do that is that you discover things. Empirically things happen, like this particular set of oscillations happened many, many years ago. Then you analyze those. That's what graduate students are for, and you develop them.

But unquestionably there are thousands of other oscillations out there, some of which may actually be unstable, even in the linear domain, that people haven't looked at because they haven't shown up. It's a large world out there.

MR. CARROLL: I was kidding General Electric's original expert on the matter of core

stability, one Mr. Eric Beckjord, about this the other day. When I first knew Eric, he was back trying to make Dresden 1 be unstable. I said, "You know, Eric, you should have solved this problem in 1959." He said, "I did. I kept telling people you need to keep flow going through the core."

CHAIRMAN CARR: Well, from a safety standpoint it's handleable with administrative procedures. But as a problem for the curiosity solvers, I guess it could be worked on.

MR. WARD: I think one of the reasons for what we call our disappointment was our observation that European developers of similar BWR systems seem to have, over the last 20 years, developed more comprehensive tools for -- and, in fact, ran tests that were pertinent to this particular thing.

CHAIRMAN CARR: Were you happy with the staff's comment on that when they came back and said, "Yes, but that didn't take into account the ATWS part of the problem"?

MR. WARD: I think that's correct and I appreciate the staff's comment because we came to the conclusion that although it is a problem, the safety significance seems to be, as Doctor Kerr said, tied up with its coincidence with an ATWS. The staff did make

that point in responding to us, that the Europeans haven't looked at that part of it either. I think that's correct.

We, I think, were disappointed that there wasn't a -- after 30 years in this mature system, there wasn't a tool there. The initial attempts at analyzing this were really quite primitive and compared with some of the other sophisticated analyses that are made it other areas, I think it surprised me.

COMMISSIONER ROGERS: Well, do you think our research program is adequately addressing possible problems out there that haven't been looked at? Again it's a question of adequate. You could look at everything under the sun, but --

MR. WARD: Yes. You can't look at the universe. In our thermal-hydraulic research letter of a couple months ago, we suggested some other areas that should be given attention. But it is very difficult and I --

CHAIRMAN CARR: They are doing follow-up research on this item.

MR. WARD: Oh, they are this item, right.

DOCTOR REMICK: I think the Agency has to be alert and when it sees things that perhaps have not been explored as thoroughly to see that it's done.

But to anticipate every possible one, I don't think anybody can do it.

CHAIRMAN CARR: Hopefully that's what we've got operators for. If they see something they don't understand they take the right action.

DOCTOR SEISS: Excuse me. You might ask Eric Beckjord to tally up for you how many dollars NRC has spent on research to answer questions that haven't been asked yet.

CHAIRMAN CARR: All right, sir. Unfocused research, right?

DOCTOR LEWIS: I have to interject that many years ago, maybe ten, I remember all existing and past NRC directors of research were lined up on one side of the table and each of them was asked to describe a way in which the NRC research program had made reactors safer than they would otherwise have been. They all gave the same answer, "Oh, there must be such cases."

CHAIRMAN CARR: That's probably our fault.

That completes your rundown?

DOCTOR REMICK: Of items that you specifically suggested, yes.

CHAIRMAN CARR: Commissioner Roberts?

Commissioner Rogers?

Commissioner Curtiss?

COMMISSIONER CURTISS: I just have a quick question on a subject of future attention. On the containment design criteria initiative, I wonder if you could say a word or two about what the status of that is, what your view of the timing and schedule for that might be.

DOCTOR REMICK: I'd like to ask Dave Ward to respond to that.

MR. WARD: Yes. Our intent there is to pull something together by early calendar 1990. We're planning a series of information gathering meetings. The first is scheduled for September 13th, another one for October 17th, and a third one probably in November, at which we're going to solicit ideas from expert people who have done research and given thought in this area. Then we'll try to gel that to put together in some sort of a synthesis and we hope to have that completed or first cut at it in January/February.

I should say I think that there might have been a little bit of confusion about what we're trying to do. Our effort is directed toward developing what I might call a zero-based, clean slate set of containment design criteria. Because of this, they would be for reactors that are not yet being designed,

that they won't be applicable to existing reactors. They won't be applicable to the evolutionary reactors, which are already designed. Depending on what they turn out to be, they might be useful as some sort of a standard for evaluating these already existing designs, but that's not our primary focus.

COMMISSIONER CURTISS: All right. So the focus would be beyond the evolutionary class?

MR. WARD: Yes.

COMMISSIONER CURTISS: Passive and advanced non-LWRs?

MR. WARD: That's correct.

COMMISSIONER CURTISS: And then will you review -- I take it from what you've got here that you're already reviewing the GE ABWR and may review the requirements document that EPRI is putting together --

DOCTOR REMICK: That's correct, yes.

