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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

495TH MEETING

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THURSDAY,

SEPTEMBER 12, 2002

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ROCKVILLE, MARYLAND

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The subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 1:00 p.m., George E. Apostolakis, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

GEORGE E. APOSTOLAKIS	Chairman
MARIO V. BONACA	Vice Chairman
F. PETER FORD	Member
THOMAS S. KRESS	Member-at-Large
GRAHAM M. LEITCH	Member
DANA A. POWERS	Member
VICTOR H. RANSOM	Member
STEPHEN L. ROSEN	Member

COMMITTEE MEMBERS PRESENT: (cont'd)

WILLIAM J. SHACK Member

JOHN D. SIEBER Member

GRAHAM B. WALLIS Member

STAFF PRESENT:

JOHN T. LARKINS, Designated Federal Official

MARK CUNNINGHAM, NRR

ERASMIA LOIS, NRR

HUSSEIN NOURBAKSH, ACRS Senior Fellow

JAY PERSENSKY

NATHAN SIU, NRR

MAGGALEANA WESTON, Staff Engineer

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

(1:02 p.m.)

CHAIRMAN APOSTOLAKIS: The meeting will now come to order. This is the first day of the 495th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the committee will consider the following: human reliability analysis research plan, subcommittee report on the proposed resolution of Generic Safety Issue 185, subcommittee report regarding D.C. Cook switch gear fire, CTL fire, subcommittee report regarding the reactor oversight process, subcommittee report on fire protection, and proposed ACRS reports.

A closed session was held this morning in the NRC Auditorium to discuss classified information applicable to DOE/DOD Naval Reactors, Virginia Class Nuclear Propulsion Plan Submarine Design.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Dr. John T. Larkins is the designated federal official for the initial portion of the meeting.

We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions.

A transcript of portions of the meeting is being kept, and it is requested that the speakers use one of the microphones, identify themselves, and speak with sufficient clarity and volume so that they can be readily heard.

I will begin with some items of interest. I would urge the members to review at the break or tonight the reconciliation of ACRS comments and recommendations. There are a number of letters here that we have responses to from the EDO's office, and please make sure you read it.

There have been some changes to the agenda of today. There will not be any presentation by the NRC staff on GSI-185. Instead, the subcommittee chairman will provide the report.

There will be a subcommittee report on fire protection today, and this report was scheduled for Friday between 1:30 and 2:00 p.m. So it will be done today.

These reports by the subcommittee chairmen will be transcripted. We will have the Court Reporter here.

I would like to introduce our new ACRS Senior Fellow, Dr. Hussein Nourbaksh. Hussein? Dr.

Nourbaksh has more than 20 years of research experience in many aspects of reactor safety, including accident phenomenology and source terms, containment performance, thermal hydraulic analysis, and code development, uncertainty analysis, PRA, accident monitoring, risk integration, and consequence analysis.

He has a Ph.D. in chemical engineering from the University of Minnesota, and he has held a number of research positions at Brookhaven National Laboratory, including the group leader of the Safety Analysis Group.

Hussein, welcome.

(Applause.)

CHAIRMAN APOSTOLAKIS: And now we are ready to move on to the first item on the open agenda. This is the human reliability analysis research plan. Dr. Powers is the cognizant member.

Please, Dr. Powers.

MEMBER POWERS: Thank you, George.

It goes without saying that the committee has, especially in its recent research reports, indicated a belief that the issues of human factors and human reliability analysis were of paramount and perhaps growing importance in the safety of nuclear reactors, especially in an era where risk assessment plays such an important role in the regulatory process.

It is interesting that the perception, certainly within the subcommittee on human factors, is that this ubiquitous role of human factors and human reliability assessment will remain, even as we move into an era of advanced reactors where passive safety is emphasized, not so much because of the issues of errors -- human errors of omission as they are of human errors of commission. Also, because the issues of latent errors, attributable either to engineering, manufacturing, or maintenance, are likely to remain.

Consequently, the ACRS as a whole has attributed a great deal of significance to the development of the technologies, and the area of human factors and human reliability analysis at the agency is important.

But we have, it goes without saying, been somewhat critical of past plans that the NRC has brought forward to coordinate all of the activities in the -- in connection with the word "human" that are going on at the agency. And the agency has, in fact, abandoned those attempts to cross-correlate everything that's going on and, instead, chosen to focus on its research activities in human factors and human reliability analysis.

The staff distinguishes those two activities, though they are closely interconnected, whereas the ACRS tends to lump them all together. And I think the staff forgives us for our inability to make fine distinctions here.

We did have a chance to have a subcommittee meeting to discuss the research plans in the area of human factors and human reliability analyses with the staff. My own feeling was that it was an exceptionally good subcommittee meeting.

We spent nearly a full day doing that, and as a result the staff is coming before us now to give you at best a synoptic representation of all the material that they presented to us at the subcommittee meeting. I will say that they gave us a very good exploration into many of the activities that are going on. We asked them to emphasize those things they put into a category called "infrastructure," what we might call research to develop the technological capabilities that they have, because they have quite a few other activities that I would class as applications of the technology, where they are fielding the work, using the technology in support of other major activities within the agency, be they within research or in our -- or other places in the agency.

We do not ask them to explore those applications to any great extent, largely because we see the results of their fine work when we explore those applications as topics alone.

Nevertheless, they were able to open my eyes into some of the important capabilities that are available to the agency to use, not the least of which is -- was an extraordinary presentation on how we might be able to derive new technological insights in the area of human reliability assessment from the Halden program.

Unfortunately, I don't think they're going to have a time to do that particular subject a great deal of justice here. I certainly hope that they will, instead, spend their time exploring for us the research plans, especially the research plans and technological developments that they have in the works here, because I think in our -- in spite of the days of exploration of this that we really did not get a good understanding of what was not being done, and the length and breadth of what was being done in these -- you know, what they call the infrastructure development, maybe some sense of that to the extent that they can augment our understanding there. I think it would be very useful.

Nevertheless, I will say that it was one of the most positive meetings on human factors in a broad sense that I've ever participated as a member. And, quite frankly, they seem to have their act together here.

With that introduction, I guess -- do I turn to you, Mark?

MR. CUNNINGHAM: My name is Mark Cunningham. I'm the Chief of the Probabilistic Risk Analysis Branch in the Office of Research.

With me today, starting at the far end, are Nathan Siu of the PRA Branch, Erasmia Lois of the PRA Branch, and Jay Persensky in the -- in a branch with a very long name, including Human Factors --

(Laughter.)

-- that I can never remember.

(Laughter.)

MEMBER POWERS: Not a human factors name, right?

(Laughter.)

MR. CUNNINGHAM: Yes, that's right. Not a human factors name.

(Laughter.)

I'm going to provide some of the general background on the work that we've been doing in human reliability and human factors, and following me Jay and Erasmia will do the real work of telling you what's in our program and what some of our plans are.

Can we go to the next slide, please?

We're here today to provide an overview of the work that we're doing in human reliability analysis research and human factors research, and I'll come back to the distinction we make in a couple of slides.

We're going to talk both about the activities that we have underway and the relationships and interactions that we -- that exist between the two programs.

We were interested at the subcommittee, and we're interested in today, in getting feedback from the committee on -- to help us better plan our upcoming activities. We're in the position now of updating our human reliability plans and human factors plans for the next couple -- four or five years. We do this about once a year, but it's the right time of the year to do this.

And we're interested in getting feedback from the committee. Like yourselves, we see this as a very important activity in the office, and we want to -- and as you well know, this committee has not been as positive about this -- these programs in the past as they seem to be today. We're interested in getting feedback for all those reasons.

Go to the next slide, please.

There's really three parts to the briefing today. I'm going to talk a little bit about the -- how the two programs and how the two technical disciplines relate to each other, at least in the context of how we do our work around here. Jay then will talk about the human factors activities and needs, and then Erasmia will finish up on human reliability analysis activities and needs.

Next slide, please.

The human factors and human reliability analysis support a number of activities in the agency in a sense that we want -- we aren't going to talk about today. Human factors work is used in deterministic evaluations of control rooms, many things like that. PRA is used in many areas -- in risk-informed regulation. We're not going to talk about that particular either. What we're talking about today is the relationship between the two programs.

We have a model of an oval here I guess that -- I can start at the right-hand side that -- in our area where Nathan and Erasmia and I are is in the probabilistic risk analysis area. A key component of PRA is human reliability analysis.

We use information from the human factors program in a couple of ways. One is basic information and data models on how humans perform. You can think of that as, again, in a deterministic sense of that under a certain set of conditions this is how we would expect individuals or crews to react to certain context or situations.

The human factors program also identifies areas where human reliability analysis ought to be focusing some of its modeling, and can tell us of all the things that can cause humans to perform incorrectly, what seem to be the more important areas and where we ought to be spending time in human reliability analysis.

Looking back -- going then from HRA and PRA back to human factors, human reliability analysis and PRA give information to the human factors programs on the situations and the scenarios that can be most important in evaluating the risk from a nuclear facility, or any other facility for that matter.

We've talked in the past, and some of the changes in thinking in HRA over the last few years have brought about -- have made us think more -- characterize the information more in terms of the context that the operator or the human is put into, that it's -- we shouldn't be thinking so much of the human as being a separate thing out there independent of the situation that he or she is put into.

So I think that's an important element, going back to the human factors program and saying we ought to be thinking about how humans, individually or in groups, perform in these types of contexts, put into a situation where they're in -- for example, in the middle of an event. Fire might be an initiator, or something like that, and what would we expect? How would we expect the individual humans or the crews to perform in that context?

Like coming from -- like as comes from human factors to human reliability, we identify HRA modeling needs, that we need better information on this aspect of human performance. Through these, we have an opportunity in this sense to help prioritize what the human factors program does, at least a part of -- a segment of what the human factors program does.

In that we can say, "Again, these are the situations or human performance issues that seem to be the most important or most uncertain in the context of a risk analysis of a facility." And that helps Jay and Company to define what types of research ought to be performed in human factors.

Next slide, please.

Given that general background, that context of how we use -- how the two programs interrelate, I guess it's -- Jay is going to proceed now and talk some more about the human factors research program at NRC.

MR. PERSENSKY: Good afternoon. This slide is titled "Role of." I wasn't sure what to call it. We have called it goal. We have called it all -- various different things.

(Laughter.)

The bottom line is this is what we do. Our role, as I see it -- and especially in the human factors group -- is to develop tools for the regulators, for the regulated -- the regulator staff, because they have jobs. They do rulemaking. They do licensing. They do monitoring. And at times they need some sort of tool. That tool could come in various forms. It could be a rule. It could be a regulatory guide. It could be inspection protocol.

We try to develop those things using the best technical basis available. In many cases, that means that we're borrowing or adopting material from other places. When we talk about guidelines, guidance, the military, the transportation, the aerospace industry, have major research programs where they develop a lot of the kinds of things that we use as part of the guidance that we develop. We don't necessarily have to go out and develop our own -- do our own research from the standpoint of a laboratory setting.

However, there are times when we either want to test those concepts from these other applications to see how well they fit within the nuclear industry. It's a different setting. One of the things that we're involved with, for instance, is fatigue. The Commission has directed us to write a -- NRR to write a rule on fatigue and how we can deal with fatigue in the nuclear setting.

Most of the research that's been done in that area has been done in the transportation area, some in the military -- a little bit different. Most cases there you're dealing with one person that's responsible for keeping that truck on the road, keeping that train moving in the right direction, or flying an airplane.

Whereas, we have a situation where you have a number of people; you have teamwork. So you have a little bit different setting. So there are times you have to take that information and adopt it. That might mean we can adopt it directly, or it might mean that we have to go out and try to do some confirmatory research.

So that's where the technical basis aspect comes in. So part of what it takes to do that is to have core competence in people in research, to know where to go to get the information and how to take that and adopt it, as well as to develop the research if it's necessary to do something more like a laboratory kind of setting.

The bottom line, though, is, why do we do this? And that's to ensure that the nuclear facility personnel have all the right tools that they need to have the information, and the information was going to come through a man-machine interface. That information might come through procedures. That they have the right knowledge. That knowledge is going to come through their training program; again, through their procedures.

That they have the right kind of working environment. That means everything from the temperature, the humidity, the lighting, to the organizational environment, because these all impact on what the people do.

And, again, we want them to work -- do their work safely, or, to some extent, efficiently. But our job is primarily in the area of safety. So that's what we do. That's what we attempt to do through developing these tools.

MEMBER WALLIS: Hold on a minute.

MR. PERSENSKY: Yes.

MEMBER WALLIS: I find this interesting. I mean, the most interesting part of your presentation the other day to me was when things began to get possibly quantitative. And to me, if a tool is something like a computer program or a way of calculating quantitative success criteria or quantitative numbers to put into a PRA, or calculation methods which are based on some logical developments -- I mean, you didn't mention any of those things when you talk about tools.

The interesting thing to me is all of these other kinds of tools. I think that's the way you ought -- for me, that's the way you ought to be going, in the quantitative direction.

MR. PERSENSKY: Okay. And I don't disagree with you. I feel that that's the infrastructure part of building the tools that the regulator uses. The regulator uses the criteria, the guidance, the inspection protocols that are developed, because that's what they use out in the field.

MEMBER WALLIS: Yes. But how does this relate to making the science or whatever more quantitative? So it can be compatible with PRAs and things like that.

MR. PERSENSKY: The quantitative aspect of that is in doing the research, for instance, at a simulator we would collect data in these various areas.

MEMBER WALLIS: That's the interesting part to me.

MR. PERSENSKY: I understand. That is the interesting part to me, but the application of what we do is not solely to put it into a PRA.

MEMBER WALLIS: I realize that.

MR. PERSENSKY: But to do something for the regulator.

MEMBER WALLIS: I realize that. You do a

lot of other things as well.

MR. PERSENSKY: Yes. I mean, we do other things as well, but, again, that's our bottom line responsibility is to support our regulator. And as Mark said, there are some loops here as far as as we collect data, for instance, in the laboratory setting that can be used to develop those regulatory tools, it also provides a basis for the kinds of things that are needed for the HRA. And that's what we talked about in terms of how these things interrelate.

So that's where -- the quantification from the standpoint of PRA. But that doesn't solve the regulator's problem, until he has something in his hand -- his or her hands to go out and do an inspection.

MEMBER ROSEN: My perception, Jay, is that you've spent a lot of time thinking about human performance of individuals, and a little time thinking about performance of people in crews, and practically no time at all thinking about the overall organization context in which the whole thing operates. In fact, you've been enjoined in an organizational context.

Is that -- pretty soon it gets into the issues of culture and all kinds of things that happened in the past and something that you've been waved off of, and that's principally where I think the program is weak.

So I think your second bullet is a little bit overstated. It says ensure that you have the tools for physical and organizational --

MR. PERSENSKY: You know, that's the wider view, yes.

MEMBER ROSEN: But I think as you try to open your perspective out, which I think is essential ultimately, you know, to get a good handle on how important this is, you are actually not focused very broadly. Your focus is fairly narrow, and I'm just trying to broaden the scope.

MR. PERSENSKY: I agree with you. In the past we have focused primarily on individuals. We have focused primarily on the operator. But it has not been entirely that. I mean, in terms of even the operator, we have done work on team research, team behaviors, in order to deal with some of the operator licensing concepts where they license the team -- they look at team behaviors in their licensing, and we helped develop some of that.

MEMBER ROSEN: Well, after all, that is teams that respond to accidents, not people.

MR. PERSENSKY: I understand. And we're

trying to -- we are trying to broaden that whole concept. Some of the work that we've done has then identified that that's an area that we have been weak, and we are hoping to expand in some of those areas.

MEMBER ROSEN: But it is organizations that set the conditions for incidents and accidents.

CHAIRMAN APOSTOLAKIS: I think that's an excellent point, and maybe in some future presentations, not only to us but also to others, you can have a nice picture, say, as individuals, teams, organizations, because people will appreciate that.

I mean, they -- you are educating people, I think, regarding what is needed in this field. And, you know, I don't think that my colleague Mr. Rosen wanted to assign blame here. It's just that that's the way the field evolved; that is, in the nuclear business. But I think now we are wiser, and we recognize that the individuals is not the end for us.

But I like this hierarchy -- individual, team, organization. And it's important. I mean, we see -- you know, the recent events show that it's extremely important.

Okay. Great.

MR. PERSENSKY: Thank you. Any other questions before I go on?

CHAIRMAN APOSTOLAKIS: Oh, don't worry, Jay. Just go on.

(Laughter.)

MR. PERSENSKY: Well, I mean -- well, I know there are going to be more questions. I just want to make sure before I take off the slide.

(Laughter.)

Next slide.

This slide talks about or tries to depict -- tries to -- we'll see if it worked. These are the primary areas that we're working in in terms of the agency is responsible for developing rules and licensing, because they -- they have -- they license plants, and the monitoring activities includes everything from the inspections to the reactor oversight process.

This bottom part, which you can't see very well, is the infrastructure, which is more of that development area of how do we get to these other things. We focused some on our discussions on Tuesday on these areas above the line, above the dotted line, which are, in fact, as Dana mentioned, these are mostly applications.

This is where we're working on a rule for fatigue. We're working together. We're developing technical basis so that there will be a rule that addresses that aspect.

In the area of staffing, we're developing a method, a model-based method, computerized model-based method, where we can actually evaluate using the computerized tool as opposed to having a prescriptive rule that says you must have X number of people regardless of what your plant condition is. So we're looking at that from that standpoint.

But this -- just to touch on this one a little bit, because I know that was of interest to the subcommittee, we did a report -- 6755 -- which we sent to NRR recently that describes some work that we did in the area of comparing the reactor oversight process. That includes everything -- the PIs, inspection protocols, the SDP -- to events that occurred that were high-risk events out of the ASP program, over a five-year period all of the events that were above 10^{-5}.

From that, we identified a number of commonalities, common errors or problems that occurred. Among those were latent errors played a role of about three to one or four to one, depending on how -- where you're counting -- to active errors, where latent errors are something that occurred at some time in the past and doesn't show up until a piece of equipment is called on.

MEMBER POWERS: Jay, aren't those latent errors reflected in the PRA and judgments on the reliability of the hardware?

MR. PERSENSKY: That is the theory. That's the concept, and we've taught that, and we have, I think, some difference of opinion on that. That's one of the reasons why we're going to be working in the future, I think, on some -- under the HRA program, a better look at latent errors and how they really do play out in the PRA. So that's an effort that is in the PRA program for the future.

But, again, if you go back to the slide that Mark showed, sometimes we identify where there are some areas that HRA might be doing some work, as well as the other way around.

MR. SIU: Jay, maybe I could add --

MR. PERSENSKY: Go ahead.

MR. SIU: Yes. I think we can certainly discuss whether the failure rates, the hardware failure rates, include these -- the contributions from latent errors. I think it's pretty clear that we don't have clear mechanistic models to address the tendencies between latent errors, and, therefore, any kind of causal mechanism that would eventually link us to organizational issues.

MEMBER POWERS: Well, as it is set up now, it seems to me that without being able to make a clean distinction between hardware physics failures and failures due to latent errors that when you analyzed your PRA results you come up with the wrong solution -- I have to buy better pumps when, in fact, you've got to train better maintenance people. I mean, it seems to me you can make errors this way.

MR. SIU: Yes, you could. I mean, of course, people -- if they find out that that's indeed driving the risk, typically they go back and look at the data to see what driving it, and, without the mechanistic model, still might be able to come to some reasonable conclusions. But we don't have the models that would predict a priori there's the dependence level between these other than our, as you know, statistically-based common cause failure models, which aren't mechanistic.

MEMBER WALLIS: At some level all -- all accidents errors are human errors. I mean, if somebody puts the wrong coefficient in some equation in a computer program to design something, and eventually shows up 10 years later as an accident, that's also a human error. How far back do you want to go in this cause? I'm sure you don't want to go that far back.

MR. PERSENSKY: Not as far as computer programs. But, in fact, in the study when we were looking, I mean, we did go back as far as looking at things like design process and design change packages, because those -- especially the design change packages, that's more immediate. And we found that some of those errors came about because of that process, not necessarily -- even the maintenance error might have been the result of a design package.

MEMBER WALLIS: It seems like, for instance, what Steve was saying -- it also does apply in these computer programs. Very often, I think, the computer program, the modeling, goes back to some management who is on some engineer's back to get on with the job and assume something and put it in. That is also a human factors program. But let's go on.

MR. PERSENSKY: Okay. Back to the organizational issues --

CHAIRMAN APOSTOLAKIS: The latent errors or conditions is one of the major, let's say, advances of the last several years, where people became aware or sensitized to it. Another one that was proposed by reason also was this idea of circumvention, which ATHENA, in fact, in its early reports talked about.

This is when people take shortcuts, you know, and they do this so intentionally. It's not a mistake now. They do skip some steps in a procedure, because they think it's too detailed and tedious, and so on. Airline pilots do it all the time, by the way.

I wonder whether you plan to do anything about those. I mean, it's a fact. I think that in industrial organizations, experienced people don't go by the book line by line. I mean, they don't. Period. And most of the time this works out fine. It results in an efficient organization. But sometimes, you know, there are mistakes.

Is there something we want to investigate, or is it too much at this stage of development? I mean, looking at latent conditions is already something that's big.

MR. PERSENSKY: From an applications standpoint, I know one of the concerns that came up from some regional meetings I've had in the past was the concept of work-around --

CHAIRMAN APOSTOLAKIS: Yes.

MR. PERSENSKY: -- which might be considered a circumvention. And how do we best incorporate that in the various tools that we use, including how might we incorporate it in any risk analysis?

We haven't gone very far with that yet. We have not had the resources to put it into anything, but I know that is an issue amongst our regional inspectors.

CHAIRMAN APOSTOLAKIS: But it could be one item of the infrastructure there. It's just that, you know --

MR. PERSENSKY: In any event, back to this particular study, the issue of latent errors came out. There are other aspects of it in terms of the -- all I've got is the acronym, CAP.

CHAIRMAN APOSTOLAKIS: Corrective Action Program.

MR. PERSENSKY: The Corrective Action Program. Sorry, blocked on that. Corrective Action Program. We found that a lot of the issues that were still coming up -- and, again, these are -- this is archival data before the ROP was in place, but that things that were in the Corrective Action Program were still happening, that there wasn't a good cleanup of that activity.

So we proposed to NRR that we look at it particularly from a risk perspective, a risk-informed approach, to try to improve that process. We have sent a letter to NRR along with the report asking for some feedback from them. I understand they are preparing some response to that. I don't know at this point what that response is. But that's sort of an example of how we've used that kind of information.

As far as this under the line here -- by the way, one way you might look at this, by the way, is where there's holes, where there's nothing there, it's an area that might be considered a need in the sense that we have not yet done any work in those areas. So under advanced reactors our focus has been in this area of staffing and also the qualifications of the staff.

CHAIRMAN APOSTOLAKIS: Why is it materials and materials?

MR. PERSENSKY: Well, it's because it should be materials and waste, and I screwed up when I typed it.

CHAIRMAN APOSTOLAKIS: Oh.

(Laughter.)

MR. PERSENSKY: I made a human error.

(Laughter.)

CHAIRMAN APOSTOLAKIS: Human failure.

MR. PERSENSKY: Unfortunately, I have a very high probability when I'm at a typewriter to do that.

MEMBER POWERS: It's also latent, because it didn't get discovered until much later.

MR. PERSENSKY: And plus it had to be discovered by someone else.

(Laughter.)

I thank you for a big find.

MEMBER ROSEN: And the implications are that we will not have any work on waste in the area of rules, licensing --

(Laughter.)

MR. PERSENSKY: Well, the implication is we are not working in that area. We have not -- as far as the human factors people, though we are working in some of the licensing areas for -- in fact, in this case this is for the MOX fuel and the gas centrifuge facilities. And we're also working on some -- in this case a manual -- inspection manual updates for nuclear waste.

MEMBER WALLIS: And working on monitoring in the area of security and safeguards.

MR. PERSENSKY: Again, these are -- what I'm trying to say is the blanks are places we are not working, but --

CHAIRMAN APOSTOLAKIS: The human factors problem is when someone is holding the --

MR. PERSENSKY: Now, if you look down here, though, there should be something called a human factors -- we're doing a white paper on human factors and security and safeguards. What can we be doing? What should we be doing? So we've been given the authority to get started in that area.

The only thing under security and safeguards right now is fitness for duty. Again, that is a rulemaking activity that we've been asked to help with in terms of updating that particular rule.

Again, below the line, this is more the researchy kind of things. Erasmia will talk about this data collection and analysis project. It's a cooperative project with HRA. The latent error I mentioned.

The Halden reactor project is one which you have discussed in the past and is part of this data collection analysis. It's an ongoing international program. The thing about it from my perspective and from the infrastructure perspective, it is the only research simulator that we currently have access to, and so that's why it's the infrastructure, because we use it as a tool both for human factors, and we're going to be using it more for HRA as well as for digital I&C areas.

The other thing here, what I call human factors tool box and knowledge transfer, really looking into some methods that EPRI is studying now on trying to determine, as the aging -- we have an aging population out there, both in the industry as well as here in the NRC, of how can we put the information that we already know, and especially the undocumented knowledge, and transfer that to new people and put it in a form that it's easy to read and acceptable. That's the kind of thing that we're doing research on, that area.

And at this point, I'd like to turn it over to Erasmia, because that's kind of where I -- what I wanted to talk about today as an overview, unless you might possibly have some questions.

MEMBER POWERS: Difficult to imagine. But, Jay, could you walk through your infrastructure list and just if Erasmia is going to cover it, say so. If she is not going to cover it, give us a thumbnail sketch on it.

MR. PERSENSKY: Okay. The data collection analysis Erasmia is going to do. The latent error --

again, that's one of the things that's in the HRA plan that we'll probably do some cooperative work on. You're going to touch on that, I assume.

The Halden reactor project I just did. Risk communications is actually a user need from the EOD.

MEMBER POWERS: Well, let me come back to the Halden program.

MR. PERSENSKY: Yes.

MEMBER POWERS: Do you have specific activities that you are participating in following or bilateral agreements that you have undertaken with the Halden project? By "bilateral agreements" I mean not the general Halden program that you participate in, but specific things that -- between you, the NRC, and Halden.

MR. PERSENSKY: We do not have any ongoing bilateral efforts. We don't anticipate any in the next year or so, though we are working very closely with the staff to work on a couple of things that are in the general program. One has to do with level of automation. How do you balance automation and manual action?

The reason for that is we feel it's going to fit -- feed into some of the advanced reactor efforts, as well as some of the things that are going on now for the hybrid --

MEMBER POWERS: No. I mean, that issue of, when do you need to automate versus when can you have manual action? That particular need arises frequently in front of this committee.

MR. PERSENSKY: Right.

MEMBER POWERS: Surprisingly frequently, I mean.

MR. PERSENSKY: And part of that is because we're also, in some of the plants, one of the other problems we're addressing is the fact that some of the automatic systems are beginning to break down, and we have to replace it with manual action.

MEMBER POWERS: Right.

MR. PERSENSKY: But, so there's some work going on in that area. It's a particular interest, also, of France. So that's how that got into the general program.

From the human reliability standpoint, they are trying to build some programs in human reliability. They haven't had much in the past. We're going to be working very closely with them in that area. Some of the issues that they're concerned about is, for instance, performance recovery.

MEMBER POWERS: One of the criticisms that this committee has leveled at the Halden project as a general entity in this area has been a perception, perhaps incorrect, but a perception that the results are not migrating into the archival literature of the field. Is that a situation that is either an incorrect perception or a correcting situation?

MR. PERSENSKY: It is a correct assumption in that because the Halden project is a membership project, as is EPRI, their reports, their detailed reports, especially for the first, I believe, seven years, five to seven years, are held proprietary to the members. So that from that standpoint it doesn't get out very quickly.

Now, they do give summary presentations. They do a lot of presentations at conferences, and they do write for journals. It doesn't have the level of detail that you would have at -- you know, from the detailed reports that they do.

But because, again, it is a membership -- there are 20 countries that pay to belong. And some of those also include some of the vendors, and they don't particularly want the other vendors to take advantage of the free information. So that's their reasoning for it. But they do try to get out and give papers at conferences.

MEMBER POWERS: Go ahead through your list.

MR. PERSENSKY: I'm sorry.

MEMBER POWERS: We were on communications.

MR. PERSENSKY: Okay. Risk communications, user need from the EDO -- they'd like us to develop sort of a handbook for the staff to use when they go out to the public and are trying to better communicate risk information in a public way. We're doing some work with the communications office on that.

The human factors infrastructure for advanced reactors -- you've seen the human factors plan or, I'm sorry, the advanced reactor plan. There is an element in there to find out, what are the problems? As you mentioned, passive reactors -- some people believe that there is no human factor problem. In fact, I believe you asked the question the other day as, what keeps me awake at night? And that's one of the things that keeps me awake at night.

There's a belief by many people that advanced reactor -- there should be no human factors in advanced reactors, because it takes so long, and, you know, you can call everybody in.

I mentioned the security and safeguards. We're working on a white paper in that area. The tool box and knowledge transfer -- this is trying to bring some technology into taking the knowledge of the people that are moving, retiring, whatever, and putting it into a form that is more useful to new people.

The other two things are consensus standards. We are involved with the IEEE and ANS on various consensus standards that they work on in the human factors area, as well as reliability area and international activities through Halden, through CSNI, through IAEA.

I mentioned at the meeting that there is going to be a seminar on September 23rd. A member of the IAEA is going to come talk about their safety culture program at the IAEA, and that's open to you, of course.

MEMBER POWERS: If you have a chance, I invite you to look at a document one of our fellows put together on safety culture and --

MR. PERSENSKY: I'm familiar with that.

MEMBER POWERS: And I would characterize it as dismissive of the IAEA view on safety culture. And it would be interesting to -- for me, in particular, to know how IAEA responds to that. I mean, you know, it's not abusive, but it -- it does not draw a lot from what the IAEA did in safety -- has done in safety culture.

MR. PERSENSKY: Yes, I understand.

MEMBER POWERS: I'd just to see -- know what their view is on it.

MR. PERSENSKY: Okay. Actually, I do have one more slide, just quickly since I've probably hit on all of these things anyway, in terms of this overall vision. Again, our role is to provide regulatory tools, and they're going to come in different forms. But in order to do that, you have to have this infrastructure of technical basis development, and for that you need core competence. You need tools like simulators.

But, so one of the things that I think has been a weakness here is there's not enough of appreciation or familiarization of what human factors is, how it's done, what we can do for it. When we work with the regions and all this, you know, we find that the regions are -- that would be helpful. I wish I would have known about this before. Let's do more of it. We're trying to spread the word, so I think part of it is also going to be spreading the word.

MEMBER POWERS: If I were you, or those working on that spreading the word, they should carry along a copy of Admiral Rickover's comment on human factors, just to remind them what the mind-set is of a lot of people in this area.

MR. PERSENSKY: All right.

MEMBER LEITCH: Jay, I had a question about the previous slide. You don't have to go back there, though. It's just I think I have a picture of what human factors is. I think I understand risk-informing the corrective action program, but I'm not sure I understand the linkage. What are you doing to help with risk-informing the corrective action program?

MR. PERSENSKY: Well, I think -- the recommendations that were made had to do more with developing a tool, a type of risk tool that would help them -- help the inspectors go through the items, do a better job of selecting the items. So that really wouldn't be so much of a human factors effort. It's something that we identify that would be turned more towards the HRA/PRA people.

MEMBER LEITCH: Okay. So the HRA/PRA people say that this particular system is more risk significant than another risk-significant system.

Therefore, the corrective actions in that system should take a higher priority. Is that -- is that -- I'm trying to --

MR. PERSENSKY: Again, it would be more of the development trying to test how that system worked. I mean, there's issues -- for instance, how long -- we talked about it again Tuesday. There is other parts to this. How long has something been in the backlog? What is the size of your backlog items? You know, how do you do trend?

I think a lot of what might have helped at Davis-Besse would have been the trending of changing out those filters.

MEMBER LEITCH: Yes, absolutely.

MR. PERSENSKY: He would have seen this great rise, and that might have helped to identify it. So, again, part of it is pointing out what needs to be done. And we build tools for our inspectors, not for the licensees. So our current CAP inspection module says to make a selection from the CAP program.

MEMBER LEITCH: Okay. I see.

MR. PERSENSKY: And the question is: how do you make that selection?

MEMBER LEITCH: Okay.

MR. PERSENSKY: And one element of that

should be risk.

MEMBER LEITCH: So the deliverable out of that effort might be to modify the inspection module concerning corrective actions program to make it more risk-based.

MR. PERSENSKY: Right. And in theory, if we could do it, it could build some sort of mechanistic tool, computerized tool.

MEMBER LEITCH: I think that we are doing that, Jay.

MR. PERSENSKY: Pardon?

MEMBER LEITCH: I think inspectors are already doing that.

MR. PERSENSKY: Inspectors are -- the inspection module already does say use risk, but they don't have any tool to -- any way of really making a judgment on what --

MEMBER LEITCH: Just go to the licensee. Well, any inspector that's been there more than a week will have found the PRA group and asked them what the most important systems are, what the most important components within that system are. If he doesn't ask that, the SRA from the region will ask him what he -- does he know yet which is the most -- I mean, you're way behind. It sounds like you're way behind the times. Not that it isn't good. Clearly, the inspection --

MEMBER POWERS: Being behind the times is a good thing?

(Laughter.)

I'm confused on that.

MEMBER ROSEN: I think he's saying it's a good idea, but --

(Laughter.)

MEMBER LEITCH: It's a good idea to make sure the risk -- the module has that sort of stuff in it. And if you can edit it to get it, you know, using your techniques and credibility to get that in there, it's fine. But I think the better inspectors are already doing that.

MR. PERSENSKY: Yes. Again, it's -- sometimes it's just not being done generally across consistently. So --

MEMBER ROSEN: I'm not being -- I'm not trying to depreciate what you do.

MR. PERSENSKY: Okay. Erasmia is next.

MS. LOIS: My name is Erasmia Lois. I work for the Probabilistic Risk Assessment Branch, and I took the responsibility for HRA lately. Nathan Siu was leading it for quite a while. And this is a transition period, and, therefore, I guess both of us will be speaking.

I'll start out with some slides, and we can make comments and add to the conversation.

Another purpose of the HRA program is to both perform technical work, supporting technical basis for regulatory decisionmaking, as well as to improve methods and tools and the guidance needed for addressing the concerns that HRA -- people have for HRA regarding the availability and the adequacy of the HRA results used for regulatory decisionmaking. That's the broad scope.

Next slide, please.

Again, this is a similar table that Jay presented. And Dr. Dana suggested to concentrate on the bottom side of it, which is the infrastructure. I would like to point out that it's not a clear cut between those lines, because work for -- the assumption is that we are going to perform an HRA for an upgrade for advanced reactors. But actually most of the work will include -- will be infrastructure-related work, and that's encompassed into the -- do I have it here? No.

So, but it -- I have listed it over there, but actually it belongs in both places. Same thing, the work that we may do for fitness of duty rule revision. It may need developmental work.

What is being done? The infrastructure column presents what we do and what we plan to do. It does not speak well as to what we are not doing.

MEMBER WALLIS: Does the color code of the blocks or the squares mean what you have done or are doing, and the others are things you're going to do?

MS. LOIS: No. When I leave the -- what is the color code? The bullets is -- if it's more than one thing in the -- I have bulletized it.

MEMBER WALLIS: But will these things -- are these things you're going to do or you have done or -- I'm not quite sure how this --

MS. LOIS: Oh, okay. So let me quickly go down. PPS would -- I'm sorry?

MEMBER WALLIS: I don't know that I need the details on it. Just kind of --

MS. LOIS: Yes. But that doesn't mean that we -- it's just bullets. It's more than one item on -- yes. Now, the question is if it's -- the bullets are --

MEMBER WALLIS: I mean, I need input on upgrades, for instance, to make decisions.

MS. LOIS: Yes.

MEMBER WALLIS: And I'm not quite sure whether you've done the work or you're going to do the work or --

MS. LOIS: No. And that's why I just said that although I chose here the application, it's part of the work that we have to do as infrastructure.

MEMBER WALLIS: It's going to be done in the future.

MS. LOIS: Yes. So, then, if we -- I thought that I would focus here on the bottom column. I'm going to talk a little bit more extensively on -- on the data development work. We also are doing work, and it probably is near completion, on quantification, including addressing uncertainty. And this is a more formalized process for doing ATHENA analysis -- analysis using ATHENA.

Latent errors is something that we plan to address. It's how to better account for latent errors in HRA. Now we have a new terminology, which is latent conditions. So then we are going to expand our plan to include conditions in this work.

The extended applications include issues that are not typically -- we haven't -- we don't have good methods to deal with, mainly HRA methods that are full power, Level 1 HRAs. Now we need to look at the shutdown conditions, Level 2 PRAs.

Other conditions I have -- probably should -- the synergism work addresses the global changes that nuclear powerplants are going -- are undergoing today. It's the aging, the changes in licensing changes, personnel aging, all of those in use potentially dependent -- have a dependent effect on plant operations, and the PRA reflects operations as -- as are in the books in a way. And, therefore, we have to do -- I guess there is a more -- a bigger program here that looks at the system synergies as part of that, will look from the HRA perspective.

Formalized methods includes -- addresses how screening analysis versus how we can limit the number of human actions that are incorporated or analyzed in a PRA, but also address the individual issues that we have talked about in the committee and how we -- actually crews are working in that. The crew performance is more important probably than the individual performance.

But that -- that includes the work processes and the culture issues that -- safety culture issues that --

MEMBER ROSEN: At the crew level.

MS. LOIS: -- have been -- yes.

MEMBER ROSEN: At the team level.

MS. LOIS: Yes.

MEMBER ROSEN: Now, on the bullet you just mentioned just before that, you know, we talked about earlier, we focused on individual performance, and now you're beginning to focus on team performance or crew performance. And ultimately you need to focus on organization of performance.

In that bullet above there, you said you're thinking about aging as a -- well, that's an individual consideration, but it's for all -- all of the people. The stresses on the organizations are very significant, and one of those which is global, at least in the U.S., is the deregulation. And those are -- those kinds of stresses -- stressors on the organization can have very significant effects on teams and individuals and overall.

And I -- you know, when you go forward as I hope you will, to consider organizational performance, you'll think globally about the stressors on organizations and come naturally to be thinking about these things that have -- that are having big impacts.

If you read, for example, some of the big reports and others, you will understand the impacts on reactor safety of some of these things. For example, deregulation is changing power flow patterns and placing different demands on switch yard and switching facilities because the power flows have changed because of deregulation. Those are organizational issues that reflect reactor safety, global issues that have impacts.

And that's why I've been encouraging you to -- you know, it's fine to think about individuals, and it's good to think about crews operating a team -- people operating in crews as teams, but that very important reactor safety impacts are occurring because of these other global issues.

MS. LOIS: And these are the issues that we have to work closely with -- with the human factors area, because you have to develop the comprehension and then the capability to quantitatively incorporate that into an HRA.

MEMBER ROSEN: Right.

MS. LOIS: So it's --

MEMBER ROSEN: I'm going to come off my example of the switch yards and come back to deregulation's impacts on organizations through the vehicle of financial pressure and what that does to -- for example, work planning during outages.

The real financial pressures say that we need to have a plant back on the line in 29 days, not 32 days, and that means that maybe you can't do everything you want to in an outage. And so things that are -- that seem discretionary don't get done, because clearly you have to change the fuel, and clearly you have to do the required tests that are required by tech specs. Clearly, you have to fix things that are known to be broken.

CHAIRMAN APOSTOLAKIS: And maybe you will fix all of the flanges all together.

MEMBER ROSEN: But maybe you won't fix all of the flanges all at once. You'll fix the ones that are leaking a lot, and maybe the ones that aren't leaking so much you'll get next time.

MEMBER LEITCH: I'm still a little confused about just what the deliverable is, for example, from HRA to the SPAR models. In other words, the SPAR models are being used -- are being developed to support the significant determination process, among other things. Is that correct?

MS. LOIS: Yes. And there is an HRA --

MEMBER LEITCH: There's an HRA input to that, because you need to know what is the human reliability. And so that factors into the SPAR model.

So you're not really developing the SPAR models in HRA. You're just providing the human reliability data into that calculation. Is that correct?

MS. LOIS: Exactly. And here the activity is improving the HRA modules that are currently used by SPAR.

MEMBER LEITCH: Okay.

MS. LOIS: And that's an activity that may not -- you know, it could be done as part of this branch or the division. It includes the HRA part of SPAR.

MEMBER LEITCH: Thanks.

MS. LOIS: And I guess what I left out is the guidance and standard development, and the plan is to develop guidance for the analyst as well as the NRC staff that is reviewing HRAs and HRA results. And the standard is part of the ASME standards development and IEEE standards development in the HRA area.

Are there any questions here? Do you want to add something?

MEMBER POWERS: Can you remind me again what you mean by extended applications and formalized methods?

MR. SIU: Actually, let me take that. The extended applications -- there are some specific areas where we were anticipating HRA development needs. One was low power and shutdown. One was Level 2 PSA. Another one was extended outage -- I'm sorry -- extended recovery times.