COMMISSIONER CURTISS: -- to focus on the containment question.

DOCTOR REMICK: What we're working on that Dave's talking about is not related to those. It's for future.

COMMISSIONER CURTISS: All right. That addresses my questions. Thank you.

CHAIRMAN CARR: I've got a couple of other comments. One is I'm a little disappointed about the request for comments on the integration of the regulatory process. We're struggling along with a few of those items now and my understanding is you won't be able to give us some comments on that until November. I guess we'll take it when we can get it, but it's a --

DOCTOR REMICK: Our subcommittee met for the first time on that yesterday. I don't know if you want to ask Doctor Lewis to quickly summarize where we stand.

CHAIRMAN CARR: I'd be happy to -- sure.

DOCTOR LEWIS: Well, it just so happens that I anticipated that this might come up. Sometimes you can predict the future.

We really don't have a real report. We're on the hook to report to you in November and we had our first subcommittee meeting yesterday to talk about it. Commissioner Rogers was nice enough to come and help us in our confusion. We don't have any real conclusions, but we tried to put the question together in roughly the following way, and this may change by November. We're going to meet again and try to do it.

You've issued four policy statements in the

last few years that are significant. Of course everything you issue is significant, but there are four real policy statements --

CHAIRMAN CARR: Only to us sometimes.

DOCTOR LEWIS: Safety goals, severe accidents, standardization and advanced reactors. Two of those, the last two, have to do with the future and the first two have to do with the present. So we decided we would stick to the present and let the future take care of itself in the future.

We had a feeling that the word "integration" means different things to different people. The staff has produced a report which is called 178 which consists of a series of charts linking these policies together with lines and it was not easy for some of us to understand how that constituted integration.

COMMISSIONER ROBERTS: You're not the only one.

CHAIRMAN CARR: Did you not have the colored charts?

DOCTOR LEWIS: Darn, we had the blanket white version. We had the monochrome version.

CHAIRMAN CARR: You need the colored charts.

COMMISSIONER ROBERTS: The colored chart would make it clear as mud.

DOCTOR LEWIS: Undoubtedly that was it because one thing that was in the first chart there, the safety goal policy and the safety goal implementation were linked by a line and that complex was not linked to anything else by any other line. But now I know that it was a line in a color that doesn't reproduce on your Xerox machines. So, it was undoubtedly there, which relieves me a great deal.

But in any case, we decided that as a sort of first step, and as I say this may change, that the safety goal policy really is the ultimate expression of what the Commission wants from the nuclear enterprise and that everything else really has to be in some way subservient to that, severe accident policy being the only other one that is relevant to the current generation of reactors. Therefore, it has to be consistent with the safety goal policy, not the other way around. Speaking of integration, in a sense it tends to put them on a par and make people look for blanks where there is really a structure, kind of up/down structure.

The reason we're sensitized to this, and we've written you a number of letters on the subject, is that we do see things coming out of the staff that are incoherent. Not incoherent each in itself, but

when you look at the mass of them, they're incoherent and incoherently applied in the sense that they each pose jobs on the industry and on the utilities with really not much attention to how much each one contributes to the grand enterprise, which is to somehow meet the safety goal or to meet the standard of adequate safety.

We thought we might be able to do the following for you by November, put together some kind of integrating or coherence generating structure at the top, not recommend how to reorganize the Nuclear Regulatory Commission. Thought tempting, we will try not to do that. But to, at the bottom, put together a list of things that we've all seen in which the lack of integration or coherence is relatively clear and try to set the philosophy or strategy, name the things at the bottom which violated and invite you and the staff to try to fix those on the theory that those fixes would work their way up into the guts of the organization, point out the things that need to be done.

We cannot make this operation coherent, but we can try to help focus where some effort might be and I think that's just a status report.

CHAIRMAN CARR: All right.

Any questions?

The next one is you wrote us a letter on clearing up the division responsibility between you and our ACNW.

DOCTOR REMICK: Yes.

CHAIRMAN CARR: And we'll address that. I recommend to my fellow Commissioners that we ask for the ACNW comments so that we get -- I have some problems sorting out the real problem, so I want to make sure I understand it before we come down with a nice division of work. But we ought to be able to sort that out and we'll get you an answer back on that.

DOCTOR REMICK: I just might add one point there to know where we're coming from. If you look at it from future licensees perspective and what they have to go through, the question is in coming in for a reactor facility license, must they go to the ACNW for such matters as handling low-level waste in the plant, things like that, or is there one reactor safety advisory committee on those items? Is waste then something that's defined off-site and involves possibly Part 72 license or 60 or 61 license and not Part 50 license? I think there's potentially some confusion and unclear areas of responsibility in the

way it's defined now.