MEMBER POWERS: What do you mean by extended recovery times?

MR. SIU: Very, very long recovery times. For example --

MEMBER POWERS: At D.C. Cook --

MR. SIU: -- you might need something for a low power and shutdown PRA where, again, it's a very long time for the evolution of the event because of the power. Or if you're in an advanced reactor space, again, you might need some different way of looking at it.

This is an issue that I know the U.K. is very interested in, and it's part of COOPRA. We were thinking of possibly cooperating there. It's been raised at least as an issue.

And let me back up a bit. The reason I wanted to jump in here, Dana, you had asked about the length and breadth of the program. So I just want to kind of give you a high level view of that. What you see on this list here, you can see that we've been focusing on specific situations, and a lot of our work looks at main control room issues. And we do consider the teams performing. We haven't studied the team interactions explicitly in our modeling.

Again, we've had some specific issues addressing the extended applications, and another thing we're trying to do is increase the science in the analysis; hence, the discussion on data Tuesday. And also, now getting to the formalized methods, what we lack right now are, indeed, the mechanistic models for performance, for individual performance.

So you saw a correlation between performance and performance shaping factors. Obviously, you'd like to fill in that gap, or we would like to fill in that gap. And that's kind of the point here.

We learned more collecting data from our applications. We are planning to get back into the modeling efforts. What we are not --

MEMBER POWERS: By modeling efforts, do you mean something different than correlational efforts?

MR. SIU: That's right. So, for example, we talked briefly about behavioral models, simulation models, a few days ago. Those are being used in some applications. Jay referred, I think, to them at one point being done in the military. In fact, there was some early work funded by NRC on modeling team performance as a simulation.

There is -- so that's the kind of modeling, getting more mechanistic in the representation of how the individuals perform singly and as a team. There is work going on right now in the cognitive simulation with respect to control room operators, not -- we're not doing that, but others are doing that.

So, again, these are things where we're -- I'm not saying we're doing that right now, but that's the direction I think we'd like to be investigating at some point in time.

MEMBER POWERS: I'd sure like to -- I mean, some day if you'd start moving in that direction, I'd sure like to see a defense --

MR. SIU: Sure.

MEMBER POWERS: -- you know, like a white paper on here's why we should do it. I mean, I can't imagine -- it's difficult for me to imagine criticizing a guy that wants to become mechanistic. But in this case, I think I'm willing to take --

(Laughter.)

I mean, I see it as a tour that may exceed your capacity to contribute. If what -- if you came back and said, "What I want to do is keep a foot in the pool of people that do this kind of thing" -- and they do it for the military and things like that -- "and I want to stay aware and have some expertise to be able to talk their language," you know, I'm very -- I'm much more comfortable with that.

MR. SIU: Yes.

MEMBER POWERS: The actual doing it yourself, you know, it's a long time between initiation of work and getting a product out the door.

MR. SIU: Yes. Well, as Jay pointed out, we hopefully won't be starting from scratch. And George reminded us on Tuesday we're certainly going to build on what others have done.

But, again, this is not something that we had even planned for the next fiscal year to do. This is longer term.

MEMBER POWERS: But I wanted to talk that late.

MR. SIU: Sure. And that will be a very fun discussion, I think, when we get to that point.

MEMBER POWERS: Well, I mean, I even thought you brought up the issue of using flatland models to try to understand --

MR. SIU: For example, yes.

MEMBER POWERS: -- what the more fundamental driving forces and activities are.

MEMBER WALLIS: What is a flatland model? Is it developed in the Midwest or something?

(Laughter.)

MEMBER POWERS: Actually, they started that at an esteemed institution in -- up in the Cambridge area, where they create very simple computer geese that responded to stimuli.

MEMBER WALLIS: It's a two-dimensional --

MEMBER POWERS: Yes. They lived in a flat world, and they ate sugar and reproduced. And they have gone on to get sophisticated enough that they see things unanticipated, tendencies for computer geese who operate in a cooperative or competitive nature based on stimuli from the outside.

This is kind of the fundamentals that Nathan is talking about, and it -- I mean, the reason one would do it is it is -- it's just like in thermal hydraulics. If you understand the physics better, you know what dimensional groups to use in your correlation a little bit better. And that's how you would I think use that whole mechanistic --

MEMBER WALLIS: Also, you have gained tremendously in being able to explain it to other people.

MEMBER POWERS: Yes.

MR. SIU: Just as a matter of side interest, in the fire protection community, for example, people are using simulations of individuals and then working with various rules for movement to look at egress during fire events. So there are applications that people are looking at.

Let me just quickly, so I won't eat up all of Erasmia's time, you wanted to talk about a little bit what we're not doing and what we're paying less emphasis to. Clearly, as the committee has observed, organizational factors of safety culture is one area we haven't been doing anything.

As Scott talked you on Tuesday -- or talked to the subcommittee on Tuesday, that's an area I guess we're going to open up to and at least reinvestigate whether we should go after that.

MEMBER POWERS: You know, I think Steve is giving you some language that opens that area up in a nice fashion.

MR. SIU: Yes, right.

MEMBER POWERS: I like the points he was

making about people working in teams and things like that.

MR. SIU: Another aspect we haven't been focusing on is organizations in the little sense, the team interactions within the team. Again, I think we tend to treat, for example, the control room teams as a group, but -- and we talk about how they -- there are different styles, say, for different teams in responding to an event, but we don't talk about the interactions between them in an explicit model sense.

MEMBER POWERS: Interactions between what?

MR. SIU: Members of the team.

MEMBER POWERS: Within the --

MR. SIU: That's right. That's right.

MEMBER ROSEN: We also need to think about interactions between teams.

MR. SIU: Right, right. Yes.

MEMBER ROSEN: For instance, the engineering team and the control room team.

MR. SIU: Right, exactly. There are all sorts of scales of the organization.

MEMBER ROSEN: Maintenance team and the operations team.

MR. SIU: Exactly.

MEMBER LEITCH: While you're right on that point, yesterday we had an all-day meeting on fire protection.

MR. SIU: Yes.

MEMBER LEITCH: And one of the things that I thought I heard at that meeting was that we are not -- inspection reports were not commenting on the performance of the fire brigade because I -- I guess there weren't standards or acceptance criteria for what should be the standards. If I heard the comment correctly, it's a little --

MR. SIU: You heard it right.

MEMBER LEITCH: It's a little incredible, but I think that's what I heard.

MR. SIU: You heard it precisely.

MEMBER LEITCH: And I guess it seems to me that HRA should be playing a very significant role in that area as well, and I'm a little surprised that -- and I don't know where it would fit on your table, but perhaps under monitoring of conventional reactors something about the HRA of the fire brigade seems like there would be a -- a good -- would be a necessary input.

MR. SIU: It's a really nice point. We do have, of course, fire support in that.

MEMBER LEITCH: In the licensing.

MR. SIU: Yes. And that's part of -- you heard about the requantification study, and there will be -- HRA is part of that.

MEMBER LEITCH: Right.

MR. SIU: Now, where fire PRA kind of splits, draws a line -- you also heard the discussion on suppression analysis, where the suppression analysis was basically treated as a statistical -- in a statistical manner.

MEMBER LEITCH: Right.

MR. SIU: And the fire brigade performance is incorporated into that statistical distribution. So you don't see specifically whether -- if I have a degraded brigade or I don't have a degraded brigade. There is no knob to turn to change that distribution.

MEMBER ROSEN: And we know that's a mistake now, because the -- only three percent of the fires are -- or six percent of the fires are put out by fixed actuation. It's the brigade that puts out the fires.

MR. SIU: So what's happening, of course, is that whole range of --

MEMBER POWERS: Steve, recognize that that's an infinite percent higher than we've always assumed.

MEMBER ROSEN: The brigade puts out fires?

MEMBER POWERS: We've always assumed that the brigades put out 100 percent of the fires.

MEMBER ROSEN: That's almost true.

MEMBER POWERS: I mean, in classic fire analysis, automatic systems are not credited with putting out fires. They suppress fires.

MEMBER ROSEN: Oh, okay. Suppress.

MR. SIU: They control putting it out.

MEMBER ROSEN: Actually, what we heard was that -- that automatic systems I think don't suppress more than six percent of the fires. And that's because most of the fires occur in regions where there's no automatic suppression, because people are much more careful in areas where automatic suppression is installed, because those are the important areas. So fires tend to not start there.

You know, this is -- you know, you can draw the wrong inferences from the data if you're not careful.

MEMBER POWERS: It's really simple. You just put signs up everywhere that says this is -- this area is served by automatic fire suppression equipment that will hurt you if it goes off. And then you don't have to install it because people are very careful, right?

MEMBER ROSEN: Okay. Kind of like the tanks the British had during World War II in the early days made of cardboard.

MEMBER LEITCH: But, Nathan, this dialogue aside, let me make sure my thought is captured here, and that is that we need somehow to facilitate the inspectors being able to comment on the --

MR. SIU: Yes, thank you.

MEMBER LEITCH: -- on the effectiveness of the fire brigade, fire drills, fire -- their training, and so forth. And apparently, we are unable to do that right at the moment because we don't have criteria, if I understand the situation correctly. I mean, it seems to me that HRA could play a significant role in establishing what the criteria would be.

MR. SIU: Okay. So, again, I think in the area of organizations on a whole variety of scales we don't -- haven't yet put in tasks in the plan to address that. So, again, this is where we welcome the committee's input.

And the other thing -- again, I indicated we were focusing on main control room activities, although clearly latent errors, latent conditions are -- is an issue outside. So we're -- that's our entry, if you will, into that -- the general issue of looking outside the control room.

We had clearly thought also -- or we are concerned about, as Steve indicated, the interactions between teams -- the control room team and teams outside -- in the evolution of an event.

So with that, Erasmia, if you can go on to the data discussion.

MS. LOIS: Okay. Next slide, please?

The last time we heard a presentation on how we can take advantage of existing status at Halden to develop HRA data. This is the staffing study that Jay mentioned before, and it has been documented in this NRC IA document.

The main effort was -- or the objective of the study was to -- to study the effects of staffing levels on true performance. But in actuality, it was a -- what -- it was called imbedded. We call it a follow-on effort to explore the relationships between PSFs, the performance shaping factors, and true performance.

The facilities used were the Loviisa simulator and the Halden simulator. And in order to do the work, factors that are important for nuclear powerplant USA experience were evaluated. They looked at the similarities or how well these simulators could reflect thermal hydraulic characteristics, operation -- operator roles, the training and the procedures used by the operators, training they had, etcetera.

So all of these issues were taken into consideration to perform the studies, and, in actuality, where necessary changes were performed -- were done at the simulators. And I think the crews were trained so that they -- we can have better data.

I'm going to quickly present the results. Can I have the next slide, please?

Now, in the viewgraphs I have the wrong -- a couple of wrong figures. This figure here demonstrates that relationships between staffing and performance can be developed and based on one that you have in your handouts. And also, and this other one here, its relationship with the situation awareness and workload.

So I guess the first one is kind of self-explanatory. Even the other one, but what it shows here -- that the situation awareness becomes better at the beginning, but then as the workload progresses it -- it really -- people do not have a good awareness for a while, and then it starts increasing again.

Did I explain it well, or is that --

MEMBER POWERS: That was --

MS. LOIS: I got the -- I'm sorry.

MEMBER WALLIS: That's to be in a response of the ACRS to a presentation.

MS. LOIS: I'm sorry?

MR. PERSENSKY: It's actually a fatigue curve.

MEMBER WALLIS: That's what he was saying.

(Laughter.)

MEMBER ROSEN: I have to confess that I don't understand the one on the right, that curve. It says related crew performance? Is that what it says?

MS. LOIS: Rated.

MEMBER ROSEN: Rated crew performance.

MR. PERSENSKY: Rated crew performance.

MEMBER ROSEN: Rated crew performance for -- looking just at the red one, red line, that's the minimum crew complement. In the conventional plant, it's five point something. What does this mean?

MR. PERSENSKY: The rated crew performance is actually a measure where people who are observing giving a rating on how well the crew is performing.

MEMBER ROSEN: So a minimum crew --

MR. PERSENSKY: And the minimum crew is the --

MEMBER ROSEN: -- performs much better in an advanced plant, because presumably the task demands are less. The same small crew performs much better in an advanced plant because the task demands in an advanced plant are lower than they are in the conventional plant, is that correct?

MR. PERSENSKY: That is part of the reason.

MEMBER ROSEN: That's part of what that data shows?

MR. PERSENSKY: Right.

MEMBER ROSEN: And that for the -- the blue line, the model crew complement, for normal crew complements, it doesn't make much difference in terms of rated crew performance between conventional plants and -- in other words, you don't -- and advanced plants.

In other words, you don't get a whole lot of advantage of having an advanced plant where the task demands are lower because you have plenty of people around in both cases.

MR. PERSENSKY: Yes.

MEMBER ROSEN: That's what that's supposed to tell me.

MR. PERSENSKY: And that there's an

interaction. There's actually a statistically significant interaction there. But it shows that, in fact --

MEMBER ROSEN: Statistically significant interaction. What do you mean?

MR. PERSENSKY: That there is a difference between the shapes of those two lines, the way they are -- how they interact.

MEMBER ROSEN: The slopes of those lines.

MR. PERSENSKY: The slopes.

MEMBER KRESS: Yes. I think you can assume that end point is the same point. I mean, statistically, the uncertainties are so large at that end where the 7.5 and the 8 are, you can't tell the difference between them.

MR. PERSENSKY: One way of looking at it, if one were to say, "Gee, can I reduce the size of my staff if I have an advanced reactor?" the answer would appear to be yes.

MEMBER KRESS: Yes, without --

MEMBER SIEBER: You're better off with less people than with --

MR. PERSENSKY: It depends on whether or not those two points are statistically different.

The other slope here is a situation of

where it's how well you know what's going on. That's the period of -- during the scenarios, the situation where it drops and then goes -- starts to go back up, but for some reason also drops again, so -- near the end of the cycle.

MEMBER LEITCH: Is there one line there for conventional plant and one line for --

MR. PERSENSKY: This is actually average data. This would be main effect from a statistical standpoint.

MEMBER POWERS: Yes. I think the dropoff at the end is because the situation was being resolved and there was less importance to --

MR. PERSENSKY: Well, we would hope that the crew got up to about the same level of situation awareness after an event than -- I mean, because they should be back to a normal situation. They should be closer to where they started off with.

MEMBER WALLIS: I would hope they might even be higher. They've been stimulated by the situation that resulted. They really understand what's going on.

MR. PERSENSKY: So we weren't able to explain, to be honest, what exactly brought that -- that tip down. It's just -- that's data, and sometimes you have to accept the data and then try to figure it out and do further work to resolve it.

MS. LOIS: Next slide, please. Do you want to explain the next --

MR. PERSENSKY: No, this is yours.

(Laughter.)

MS. LOIS: Again, this slide here is -- the one that you have in the handouts is the wrong one and --

MEMBER WALLIS: How did you make so many human errors?

MS. LOIS: Oh.

(Laughter.)

Probably this one is the first one I did. And this one shows that you can -- if you collect data, the simulator -- on performance shaping factors, you can actually develop a relationship between performance shaping factors and measure performance shaping factors and crew performance.

And the line here, it's one of the several ones presented last --

MR. PERSENSKY: The horizontal axis is predicted value. The vertical axis is observed values. So it's --

MS. LOIS: Observed values. This is

predicted value.

MR. PERSENSKY: It's the correlation between the predicted using the model and the observed values from the actual experience.

MEMBER LEITCH: And that data point supports that line, is that what we're saying? I mean, the data supports that line?

MEMBER POWERS: Let's be absolutely accurate here. This is a research activity underway, and I would say that what the speaker said is accurate. This shows that it might be possible to find consistent trends. I don't think it demonstrates a consistent trend.

The fact that the things are all on the same sheet of paper I think is a major --

(Laughter.)

-- in this field.

MEMBER WALLIS: Well, there are obviously some anomalies. You're predicting negative values which are impossible, because there are no known negative values recorded. So you need to stop criticizing, and we should probably move on.

MS. LOIS: I guess the thrust here is that we can use -- and what we hope is that we can use simulator experiments to develop more objective data for HRA purposes. That's what -- and next slide, please. No, next slide.

So then on, what is our vision, we would like to have a consensus and a better capability to high level modeling of HRA. We would like to have range of methods and tools to address recognized issues currently, data reference points, interpolation scheme and uncertainties.

We would like to develop guidance for HRA analysts as well as others, and the bottom bullet here is we would like to have -- this is the -- do you want to have a simulator at the U.S.? Yes, we do. Capability to identify and address emerging issues include -- rather, would include a simulator in the U.S.

That concludes my presentation.

MEMBER POWERS: You're done?

MR. PERSENSKY: We're done. We have nothing else to say, not at the moment.

MEMBER POWERS: Let me ask you just a little bit of speculation. I think when I pose this question to Jay I'm a little bit unfair to him, because I think he is doomed to responding to the crisis of the times, just because of the nature of human factors. It's always different. Everything new that comes along has some human element into it, and it's a little hard to anticipate what's going to come on, and what not, but maybe there are tools developed.

Human reliability analysis, it seems to me that that's a much more inherently quantitative field. It has a character of a certain amount of physical science to it, because you're producing -- in the end, you produce numbers. That I learned at our subcommittee meeting is half the job. The other half of the job is identifying what to produce numbers about.

And what we see in the number producing field is a proliferation of models. I mean, that's not terribly surprising, because in the beginning when people first started doing the human reliability analysis, they said, "Well, what really makes a difference is how much time people have to do -- to respond to a stimulus that says do something."

So they build a model to look like that but not -- as we got smarter, we identified more and more variables that affected the reliability of humans doing this.

And as additional variables got identified, you know, people created models to reflect subsets of them. And so now we've got a whole alphabet soup.

I believe Dr. Apostolakis said references 1 through 35. So I assume that there must be 35 alphabetical things out there for doing human reliability analysis. And each one of those was developed by an investigator who was dedicated to ignoring, as much as possible, any of the work of his predecessors.

It seems to me that maybe we've reached the point where you want to not do that any more. That you want a model that you can refine -- develop, refine, and validate in some disciplined fashion. Can you tell us what your aspirations are along that direction? Noting that the one person that actually understands the meaning of certain Greek words is not here right now, so you can speak freely using the famous Greek word.

MR. SIU: Actually, I think in our haste to finish by 2:30, we rushed right through perhaps one part of the answer to your question. The first bullet Erasmia had on her slide was a consensus high level model. We think that -- we completely agree with you, obviously, and the same question was raised in the subcommittee by George. Should we be working with others, building on others' work? Absolutely.

And in conversations with others in the field, there are many others who feel the same way in other organizations. It doesn't help everybody to have this, as you said, plethora of models. It's probably more like a plethora of methods. There aren't that many separate models out there or really distinct models.

So I think there is a general desire to work towards some consensus, and that was expressed at a May workshop we had here back in 2001. In fact, outside observers, when they come in and listen to these meetings, they say, "You guys seem to be in violent agreement. What's the problem here?"

So I think one of our desires is to help drive towards that consensus. Part of that involves the development of common vocabulary. We like Air Force in context, but, heck, if somebody else, you know, prefers a different term, and everybody can agree to that term, that's great. So there's a vocabulary issue. There's a parsing issue.

Part of the variation in these models comes from simply different classifications for performance shaping factors, and that comes from a different organization of some of the same basic issues.

MEMBER POWERS: Well, the fact is that if I define the performance shaping factors, and you define the performance shaping factors, we're very likely to have two sets that cover the entire space within our stats. They're not going to be orthogonal elements of that space.

MR. SIU: So there's a desire there also as part of a terminology issue, but also more technically just to come to an agreement on these things. That will be a little bit harder, because everybody has their favorites and they're dealing with it. But I think that some agreement, at least some high level grouping of those factors, would be necessary to support the data collection activity that Erasmia referred to. And I think that's also recognized.

So I think the short answer is yes, we agree. We'd like to drive towards that. And I think with the weight that we have as NRC we probably can have some influence there. We just have to see how it plays out.

MEMBER POWERS: Well, you emphasized the agreement that exists within the field, and I am reminded of a paper that I once read that I seem unable to find, and I was hoping you'd find it for me, in which they applied these various methods -- I take it it was done by some Koreans -- in which they applied the various methods and there was, shall we say, a weak correlation between the results derived from the various methods.

MR. SIU: You're not referring to the ISRA benchmark exercise that --

MEMBER POWERS: Maybe that's what it was.

MR. SIU: That was the Italians.

MEMBER POWERS: Italians. Italians, Koreans, it's close. They're all part of some axis, I'm sure.

(Laughter.)

MR. SIU: Part of the world. Right. Yes. And there were a lot of issues raised as a result of that benchmark exercise. It was clear that there were different understandings as to exactly what was being modeled, what was within the scope of the analysis, what was outside the scope of the analysis.

We had floated the idea -- again, we had rushed by that I think in the slide on Tuesday, the notion of using simulators to develop data to support a benchmarking exercise, so there is some objective reference that people can look at.

And then not to beat people over the heads why they don't match it, but understand what's the difference, what's driving that. And, again, that could support some sort of common or development of a consensus approach.

So, yes, clearly it's possible to generate many different numbers for what appears to be a similar situation.

MEMBER WALLIS: Jay, it's essentially the same question, but you may have a very different approach to it, because you live in a different world.

MR. PERSENSKY: Well, at the risk of knowing when to keep my mouth shut --

(Laughter.)

-- the only thing I can say is that human factors has been a profession or a discipline for over 75 years, developed around the time of the first World War to help the design of cockpits in airplanes. And, in fact, whether it's quantitative in the terms that we now use when we talk about risk PRA, we talk about risk from the Webster's standpoint back then, and --

MEMBER WALLIS: The age of a profession is not a measure of respectability.

MR. PERSENSKY: I didn't say it was a measure of respectability.

MEMBER POWERS: Witness, thermal

hydraulics.

(Laughter.)

MR. PERSENSKY: It's a measure of the fact that it's been around for a while, and whereas risk -- HRA has only been around for about 20 years. So human factors was able to do some things for about 75 -- or about 50 years before we got into the quantification from the standpoint of risk. I mean, we dequantify many things in terms of error rates, workload situation, whereas other kinds of measures -- in order to help design better tools in the process --

MEMBER POWERS: One of the biggest fiascos in the field was when they first started trying to quantify like time-motion studies.

MR. PERSENSKY: That was the --

MEMBER POWERS: A long time ago.

MR. PERSENSKY: Yes, a long time ago when they -- the problem was -- well, actually, it was part of the -- it demonstrated the need to, when you're collecting data, to not make it clear that you're collecting data.

(Laughter.)

The Hawthorne effect. But, in fact, I mean, the field is a relatively old field. It may not be as old as others, but there has been quantification. There has been things that have come out of it without that type of -- the same type of quantification we're talking about now.

But what we have been doing is trying to grow together, that we can provide information in various forms to the HRA community that will help that quantification effort, which in turn will help direct some of the work that we do. But I do object to saying it's not quantified.

The other thing is we're trying to build, as Nathan mentioned -- and I mentioned Tuesday -- more of this model. How do we characterize people in a behavioral sense? Not necessarily just a risk sense. So there are tools that have been developed, primarily in the military but in other places, and we're beginning to make use of those here. We're trying to validate them to make sure that they apply here in the nuclear community.

In the long term, there's a possibility that we can link the kinds of models I talk about with the kinds of models that Nathan talks about, and generate some of that data. So that's a long-term vision.

VICE CHAIRMAN BONACA: Dr. Powers, want to wrap up this meeting in five minutes?

MEMBER POWERS: We'll wrap it up in probably one sentence.

VICE CHAIRMAN BONACA: That's great.

MEMBER POWERS: It depends on how they respond to an outrageous comment I'll make here. Okay? But I do think that I will compliment you, and I think that you have done a better job than I've ever seen in the past at showing the linkage between human factors and human reliability analysis in your presentation to the subcommittee.

That was my last outrageous comment. I'm sure you're ready to refute me.

MR. CUNNINGHAM: I will remain silent.

(Laughter.)

MEMBER POWERS: Do any of the members have any additional questions they'd like to pose here? Seeing none, I will turn it to the Vice Chairman. I don't know whether he speaks Greek or not.

VICE CHAIRMAN BONACA: No, I don't speak Greek, but I think I know how to take a break.

MEMBER POWERS: What, by the way, is the Latin equivalent of a misspelled Athena?

VICE CHAIRMAN BONACA: Athena.

(Laughter.)

We've got to take a recess until 3:00 p.m.

Thank you.

(Whereupon, the proceedings in the foregoing matter went off the record at 2:41 p.m. and went back on the record at 3:02 p.m.)

VICE CHAIRMAN BONACA: We will start with a presentation by Graham Wallis on Generic Safety Issue 185. We were supposed to have a group presentation from the staff, but for some reason we are not having it. So Graham will give us a presentation.

MEMBER WALLIS: And I'll remind you that this is the issue of the water boiling off in the vessel, condensing in the steam generator, but it doesn't take the boron with it, so you build up in the steam generator the slug so-called of non-borated water. And in the early life of these reactors you need the boron worth in order to control the reactor. It's critical.

And so your concern is that if this slug of non-borated water comes into the reactor, you can get a criticality. What happens then?

We had a meeting in June, and that's what -- the fat handout you have in the documentation is from the meeting. That really is now out of date.

It's very interesting, but there has been work since then which is rather different from what you find in the reading material.

We tried to summarize this new work. We were shown some new work earlier this week, on Monday. There are really two concerns. One is when you refill the system enough with HPI, and natural circulation can start this boron slug moving into the reactor, the new work consists of making some conservative assumptions, make an assumption that the slug is as big as it could possibly be, make the assumption that it doesn't mix with borated water in the downcomer and other places, and that it comes through -- so the limiting assumptions, and from that develop the scenario of what is the boron level in the reactor versus time.

Give this to the people who can do the neutron behavior and criticality, have them predict the transient and the amount of heat that is dumped into the worst -- the one that's heating up the most and find out if it fails.

The conclusion from this we were presented with orally, but it wasn't written up in a formal way, which is one reason it is not coming to this full committee, was that with these worst case assumptions the worst -- the worst that could happen to the one that was challenged the most was not a problem.

So the -- what the staff wished to do with the natural circulation issue was to make it go away by assuming the worst that could happen is showing it was not a problem. In so doing, they may well have made the scenario a lot worse than in reality it would be, particularly with B&W reactors, which are the ones that they analyzed, their event valves, which they neglected. The event valves lead to mixing in the downcomer which puts boron into the pure water soil, and the event isn't as -- anywhere near as bad probably as in the limiting analysis.

MEMBER KRESS: I thought those vent valves were putting steam into the system. I thought the vent valves were putting steam into the incoming boron -- the incoming --

MEMBER WALLIS: The system is now filled. The natural circulation system is filled. There is steam, as well as water, going through those vent valves. So there is some borated water going through the vent valves, too.

MEMBER KRESS: Okay. I thought the problem was unborated water --

MEMBER WALLIS: Well, anyway --

MEMBER KRESS: -- being added in.

MEMBER WALLIS: -- the approach was, which seemed believable, was to look at the worst that could happen and show that it's not that.

In the case of starting the pumps, the pump is started to take the slug of non-borated water and throw it into the reactor, and then I guess you can turn the pump off. Their approach here is called bumping the pump. Their approach here was to say -- take the other extreme and say, "Well, let's try to be non-conservative. Let's assume that the pump only pumps in a quarter of the water instead of all the water, or at a rate of -- a quarter of the rate it could pump it in. And let's make some other assumptions."

And they show that if they made those assumptions and gave them to the neutronics people that the amount of energy dumped into the -- the water that was heated the worst was enough to challenge its integrity. And they said, "Well, in that case, if other -- the situation could be worse than that."

And so there really is a problem with the pump bump, and the way the staff wanted to handle that was to say, "We will work on the procedures, operator actions, training, so that this is resolved by making sure the pumps are not bumped." And also, using risk analysis to show this event is unlikely, and so on. So the combination would make one say that the GSI has been resolved.

This was done for the B&W situation. Now, for the Westinghouse reactors, there was some sort of oral argument presented. Certain volumes were smaller, so that it wasn't so much of a problem. However, you need the boron for a long period of time in the cycle of the reactor. You need the reactivity control of the boron for a much longer period.

So there's a combination of things that are different for Westinghouse. And one reason the staff wasn't ready was that they hadn't analyzed these other reactors extensively. It was a kind of qualitative presentation on that.

The reasons they weren't ready to come here were that they weren't ready. They weren't ready even with the B&W story. It looked good. It was different from what we heard before. It was a surprise to us, I think. And it hadn't been written up, and it wasn't -- the logic wasn't clearly developed so you could say they are ready to make a presentation to the full committee.

We hope they will be ready. I think it's going to be before the end of the year. And because we have had two meetings with them already, and they haven't been ready to come already, we said, "Before you come to the full committee again, you'd better go through the subcommittee, so you're really sure that you're ready to come to this full committee."

VICE CHAIRMAN BONACA: I always thought that the combustion engineering design was the most vulnerable. That's the one you have not mentioned, so that --

MEMBER WALLIS: That's the one, again, I haven't mentioned. You see, there's always this curiosity. You've done all this work on Babcock and Wilcox. How about the other designs? And that's certainly an area where they need to get their act together.

VICE CHAIRMAN BONACA: As a minimum, I mean, within combustion engineering staff there was a lot of talk about that issue --

MEMBER WALLIS: That's right.

VICE CHAIRMAN BONACA: -- for --

MEMBER WALLIS: We didn't hear too much in detail about this analysis of the other reactors.

MEMBER FORD: Essentially, they were sloughed off because of the law of volume, available volume.

MEMBER WALLIS: But that needs to be clear, and we need to show a picture, and it needs to be clear just what the implication is. Something needs to be given to the neutronics people to handle the real transient there.

MEMBER SIEBER: There is a large amount of reactor coolant system piping in the B&W in the candlestick area. And that's where the spill is that's removing the boron from the water. So I would just guess by the configuration that that would be the most --

VICE CHAIRMAN BONACA: I can only say that it was -- there was a lot of awareness in the CE staff in the early to mid '80s, and they dealt with it slowly. It took a long time to -- to deal with it, the procedures.

So I don't know if there is a more limited plant, maybe there is a better time for other plants because nobody raised it.

MEMBER WALLIS: It became an issue because it was addressed by the BNW owners. That's how it came to the stop.

Maybe there may be a measure there for the staff, you better look in CE reactors and get the conclusions about that.

MEMBER SIEBER: I looked through the slides because I was in another meeting and I verbally heard somebody say well, this has all been covered in the EOP. Part of the slide was pages from the EOP where it supposedly was covered and never really discussed the phenomenon at all in the EOP. So it's not clear to me if operators, if they got out of sequence some place along the line or didn't pay attention to the pressure temperature relations which were restrictions, they wouldn't know that this phenomena was going to take place. It's not obvious that it will just from thinking about it.

MEMBER WALLIS: I thought it was explained to us that there were enough steps in the EOP that they wouldn't bump the pump. Even if they know the things that you're saying they might have to know in order to understand what's going on, they still wouldn't bump the pump.

MEMBER SIEBER: If it's not spelled out in the basis document why it is you're not supposed to do something or you are, the trainer will not tell him. In the heat of the battle in trying to deal with one of these burdensome situations, there's a presentation here on how to make them stay.

MEMBER WALLIS: I'm a little nervous about saying that it's a problem, but it's all going to be taken care of because the operators will do the right thing.

MEMBER LEITCH: Right. They may. But you can assure you will known by not putting the procedures and training.

MEMBER SIEBER: Even if they rely on procedures they better beef up procedures why they're doing that.

MEMBER ROSEN: Well, the other thing they have to do is, they have to tell them how to get out of that circumstance if they suspect that they're in it.

MEMBER RANSOM: It wasn't entirely clear that there was a problem because most of the calculations were made for worse case type situation and if they really wanted to fully resolve the issue, it would seem like you should do a more complete system calculation. And in fact, in the end it might be necessary to even generate some experimental data more than they have with regard to the mixing that occurs in the lower plenum of the vessel and as a result of recirculation through the vent valves during this. The detailed neutronic calculation they had made assumed boundary conclusions. You had to put them in at the bottom of the core. It had no dilutions as a result of recirculation through the vent valves and so it was very unclear whether that -- it was a situation that would ever really exist or not.

Now whether they want to go that far, I don't know, but based on the data they have, you can't rule out the possibility of damage.

MEMBER WALLIS: Well, they're on a time line. They're supposed to be finished, I think this year, this calendar year. There's no way they're going to do significant experiments.

MEMBER RANSOM: Well, I guess I interpreted that. There was a plan that RES had put together that went out to 2003 with a significant effort, but I guess they would rather not do that if they don't have to.

MEMBER WALLIS: I talked with Jack Rosenthal who is the manager and he's clear that the story has to be put together really clearly next time.

(Off record discussion)

CHAIRMAN APOSTOLAKIS: The Fire Subcommittee Chairman, are you going to report today? Because what my request was was that I needed advice from the Committee regarding the letter in 5069 as soon as possible. Now the presentation by the staff is tomorrow so what we would try to do is to free this time between 1:30 and 2:00 which was scheduled for Steve. So Steve will talk today. It's not so urgent to cover the Subcommittee on the reactor oversight process now. We can do it later.

Peter wanted something on research, some time on research and I felt today you wanted some, so we can do it today.

MEMBER WALLIS: George, while you're looking at the schedule we have another letter due on this Guide DTL20 which you won't hear about until around lunch time tomorrow.

CHAIRMAN APOSTOLAKIS: Right, right.

MEMBER WALLIS: And I feel like we're not going to have major comments, but if we do there will be a rush to put them together.

CHAIRMAN APOSTOLAKIS: Right, and we can always push the future ACRS activities down a little bit. Let's make sure that tomorrow at 1:30 we give -- or you gentlemen give me advice regarding the letter on 5069 and then we go on to give advice to Graham on DG1120 and then we go back to the future activities. Okay?

MEMBER LEITCH: Am I understanding that there's no letter on this then at this time?

CHAIRMAN APOSTOLAKIS: No. Let's see. Let's start with Graham, then go to Peter and then we'll go back to Jack.

MEMBER ROSEN: I'll go.

CHAIRMAN APOSTOLAKIS: The man is standing up. Let's have Graham.

MEMBER LEITCH: Recall that our off-site self-assessment meeting last time we met, we said that each meeting we would spend just a few minutes on current operating events and that's what I propose to do here.

Let me say that most of this is not at all a detailed discussion of these events, but just to simply say that these are some interesting things that happened and if we want to have a more detailed discussion we can do that in the future. The purpose of this is just a quick 10 minutes in and out, here's some interesting things that happened. Do they pique your interest? Do we want to hear more about them, that type of thing.

This may be an unusual way to make a presentation, but the first thing I wanted to say and by the way I'm interested in your comments on this, is what I'm not generally discussing here are things related to medical misadministrations. There's a lot of those things going on. Lost, stolen or missing small quantities of material. You read every day about the missing, stolen or damaged trucks or gauges and so forth. Minor environmental issues, somebody found a dead sea turtle and generally not radiography issues. So I'm talking mainly about operating events.

Now just by way of being aware of things that are going on, this is not a nuclear issue, but there was as fatality at a nuclear plant. At IP-2 there was an electrocution of a tree surgeon.

MEMBER ROSEN: Was he off-site?

MEMBER LEITCH: No, he was on-site.

MEMBER ROSEN: In the under controlled area?

MEMBER LEITCH: In the under controlled area working on some trees.

MEMBER ROSEN: Was he up in the tree?

MEMBER LEITCH: I don't know if he was up in the tree or not?

MEMBER KRESS: See, I thought maybe somebody got into one of the electrical --

MEMBER LEITCH: I suspect it's that kind of thing that happened, but I don't really know.

In other words, we can find out a lot more about these episodes if they pique your interest. I haven't done that research, but really I think this is not a nuclear thing. It just happened at a nuclear plant. It's a sad thing, but I don't know if it's necessarily any of our business.

Then I've just listed some scrams here. These may not be all the scrams that occurred, but I guess I was just kind of looking for some common threads and maybe I haven't seen enough evidence yet to seek common threads. I do see a couple of loss of vacuum things. If we continue to see a lot of loss of vacuum maybe we can ask somebody to come tell us why we're having so many loss of vacuum trips.

There's a loss of vacuum at Cook, lost of vacuum at Limerick.

MEMBER WALLIS: Do these turbine trips have any risk significance?

MEMBER LEITCH: Very little. We've heard that the scrams -- that we need 25 scrams to be a --

MEMBER WALLIS: Do turbine trips have any risk --

MEMBER LEITCH: A normal turbine trip ought to have essentially no risk.

MEMBER SIEBER: It depends on the plant.

If you're at 100 percent power, water plants can't withstand a turbine trip.

MEMBER LEITCH: Oh yeah, all these turbine trips, in fact, result in a reactor trip, so I mean -- I'm sorry if I misunderstood your question.

MEMBER SIEBER: If you're at 50 or 60 percent, sometimes the reactor will trip.

MEMBER LEITCH: Sometimes as low as 25 percent, you need to be under 25 percent to avoid a reactor trip. But most -- I think every turbine trip that's on the page here -- these are scrams. That's why they're on the list. These are all scrams.

CHAIRMAN APOSTOLAKIS: These now would be counted in the performance indicator, right?

MEMBER LEITCH: Yes. These are automatic scrams. I have another list of situations where the plant was removed from service, but these are automatic scrams.

MEMBER WALLIS: My question was do they have risk significance. You can scram a reactor, but is there any risk involved --

MEMBER KRESS: Only for six of them.

MEMBER LEITCH: Uncomplicated scams, yes, and these all appear to be basically uncomplicated scrams.

MEMBER ROSEN: Oh, I don't know about loss of vacuum scrams means that you have to find a way to reject the heat --

MEMBER LEITCH: So they're accommodated by loss of normal heat removal.

MEMBER ROSEN: Right.

MEMBER LEITCH: So they're a little bit different class.

So maybe one comment might be though in the future, maybe I could segregate them as to uncomplicated scrams versus scrams versus scrams with normal loss of heat removal. That might be a valuable thing to do and I'll do that. That's easy enough to do.

The next thing is fires, a couple of fires.

CHAIRMAN APOSTOLAKIS: We haven't talked about those.

MEMBER LEITCH: Not to mention the one that Jack's going to talk about. That was earlier, I think.

They had a fire in a 1C service water pump while 1A was out of service. So the 1B was fine and saved the day. By the time the fire brigades arrived, the fire was out and I think it's one of those that in the terminology of yesterday would be considered a self-extinguishing fire, the relays that was in the motor.

MEMBER WALLIS: You don't have a fire in the pump. You have a fire in the motor.

MEMBER LEITCH: Motor, yes. You're quite correct.

MEMBER WALLIS: You can't have a fire in a pump.

MEMBER LEITCH: No, you can't.

MEMBER ROSEN: Gentlemen, gentlemen, let's focus on the real issue here. The real issue is that 1B was -- 1A was out of service and 1C failed, the only one pump that had access to the ultimate heat safe. That's probably done correctly.

MEMBER SIEBER: Well, that's a 305 --

MEMBER ROSEN: This was a risk significant event.

MEMBER LEITCH: Yes, we were down to the last pump and it fortunately worked okay, but --

CHAIRMAN APOSTOLAKIS: What caused the fire?

MEMBER LEITCH: What caused the fire? It was an electrical fire in the motor. I don't know any more detail than that and the motor tripped and by the time the fire brigade got there, the fire was out.

CHAIRMAN APOSTOLAKIS: And what was the fire protection system?

MEMBER LEITCH: I don't think -- that's what the report said, but I don't think it correctly was a fire protection system. In other words, I don't think there was any kind of an automatic system. I think the motor trips and the fire went out.

MEMBER ROSEN: That's not what it says.

MEMBER LEITCH: I realize that's not what it says, but reading some more about it, since this was typed, I think this is incorrect. I really was an automatic.

MEMBER WALLIS: When you say the system pressure was okay, for me the question would be if there were demands on this system during an accident, would the --

MEMBER LEITCH: I'm not familiar with the design of this particular plant, but probably under some circumstances, if they had three pumps, usually there are two 50 percent pumps in a situation like this.

MEMBER SIEBER: Now at Cedar Valley we had a third pump because you're pumping water plus a lot of debris and silt and stuff and so they wear out.

One of them you could switch from one bus to the other. The Tech Spec requirement is you have to have two trains. And if you have two pumps out of three out of service, you no longer have diversity so Tech Spec 305 applies which requires you shut down, begin to shut down within two hours and hot standby in six hours and cold shut down in 24 hours. So under these circumstances, unless the A pump was a swing pump which they could put on the other bus, then they have been required to shut down. Do you know if they shut down or not?

MEMBER LEITCH: I think they did not.

MEMBER SIEBER: Well, that's probably what the status was and A pump was --

MEMBER ROSEN: Didn't you invite us to ask if we saw an even that was interesting that we would get more information on it?

MEMBER LEITCH: Sure.

MEMBER ROSEN: The fire on 8/21. More information. It may have been a risk significant.