CHAIRMAN CARR: We do not want to proliferate the problems. We'd like to solve a few of them if we can.

DOCTOR REMICK: That's basically where we're coming from.

CHAIRMAN CARR: I understand. So, we'll do that.

Are there any other comments?

Well, I would like to thank the ACRS for this briefing and encourage your continued high quality support. We appreciate your independent reviews and we need them. We'll be bringing to you our problems that we want you to help us solve. So we thank you for this briefing and we'll look forward to the next one.

DOCTOR REMICK: Thank you. We thank you for the opportunity.

CHAIRMAN CARR: We stand adjourned.

(Whereupon, at 3:08 p.m., the above-entitled matter was adjourned.)

CERTIFICATE OF TRANSCRIBER

This is to certify that the attached events of a meeting of the United States Nuclear Regulatory Commission entitled:

TITLE OF MEETING: PERIODIC GRIEFING BY ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
PLACE OF MEETING: ROCKVILLE, MARYLAND

DATE OF MEETING: AUGUST 10, 1989

were transcribed by me. I further certify that said transcription is accurate and complete, to the best of my ability, and that the transcript is a true and accurate record of the foregoing events.

Reporter's name: Peter Lynch

8/10/89

SCHEDULING NOTES

Title: Periodic Briefing by the Advisory Committee on Reactor Safeguards (ACRS)

Scheduled: 2:00 p.m., Thursday, August 10, 1989 (OPEN)

Duration: Approx 1-1/2 hrs

Participants: ACRS 60 mins

- Dr. Forrest J. Remick
- James C. Carroll
- Dr. William Kerr
- David A. Ward
- Charles J. Wylie

Other Attendees

- Harold Lewis
- Carlyle Michelson
- Paul Shewmon
- Chester Seiss
- Ivan Catton

Speaking Topics:

- NRC's Human Factors Program and Initiatives (ACRS Report dated May 9, 1989)

- Generic Letter Relating to Occupational Radiation Exposure of Skin from Hot Particles (ACRS Report dated May 9, 1989)

- Application of Diversity in Systems that Use Redundancy to Achieve High Levels of Reliability (ACRS Report dated June 14, 1989)

- Proposed Resolution of Generic Issue 128, Electrical Power Reliability (ACRS Report dated June 14, 1989)

- Boiling Water Reactor Core Power Stability (ACRS Report dated June 14, 1989) (if time permits)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

May 9, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: NRC'S HUMAN FACTORS PROGRAMS AND INITIATIVES

During the 349th meeting of the Advisory Committee on Reactor Safeguards, May 3-6, 1989, we discussed the draft Commission paper related to the NRC's human factors programs and initiatives. Our Subcommittee on Human Factors discussed this matter with the staff during a meeting held on April 19, 1989. The subcommittee previously discussed draft Revision 1 of the Human Factors Regulatory Research Program Plan with the staff on January 26, 1989. We also had the benefit of the document referenced.

We are pleased that the NRC again is devoting a portion of its research program to human factors issues. The list of topic areas being worked on or planned is extensive. This will require dedicated research program management attention to help ensure that the research progresses in a timely fashion and the results are provided in a form for possible use by the agency.

During the January 26, 1989 meeting of our Human Factors Subcommittee, it concluded that the Human Factors Regulatory Research Program Plan be expanded into a human factors plan for the entire agency, i.e., to include the human factors programs and initiatives of all of the NRC offices. We are pleased to see that the staff has subsequently reached the same conclusion. We believe that the more comprehensive document will be of greater use to the Commission and to the interested individuals. We recommend that the discussion of the other office programs and initiatives be retained in the NUREG document when issued.

We believe that the Office of Nuclear Materials Safety and Safeguards' human factors initiative, addressing material and fuel cycle activities, is a welcome and needed addition to the NRC human factors efforts. Because few human factors considerations have been included in these activities in the past, much effort will be required. It is likely that additional human factors personnel will be needed by NMSS to carry out these activities in an effective manner.

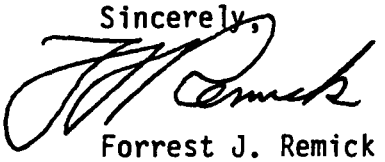
The utilization of a number of diverse institutions and organizations as human factors research providers is commendable. This is particularly

noteworthy in the organization and management and in the reliability assessment program elements of the research plan. The use of diverse research providers has already generated new input to, as well as interest in, the human factors research program.