MEMBER KRESS: Do you know the time of day these occurred? I have a theory that all these things happened in the middle of the night.

MEMBER LEITCH: I don't think I recorded that data. I think that's available. We'll find out a little more about Farley.

Next one, McQuire fire in a generator hydrogen dryer. This is a device that sits down under the generator a little gadget that dries the hydrogen. I think they blew out a plug, a grain plug on the bottom of this. They had a fire down there, lasted for 22 minutes, an unusual event was declared. They manually scrammed the reactor.

MEMBER SIEBER: Did they purge the generator?

MEMBER LEITCH: I think they were able to isolate the hydrogen drier and they extinguished the fire.

CHAIRMAN APOSTOLAKIS: Why was it -- why did it take 22 minutes?

MEMBER KRESS: That was surprising

CHAIRMAN APOSTOLAKIS: Were they trying to put it out?

MEMBER SIEBER: You can't put it out.

CHAIRMAN APOSTOLAKIS: You can't put it out?

MEMBER SIEBER: The fuel is going --

MEMBER LEITCH: They had to isolate it.

MEMBER SIEBER: You have to isolate it.

MEMBER KRESS: Is this like a jet coming

out of a hole and burning --

MEMBER SIEBER: I think hydrogen is one of those gases Dana can tell us -- well, maybe not.

MEMBER KRESS: Is it the hydrogen.

MEMBER SIEBER: Hydrogen coming out of an orifice, I think, generates heat.

MEMBER POWERS: It does.

MEMBER SIEBER: It will burn. That's the ignition source.

MEMBER KRESS: It depends on the orifice. It can go back in.

MEMBER SIEBER: Can't go back into -- if it's moving fast enough, the fire won't go back.

MEMBER LEITCH: I'm taking too much time. Do you want to hear about the McQuire fire? I don't want to speculate here. I just found out the facts.

Other interesting issues. This is a conglomeration of miscellaneous things that may or may not be interesting. We just were working on license renewal for North Anna. It was just interesting to me that during the drought there they had a low lake level.

VICE CHAIRMAN BONACA: They have to fix the lake.

CHAIRMAN APOSTOLAKIS: Is that a

regulation?

MEMBER LEITCH: Also, North Anna and Surrey, there was a potential labor strike. It was resolved.

Here's an interesting one. Susquehanna. Dry fuel storage cask-filled with the wrong gas. They filled it with argon and helium versus 100 percent helium. They were concerned about the reduced thermal conductivity of the mixture, versus the 100 percent helium. Evidently did an analysis and concluded that it's okay. This was just an interesting error.

Crystal River, cable failure caused loss of off-site power.

MEMBER POWERS: What's interesting about the error is how many people buy mixed bottles of argon and helium?

(Laughter.)

I mean you've got to go out of your way to do that.

MEMBER KRESS: You can't hardly get it. You got to make it yourself.

MEMBER POWERS: No, you can get any mixture you want to. It's a special order.

MEMBER LEITCH: You can ask lots of questions about why did they have this mixture.

MEMBER KRESS: But I thought the storage cask heat transfer was dominated by natural convection internally.

MEMBER POWERS: It is natural convection, but it depends critically on the gas.

MEMBER LEITCH: Crystal River, loss of off-site power.

MEMBER POWERS: When you dump air into the cask, with fuel in there, you get an almost immediate ramp up in the fuel temperature because the thermal conductivity of air is so much less. It amazed me too. The fact is those heat transfer coefficients all have K thermal.

MEMBER LEITCH: Let's just run through this quickly. These are other plant shutdowns not scrams. Calvert Cliffs took the unit off because of a -- the number 1 was shut down because of an RCP oil leak. It turned out to be a defect on the valves. It was a good catch by the operators. They were losing the oil level and they took it off.

Millstone 2 shutdown due to a rack coolant system leakage. It was a through wall crack in the charging system.

Duane Arnold shut down loss of residual heat removal due to high strainer differential pressure.

MEMBER WALLIS: I wonder how long it took them to check the leakage.

MEMBER LEITCH: Well, that's pretty well monitored. The instrumentation would tell you. That's why they took it off, yeah. It was approaching on a tech spec.

Quad Cities, I think you're all aware of that situation. Maybe we'll talk some more about that later.

Duane Arnold, tech spec required shut down due to RCIC out of service.

Duane Arnold, high drywell leakage. Of course, they shut down there.

MEMBER KRESS: We've got three Duane Arnolds on there.

MEMBER LEITCH: They have been having their problems. Yes, they've been having their problems.

MEMBER WALLIS: Uprate have anything to do with it?

MEMBER LEITCH: Just a couple of quick regulatory issues, just to be sure we're -- the CPPU disapproval. I guess we're all aware of that. New bulletin on plants to inspect heads and head penetrations other than visually.

Now this next one -- these next couple, in fact, are enforcement meetings, I guess, that are going on that I thought were interesting. These are events that occurred some time ago. D.C. Cook, partial plugging of equipment cooling system. Clogged water supply to the diesel generator. This occurred last year and they're having a meeting on that issue.

Framatome, criticality protection violation. I just thought that was interesting since some of us are going there in a couple of weeks. We'll find out what happened. I don't know the details.

Cooper. This, I thought was interesting. They've had five findings recently. It just looks like there's some interesting stuff going on at Cooper. Four were related to emergency planning and one was an operator requal. issue.

CHAIRMAN APOSTOLAKIS: I'd like to know a little more about this and whether there's a change as a result of this.

MEMBER LEITCH: At Cooper because of these five findings?

CHAIRMAN APOSTOLAKIS: Maybe just a short discussions.

MEMBER LEITCH: I think there were -- I think the answer is yes. Particularly since all these four things were in the EP area.

Okay, the last one, I'm taking too much time. Oconee, lack of adequate procedure to close containment door on loss of shutdown cooling. We're going to have a meeting there. This is during an outage where they have a whole lot of stuff strung through the containment door, an inadequate procedure there, to get it out of the way in a timely fashion.

Peach Bottom is coming up for license renewal. Two emergency planning issues. One was an inadequate critique. The other, they took 31 minutes to declare an alert rather than 15 minutes of just required.

MEMBER WALLIS: So people sometimes take longer than required? That's interesting.

MEMBER LEITCH: No, you're not supposed to. It's a violation if you do. You've got to do it in 15 minutes.

MEMBER WALLIS: We're always being assured that they always do things on time.

MEMBER LEITCH: Point Beach, a RED finding. The aux. cooling water system might fail to function under certain abnormal conditions. This was licensee-identified. There is some question about whether this should be treated. We were talking about the ROP process a little bit yesterday, day before. There's some question about whether this should be treated as an old design issue. It evidently has been a situation that existed since the beginning of the plant.

But it's interesting that this was RED and nothing happened here yet. This is just --

CHAIRMAN APOSTOLAKIS: What is the design issue?

MEMBER LEITCH: My only comment there is -- I'm not saying that shouldn't be RED, but how long is it going to stay --

CHAIRMAN APOSTOLAKIS: What does it mean "might fail"? They did the calculations, I'm sure. I don't understand how a "might fail" would lead to a RED finding.

Something must have failed.

MEMBER LEITCH: They did a design review.

VICE CHAIRMAN BONACA: That's right and they don't meet the requirement. So they say on the best estimate, that is okay.

MEMBER LEITCH: Some set of circumstances.

CHAIRMAN APOSTOLAKIS: But to go to RED,

you have to go to some sort of PRA and do an estimate of risk.

DR. SHACK: So if this system didn't work because of the --

CHAIRMAN APOSTOLAKIS: Okay, so it's not "might fail."

MEMBER LEITCH: Under some circumstances, it could fail.

MEMBER ROSEN: It hadn't failed. It physically hadn't failed. The circumstances hadn't pertained.

CHAIRMAN APOSTOLAKIS: So they assigned a probability for failure to the system.

MEMBER LEITCH: And I guess when you look at it, it's probably been there for years.

MEMBER ROSEN: I think it's the aux. feed system we're talking about.

MEMBER LEITCH: It is the aux. feed system, yes. They called it aux. cooling, but I think it's what all know is the aux. feed system.

CHAIRMAN APOSTOLAKIS: May that's one that we should look into in more detail. Like the Commissioner said, if it's RED, we're interested.

MEMBER WALLIS: They all might fail under normal conditions such as leaving the tail closed at

TMI.

MEMBER LEITCH: I think this is a postulated situation.

MEMBER WALLIS: It's something that couldn't work just because of the way it was designed. It would be unable to work. It's not through an error or anything.

MEMBER LEITCH: That's correct. There's some set of -- not that it would always fail, but there's some set of circumstances that I'm not familiar with. There are some set of circumstances when it's supposed to work and it might not have worked.

MEMBER WALLIS: And there isn't anything wrong otherwise.

MEMBER LEITCH: No, no. It's a design problem.

CHAIRMAN APOSTOLAKIS: It's like an MPSH on the recirculation system.

VICE CHAIRMAN BONACA: Something like that, under some limiting condition that you have to assume an analysis. It might not work. It's the likelihood of having those conditions.

MEMBER LEITCH: So we will --

CHAIRMAN APOSTOLAKIS: That's why I'm

surprised it's RED.

MEMBER LEITCH: I was a little surprised too, George, I mean here we have Davis Besse and we don't know what it is.

CHAIRMAN APOSTOLAKIS: Okay, so what's the plan now?

MEMBER LEITCH: I'll get responses to those at the next meeting and then --

CHAIRMAN APOSTOLAKIS: So you will need some time.

MEMBER LEITCH: And I will also give you highlights of --

CHAIRMAN APOSTOLAKIS: How much time would you need next time to cover these?

MEMBER LEITCH: I don't know.

CHAIRMAN APOSTOLAKIS: You don't know? Okay, you work that out with --

MEMBER LEITCH: I think we'll be on the agenda for half an hour or something like that.

CHAIRMAN APOSTOLAKIS: Maybe a little longer.

You get the questions, Graham. When you sit in that seat, no matter who you are, you get questions.

(Laughter.)

VICE CHAIRMAN BONACA: This is very nice, by the way.

CHAIRMAN APOSTOLAKIS: I think it's great.

MEMBER KRESS: This is great.

CHAIRMAN APOSTOLAKIS: We should be doing this regularly.

MEMBER LEITCH: And we've got a plan to put an item on the agenda. The time may be a little flexible or a little different, depending upon how much we have to cover, but we'll put a little time on the agenda to talk about these things.

CHAIRMAN APOSTOLAKIS: Very good.

MEMBER LEITCH: And I'll try to keep it at a high level. I mean not to waste time with trivia, but I think some of these things are very interesting.

CHAIRMAN APOSTOLAKIS: Great. Thank you very much.

MEMBER SIEBER: We had a briefing with members of the NRR and research staff on 9/11, the ACRS Fire Protection Subcommittee did. I wanted to have the Subcommittee meeting to hear what was going on in fire research for the purpose of getting myself, Committee Members up to speed and to be able to use the new found speed by adding a vector, to develop a velocity. Maybe we need to have some input to the advanced reactor research plan.

MEMBER POWERS: Getting up to speed only involves the magnitude. It does not involve the vector.

MEMBER ROSEN: Well, that's the point. I wanted to impart a vector to it, to use that magnitude.

CHAIRMAN APOSTOLAKIS: So the speed is not generally --

MEMBER POWERS: You've got to worry about the momentum equation here, sir.

MEMBER ROSEN: Really, I just wanted to get some information so I could use it. What I wanted to use it for was to help Peter with his review of his advanced reactor research letter. I learned a lot. I achieved the first objective. I got a lot of information, but not the second, because the minute I went back to the advanced reactor research plan I found they had no explicit discussion in fire research. Maybe that's the null finding. The thing we could say is there isn't anything in the advanced reactor researching plan about fire research.

Now that's not to say the things they're doing in fire research area are invaluable to advance reactors. I think they are. But the idea that one needs to focus the advance reactor research plan in the area of fire still is important. And I think that's going to be one of the inputs I'll offer.

There were seven members, ACRS Members who attended the Subcommittee meeting. We started off with a fairly detailed discussion with the staff on fire risk research plan. The status of the current plan, that is the plan that ends the end of this fiscal year. They are considering a new plan, a 4-year plan, goes from 2003 to 2006. It only has detail for the next two years, 2003 and 2004.

The Committee asked a lot of questions and this is the format I'm going to use to tell you what the subject matter was and then tell you what the Committee's interest seemed to be.

With regard to fire risk research plan, the Committee was interested in revision, what was in NRR's or research revision for fire protection research and what is the future, what was desired. We really didn't hear that too clearly, I would have to say. Although there's a lot of good research going on, we were interested in the likelihood of multiple fires. I don't think we heard there was much research going on, although we know that fires have been tending to lead to additional fires and that is this hot short issue that's been discussed quite a bit.

We asked questions, that is, we as members of the Committee asked questions about the cleanup from the smoke effects of fires. Fire risks in nonreactor facilities, including facilities being decommissioned. The fire risk at the mixed oxide fuel fabrication facility. Sometimes the staff had answers to these questions. Sometimes they didn't.

The staff doesn't have criteria or a process to decide when testing is needed and furthermore, when -- who should pay for that testing, should it be the NRC or should it be industry. It seems to be a need for definition of when testing is needed to support some conclusions in the fire area and then having drawn the conclusion that you need to have some testing to support some findings that you are trying to make, who should pay for those, that testing.

That's all I'm going to say about fire risk research.

The next thing we talked, we heard a presentation on something called the fire risk requantification activity. That's an activity the staff is undertaking in cooperation with EPRI. We asked questions about the scope of this effort, the schedule, the process, the participants. It's basically doing the fire -- re-doing fire PRAs or coming up with methods to do fire PRAs.

CHAIRMAN APOSTOLAKIS: Is that going to be a glorified 5 or a real PRA?

MEMBER ROSEN: I'll let the staff answer that. I think it's going to be a real PRA. The idea is to come up with a real --

MR. HYSLOP: This is going to be better than 5. We're looking at the methods.

CHAIRMAN APOSTOLAKIS: Six of 7 perhaps.

MR. HYSLOP: We're going to be improving HRA methods, looking at remote shutdown better than has been done before. WE're going to be employing the circuit analysis in sites. We're going to be looking at the FAR modeling.

CHAIRMAN APOSTOLAKIS: Are you going to develop a fire propagation model?

MR. HYSLOP: We'll be using the codes that are out there. There's EPRI codes. There's MAGIC. There's zone codes.

CHAIRMAN APOSTOLAKIS: So you would see whether these codes --

MR. HYSLOP: And we'll be looking at those.

CHAIRMAN APOSTOLAKIS: And possibly adopt them?

MR. HYSLOP: Pardon?

CHAIRMAN APOSTOLAKIS: You may have to change them a little bit to make them useful to a fire PRA.

MAGIC, for example, I am not sure it calculates the time for failure of cables. Isn't MAGIC more spread from compartment to compartment?

It might be able to with some adjustments, but I don't think a lot of these codes were developed having PRA in mind.

MR. HYSLOP: I don't know. I can't imagine using them as you say unless they do give us too much information, things like that, that would lead to fragilities.

CHAIRMAN APOSTOLAKIS: When is this project going to be completed?

MR. HYSLOP: This project is going to be completed at the end of 2002. EPRI intends to provide an update to their fire implementation guide and NRC will be producing a NUREG also on insights and some methods.

CHAIRMAN APOSTOLAKIS: Okay, good. So we'll have other opportunities to review this and supplement the record.

MEMBER ROSEN: Yes, as I said, there's a lot of good things going on. This is one of them.

The Committee asked questions about chemical specification resulting in fires and as I said this affects fires, including cleanup and when one cleans up after you've had a fire and areas that were not directly affected, it's a question.

We also talked about past work built around operating curves in the event of a fire. At times, other than during the day, when the staffing is minimal at the plant, sometimes some plants the operating crew provides a member to the fire brigade or what may be more than one. So now you have the circumstance of the plants and the transience, does the fire typically cause transience and to shut down the plant. The crew has to shut the plant down, has to fight the fire, has to make emergency plan notifications. It's going to be very busy. And the question was when you get very busy you tend to make mistakes, that's what our human error models tell us. It could be a hazardous situation.

CHAIRMAN APOSTOLAKIS: Has ATHENA been applied to it or something else?

MEMBER ROSEN: The discussion was just about this is a hazardous -- to identify and ruminate to each other that this is a hazardous situation. We didn't do an analysis.

That's all I'm going to say about the requantification because requantification should be able to handle all of that if it's really good.

Fire detection and suppression analysis was the next thing we had presentations on. The Committee asked questions about fire brigade performance and the likelihood of successive fire suppression.

The Committee had questions, Members of the Committee had questions about the modeling of self-extinguishing fires. We heard about one today in one of the plants.

The Committee had questions about damage to operable safety system equipment caused by actuation of fire suppression equipment, either manual or automatic. Automatic, I've heard often discussed, but manual, not as often. But fire brigade guys with hoses can do lots of different things including cause damage.

VICE CHAIRMAN BONACA: They also show a flawed approach from the literature, detection and suppression. They were showing a model that I think you and --

CHAIRMAN APOSTOLAKIS: How comes these guys -- don't they have a conflict of interest when they do that? I have a conflict all the time.

(Laughter.)

Nathan doesn't have a conflict?

MEMBER ROSEN: We were very complimentary of Nathan's work on that project. They even spelled your name wrong.

CHAIRMAN APOSTOLAKIS: Nathan?

MEMBER KRESS: It wasn't Nathan, it was the guy from Sandia.

MEMBER ROSEN: It says here that Siu and Apostalakis event tree modeling is valuable and needs to be extended and used.

All right, it was 20 years ago. What have you done since then?

The meaning of suppression failure in fire event tree models was discussed. Fire suppression. That's all I'm going to say about the suppression and detection presentation.

There was a presentation on circuit analysis and Fred Emerson of NEI was here and also was given time to discuss fire induced circuit failure which was his set of words. It's all about hot shorts and spurious actuations that may be result from hot shorts.

The Committee was interested in the enclosure of the fire tests. There were fire tests conducted at the Omega Point Laboratory in San Antonio. They were conducted and Graham Wallace precisely characterized as he usually does, as an oven. It was actually a plate steel box room. It was not representative of typical rooms in the plants and the Committee was interested in what does that mean with regard to the results? We don't have fires in those kinds of rooms in plants because we don't have those kind of rooms.

Questions about the physical failure mode of cables. Were they burning? Were they melting? Were they charred? Questions about times of failure and heat deposition rates in cables. Questions about the validity of using conductor or conductive failure probably of 80 percent. That's a number that was derived. There are only 18 tests, but they derived that number. The question was whether that's a good number because you use it for other cable tray configurations, for instance, vertical cable tray versus horizontal.

In general, these tests are only suitable for that limited purpose, that is, how likely are spurious actuations from hot shorts. That's what we concluded. The testing was done to answer the question and these people believe, oh no, you can't get a spurious actuation from a hot short if you deal with this very rare event. Well, they did the test and they found out it happens about a third of the time.

CHAIRMAN APOSTOLAKIS: At Brown's Ferry.

MEMBER ROSEN: Brown's Ferry. But I think that has now been dispelled in the industry. If you have a hot tire, you're going to have hot shorts. The question is where.

We then concluded there was not enough data to support fire modeling analysis or broad conclusions from these tests, but before we throw too many stones in the direction of the tests, we should remember what their purpose was, which was to get the industry out cheap by proving that hot shorts don't happen. And what happened was they proved, to the industry's credit, that have acknowledged that fact.

MEMBER WALLIS: They successfully, George, avoided the irresistible temptation to do any technical analysis based on mechanistic models.

MEMBER ROSEN: Graham proposed at least a dozen different homework assignments that he would have asked --

CHAIRMAN APOSTOLAKIS: And he has already graded them too.

MEMBER ROSEN: That wasn't the purpose and so we moved on. Let's see, we talked -- there was a long presentation about the SDP process, significance determination process in the ROP in the fire protection area.

The Committee was interested in such things as the fact that all fire protection, Phase 1 findings, almost all of them seemed to go beyond the Phase 1. Phase 1 doesn't seem to be too good a screening tool. Fifty-two out of 73 Phase 1 findings have moved beyond that.

We noted that inspections on associated acceptance is still on hold. Suzanne is here, so she can get up and talk about that if she wants. That is apparently a temporary condition the staff is trying to work through with NEI, the correct way to analyze hot shorts and that's where the associated circuits are, where they happen. And how properly to do that analysis.

Suzanne, do you have any idea of how soon that might come to close?

MS. BLACK: Our current schedules shows

those inspections in 2002.

MEMBER ROSEN: In 2003. The issue will be resolved enough so that the staff will be able to say okay, here's how you captured the analyses if you had a finding in a fire or then here's how you do the inspections.