Finally, we have recommended to the staff that a human factors research effort be initiated to develop improved methodology for the selection and training of resident inspectors. These individuals play a significant role in the regulatory program for operating nuclear power plants. Effective resident inspectors can have an extremely positive impact on nuclear safety through their interfacing role between the NRC and licensees. Conversely, inspectors who are poorly qualified either technically or in their approach to regulation or their interpersonal skills can have a detrimental impact on nuclear plant safety performance. We believe that appropriate human factors research could develop aptitude testing to assist in the selection of resident inspectors and develop training material relating to their work assignments and their relationship to licensee personnel.

We recommend proceeding with the proposed human factors research program and initiatives. We would like to be briefed by the staff on the results of the research and any proposed implementation into the regulatory process at appropriate times.

Sincerely,



Forrest J. Remick
Chairman

Reference:
Letter dated March 31, 1989 from F. D. Coffman, Jr., Office of Nuclear Regulatory Research to Herman Alderman, ACRS, transmitting the Commission Information Paper on NRC's Human Factors Programs and Initiatives (PREDECISIONAL)

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

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AUTHOR: F.J. Remick
AFFILIATION: ACRS (ADVISORY COMMITTEE ON REACTOR SAFEGUARDS)

LETTER DATE: May 9 89 FILE CODE: O&M-7

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AFFILIATION:

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

May 9, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: GENERIC LETTER RELATED TO OCCUPATIONAL RADIATION EXPOSURE OF SKIN FROM HOT PARTICLES

During the 349th meeting of the Advisory Committee on Reactor Safeguards, May 3-6, 1989, we reviewed the referenced draft generic letter, including a draft Interim Standard on Occupational Dose for Skin from Beta Radiation Emitted from a Hot Particle. Our Subcommittee on Occupational and Environmental Protection Systems, its consultants, and invited expert, Dr. Dade W. Moeller, discussed this matter during a meeting held on April 20, 1989 with representatives of the NRC staff, the National Council on Radiation Protection and Measurements (NCRP), and the Nuclear Management and Resources Council (NUMARC). We also had the benefit of the documents referenced.

During the past few years, high sensitivity personnel contamination monitoring equipment has been installed in most nuclear power plants to improve their radiation protection programs. This has resulted in the occasional discovery of microscopic hot particles on workers' skin and clothing at many nuclear power plants. (Fragments from Stellite faced components containing cobalt-60 and irradiated fuel fragments are the most common hot particles.) It is clear that hot particles have always been around nuclear power plants but generally were not detected. We have been told that there is no evidence that these hot particles have caused workers any adverse health effects. The staff has concluded that the existing 10 CFR Part 20 limits intended for exposures of large areas of skin (7.5 rem per quarter for skin of the whole body and 18.75 rem per quarter for the extremities) are overly restrictive when highly localized exposure results from a hot particle. The staff plans to amend 10 CFR Part 20 to provide a less restrictive limit for exposure of the skin by hot particles. Until this amendment to 10 CFR Part 20 becomes effective, the staff proposes to use the interim standard, that is enclosed in draft form with the generic letter, in taking enforcement actions.

Industry representatives have been expressing concern since 1987 that, as a result of the current interpretation of the regulation, an unduly high level of attention and emphasis is being given to hot particle doses at nuclear power plants. These representatives have indicated that this situation is causing unnecessary fear and concern among nuclear power plant workers. We believe this to be a very serious issue. Industry has also provided data showing that workers could be exposed to substantially less whole-body

radiation (from sources other than hot particles) by setting a more realistic hot particle exposure limit. In order to avoid what the staff is considering as "overexposures" from hot particles, licensee radiation protection programs require that workers be monitored frequently for hot particles during work in areas that have the potential for hot particle exposures. This more frequent monitoring increases the time workers spend in radiation areas to complete a given task and thus increases whole-body radiation exposures. The results of an industry survey reported by NUMARC indicate that implementation of a more realistic limit (discussed below) for hot particle exposure would result in an estimated reduction in whole-body dose of 5 to 45 person-rem per year per nuclear power plant unit. (For 1987, the average total collective dose per unit was 420 person-rem.)

Other concerns expressed by industry are cost related (reduced worker productivity and the need for more health physics technicians), increased radwaste volume, impact on SALP ratings, and potential insurance and legal considerations.

Industry representatives have emphasized that a change in the NRC position would not result in a decrease in the protection of workers or the general public nor in the controls that have been established to prevent hot particles from being transported off-site.

The staff, in March 1987, asked the National Council on Radiation Protection and Measurements (NCRP) to study the health significance of exposure from hot particles on the skin and to provide recommendations based on the findings of this study. (NCRP has an international reputation for excellence in the field of radiation protection and has been chartered by Congress to work with federal agencies and others in developing guidance in radiation protection matters.) A five-person NCRP subcommittee made this study, and the NCRP provided a report entitled, "Recommendations on Limits of Exposure to 'Hot Particles' on the Skin" to the staff on June 17, 1988. This report was subsequently reviewed and approved by the full 75-member NCRP.

The NCRP recommendations are "based on ensuring that ulceration of minute areas of the skin" does not occur. The risk of radiation-induced skin cancer from exposure to a hot particle was not considered to be significant or controlling by NCRP. NCRP's recommended exposure limit for particles less than 1 mm in diameter is 1E+10 beta particles emitted from the surface of the particle. (This limit is expressed as 75 microcurie-hours where one beta particle is emitted per disintegration.) They recommend that any overexposed individual be provided with follow-up medical evaluation with respect to skin ulceration. Depending on particle size and isotopic composition, this results in a dose limit ranging from 300 to 800 rad. To place this dose in perspective, a 2000 rad dose is the accepted limit for radiotherapy treatment involving large areas of the skin. This limit is also based on avoiding skin ulceration.

In its June 17, 1988 transmittal letter, NCRP stated that its recommendations may be considered "firm" (subject to final editorial changes) and "may be

used and quoted as appropriate." This letter indicated that the NCRP report would be published in final form in the fall of 1988. The staff subsequently raised a number of technical and philosophical questions with respect to the NCRP recommendations that are currently in the process of being answered. NCRP also requested that NUMARC provide comments on the NCRP report.

NUMARC's comments supported NCRP's approach to the hot particle problem but pointed out what NUMARC believed to be considerable conservatism used in the NCRP recommendations. As a result of the staff and NUMARC comments, there is no firm schedule for final publication of the NCRP report.

The staff plans to revise appropriate sections of 10 CFR Part 20 to limit hot particle exposure of the skin and will consider the final NCRP recommendations and recent research results. However, the staff recognizes that it will be at least two years until this revision can become effective and believes that it is appropriate to use an interim standard in the exercise of its enforcement discretion regarding hot particle exposures.

The staff considered implementing the recommendations in the NCRP report in its interim standard for skin exposures to hot particles. However, the staff decided, for a variety of reasons cited in the draft generic letter, that it would be inappropriate to implement these NCRP recommendations at this time. Instead, the interim standard enclosed with the draft generic letter, in effect, changes the limit for exposure of the skin to radiation from hot particles from 7.5 rem (skin of the whole body) or 18.75 rem (skin of the hands and forearms, and feet and ankles) per calendar quarter to 50 rad per hot particle exposure.

Recommendations

We do not endorse the staff's proposal to issue the generic letter and interim standard in its present form. Industry, in its presentation to us, has made a strong case that the proposed interim standard for hot particle exposure would provide very little relief in addressing the hot particle problem and believes that the interim standard should be based on the NCRP recommendations.

The staff, on the other hand, has obvious difficulty in basing an interim standard on an unpublished NCRP report. Accordingly, we recommend that staff senior management take an active role in effecting a timely resolution of remaining outstanding issues with NCRP so that its report may be published. The staff should then develop on an expedited basis an interim standard based on the NCRP recommendations. Based on what we have been told, we believe that this interim standard could be completed by September 1989. To the extent the standard differs from the NRCP recommendations, the staff's reasons for such modifications should be clearly and completely documented. Also, the staff concurrently should move ahead with its planned revision of 10 CFR Part 20 rulemaking on this subject.

There are two additional items concerning the draft generic letter and interim standard that we believe should be corrected in the final interim standard.

First, the draft interim standard fails to define a hot particle with respect to size for purposes of regulatory control. This is a very important issue, since the size of the exposed area of skin is central to the determination as to whether the exposure limits for large areas of skin or hot particles should be used. NCRP uses 1 millimeter as the maximum size that should be used in implementing its recommendations. We believe that this issue needs to be clarified in the final version of the interim standard and in the planned revision of 10 CFR Part 20 on hot particles.

Second, we recommend that the regulatory concept contained in Section 4, Occupational Exposure Limit, of the draft interim standard be reconsidered. The section states that the NRC will not issue a notice of violation (NOV) for a single hot particle exposure (less than the proposed limit) to an individual during a calendar quarter. It further states that the staff may issue an NOV if any individual is exposed to two or more hot particles during a single event or to hot particles in two or more separate events during a calendar quarter. This policy appears to be an unnecessary and complicating feature of the draft interim standard given the existing regulatory requirements of 10 CFR Part 20.201, Surveys, which requires that licensees must perform "adequate surveys." It is also inconsistent with the staff's position that hot particle exposures are not to be added to skin dose for record-keeping purposes and are not themselves additive unless they occur in the same location on the skin.