We had a discussion of fire protection findings by Doug Coe of NRR. He told us that there had been 156 fire protection findings at a certain period recently and 29 are in the category called unresolved because there were issues of the inspection standards and they're working to try to get those findings resolved.

One of the things that was a little troubling was that we heard that -- and Graham Leitch mentioned this earlier was that there had been -- it's been a hiatus in -- by the staff and the inspection fire brigade performance. I think they're still inspecting fire brigades and how they perform, but they're not putting their results in inspection reports because there are not specific standards.

MR. KOLTAY: My name is Peter Koltay and I think yesterday when we discussed this I was told that perhaps my discussion led you to believe that we suspended inspection in this area. And the inspection requirements are very specific in the inspection procedure. The resident is given time each year to observe and record his observations of fire brigade, at least one fire brigade drill.

When we do have problems, there's some -- and I again went back and reviewed all the findings in this area and we do have some findings that were recorded as to proponents of fire brigades, but there's really not a good detailed guidance and instructions how to categorize those findings and get them into the inspection process, into the inspection report.

MEMBER ROSEN: So you're not being included in this section?

MR. KOLTAY: Some regions will include them certain ways and some regions will include some, so there's no uniform -- there's no uniformity there. It's probably because our guidance should be a little better.

MEMBER ROSEN: We see that as a significant problem because what we saw was a lot of data on how fires are treated in plants and what we know is fire brigade performance is very important to control and ultimately suppress fire. That seems to be an issue that we want the staff to -- I would say report back to us on when you get it cleared up and how it's going to be cleared up. It's an important risk significant issue.

That's all I had to say about the meeting. It was helpful.

CHAIRMAN APOSTOLAKIS: Are you planning to have a letter of some point.

MEMBER ROSEN: Not on this, no. The purpose of the meeting, as I said, was to --

CHAIRMAN APOSTOLAKIS: Information.

MEMBER ROSEN: It was information to the Subcommittee and to me so that I could get -- as a new Chairman of the Subcommittee, understand what's going on and also to get some input, I hope for the advance reactor research. A lot of what's being done is very good and it will be useful in advance reactor analysis and that sort of thing, but none of it is tagged specifically for advance reactors and clearly --

CHAIRMAN APOSTOLAKIS: I understand.

MEMBER ROSEN: Clearly in advance reactors they have new sets of issues, card and graphite, those kinds of things. So now that I know what's going on, I can make some comments in the report, our report on advance reactors that might be useful to the staff.

CHAIRMAN APOSTOLAKIS: Is the staff going to request a letter any time soon?

STAFF: Not at this time. Maybe when we come back to the revised research plan. Maybe at that time we do that. We have to revise the research plan.

CHAIRMAN APOSTOLAKIS: What about this requantification project? Are you going to come up with a final product and ask us to comment on it? Before that?

MR. HYSLOP: I haven't thought about it.

CHAIRMAN APOSTOLAKIS: It's always a fire risk operation to come through with a finished product.

MR. HYSLOP: You know --

CHAIRMAN APOSTOLAKIS: There is never a surprise at the meeting.

MR. HYSLOP: Well, we gave a presentation over an hour yesterday.

CHAIRMAN APOSTOLAKIS: Yes, but we are not writing a letter. What I am saying is maybe at some point -- because this seems to be a significant effort.

MR. HYSLOP: Yes, it is.

CHAIRMAN APOSTOLAKIS: And what I would not like to see is a semi-finished product and then have the Committee say well, we don't like this, we don't like that. It's an acrimonious confrontation of environment we're trying to avoid. So somewhere there when you think you have something that's presentable, maybe you can request --

MEMBER ROSEN: You're going to be done in 2003.

MR. HYSLOP: We have a couple pilot plants that we're updating the FREs. When we're further along, when we've thrashed out our first series of methods debates. It seems like after we have a little more progress it will be the time to come back then.

CHAIRMAN APOSTOLAKIS: We can do that.

VICE CHAIRMAN BONACA: I think it would be very valuable for us to see a critical comparison of all the existing analysis that they have with the new analysis to understand how new methods are affecting the differences.

MEMBER ROSEN: You might have a conflict, Mr. Vice Chairman, on that because one of the pilot plants is Millstone.

VICE CHAIRMAN BONACA: I will sit quietly and silently.

MEMBER ROSEN: Comparing the new analysis with your work.

VICE CHAIRMAN BONACA: I think it's

interesting to understand what are the improvements, the state of the art with respect to what was there and the reasons why.

MEMBER ROSEN: Sure.

CHAIRMAN APOSTOLAKIS: Is that all, Mr. Chairman?

MEMBER ROSEN: Yes, Mr. Chairman.

CHAIRMAN APOSTOLAKIS: I think we have to go back and to be on schedule.

Jack, how much time do you need?

MEMBER SIEBER: For both subjects?

CHAIRMAN APOSTOLAKIS: No, just for the D.C. Cook?

MEMBER SIEBER: Probably 15 minutes.

CHAIRMAN APOSTOLAKIS: Let's do it.

MEMBER SIEBER: Since we're talking about the fires.

CHAIRMAN APOSTOLAKIS: What is that?

MEMBER SIEBER: An out of focus -- this picture is a little bit out of focus because it's been back and forth a few times. This is at the D.C. Cook Power Plant and you'll see that the device isn't very big that caused the fire. The fire self-extinguished when it ran out of fuel. And the fuel for the fire was basically transformer insulating oil which is typically pirodol or something like that. It's a -- the modern versions do not have PCBs in them and years ago when I tested the flashpoints of flammability of these kinds of oils they would smoke like crazy at about 600 degrees and usually get to flame somewhere around 675. So from a standpoint of an insulating oil, it's not bad.

I brought another overhead with a person in it. That person is probably 60 or 70 yards from the current transformer, but if you can sort of pull together the perspective, you can see the relative size of it. It is not a big device.

The capacity of that is about 250 gallons of oil. The purpose of these, if you go into a switchyard, you'll find a number of devices. You will find a lot of bus work. You'll find disconnect switching. You'll find circuit breakers. You'll find step up and step down transformers and you will find current transformers like these and potential transformers that measure voltage rather than current and then somewhere in the switch yard you'll find a concrete block building with a control board in it and a battery room with ventilation and a telephone and maybe fault reporters and things like that.

The current transformers and potential

transformers put out AC signals. They go to relay coils and if you are under voltage or over current, as measured by these transformers on any given line or device it will either close or open this relay coil and operate the circuit breakers that isolate what have you. The kinds of things you measure is instantaneous and long term of a current, under voltage.

There is a phase differential kind of a set up where you compare the voltage on three phases if they aren't all the same it will trip you up because it's phase on balance and what that does is electrically move the ground away from the real earth ground. And then there are pilto wire types which is you compare the voltage of one end of the line to the voltage of another end of the line, send the signal back and if they aren't reasonably the same, you know that your line is either broken or faulted in some place or hung up in a tree and that will trip it off too. So basically, these are the devices.

Now let's talk a little bit about the D.C. Cook. D.C. is in southwest Michigan, fairly close to the Indiana border near Benton Harbor. It's a two unit Westinghouse four loop PWRs. The older unit is a 1,000 megawatts and the new one which is two years newer is at about 1050 megawatts. And they have the distinguishing feature of having ice condensers which ice condenser containments are pretty small. There aren't too many of them in the United States.

DR. SHACK: Not too many of them?

MEMBER SIEBER: Not too many of them.

MEMBER POWERS: You said it, not me. Let the record show it was Shack and not me.

MEMBER SIEBER: I passed out a paper that I wrote to Mag Western and Clifton Martin. They provided me data and I also got data from the website and some of it came in pieces, so I wrote from the licensee event report first and then when I read later reports, I found out there was inconsistency. So you will find in this paper what looks like errors. I'll point out where those inconsistencies are and tell you how I think it's supposed to be.

D.C. Cook is, as I said, is owned by Indiana Michigan Power Company which is a subsidiary of American Electric Power. Typically, Cook Station is designed like this and operated like this where the switch yard is operated by one branch of the company and in this case it was AEP's system operations office which is in Fort Wayne, Indiana, believe it or not, 150 miles to the east. And the reactor plant and a few devices in the switch yard are operated from the control room at the plant.

MEMBER ROSEN: Let me just say that I have a conflict of interest on this. So I won't comment. AEP is a part owner of South Texas.

MEMBER SIEBER: Okay. This is just for Cook.

CHAIRMAN APOSTOLAKIS: You have no interest in that, so feel free.

MEMBER ROSEN: It's just a disclosure.

MEMBER SIEBER: Everybody owns everybody these days, by the way. You have to keep track every week.

So anyway, you have people from Fort Wayne, Indiana operating from the switch yard and their traveling operator will go to this concrete block house and he will be directed by the Fort Wayne system operator and the control room doesn't have enough instrumentation generally to tell exactly what it is they did. And they will know bus statuses and things like that. They don't have the instrumentation in the control room they have in the switch yard.

At Beaver Valley we solved it, the problem of traveling operators by putting our own locks on the gates in addition to their locks so that they had to come to our control room before they could get in.

(Laughter.)

That seemed to work pretty well. At Shipping Port, the station owned the switch board. At Beaver Valley, the system owned the switch board. So that makes a little bit of a communication and coordination problem, particularly since the instrumentation in Forth Wayne is not enough for them to identify exactly where a fault is, okay, in a switch yard. So their directing operations and people are giving suggestions and the plant operator is sitting there wondering what's happening. So that was one of the problems and issues.

I will show you a little bit about the switch yard and how it's laid out. I guess you can see that.

Here's unit one. This is unit two. And the switch yard has two sections, one in the high voltage area. One of them is 345,000 volts. The other one is 765,000 volts and there is one off-site feed on the 765 side with a disconnect switch and the step out transformer and it's connected to the 345 side which has 6 off-site pieces.

The preferred power supply for the emergency power or central power where the service water pumps are, comes from the 345 kV switch yard section found to -- and these are the two, Unit 1, 4 kV emergency buses and these are the Unit 2, 4 kV buses. And generally speaking they're tied together. The power is -- who gets the power -- Unit 2 side of the switch yard, Unit 1 gets its power from the Unit 1 side of the switch yard. And this bypass breaker right here is normally left open. Now if you lose half of the switch yard -- if you lose one side of the switch yard, you can close that tie breaker and tie the station service from both units together. And of course, you can see the four diesel generators there at the bottom.

Now if I look at the initial conditions, either one was operating at 68 percent power, it had been shut down the week before and so they were coming back from an outage. Unit 2 was at 100 percent power. Unit 2's train A essential service water pump was inoperable, in fact, it was in pieces on the floor because they were overhauling it. And it was in the 72 hour limiting condition for operation and they expected to finish rebuilding that pump that night.

Unit 1's train B essential service water pump was hydraulically tied to the Unit 2 service water header. They had a pipe with a valve in it and so they opened that valve and that provided service water to both units.

And because of the cross tie, however, Unit 1's train B service water pump was declared inoperable. This is also a 72 hour tech spec that when they finish rebuilding the Unit 2 pump, they would close that valve and they will both be operable.

Work was on-going in the switch yard. In other words, the traveling operator and the construction crew were in there, getting ready to replace a circuit breaker.

The main generator output breaker which is K1 which ties it to this section of the 345 bus was out of service because its associated disconnect switch which is an open air switch was not properly connected.

Now a disconnect switch is like a fork and the arm comes up and the head on one side goes into this fork and makes contact for about 180 degrees. What happened is when the operator closed that disconnect switch, it was on the outside of the fork so instead of 180 degree contact, it was a 1 degree contact.

You can't operate like that because the resistance is so high you would melt the switch. You can't open those switches under load, so the only way to take that section out of service is to open the circuit breaker. That meant that Unit 1 was only feeding one of the buses, the 345 buses directly and had to make the cross ties down through either N, M or L branches in order to pick up the other bus. If you lost that other bus, there were a couple of off-site feeds that you would lose. So basically that's the set up.

DR. SHACK: That was a known condition, right?

MEMBER SIEBER: That was a known condition. It's allowed. It's allowed. What happened is that when the current transformer power started it came down and it damaged one of the circuit breakers and that would be the L breakers. And some degree and stuff also went and damaged the M breaker. So now you had K1 out of service. L was subject to fire and damaged in a trip and M was damaged and it tripped.

Also, one of the construction workers was injured. I doubt that it was serious because it was only mentioned once. And so the traveling operator calls Fort Wayne says what do I do? Isolate the fault. So he starts opening breakers and ended up opening up the preferred power supply to the plant.

Okay, and that automatically closed the bypass breaker.

There are places in this description where I said things happened automatically, but that was because a control room operator was writing the log. He didn't know whether it was automatic or manual, but the people were actually up there opening breakers. They finally got down to one feed in the 345 yard to the outside and one in the 765 to the outside. That made -- and in addition, that was a very hot day. It was June 12th. It was a little after a quarter to 2 in the afternoon. And the whole system in Michigan was under degraded grid voltages.

Now even if they could get -- under the condition that they were in right there, they had another problem in the plant. It was an on going problem with space and service transformers or tap changing transformer. They rely on a voltage detector and then you move the taps across the secondary winding to raise and lower the voltage so that the voltage in the plant met the required specification. Tap generators were broken. Hadn't worked for a while.

So they couldn't adjust the voltage. That made the service water pumps inoperable because they didn't meet the minimum voltage requirement. Put them in tech spec 305 which is shut down in two hours and a hot standby in 6. Hot shutdown in another 8 and then cold in 8 and they already had degraded rib voltage and they were going to force them to take on this 2000 megawatts off the system which then would certainly make the voltage so distressed, made the grid unstable, but it would maybe trip other units and this is my speculation. That certainly voltage would be so degraded that if you had a LOCA, you wouldn't have the service water to run the big service water loads that happen on a CIV operation which was containment isolation and spray coolers and things like that.

So they went to the NRC, requested a notice of discretionary enforcement so they wouldn't have to fall tech spec 305. That way they could stabilize the voltage, try to restore the system, finish rebuilding the other pump and all of which operations were successful. Because the fire was a switchyard fire, it's outside the protected area, by the way. But it's a switch yard fire lasting more than 10 minutes or 15 minutes, I'm not sure what the regulation is. That put them into a work classification.

MEMBER ROSEN: 15.

MEMBER SIEBER: 15. It had to be longer. Because they were in an alert, so -- and they went all the way to the emergency organization that you would have for site area in preparation for things getting worse. Since this was in daylight, it was good because most of the people were already at the site and so manning the emergency --notifications were on time, it appears. There was no violation.

Finally, not all the oil burned. Itself extinguished sooner or later, but some of it didn't burn and went on the ground which is a national pollution, you need a permit for that, so they had an oil spill too at the same time.

Other than that, things were going pretty good. A pretty good day.

So anyway, the units stayed on line. There was a special investigation from Region 3. They did a significance determination and screening for significance determination. It screened a yellow finding and so that caused them to try to do a SPAR model, but a SPAR model doesn't model the switch yard. Okay? So they couldn't get an estimate as to how degraded they really were and I did finally get an e-mail here that describes exactly what it is they did. And those reviews who went to the Region 3 office may remember that the senior reactor analyst is a lady named Sonia Burgess and so she ran the SPAR model, didn't get a result, but they made some assessments as to what the conditions were and they said breaker L which is the generator output breaker had been in this deficient condition for a year. And they gave that an order of magnitude increase in risk for a loop.

And they decreased the failure probability of operator recovering the offsite power in a short term because they said and this drawing doesn't show it, but they said there's another 69 kV feed that they could connect directly into the emergency power. The third factor is all four diesels were operable and I'm not sure why they didn't start them. I would have started them and have them running so that all I had to do was close in if anything else opened up.

And so that -- when you consider those things the risk turns out to be the same in that condition because of the 69 kV line, so then it was evaluated as a green finding and there was letter writing back and forth between the company and the NRC questioning, for example, the containment vulnerability, the probability of containment failure under severe accident or an ice condenser. One place is stated as .82 which was pretty high. And in another NUREG which the licensee was trying to use was .28 which to me looks like a typo.

But the NRC staff was using .4. The licensee wanted justification, why are you using this number when all these other numbers are out there, but they finally ended up using .4. And once it turned out to be green, everybody agreed that that was it. So that's basically the extent of the event. Eventually, the sun shone brightly again and they had two circuit breakers to repair and they had a new current transformer to buy and some gravel to dig up. And that's the report.

MEMBER KRESS: What caused the fire?

MEMBER SIEBER: Pardon?

MEMBER KRESS: What caused the fire?

MEMBER SIEBER: I don't know, but amongst fires, I think that CTs and PTs, they every once in a while commit suicide.

They're a small device and they're under a lot of stress. This one is 25 kV on one side and 110 volts on the other side. And so if you get a fault in them, since they're so small they generally blow out the low voltage bushing which is on the bottom. And that's where the fire starts.

MEMBER WALLIS: At least it doesn't have enough momentum to go into wall.

MEMBER SIEBER: This is lift off right here.

MEMBER ROSEN: That because the momentum equation doesn't have that curve.

MEMBER SIEBER: I don't think we know how to use it. But in any event that's where they usually blow. I've seen a few.

MEMBER POWERS: The problem is there hasn't been any phenomenological analysis prior to this experiment so they didn't want to carry it too far.

MEMBER WALLIS: It's interesting the flame didn't burn anything else.

MEMBER SIEBER: There's nothing much else to burn.

MEMBER WALLIS: That's not so important. There's no transformer or something else.

MEMBER SIEBER: You try to separate them in the switch yard for a couple of reasons, fire protection is one, explosion distances is another one. Since you already own the land you can make the switch yard pretty big. The only thing that really costs you is the extra chain link fence, but some of them are bigger than the power plant.

MEMBER LEITCH: Did the potential or current --

MEMBER SIEBER: Current.

MEMBER LEITCH: The current, did that directly trip any breakers?

MEMBER SIEBER: Yes, it did. It tripped L.

MEMBER LEITCH: L.

MEMBER SIEBER: Right. And apparently pieces came off of that and damaged -- so that's my report.

CHAIRMAN APOSTOLAKIS: Any other questions?

Great, thank you, Jack.

MEMBER SIEBER: You wanted a self-extinguishing fire, don't you?

CHAIRMAN APOSTOLAKIS: You have another subcommittee report to do, but maybe we should take a break first.

MEMBER SIEBER: I'd love to. I'd also like you to help me with that.

CHAIRMAN APOSTOLAKIS: Yes sir.

MEMBER SIEBER: Since you were the co-chair.

CHAIRMAN APOSTOLAKIS: Okay, so we'll recess until 4:45.

(Off the record.)

CHAIRMAN APOSTOLAKIS: Okay, we'll start a few minutes earlier. We have to finish by 5 of 5, right? Okay.

MEMBER SIEBER: When it's 5 of 5, I'll just quit.

CHAIRMAN APOSTOLAKIS: Wonderful.

MEMBER SIEBER: And this will be probably no longer than the Cook report.

CHAIRMAN APOSTOLAKIS: Okay.

MEMBER SIEBER: Some background. In September, we met with the staff, September of last year, met with the staff on the ROP and we discussed it again in October and wrote a letter. That letter had some comments in it that made recommendations for improvements to the ROP process, pointed out some philosophical conflicts, for example, if you recall there are seven cornerstones in safety. Three of them are risk based.

One of the risk based ones had performance based elements in it. And that's the defense-in-depth for containments. And four of them were performance based. And then you had a conflict between the performance indicators on the one hand and how do they relate to the risk information that comes from the SDP process and since the action matrix uses the same colored system for both their inconsistencies caused by that, for example, a green SDP is not a good thing, whereas a green performance indicator is a good thing. And so that creates some philosophical consternation for anyone thoughtful enough to try to think it through.

So we made a number of suggestions. We met with the Commission in December and I gave a presentation there where I reiterated what was in our letter. The Commission turned around and wrote an SRM and that was dated December 20th and it said the staff of ACRS input should provide recommendations for resolving in a transparent manner conflicts of discrepancies between aspects of the revised reactor oversight process that are risk-informed, e.g., significance determination process and those that are performance based, e.g., the performance indicators.

So we had a subcommittee meeting on the ROP. We had a get together about three or four months ago. I guess it was in May, where we gave suggestions and clarifications, how these discrepancies could be cleared up and this week's presentation from the staff was to show us how they were going to implement those suggestions.

On the other hand, the staff, if I go to their conclusions, they have concluded that the ROP is working and that incremental improvements would be done as opposed to changes we suggested which I thought was a disappointment and they're basically telling us they're not going to do our suggestions and it's okay to mix risk information with performance information and it's too bad that green means two different things and they also like the 25 scrams for the threshold for red in the initiating events.

MEMBER ROSEN: Because they say it's a communication tool with the public.

MEMBER SIEBER: That's right.

MEMBER ROSEN: Which I thought was most astonishing lack of miscommunication, the knowledge I heard a long time ago. I've heard astonishing things about risk communication.

MEMBER SIEBER: It communicates something to me that I think the public should know which is look how lax we are. We let these guys trip these things all the time. We don't even yell at them until it gets preposterous.

So in any event, I think we're sort of back to square one on our comments, the discrepancies will stay. They are doing some things to improve the process. One of them is they're beginning to conduct a pilot program for the mitigating system performance index and that's a good thing. They say they're continuing to improve and develop other performance indicators and that they're going to improve the SDP processes. There's a whole bunch of them. I think fire is an example where they're doing that. But that's it.

So that would be my report of what went on, Mr. Chairman. You may want to add some because you were the co-chair for that.

CHAIRMAN APOSTOLAKIS: Yes, the disappointing thing was that the presentation was very high level and did not address, until we asked, our letter of last May, was it. No, before that. Maybe it's because there are new people that are managing and working on this project now and I didn't get the impression that they were really on top of the issues that we raised.

So you know, when you have a subcommittee meeting after such a long time and letter and SRM and what they are telling you is that they are trying to comply or to meet, to satisfy the four strategic goals of the Commission that really is bordering on insult. It's so hard to schedule subcommittee meetings these days, we're already busy and Mario pointed out earlier today that in October we are here every week almost or we're doing something for the ACRS almost every week, we are going to Germany and some people are going to France. We have a full Committee meeting. So to waste a subcommittee meeting on such high level stuff is really very irritating.

And you know, the meetings we've had in the Caucus Room that Jack mentioned, it's as if they never took place. They never addressed the issues and after we pressed them a little bit, one of the presenters said okay, let's discuss this issue. Well, discuss again? In September, when they are planning to send the report to the Commission in March? And their plan was to come to us some time in February or December --

MEMBER SIEBER: December.

CHAIRMAN APOSTOLAKIS: The full Committee.

MEMBER SIEBER: And wanted a letter.

CHAIRMAN APOSTOLAKIS: And want a letter.

MEMBER SIEBER: And I asked them what kind of letter do you want? The only letter I could write now is one that says we made these recommendations. We met with you and you came back and said you weren't going to do it. And so -- that would be the letter.

CHAIRMAN APOSTOLAKIS: So it was really very disappointing, so now we are trying to find another half a day some time before December and they promised to come with written positions. It's very hard to find the time. Mag Weston is working very hard to try to find the time where people can come.

MS. WESTON: We have a tentative date of the morning of October 31st.

CHAIRMAN APOSTOLAKIS: Okay. And they promised to send written materials to us before then. Because it's one thing to sit around a table and have people express views and quite another to have a slide that says this is what we're going to do. I'm not even sure that they would dismiss our comments. I'm not sure they read them.

MS. WESTON: Well, you know, George, with the change of the guard, the agenda was supposed to give us the detail that we have talked about, but they ignored the agenda. And we don't get something in writing the next time. I don't know what we're going to do because this was a complete surprise in terms of the lack of specifics.

CHAIRMAN APOSTOLAKIS: So it was not a very good meeting, I don't think.

We have this issue Jack mentioned, performance versus risk based, SDP calculations. These are important issues. And I don't think they were on top of it.

VICE CHAIRMAN BONACA: October 31st we should ask for something.

CHAIRMAN APOSTOLAKIS: Yeah, we have to have something tangible, otherwise we'll cancel the meeting. We will have to send the letter to the Commission separately.

DR. SHACK: Did they address anything in the IG report?

CHAIRMAN APOSTOLAKIS: No, no, it was very general.

DR. SHACK: Everything was general?

CHAIRMAN APOSTOLAKIS: It was as if they were introducing the Committee to the reactor oversight process.

And the other thing is that it was not in the SRM, but it's something that we really have to take into account is this Davis Besse thing. You can't ignore it and say well, that's something we'll think about later.

MS. WESTON: The EDO though has established a Committee to look at the IG's report on the SDP, separate from that office.

MEMBER LEITCH: I think the IG report had some very significant, I mean the one really significant thing they said was that Phase 2 analysis really needs significant rework or they need to do away with it.

MEMBER SIEBER: Phase 1 always appeared to give you the wrong user. It goes straight to Phase 3.

CHAIRMAN APOSTOLAKIS: But the other thing that I didn't like was there was a statement there after the generalities slide, the ROPs work. I don't know what criteria they're using. Davis Besse probably, yes. That it's working. How did you decide that when you have greens all over and all of a sudden you have this problem.

So I mean people are putting words down almost without thinking.

VICE CHAIRMAN BONACA: The other thing about Davis Besse was that he defended the 27 scrams.

CHAIRMAN APOSTOLAKIS: Yes, the -- 23. Don't exaggerate.

(Laughter.)

VICE CHAIRMAN BONACA: As I said, that was astonishing.

CHAIRMAN APOSTOLAKIS: But this again, I don't think it's the position of the staff. It was three guys talking. They don't have a position. They were not planning to have a position and in our letter we said there is a problem here.

In fact, I read it back to them and said we use the words "a fundamental flaw." Remember? Intractable flaw.

MS. WESTON: And I think Mike had committed to us in our first meeting to look at those things and do something about them.

CHAIRMAN APOSTOLAKIS: Yes, Mike Johnson was on top of things and we had two meetings. The first time I thought we were doing great. We said you know, we're going to think about these things. Maybe you're right and all that and all of a sudden we're starting from scratch.

Anyway, I think we made our point. Are there any other comments from subcommittee members who are present?

MS. WESTON: George, while you have that minute, will you look at your calendar for October 31st. Sam is telling me --

CHAIRMAN APOSTOLAKIS: Jack, are you

available October 31st?

MEMBER SIEBER: Yes, I'm here on the 30th.

MEMBER ROSEN: It's a day of a planned PRA subcommittee meeting. You wouldn't want to miss that for the world.

MS. WESTON: So the 31st is not?

CHAIRMAN APOSTOLAKIS: The security meeting has to be shortened again. The security was November 1st and because we had nothing to do in the afternoon of the 31st we said well, let's extend it to a day and a half. Now we will have to go back to one day. Because we can't find any other time for the ROP.

MS. WESTON: So November 1st is going to be security and we're still going to do ROP on the 31st? Is that correct?

CHAIRMAN APOSTOLAKIS: First we'll do the tech specs in the morning and ROP in the afternoon. The first of November will be security. And it is Friday, but if you gentlemen can stay -- well, you know, maybe you can leave Saturday morning. It's important too, the security briefing.

That's why it's irritating. When we finally come down here and we waste our time on this thing. We'll finish in a moment. The subcommittee was very unhappy.

Any other comments? We'll recess for 3 minutes and we'll reconvene upstairs somewhere to discuss the naval reactors letter. Somebody will take us there. Thank you.

(Whereupon, at 4:55 p.m., the meeting was concluded.)

CERTIFICATE

This is to certify that the attached proceedings before the United States Nuclear Regulatory Commission in the matter of:

Name of Proceeding: 495th Meeting Advisory Committee on Reactor Safeguards Materials

Docket Number: N/A

Location: Rockville, Maryland

were held as herein appears, and that this is the original transcript thereof for the file of the United States Nuclear Regulatory Commission taken by me and, thereafter reduced to typewriting by me or under the direction of the court reporting company, and that the transcript is a true and accurate record of the foregoing proceedings.

/s/ Matthew Needham

Matthew Needham
Official Reporter
Neal R. Gross & Co., Inc.

D. C. Cook Plant, Units 1 and 2, -- Event of June 12, 2002

ACRS Report by J. D. Sieber

Site Description

The D. C. Cook Nuclear Power Plant is located on the shores of Lake Michigan about 10 miles from the town of Benton Harbor, MI. The plant consists of two W four loop PWRs and the combined output of the two units is about 2,000 Mwe. Each reactor is housed within an ice condenser containment structure. The switchyard consists of a 345 kV section and 765 kV section. Operation of most equipment in the switchyard is under the control of the System Operator located in Fort Wayne, IN.

Initial Conditions

Prior to the event, the following plant conditions existed:

- Unit 1 was operating at 68 percent power.
- Unit 2 was operating at 100 percent power.
- Unit 2's Train A Essential Service water pump was inoperable while maintenance was being performed to replace the pump. This was a 72-hour LCO.
- Unit 1's Train B Essential Service Water Pump was hydraulically tied to the Unit 2 Service water header. Because of the cross tie, the Unit 1 Train B Service Water Pump was declared inoperable. This was also a 72-hour LCO.
- Work was ongoing in the switchyard under the control of the System Operator to make preparations to replace 345 kV circuit breaker, M1.
- The Unit 1 Main Unit Generator Output breaker was out-of-service due to the misalignment of the related manual disconnect contacts.
- The Reserve Feed Cross Tie Breaker, BD was in its normally open position, allowing the Train A in both units to be fed from 765 kV transformer 4, and Train B in both units to be fed from 345 kV transformer 5. This is the preferred alignment.

Event Description

At 1345 hours, a current transformer (CT) associated with the L circuit breaker catastrophically failed and caught fire. The CT held about 230 gallons of transformer, most of which was consumed in the fire, but some oil spilled to the ground. The fault on the L breaker caused 7 other breakers to trip. The failure of the L breaker damaged the M breaker and it tripped.

This failure and subsequent automatic actions caused the loss of the following power sources:

- 345 kV Switchyard Bus #2
- 765 kV Switchyard Bus #4
- Safeguards Train "A" preferred power source to both Units.

Both Units continued to produce power.

Control Room Operators dispatched the fire brigade and ambulance to the Switchyard. The explosion of the CT injured a worker. The CT fire was allowed to extinguish itself. Switchyard Operators requested permission from the Ft. Wayne Operations Center to open additional breakers to isolate the fault. They opened two additional breakers that resulted in the loss of the preferred power source to Safeguards Train "B" for both units. Switchyard Operators attempted to open the Unit 1 Main Generator Output Breaker, but an interlock prevented them from doing so. However, Switchyard Operators assumed that Unit 1 had tripped.

The loss of preferred power to all Safeguards trains to both Units placed both units into Limiting Condition for Operation (LCO) under Technical Specification (TS) 3.0.5. TS 3.0.5 requires that actions be initiated to place the Units in Hot Shutdown within two hours. Plant management notified the NRC Staff of the Event and requested enforcement discretion related to TS 3.0.5 to allow more time to complete work on the Unit 2 Train A Service Water Pump. The Staff subsequently issued a Notice of Enforcement Discretion (NOED).

At 1406 hours, Control Room Operators activated the Emergency Plan and declared an Alert status.

Operators restored the preferred power source to Train "B" safeguards equipment using 345 kV transformer 5. The reserve feed crosstie breaker (BD) was closed thus restoring power to Train safeguards equipment.

Due to degraded grid voltage, the voltage supplied to both trains of safeguards equipment was less that the minimum specified voltage, and therefore the Service water pumps remained inoperable (but operating). It was determined that the voltage detection device, which actuates the tap changers on the Reserve Auxiliary Transformer, did not function as designed. Because of the degraded grid voltage, had the Units been placed in Hot Standby, further degradation would have occurred, causing the quality of the power supplied to the safeguards equipment to be further degraded.

During the event all four emergency diesel generators remained operable, but were not started, and both Units remained on line.

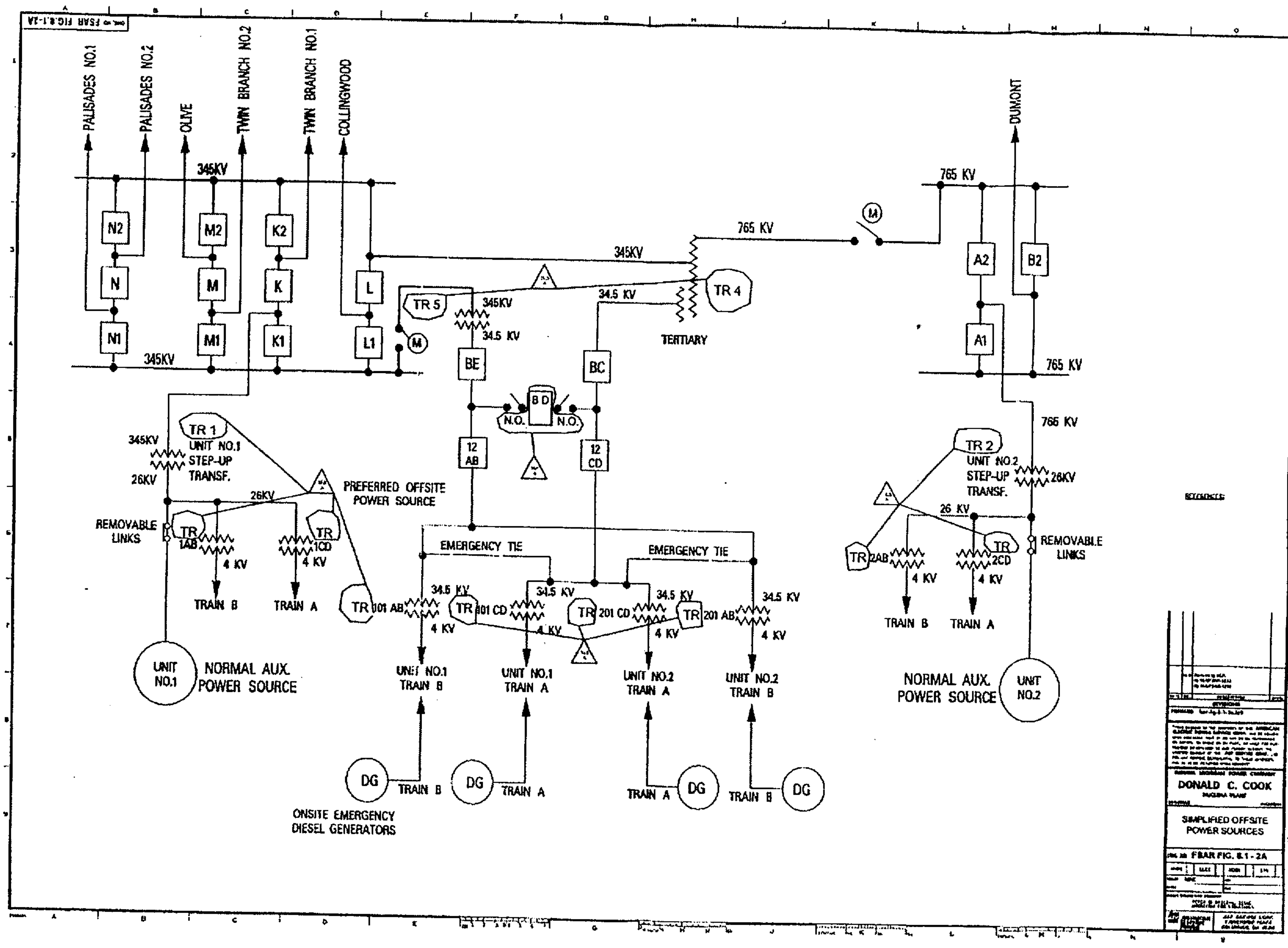
NRC Region III dispatched a special inspection team to the D. C. Cook plant to identify any violations that may have occurred, and to evaluate the Licensee's actions during the event. Part of this inspection was to verify that the conditions under which the Staff issued the Notice of Enforcement Discretion was appropriate.

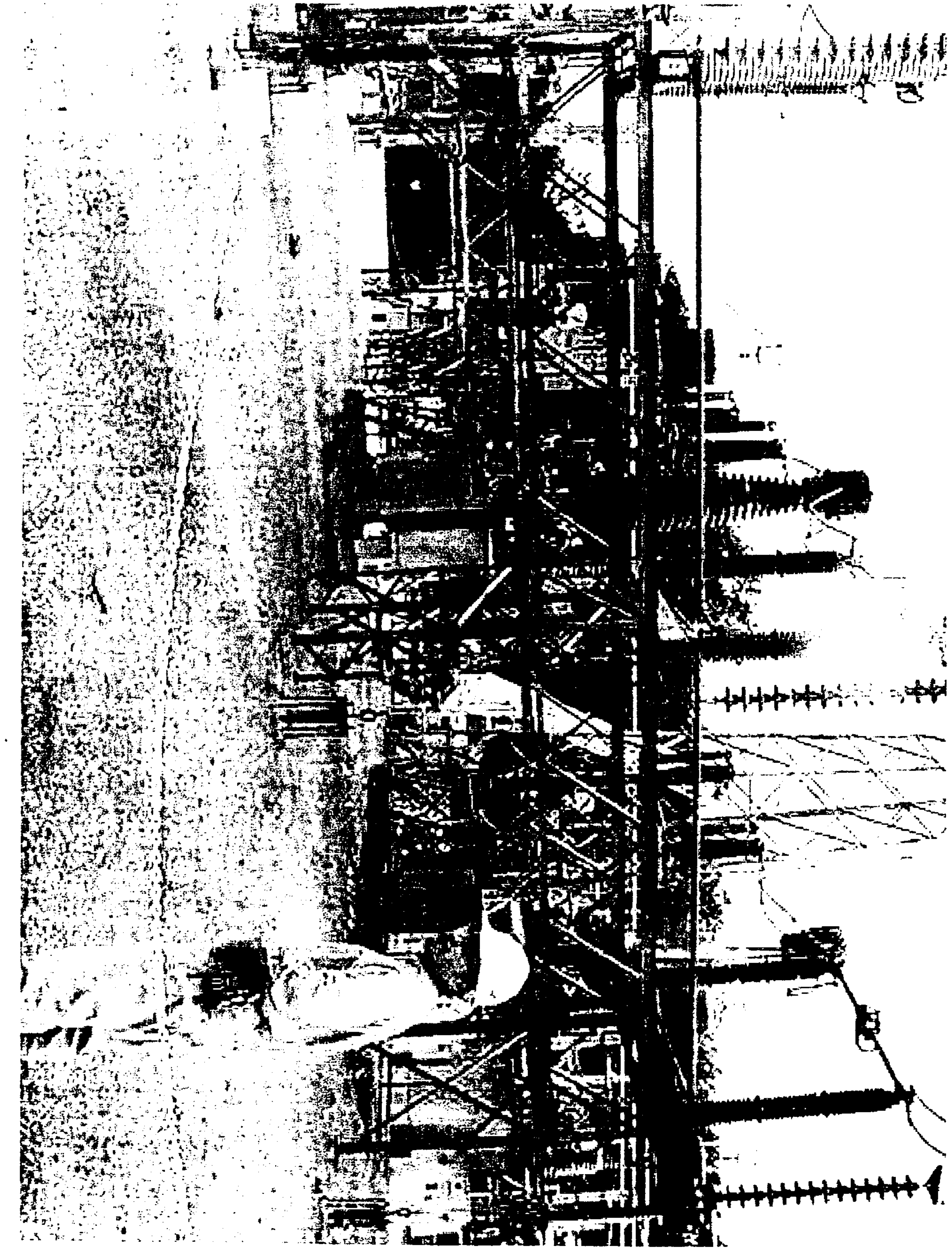
Overall, only one finding of very minor safety significance (green) was identified. That finding identified the fact that while the Licensee had included the CTs in the equipment covered by the Maintenance Rule, the vender recommended maintenance intervals were not being adhered to.

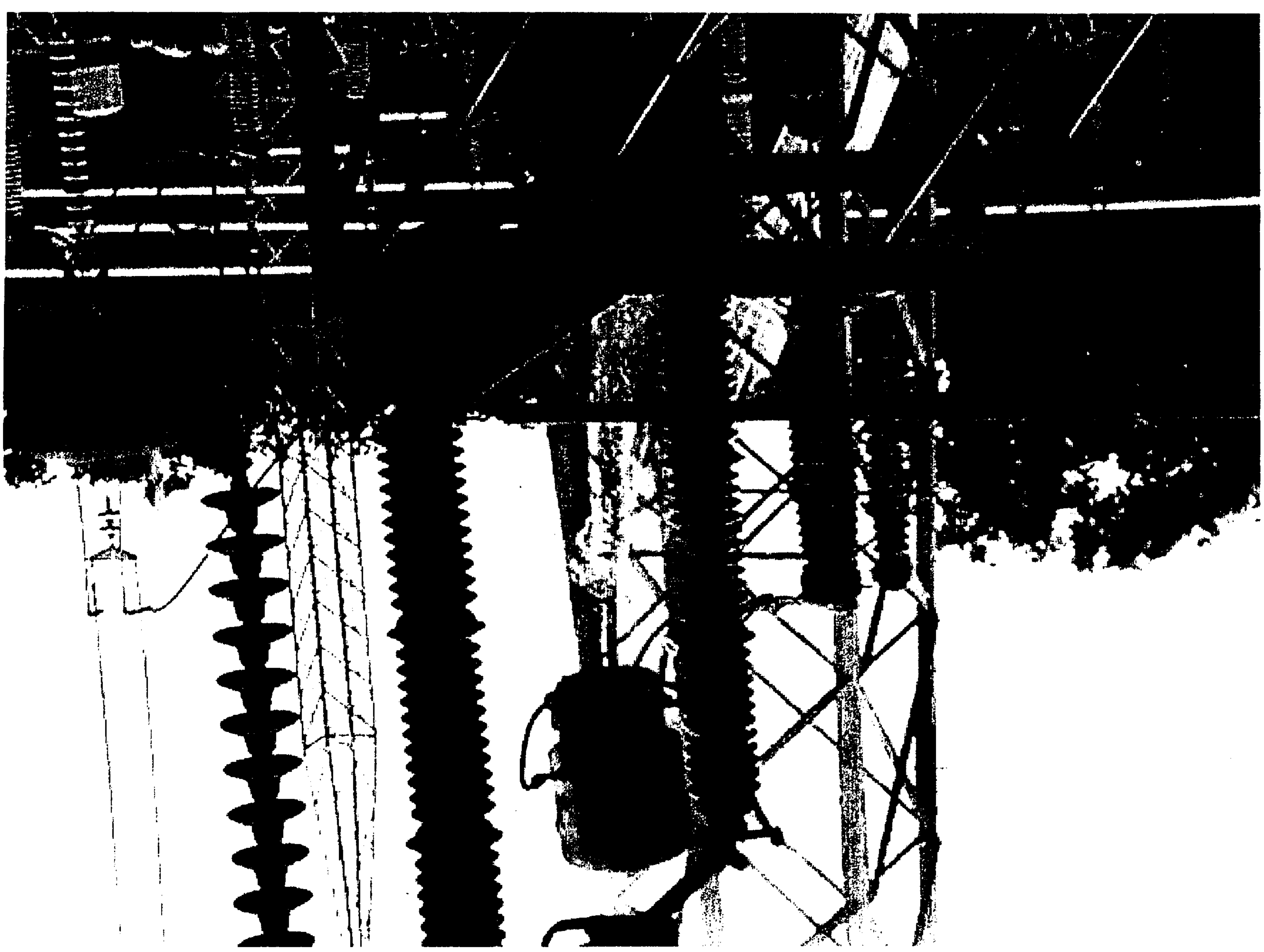
The inspectors identified several other weaknesses, but these weaknesses were determined to have no risk significance. These weaknesses were:

- Inadequate communication and coordination between System Operations workers in the switchyard and control room operators.
- The use of an incorrect code to notify emergency workers to report to their Emergency Plan Stations.
- A request to the local offsite fire department to respond to the fire, and then not permitting the fire department inside the switchyard fence.

Overall, the Licensee's actions during the event appear to have been adequate, and the NRC's investigation and the granting of the NOED appear to have been adequate.


PALISADES NO.1
PALISADES NO.2
OLIVE
TWIN BRANCH NO.2
TWIN BRANCH NO.1
COLLINGWOOD
DUMONT
345KV
765 KV
N2
N
N1
M2
M
M1
K2
K
K1
L
L1
A2
A1
B2
TR 5
TR 4
34.5 KV
TERTIARY
BE
BC
BD
N.O.
12 AB
12 CD
TR 1
UNIT NO.1 STEP-UP TRANSF.
26KV
TR 2
UNIT NO.2 STEP-UP TRANSF.
PREFERRED OFFSITE POWER SOURCE
REMOVABLE LINKS
4 KV
TRAIN B
TRAIN A
EMERGENCY TIE
UNIT NO.1
NORMAL AUX. POWER SOURCE
UNIT NO.2
UNIT NO.1 TRAIN B
UNIT NO.1 TRAIN A
UNIT NO.2 TRAIN A
UNIT NO.2 TRAIN B
DG
ONSITE EMERGENCY DIESEL GENERATORS
DONALD C. COOK
SIMPLIFIED OFFSITE POWER SOURCES
FSAR FIG. 8.1-2A





OPERATING UPDATE
JULY/AUGUST 2002

G.M. LEITCH
SEPTEMBER 13, 2002

Generally not discussed:

1) Medical Misadministrations – Dose higher or lower than expected-unless very unusual
2) Lost, stolen or missing small quantities of material-Usually stolen gauges or minor damage to shipping containers
3) Minor environmental issues-small oil spills, sea turtles, fish, etc.
4) Radiography issues

Interesting Issues-July/August/02

Industry Safety

- IP-2 Electrocution-Tree surgeon on site 7/20/02 (approximately)

Interesting Issues (cont'd)

Scrams

- Dresden-Turbine Trip-Reason un-known 7/20/02(approximately)
- Cook-Turbine Trip-Loss of vacuum 7/20/02 (approximately)
- Limerick 2-Turbine Trip-loss of vacuum 7/24/02
- Millstone 2-Low S/G level-A main feed pump controls 8/7/02
- Harris-Lightning 8/16/02
- Browns Ferry #2-Generator Load Reject from 100%-Gen. Neut. O.V. Relay

Interesting Issues (cont'd)

Fires

- **Farley - 8/21/02 - Fire in IC Service Water Pump while IA was O.O.S. IB was o.k., system pressure was o.k. Fire protection system extinguished fire. When fire brigade arrived, fire was out.**
- **McQuire #2 - 8/22/02 - Fire in Generator Hydrogen Dryer. Manually scrammed reactor. Fire out in 22 minutes U.E. declared.**

Other Interesting Issues

- **North Anna – 8/10/02 – Low lake level**
- **North Anna/Surry – 7/28/02 – Potential labor strike**
- **Susquehanna – 7/28/02 – Dry fuel storage cask–filled with wrong gas. Filled with Argon/Helium vs 100% helium. Reduced thermal conductivity a concern.**
- **Crystal River – Mid July – cable failure caused loss of offsite power. EDG started o.k.**

Plant Shutdowns

- **Calvert Cliffs 1 - S/D RCP oil leak**
- **Millstone 2 – S/D due to RCS leakage-thru wall leak in charging system hdr. disch.**
- **Duane Arnold – S/D loss of residual heat removal due to high strainer differential pressure**
- **Quad Cities – Steam flow fluctuations at uprated power. Dryer failure.**
- **Duane Arnold – Tech spec required S/D due to RCIC out of service – September 3**
- **Duane Arnold – High drywell leakage**

Regulatory Issues

- **CPPU Disapproval**
- **Bulletin Issued-Plans to inspect heads and head penetrations other than visually**
- **D.C. Cook-Partial plugging of equipment cooling system. Clogged water supply to D.G. occurred last year-Meeting 7/25/02**
- **Framatome-Criticality Protection Violation-Occurred previously-Meeting 7/25/02**
- **Cooper-Five findings – 4 E.P.; 1 Oper. Requal. Meeting in August 2002**

Regulatory Issues

- Oconee – Lack of adequate procedure to close containment door on loss of S/D Cooling – Meeting to be held August 2002
- Peach Bottom – Two E.P. Issues – 1) Inadequate Critique and 2) Declared alert in 31 minutes vs 15 minutes required. Meeting to be held August 2002
- Pt. Beach – RED finding – Aux. Cooling water system might fail to function under certain abnormal conditions. Should it be treated as "old design issue"? How does this RED compare with Davis Besse?

NRC Human Reliability Analysis and Human Factors Research Programs: *Overview*

Mark Cunningham, Nathan Siu, Erasmia Lois, Julius Persenslky
Office of Nuclear Regulatory Research

Presented to
Advisory Committee on Reactor Safeguards
USNRC Headquarters • Rockville, MD • 12th September 2002

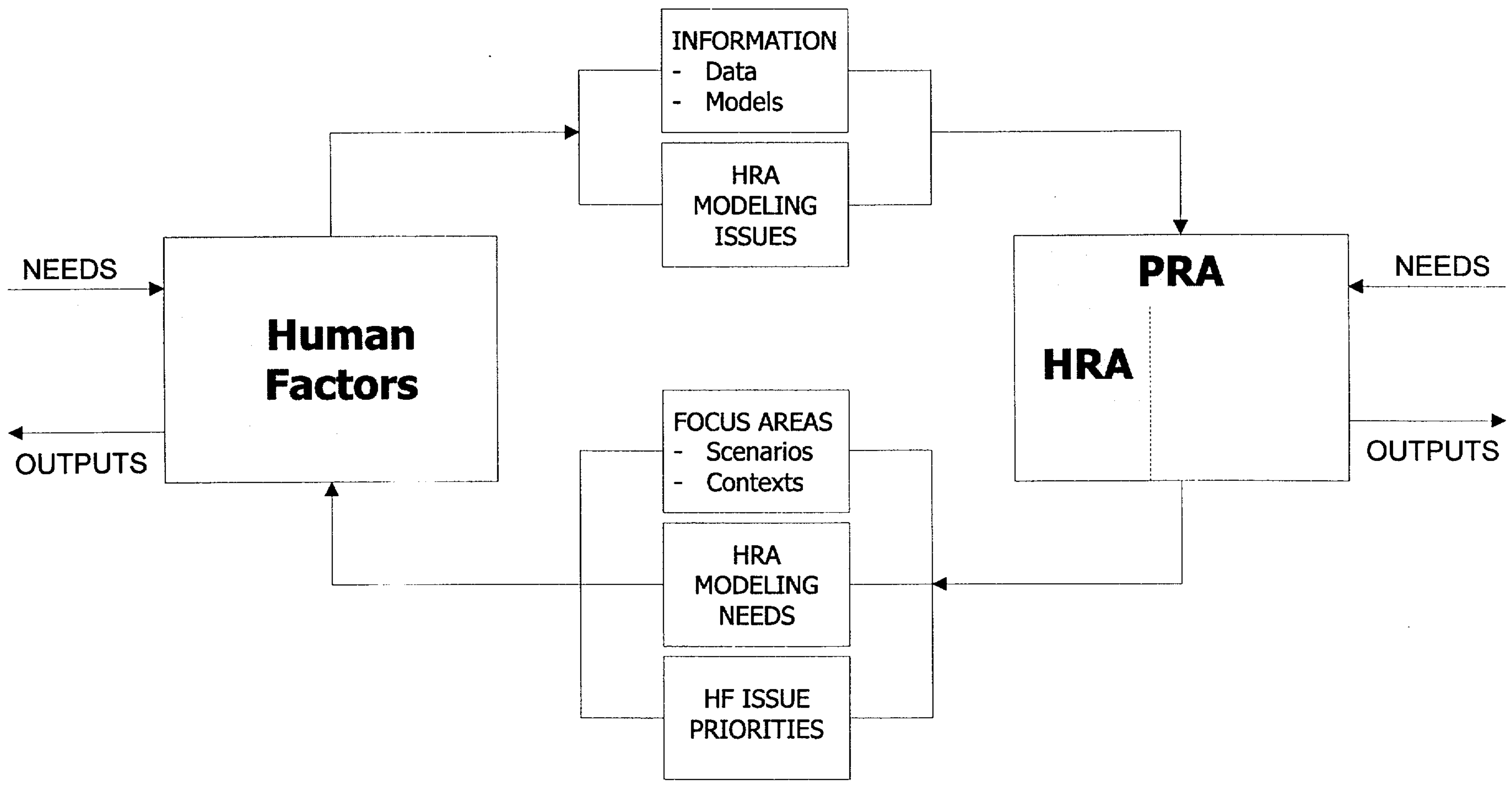
Briefing Objectives

- **Provide overview of NRC's human reliability analysis (HRA) and human factors (HF) research programs**
  - **Activities**
  - **Relationship and interactions**
- **Obtain feedback to inform ongoing planning activities**

Briefing Outline

- **Discipline and program relationships**
- **HF activities and needs**
- **HRA activities and needs**

HF and HRA Relationship



SFN 4

Role of the Human Factors Research Program at the USNRC

- Provide NRR, NMSS and NSIR staff with tools, developed from the best available technical bases, necessary to accomplish their licensing and monitoring tasks.

- Ensure that nuclear facility personnel have the tools, knowledge, information, capability, work processes and working environment (physical and organizational) to safely and efficiently perform their tasks.

Human Factors Activities and Needs

	Conventional Reactors	Advanced Reactors	Materials	Security and Safeguards
Rules	Fatigue			Fitness for Duty
Licensing	▪SRP Chpt. 18 ▪Staffing	▪Staffing ▪Licensing and Training	SRP ▪Development ▪ Review	
Monitoring ROP	Risk-inform CAP		Inspection Manual Update	
Infrastructure	▪Data Collection and Analysis ▪Latent Error ▪Halden Reactor Project ▪Risk Communications ▪HF infrastructure for Advanced Reactors ▪Human Factors in Security and Safeguards ▪Human Factors Tool Box ▪Human Factors Knowledge Transfer ▪Consensus Standards ▪International Activities			

Technical Vision - HF

- Regulatory Tools
  - Human Factors Tool Box
  - Rules/Guides/Inspection Manuals

- Infrastructure
  - Human Factors Knowledge transfer
    - Core competence
      - Regulatory
      - Research
    - Familiarity training
  - Access to research facility
    - Conventional Reactors
    - Advanced Reactors
    - Ex-Control Room

Purpose of the HRA Program

- **Support risk-informed regulatory decision making**
  - Provide technical bases for decision-making in the areas of rules, licensing, and monitoring.
  - Improve methods, tools, and guidance needed to address concerns regarding the adequacy and reliability of HRA results and insights used in various regulatory activities

HRA Activities and Needs

	Conventional Reactors	Advanced Reactors	Materials	Security and Safeguards
Rules	PTS			Fitness for Duty
Licensing	▪Fire ▪SGTR ▪Aging Cables	Upgraded & Advanced Reactors	▪Dry Cask ▪ other support	Vulnerability assessment
Monitoring (e.g., ROP Event Analysis Issue Identification)	SPAR Models			
Infra-structure	<u>Methods and Tools</u> ▪Data Collection and Analysis ▪Quantification Including Uncertainty ▪Latent Errors in HRA ▪Extended Applications ▪Reactor Synergisms and HRA ▪Formalized methods: Screening, Individual and Crew Modeling <u>Implementation</u> ▪ Guidance, Standards			

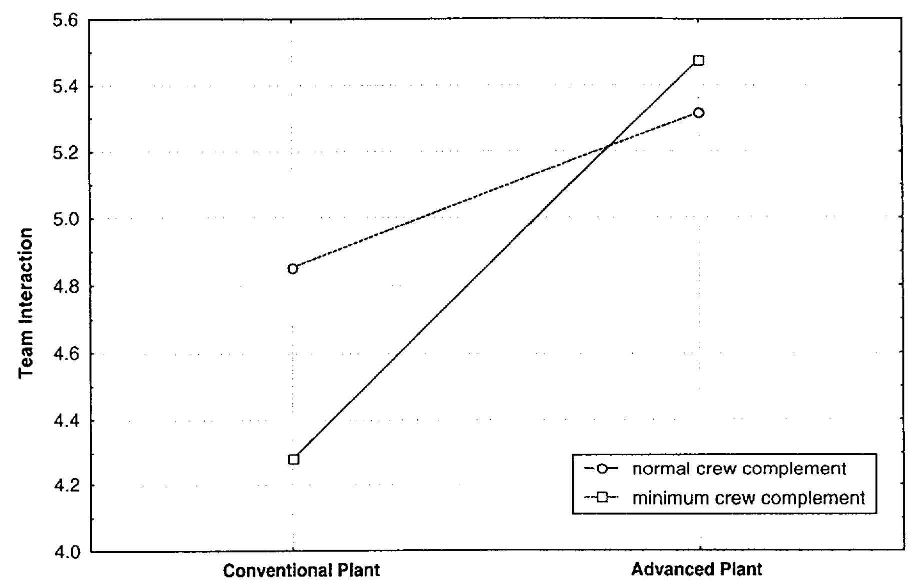
SFN 9

Example – Mining HF Data for HRA

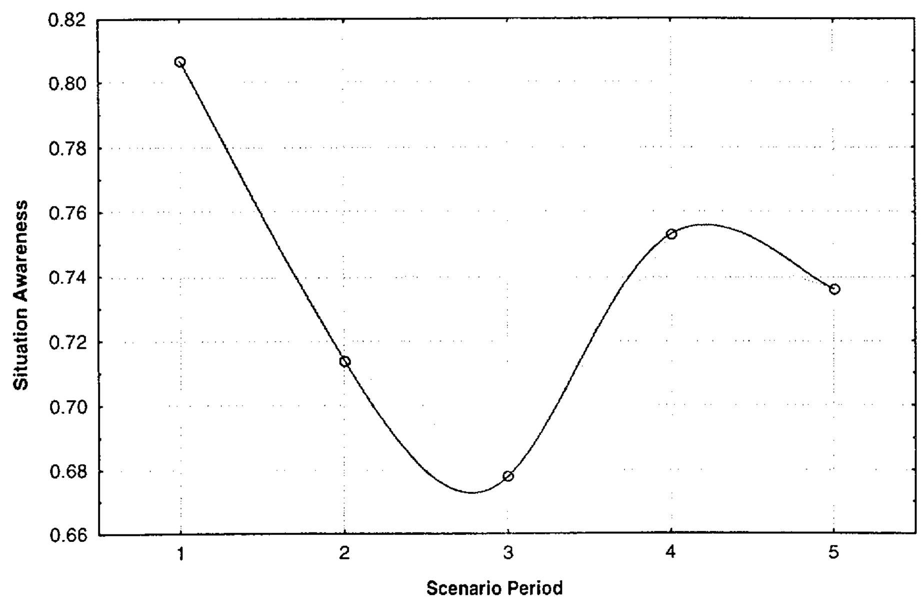
- **Advanced reactor staffing study**
  - **Main effort: effect of staffing levels on crew performance (NRC/IA-0137, 2000)**
  - **Follow-on effort: Explore relationships between PSFs and performance**
- **Facilities**
  - **Loviisa NPP simulator**
  - **HAMMLAB**
- **Factors evaluated prior to experiments**
  - **Plant T/H response**
  - **Operator functional roles**
  - **Training**
  - **Procedures**

Results

- **Demonstrated relationships between staffing and performance** ⟶

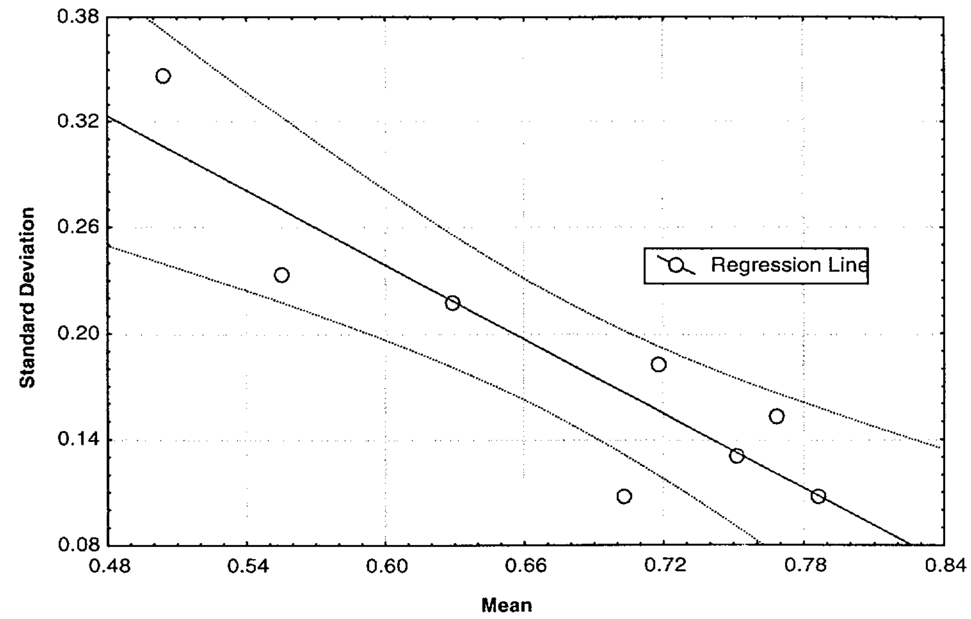


- **Demonstrated relationships between situation awareness and workload** ⟵



Follow-On Study Results

- **Data are available to support HRA model development**
  - **Identification of important PSFs**
  - **Quantification of relationships between PSFs and performance**



Technical Vision - HRA

- Consensus high-level model
- Range of methods and tools addressing currently recognized issues
  - Data
  - Reference points
  - "Interpolation scheme"
  - Uncertainties characterized and quantified
- Guidance
  - HRA analysts
  - Other users
- Capability to identify and address emerging issues