We intend to follow the progress of the interim and final resolutions of this difficult and controversial issue and will provide you with further comments as appropriate.

Sincerely,

Forrest J. Remick
Chairman

References:

1. Letter dated February 9, 1989 from J. H. Sniezek, Office of Nuclear Reactor Regulation, to E. L. Jordan, Committee to Review Generic Requirements, Subject: Generic Letter and Interim Standard Concerning Hot Particle Exposures of Skin
2. Letter dated June 17, 1988 from W. R. Ney, National Council on Radiation Protection and Measurements, to R. E. Alexander, Office of Nuclear Regulatory Research, transmitting NCRP Report 80-1, "Recommendations on Limits of Exposure to 'Hot Particles' on the Skin" (draft of June 1988/Rev. 3)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

June 14, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: RELIABILITY AND DIVERSITY

During the 349th and 350th meetings of the Advisory Committee on Reactor Safeguards, May 3-6, 1989 and June 8-10, 1989, respectively, we discussed the implementation status of the anticipated transients without scram (ATWS) rule. Our Subcommittee on Instrumentation and Control Systems also met with representatives of the staff and the industry on April 21, 1989 to review the progress being made regarding this matter.

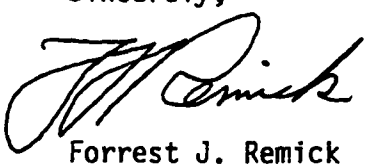
It appears that reasonable progress is being made, especially in light of some of the difficulties that have arisen in the interpretation and application of the rule. However, during the course of our discussions of compliance with the rule, two issues arose that we consider to have enough general significance to deserve further attention.

The first of these is the significance and application of diversity in systems that use redundancy to achieve high levels of reliability. The ATWS rule requires that diversity be used in an effort to further improve reliability. The staff interprets the rule to require diversity even if, in a particular application, there is no evidence that its use increases reliability. It appears, indeed, that this interpretation would be used even in situations in which, by virtue of commercial availability of components, maintenance considerations, or other relevant factors, diversity might reduce the reliability of a particular system. This seems to us to be contrary to the spirit of the ATWS rule which is aimed at increasing the overall reliability of the rapid shutdown system. Furthermore, we believe that in any situation in which diversity is considered as a means to increase reliability, it should be kept in mind that reliability is the objective, and not diversity per se. Thus, if diversity is to be required, effort should be made to ensure that it will contribute to increased reliability rather than making the system less reliable.

The second issue, which also came up during the discussion of the use of diversity, has to do with the possible influence of aging on the occurrence of common mode failures. The staff reasoned that even if diversity were not important during the first forty years of plant life, it might avoid development of common mode failures from "wear out," that might occur if operation beyond the original forty-year license is approved. We believe such concern may arise from a misunderstanding. While it is true that "wear out" of components does cluster around some "mean-time-to-wear-out," this time should be well known from test or experience, and components should be replaced or overhauled early enough to avoid it. Time-in-service for components that have not been replaced should be far enough removed from "wear out" that failure due to wear out (i.e., "aging") should not be a contributor to common mode failures.

We believe some further consideration of these two issues by the staff is merited, not only as they may bear on the application of the ATWS rule, but because of their significance generally.

Sincerely,



Forrest J. Remick
Chairman

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

PAPER NUMBER: CRC-89-0566 LOGGING DATE: Jun 15 89

ACTION OFFICE: EDO

AUTHOR: F.J. Remick
AFFILIATION: ACRS (ADVISORY COMMITTEE ON REACTOR SAFEGUARDS)

LETTER DATE: Jun 14 89 FILE CODE: O&M-7 ACRS

SUBJECT: Reliability and diversity

ACTION: Appropriate

DISTRIBUTION: RF

SPECIAL HANDLING: None

NOTES:

DATE DUE:

SIGNATURE: DATE SIGNED:
AFFILIATION:

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

June 14, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: PROPOSED RESOLUTION OF GENERIC ISSUE 128, "ELECTRICAL POWER RELIABILITY"

During the 350th meeting of the Advisory Committee on Reactor Safeguards, June 8-10, 1989, we discussed the NRC staff's proposed resolution of the subject generic issue. Our Subcommittee on AC/DC Power Systems Reliability also met with members of the staff and its contractor on June 7, 1989 to review this matter. We also had the benefit of the documents referenced.

The staff's proposal is still another example of piecemeal resolution of isolated issues, a practice we have criticized in numerous reports. It is an example also of the continuing inability or unwillingness of the staff to develop resolutions based on reliability rather than sometimes arbitrary or prescriptive criteria. We continue to believe that issues such as these should be addressed and implemented through the Individual Plant Examination (IPE) program along with assessments of the associated risk reductions. These points are elaborated below.

Generic Issue 128 (GI-128) was identified in NUREG-0933, "A Prioritization of Safety Issues," Revision 5, March 1987, as the integration of three separate safety issues, namely:

- Generic Issue 48 (GI-48), Limiting Conditions for Operations (LCOs) for Class 1E Vital Instrument Buses, which deals with a safety concern that some operating nuclear power plants do not have administrative controls or technical specifications governing operational restrictions for their Class 1E 120 v ac vital instrument buses and associated inverters that may result in the failure of the plants' safety systems to perform their safety functions when required.

- Generic Issue 49 (GI-49), Interlocks and LCOs for Class 1E Tie Breakers, which deals with a safety concern that independent, redundant Class 1E ac or dc buses can be interconnected via tie breakers which may be left closed by mistake. When left closed, the tie breakers can compromise the independence of the redundant safety-related buses and, in some cases, may prevent the emergency diesel generators from supplying emergency power when needed.

- Generic Issue A-30 (GI A-30), Adequacy of Safety-Related DC Power Supplies, which deals with a safety concern that some plants may not have adequate provisions (e.g., monitoring, maintaining, and tests) for assuring that the dc power supplies are available and capable of performing their safety functions when needed.

The staff's proposed resolution of GI-128 is to issue two separate generic letters with related information requests pursuant to 10 CFR 50.54(f), "Conditions of Licenses," to inform the licensees of related concerns and to obtain information for the staff to assess whether necessary actions have been taken to resolve these concerns. One generic letter would address GI-48 and GI-49, and the other would address GI A-30.

The proposed resolutions for the GIs considered will probably improve the reliability of electrical systems if properly interpreted for the plants for which changes are required. However, as pointed out by the staff, there are interrelationships among these GIs and several related GIs and USIs that will affect how these changes influence plant performance. This argues for an integrated approach to the identification of needed changes in plant hardware and procedures, such as that proposed for the IPE program. This will result in a more efficient use of resources and improved results compared to the piecemeal approach characteristic of the current issue resolution process.

Further, the inability of the staff to develop and apply reliability theory (instead of obsolescent criteria such as the single-failure criterion) to important plant systems leads to proposed solutions the effects of which cannot be evaluated in terms of increased reliability or decreased risk. Rather, what one achieves is compliance with regulations without a quantitative measure of what improvement has been achieved. An example of this is the proposed resolution of GI-48 associated with plant inverters. Here the emphasis is on establishing LCOs to be incorporated into the plant technical specifications rather than on specifying a reliability goal. The LCO approach gives no assurance that the power supply will be reliable; rather it requires that there be a limitation on plant operation if the power supply is unavailable. This provides little or no increase in the likelihood that the inverter, a key component and one that has been found unreliable in many plants, will be available when needed.

In summary, we recommend that the resolution of GI-128 be implemented through the IPE program along with assessments of the associated risk reductions.

Sincerely,

Forrest J. Remick
Chairman

References:

1. Idaho National Engineering Laboratory, EG&G Idaho, Inc., EGG-NTA-7727, Revision 3, "Technical Findings for Proposed Integrated Resolution of Generic Issues 128 (Issue 48 and Issue 49)," Prepared for the U.S. Nuclear Regulatory Commission, FIN No. D6025, March 1989
2. Idaho National Engineering Laboratory, EG&G Idaho, Inc., EGG-NTA-8197, Revision 1, "Technical Findings, Generic Issue 128 (Issue A-30), Adequacy of Safety Related DC Power Supplies," Prepared for the U.S. Nuclear Regulatory Commission, FIN No. D6025, March 1989

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

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AUTHOR: F.J. Remick
AFFILIATION: ACRS (ADVISORY COMMITTEE ON REACTOR SAFEGUARDS)

LETTER DATE: Jun 14 89 FILE CODE: O&M-7 ACRS

SUBJECT: Proposed resolution of generic issue 126, electrical power reliability

ACTION: Appropriate

DISTRIBUTION: RF

SPECIAL HANDLING: None

NOTES:

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SIGNATURE: DATE SIGNED:
AFFILIATION:

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D. C. 20555

June 14, 1989

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Chairman Zech:

SUBJECT: BOILING WATER REACTOR CORE POWER STABILITY

During the 350th meeting of the Advisory Committee on Reactor Safeguards, June 8-10, 1989, we discussed the issue of core power stability in boiling water reactors (BWRs). We had the benefit of presentations by representatives of the BWR Owners Group (BWROG), the General Electric Company, the NRC staff, and contractors to the NRC. This topic was also discussed at a meeting of the combined Thermal Hydraulic Phenomena/Core Performance Subcommittees on May 23, 1989. Attention has been drawn to this issue by an event which occurred in March 1988 at the LaSalle County Station, Unit 2. The chief purpose of our recent meetings was to review the general program outlined by the BWROG and the staff to address this issue. The Committee had previously considered this matter during its meeting on December 15-16, 1988. We also had the benefit of the documents referenced.

Although it is well known that BWRs can experience core power oscillations under certain conditions, the magnitude and divergent nature of the oscillations during the LaSalle event were unexpected. BWRs have inherent feedback mechanisms that tend to constrain power increases. But, if the feedback becomes out of phase with power generation, as can occur under certain operating conditions, this inherent constraint can be lost. Core power oscillations can involve the entire core behaving as a whole, or behaving in a manner where one region is increasing in power while another region is decreasing.

Such oscillations pose two threats to reactor safety. First, if peak local power becomes great enough during an oscillation, local fuel damage from overheating can occur because of a local loss of effective heat transfer through the phenomenon known as Departure from Nucleate Boiling (DNB). Substantial numbers of fuel pins could fail in such an event. This can occur even if total reactor power has not increased significantly. In the LaSalle event, the peak local neutron power exceeded 300 percent of rated core

average although there was no evidence of fuel overheating or damage. A second class of threat is, we believe, of greater significance. If core power oscillations are large and continue for an extended period, the suppression pool may become overheated and the integrity of the containment might be threatened.

Because a reactor scram terminates oscillations, the latter threat exists only if the scram fails; for example, if an anticipated transient without scram (ATWS) event triggers a severe power oscillation. Local damage from DNB could result following the onset of large oscillations if the capability for making the reactor subcritical is lost.

Following the LaSalle Station event, the staff issued two generic letters to BWR licensees. These letters endorsed a series of actions that had already been proposed by the BWROG and added some additional short-term requirements. For the longer term, it was agreed that the BWROG would develop further actions that would be reviewed by the staff and implemented on a schedule to be agreed upon later this year.

The initial BWROG action was the imposition of new administrative controls at operating BWRs that define power/flow regions of unacceptable operation. These are regions where analysis or experience has indicated potential for oscillations. The administrative controls provide that these operating regions be avoided completely, or that special actions be taken if such a region is entered during operating maneuvers. We were told that these administrative controls are now in place at all operating BWRs. The staff has added a requirement that a manual scram be initiated in certain classes of BWRs upon occurrence of an inadvertent loss of operation of two reactor recirculation pumps.

For the longer term, the BWROG and the General Electric Company have developed a provisional list of alternatives that will be made available to individual licensees. This approach is intended to recognize that differences exist among the plants and that an optimal solution will be based on plant-specific parameters. These proposed alternatives range from further administrative controls to the addition of new automatic shutdown circuits that would detect the inception of oscillations or the entry into potentially unstable regions of operation. Our understanding is that the staff will review and approve proposals developed for each individual plant.

We believe that the general program outlined by the BWROG and the staff is sound and represents an adequate response to the issue. Local fuel damage, caused by DNB, is most certainly something plant owners will want to avoid, but the safety implications are limited. In general, the potential for power oscillations of the sort being considered does not represent a significant risk to public health and safety, except in combination with an ATWS, as we have discussed above.

We believe it is important that considerable attention be given in the longer term to the development of an improved understanding of the conditions that can lead to an ATWS compounded by core power oscillations. We are disappointed, given the many years that BWRs have been operating in this country, with the present limited state of knowledge and the inadequacy of existing analytical tools. We note that in European BWR programs a more aggressive approach seems to have been taken to studies of core power instabilities and to incorporation of provisions for monitoring and controlling them.

Sincerely,

Forrest J. Remick
Chairman

References:

1. U.S. Nuclear Regulatory Commission, NRC Bulletin Number 88-07: "Power Oscillations in Boiling Water Reactors (BWRs)," June 15, 1988
2. U.S. Nuclear Regulatory Commission, NRC Bulletin Number 88-07, Supplement 1: "Power Oscillations in Boiling Water Reactors (BWRs)," December 30, 1988

OFFICE OF THE SECRETARY
CORRESPONDENCE CONTROL TICKET

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ACTION OFFICE: EDO

AUTHOR: F.J. Remick
AFFILIATION: ACRS (ADVISORY COMMITTEE ON REACTOR SAFEGUARDS)

LETTER DATE: Jun 14 89 FILE CODE: O&M-7 ACRS

SUBJECT: BWR core power stability

ACTION: Appropriate

DISTRIBUTION: RF

SPECIAL HANDLING: None

NOTES:

DATE DUE:

SIGNATURE: DATE SIGNED:
AFFILIATION: