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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

247th MEETING OF THE

ADVISORY COMMITTEE ON REACTOR SAFETY

Room 1046,
1717 H Street, Northwest
Washington, D.C.

Friday, November 7, 1980

The committee met at 8:32 a.m., pursuant to notice, the Honorable M. Plesset, presiding.

ACRS Members Present:

M. Plesset
J. Mark
M. Bender
M. Carbon
W. Kerr
S. Lawroski
W. Mathis
D. Moeller
D. Okrent
J. Ray
P. Shewmon
C. Siess
D. Ward

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Designated Federal Employee:

R. Major

ACRS Consultants Present:

NRC Staff Present:

B. Snyder
J. Collins

Industry Representatives Present:

P R O C E E D I N G S

CHAIRMAN PLESSET: We will now come to order.

This is a continuation of the 247th meeting of the Advisory Committee on Reactor Safeguards.

During today's meeting, the Committee will hear a report on the status of the TMI-2 recovery program; discuss the seismic interaction study at the Diablo Canyon Nuclear Plant; discuss the BWR hydraulic scram systems; discuss Regulatory Guide 1.97, Revision 2, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditións During and Following an Accident," and lastly, discuss the ACRS proposed letter regarding the Nuclear Data Link.

We have received a request from ANS 4.5 Standard Working Group for time to make an oral statement on Reg Guide 1.97, Revision 2. Appropriate time will be made available during our discussion of that regulatory guide.

Mr. Richard Major is the Designated Federal Employee for this portion of the meeting.

A transcript of the meeting is being kept and it is requested that each speaker first identify himself or herself and speak with sufficient clarity and volume so that he or she can be readily heard.

We will now begin this session of the meeting, and I will call on Mr. Snyder, who will give us some information regarding recovery operations at TMI-2.

MR. SNYDER: John Collins actually is going to give you the presentation because he is our senior man on the site. I am the program director back here in Bethesda. John is the man on the spot, and I think he can probably better answer your questions that you may have about the site itself.

I am going to let John go ahead. I will be glad to answer any questions you may have also.

MR. COLLINS: Good morning. For the record, my name is John Collins, Deputy Director for the TMI Program Office, and Senior NRC Official at TMI.

What I would like to do this morning in the time allotted is to discuss briefly with you the current plant status, and then I do have some slides showing various pictures of both the first and the second containment entry. Up until yesterday we were on natural circulation by steam on the A steam generator, and steaming back to the main condenser, and then back to the primary system.

Yesterday afternoon or yesterday morning we went to a different cooling mode. I did issue a PN which I assume that you received some time in the afternoon, which identified that we are into what we now call a test to ambient. We have isolated bypass valves and have gone solid on both -- gone solid on the A steam generator. The B, of course, has been solid.

We are going to remain in that test mode for about 15 days, to determine whether or not we can maintain adequate cooling, just by cooling, by convection to the reactor building atmosphere.

At the conclusion of that 15-day test, we will take a look at and evaluate the data. If it looks good, the Licensee intends to remain in that cooling mode for the foreseeable future.

We did put this week into readiness the mini-decay heat removal system that is ready for operation. The only hold-up on that now is for the NRR Staff to conclude the necessary tech spec prior to its operation. But it is available in the event we do need it for back-up cooling.

We continue to maintain reactor system pressure by the standby pressure control system. Reactor pressure right now is being maintained at about 80 to 85 pounds.

The maximum in-core thermocouple reading is about 180°. The average in-core is about 139. We did for a period of about 15 days actually lose natural circulation from about October the 15th until last Saturday. We did not experience any burps that we had been experiencing about every 24 to 30 hours. And then on Friday of last week, we did finally experience a burp up to about 60°. The delta T after the burp dropped down to about 10°.

As of this morning, I just talked to the office, we are back up now to about a delta T of 60, so it appears that we may be experiencing another burp over the weekend.

MR. SHEWMON: The burp represents a steam bubble?

MR. COLLINS: epresents the reestablishment of flow due to the density in water, recirculating water back to the core area. We call it burp because you do get a sudden surge of water through the generator.

The reactor building is still being maintained at negative pressure. It's about minus .3 psig. We will be releasing --

MR. MARK: Minus what?

MR. COLLINS: Minus .3.

This morning they will be initiating a small purge in the containment building, prior to a planned containment test on Wednesday.

As you know, if you have been following the status report that I have put out weekly, the major campaign on cleaning up the water in the auxiliary building as a result of the accident has been completed. Approximately 510,000 gallons was processed. That water is being stored in various tanks in the EPICOR-II building, and also water in the condensate storage tank.

There is, of course, a continuing accumulation of water in the auxiliary building. That water is being held up in one of the available reactor coolant bleed tanks.

The auxiliary building leak rate has been fairly constant, at about .06 gallons per minute. The RCS leak rate has been fairly constant, too, at about .09 gallons per minute.

The major effort, of course, over the last couple of months has been to make containment entries. We have made three entries into the containment for the purpose of doing radiation mapping and dose evaluations.

We were successful in the last entry to remove the pre-amplifier for one of the effective neutron source monitors. We hope to replace those amplifiers on the entry which is planned for next Wednesday. Next week's entry will consist of 11 people going in both on the 305 and the 347 level to gain additional information, hopefully, to take some more smear samples, some more radiation readings, and to take out some small pieces of equipment for further analysis by various laboratories.

That really sums up the major items at the plant at the present time. I would like to show you some slides.

(Slide.)

I think you are all familiar with the fantasy island. I have been using these at various talks over the last several months.

MR. OKRENT: That must be Three Mile Island 1, 2, 3, and 4; right?

MR. COLLINS: That's correct.

(Laughter.)

(Slide.)

This is the inner door, or the door that leads into the reactor building itself. The airlock door, of course, the outer personnel hatch is out upstream of this. This is what gave us the problem of why we were not able to make the entry the first time we had planned it, when we had to abort it.

This is the solenoid switch that was actuated. The safety pin sits directly inside the containment building. We were not able to rotate the seal to disengage the rabbit ears on the door.

Met Ed then went in and drilled through this solenoid to free up the pin and, of course, then we made the first entry which was a two-man entry, which lasted for approximately 20 minutes.

As was indicated in some of our reports, the radiation readings inside were less than what we had anticipated them to be. The average readings on the 305 level were from about 400 to 700 mr. The two people who were in there for a stay time of 20 minutes received a total body dose of less than 200.

Now up on the second entry, of course, it was made with four people. They went in on a 305 again, and then went up to the 347 level, the refueling area. The radiation readings up there were about half of what they were on the 305 level.

We were able also to get really good readings in the stairwell which leads down into the sump, which I will show you pictures of, and the water, and it appears that based on the teletechter readings, the radiation reading directly above the water itself is about 120R, which is pretty consistent with the measurements that were made through the 401 penetration and the 627 penetration.

(Slide.)

This is another picture of the famous door.

(Slide.)

This shows you a picture of the individual. This was the first entry. This shows you the type of equipment he was wearing. Of course, the Scott self-contained unit. The equipment he was equipped with -- later on I will show you some pictures of all of the TBDs that were strapped on him -- this total weight of equipment, plus his clothing, was approximately 89 pounds.

(Slide.)

This shows -- this was on the second entry. Of course, you can see the difference now. They did not have to wear the self-contained units. They were using positive pressure bore units with particulate filters, because the analysis of the airborne activity in there did not warrant the use of a self-contained. This, of course, allowed them to make a stay time of up to about 40 minutes. Again, their clothing this time was not nearly as heavy as it was on the first one. The total weight of equipment, plus the clothing, was approximately 40 pounds.

(Slide.)

Here is on the 305 level. We thought this was a rather intriguing picture, because it shows you the amount of rust that had accumulated on the grating, but it is not what we had expected to see, due to the relatively high humidity inside the building. We expected to see a lot more rust than we did which, of course, would further complicate the decontamination of the building.

As you know, in some of the pictures that we were able to take through the 627 penetration, you could actually see water droplets passing by the camera.

(Slide.)

This is an electric heliarc welding instrument. From our debriefing of the two people who were in there, the cabling looks very good. The unit itself appears to be in fairly good condition.

(Slide.)

MR. SHEWMON: What caused the extreme -- it looks like there was a flash of something that scorched part of the face, but not the rest.

(Slide.)

MR. COLLINS: Well, we are not really sure, but most of the scorching, we believe, either occurred from the hydrogen burn or the hydrogen explosion that occurred in the containment building several hours after the accident initiated. We did see the pressure transient up to about 28 psi. We believe that caused that. I will show you a better picture of some deformation of equipment in some of the later shots.

(Slide.)

This is looking down into the water, into the sump. We were able, of course, to put a teletector down in this area here, which gave us a fairly good reading right over the water.

What is of interest in here is the amount of debris that can be seen in the water. We are not really sure where that debris came from, but there is quite a bit of it laying on top of the water.

(Slide.)

Here is another picture, and you can see again some debris sitting down in this area here.

(Slide.)

Here was back to the first entry. We were just walking around, taking the various radiation readings around the D ring.

Of interest, though, is even noting the fire protection system look, in fairly good condition, again the amount of rust on the floor was not nearly what most of us had anticipated we would see.

(Slide.)

This, of course, is looking at the bottom of the core flood tank. Again it appears to be in very good condition.

(Slide.)

Here again is another shot going the other way around the D ring. Again you can see the floor looks in fairly good shape. The piping is stainless steel piping, and does not appear to have suffered any type of corrosion or rusting at all.

(Slide.)

This was up on the refueling deck. The two men here on the second entry were taking various smear samples and radiation readings underneath the bridge.

(Slide.)

This again is on a refueling area. We are not quite sure what this is. We haven't yet been able to discern what that is. It looks like a piece of metal cable piping that became dislodged from some place, but we really haven't -- we are going to take a further look at that in our next entry.

MR. BENDER: Have there been some surface smears?

MR. COLLINS: Yes, there have been, very, very many.

In the first entry we were successful in getting approximately eight. Two of them were lost on the way out, and then on the second entry, there were in the order of 20, 25 smears. On the third entry -- on the third entry, the camera they took in with them for some reason malfunctioned, and so there are no pictures of the third entry.

MR. BENDER: Did they show any apparent radioactivity at all?

MR. COLLINS: Yes, they did. On smear samples they saw both cesium and strontium.

MR. BENDER: Thank you.

(Slide.)

Again this is just some of the floor area, some of the stairwells.

(Slide.)

This was, I think, interesting, too. This is just some hosing, high pressure hosing that was inside the reactor building, and does not appear to be brittle. It appears to be in fairly good condition.

(Slide.)

This is just one of the drains. This particular drain spout here is normally used when you are going to pour liquid down the drain. You take the cover off and put it in. This normally is galvanized. Of course, it has sustained quite a bit of corrosion.

(Slide.)

Here is the interesting one. This telephone is up on the 347 level, and actually the picture doesn't do justice, when talking to the two men who shot the picture. This wiring, you can see, is very, very brittle. The telephone itself has been badly deformed, suggesting, of course, that there were extreme temperatures inside the reactor building as a result of the burn or the explosion.

(Slide.)

Again some more pictures of the floor.

(Slide.)

This is an interesting shot. This is up on the 347 level. There are three drums here. The operators who were in there didn't actually see this. They just happened to take a picture -- they were actually trying to take a picture of this, and this got included. We are not really sure what is inside these drums, but in taking an educating guess, this probably contains some lube oil. This one probably contains some water, and then when you did have the explosion, you got that deformation effect; whereas the other two did not. So it could be either transformer or some lube oil in there.

Again, this is one of the jobs that will be looked at a little more carefully in our next entry where we have 11 people going in.

(Slide.)

This is a picture, of course, of the refueling bridge. We are going to check this out carefully this time. There is some thought that perhaps it may have disengaged from its trolley slightly. This picture would not suggest that, but Met Ed wants to make a careful examination while they are in there.

(Slide.)

Again, I think of interest here was this fire hose on the wall. It appears again not to have sustained any type of damage to it.

(Slide.)

This is the door leading up from the sump area, the lower level, and I have a close-up picture of this that you can see. This door was blown open in some type of an explosion, and then wrapped around this plate very neatly.

(Slide.)

MR. BENDER: That door enclosed what, again?

MR. COLLINS: This is the stairwell going down into the lower level. You can see how this thing was blown up against this thing, and badly deformed.

Now the door on the upper level did not show this at all. In fact, it was in very good shape. It was open.

(Slide.)

This is just another -- this is one of the emergency telephones. Again it doesn't appear to have -- even the wiring here didn't appear to have suffered any type of damage.

(Slide.)

Again here is another one. Same thing. Now this one shows a little brittleness in the lower part here.

(Slide.)

This is just some of the structures.

(Slide.)

Piping again appears to be in fairly good condition. You do see some rust around the bolts, but not to any great extent.

(Slide.)

(Slide.)

This shows the -- this is on the refueling deck, and we are looking at one of the cable trays, and the discussion of the people after our debriefing said it appears to be in very excellent condition. Even the motors and switch-gears.

(Slide.)

This, of course, is the elevator. We had thought at first from looking at it, it appeared that it might have been jarred off of its normal carriage. A close-up picture of it did not indicate that to be the case.

Again we are looking at one of the emergency phones. We see a little bit of brittleness, but to the extent that we saw on the other telephone.

(Slide.)

Here they are getting ready now to come out. They are taking up their equipment and bagging it up prior to making an egress.

(Slide.)

This is, of course, a heavy duty extension on a wooden dolly, and the wooden dolly does not appear to be charred in any way, nor does the cable itself. It does not appear to be damaged in any way.

(Slide.)

Now this was on the second entry, too. You can see the number of TLDs that were on these people. Of interest here is that all the people who went in there had digital readouts on their dosimeters, and they were being read out continually in the command center. They had an administrative limit placed on them that if their cumulative dose reached 625 millirems, they were immediately to make an egress. We have never approached that at all.

On the second entry, the total maximum dose received by any of the men in there was less than 400 millirems. Even on the third entry, the maximum was less than 500.

(Slide.)

Again this is some of the operating panel for the refueling bridge.

(Slide.)

This, of course, was an interesting shot. This is one of the emergency lights. You can see that the glass here has turned an amber color. We were successful in removing some glass of the same type or the same color, and that is under analysis in Idaho at the present time.

This should give us a pretty accurate reading as to what the total integrated dose had been since the accident, since glass is a good indicator of that.

(Slide.)

Some more pictures.

(Slide.)

Here is a better picture and a close-up of the elevator door, where we had originally suspected it might have been slightly off edge. This picture would not suggest that at all.

(Slide.)

Again this is just showing the equipment that the individuals had carried in with them. Of course, this is an RO-2A, a monitor which monitors beta radiation. This is his high-powered light that he carried with him. Each of them had one, and then he's got a miner's light on his head.

(Slide.)

This, of course, was interesting, because these are the things that are used to remove the bolts off the head of the reactor, and they are covered with a plastic coating, and you can, of course, see that due to extreme temperatures, some of that plastic has melted off in this area.

We were able to get some samples of this, too.

This, again, looking at the same door picture and some of the drums and the floor area was not nearly as bad as we thought it would be, and I think that's a plus, because that should help us in decontaminating the building.

(Slide.)

Just some more shots that were taken showing various piping systems. Again, all of them appear to be in fairly good condition.

(Slide.)

This is part of the in-core thermocouple structure. This is steel braided pipe, and does not appear to have sustained any type of damage.

(Slide.)

And, of course, then a picture of the reactor itself, which looks in pretty good shape, too.

And that's it for the slides.

CHAIRMAN PLESSET: Jerry?

MR. RAY: Have you had any failures of electrical equipment components or electrical conductors in containment? And have they been energized in the meanwhile?

MR. COLLINS: We have not lost any since the time we opened DHV-2, which was several months after the water level began to rise, because actually it is submerged in water now. There was some concern several months ago about not the water level increasing so much, but the high humidity may start to affect some of the electrical switches on the decay heat valves, and that was the reason why we went ahead and opened up DHV-1.

MR. KERR: What is a DHV?

MR. COLLINS: DHV is decay heat valve or pipe, a valve, that permits you then to -- we opened up DHV-1, we were not successful in that. Of course, there is a bypass on that, it's DHV-171, but it was not necessary to do that, DHV-1 did open, but we were afraid that we may lose it because of high humidity. Not the water level itself. It's approximately three feet above the water level right now. It's the closest one to the water level. The water level has not been rising significantly. It is still approximately eight feet.

MR. RAY: Have these components been under voltage in the meanwhile?

MR. COLLINS: Yes, they have, and they have been megered on a weekly basis, oh, for months.

MR. RAY: And the insulation is holding up?

MR. COLLINS: Yes, it is.

CHAIRMAN PLESSET: Any other questions?

Carson.

MR. MARK: You said, I think, it was a piece of glass was going to give you a good integrated dose measurement.

MR. COLLINS: That's correct.

MR. MARK: Gamma and beta, or just gamma?

MR. COLLINS: Just gamma, just gamma.

MR. MARK: That was one question. Another is, has there been a thorough and respectable and authentic inventory of fission fragments, where they are, where is the iodine, where is the cesium, and so on, and how much?

MR. COLLINS: I would not say that there has been a thorough evaluation. There have been various evaluations made both by the Licensee and by B&W and by the Staff, but that effort is continuing. I don't think that I would want to leave you with the impression that that analysis is thorough at the present time.

MR. MARK: Well, now, in the Rogovin Commission Report, there was a table which was put in as an analysis or inventory, and it seemed to me to show that the amount of cesium and the amount of iodine thought then to have been in the water were very much -- very close to the ratio in which they would have existed in the core. But I didn't feel that one could take a measure of the total fraction from the core that was there. It seems to me that is a very interesting point, and it deserves perhaps more attention than looking at the telephones. Because all one knows is that the release fraction of iodine was a factor of 10^4 or ^{5} down from what WASH 1400 would have told you to expect, given the noble gases, the cesium didn't come out, and is that in the form of cesium iodide? Because that's the thermodynamically favored compound, and it's very important, if that's the case --

MR. COLLINS: Well, there was a paper that was presented at the Air Cleaning Conference, and you may want to take a look at it, in which SAI has done or did quite an evaluation, and by their analysis they would demonstrate that most of it lies in the cesium iodide.

Now with respect to your question as to why more iodine was not released, if you calculate the iodine inventory that was available for release and then compare that to what WASH 1400 would suggest, that matter, of course, is under investigation and review by the Staff. My own personal opinion is that, first of all, I think there was an enormous amount played out inside the reactor building itself. The principal points of release outside the reactor building were from the letdown system. At that point in time, you had reduced pressure from temperatures compared to what you would have inside the reactor, so that our partitioning factors from the gas to the liquid phase of iodine is based on the partitioning at hot water, meaning water that would be at the operating temperature pressures, so that we may be conservative in a partitioning factor at that point outside the primary system.

MR. MARK: But if you assumed it was cesium iodide that was there you would have a radially different partitioning factor.

MR. COLLINS: That's correct.

MR. MARK: And that the iodine is much less volatile, the compound is pretty stable.

MR. COLLINS: It's stable at certain pHs, and I think that one would have to consider the pH, so if you took a look at the pH basically normally it's about a pH of 5. I am not sure that that statement would be completely valid. I think the partitioning factor would be different. I think we are assuming a petitioning factor at a much higher pH than what we actually saw in the primary system at the time of the accident.

MR. MARK: Was that an unusual pH in the primary system, or just what things normally?

MR. COLLINS: Just what they normally are.

MR. BENDER: John, is there any way of knowing what the activity is on the inside of the pressure vessel?

MR. COLLINS: No.

MR. BENDER: What kind of steps would be taken to try to find that out?

MR. COLLINS: You mean inside the reactor itself?

MR. BENDER: Inside the reactor. It seems to me what you can do lies in whether you will be able to take that head off, and when you will be able to.

MR. COLLINS: From the information that I have seen developed by Bechtel, I have not seen any firm program for trying to acquire that information. But I agree, I think it would be very important to know that before you start lifting that head out.

CHAIRMAN PLESSET: Dade, you had a question?

MR. MOELLER: I think what both Carson and Mike -- what their questions show is that although we have learned a lot of lessons, and the Staff has summarized many of the lessons learned, apparently or obviously there are still many lessons yet perhaps to be learned, which won't be learned until you complete your investigations. Is that correct?

MR. COLLINS: I think that is a very accurate statement. I don't think that we have really scratched the surface on some of the information that would be gained from a complete evaluation of various components inside the reactor building, and that information is being accumulated under the Technical Information Office, which is a concerted effort between DOE and NRC and EPRI and GPU, and there is a deliberate program to try to acquire all of this data at various points in the program itself, and each one of the containment entries is designed to collect additional information that would aid us not only in decontaminating the plant, but would aid us in understanding whether or not the criteria presently being applied to other plants should be upgraded. I think there is an enormous amount of information that has not been learned from the accident.

MR. MOELLER: Could I ask one more?

CHAIRMAN PLESSET: Sure.

MR. MOELLER: How is the plan for each entry developed, and who all is involved? Are you, for example, involved?

MR. COLLINS: The first two entries, Dade, were made by Met Ed personnel, and that was primarily for the purpose of dc .ng initial radiation mapping in the area itself, and to get a handle as to what kind of radiation exposures the future teams would be encountering.

At the conclusion of the second one, the rest of the entries have been turned over now to Bechtel Corporation, and Bechtel has been assigned, of course, the task of putting together the total recovery and refueling program. There are very deliberate programs for each one of the entries. They are reviewed, of course, by Met Ed people and GPU engineering. They have been submitted to us for our review and solicitation for any additional information we feel that is necessary.

Our people who are on the site, on the staff up there, participate in most of the meetings as the information is being jelled, together for each one of the entries, so that we are very knowledgeable of the programs that will be conducted each time.

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MR. LAWROSKI: Have you been able to learn anything from the analysis of the primary samples, as to whether or not there is a reaction to postulated --

MR. COLLINS: Yes, I think there has been some very detailed analysis done on the primary system water, both by GPU and by ourselves. I am not in a position to give you the analysis.

MR. SHEWMON: When you say by NRC, those presumably were not done in Silver Spring. Were they done by Savannah River, or who did them for you?

MR. COLLINS: Well, I'm not sure your statement is completely accurate. The people in Silver Spring, some of our research people, were involved.

MR. SHEWMON: You have an analytical laboratory there?

MR. COLLINS: No, we took the data that was being derived from the primary samples, which for months after the accident was being analyzed by two laboratories, Oak Ridge and Savannah.

MR. SHEWMON: I had heard of some of the things in Savannah River. I didn't know what other sources you had.

MR. COLLINS: Right after the accident, Bettis, B&W and Oak Ridge were analyzing samples.

MR. SHEWMON: One of the things that circulated out of the Savannah River was that we heard that you did not find particulate dissolved fuel, or particulate zirconium oxide in that, to the extent that some people would have expected, if we had had a severe reaction between water and zirconium.

MR. COLLINS: That's correct.

MR. SHEWMON: Okay.

MR. COLLINS: One thing of interest, though, was although we did not see the transuranics in the samples of the primary coolant water, they were all down in the parts per million range in the initial samples. When they removed the filter from the letdown stream, they removed that to decontaminate it, they smeared the inside of the filter casing. We did see at that time -- and that happened about a month ago -- we did see the transuranics in good quantities. The filter itself has been taken offsite and is being analyzed at the present time for a more thorough analysis and I am quite anxious to see that. I am not -- I don't think I fully understand what happened, because if you remember, it was hours after the accident occurred that that filter was isolated, and it was bypassed, and then several days later we finally bypassed the demineralizers because the water temperature was going up and we were afraid of deforming the resins. But I don't quite understand why we saw it in that filter casing and then we did not see it in the primary coolant samples that were taken immediately after that.

MR. LAWROSKI: Are you satisfied with the quality of samples you have been able to get?

MR. COLLINS: Absolutely. Absolutely.

CHAIRMAN PLESSET: Bill Kerr.

MR. KERR: Mr. Collins, at some point I assume you plan to take the water out of the containment. What is the schedule for that?

MR. COLLINS: Well, Metropolitan Edison has, since last November, when they submitted a request to us for approval of the submerged demineralizer system, they have been in a mode of installing that submerged demineralizer system into the fuel pool. We have-- the NRC, of course, has not given approval for that. We have notified Metropolitan twice that they are proceeding at their own risk.

Our approval of that system will come after the finalization of the programmatic environmental impact statement, which we have been committed to put together. That system is a system that could treat the water from the reactor building.

MR. KERR: The environmental impact statement is not primarily a safety analysis; is that right? It's a conventional primary environmental impact statement?

MR. COLLINS: That's correct, but we required Metropolitan Edison to submit to us in their technical evaluation report a completed safety analysis and a determination under the 50.59 as to why it should not be an unreviewed safety question. That information is forthcoming to us.

MR. KERR: It strikes me that it would be desirable to get that water out of there in the interest of safety. How do you balance the need for the amount of paper work and review required on the environmental impact statement and the other procedure against the enhancement of safety that might occur if you went ahead and got the water out, with perhaps a somewhat less detailed documentation?

MR. COLLINS: Well, I think on one hand, you have to say that the Commission has dictated to the Staff that we would develop a programmatic impact statement addressing the total clean-up program.

MR. KERR: But the Commission also depends on the Staff for recommendations, doesn't it?

MR. COLLINS: That's correct. But also within the order itself, we do have the authority -- the Director of NRR does have the authority to initiate the operation of that system or other treatment systems, in the event there was an imminent danger. In balancing the risk, I guess you would have to say you have to take a look at what is the probability of potential problems. The water leakage from the RCS system in the reactor building is very small.

MR. KERR: How do you determine the potential for danger under these circumstances?

MR. COLLINS: I think the potential or the most credible accident I can conceive of at the present time -- and it is addressed in the impact statement -- would be for water to leak out of the building.

Now we recognized that that was a potential problem, and we requested Metropolitan Edison to install test wells around the reactor building.

MR. KERR: There is no equipment that is likely to fail or nothing that is likely to fail while people are going through all this routine about which you are concerned?

MR. COLLINS: At the present time, no. The major equipment that we were concerned with was the actuation of the motors to open up the valves that would permit us to pump the water out of the building.

MR. KERR: From your point of view, there is no particular danger in letting that reactor system sit there indefinitely?

MR. COLLINS: Well, I wouldn't want to say that, because I would characterize it by saying the sooner you clean up the plant, the sooner you remove the fuel, you remove potential problems.

MR. KERR: Well, I would, too, and --

MR. COLLINS: I won't argue that. I would like to see the program proceed on a much more escalated scale, but I recognize that we have certain other constraints placed on us by other agencies.

MR. KERR: Have you told these other agencies that you consider perhaps you have an emergency situation and hence perhaps one might bypass something, like, for example, a full-fledged environmental impact statement before one starts clean-up operation?

MR. COLLINS: I think the Council on Environmental Quality has been fully briefed on the problems that could occur in the plant.

MR. KERR: But they look to the NRC, it seems to me, to make pronouncements on safety. They may not agree with them, but you are the agency who takes the initiative, aren't you?

MR. COLLINS: That's correct, and I would not want to say that that plant right now is in imminent danger.

MR. KERR: I don't know what it's in, but you did tell me that you thought the sooner the clean-up started, the better off -- the better things would be.

MR. COLLINS: Well, that's true, because every time you enter a plant, you have a potential for exposure to the workers.

MR. KERR: If you feel it's a contribution to safety, do you think it's better to wait until one goes through the environmental impact statement and perhaps hearings and so on, before one starts clean-up? Could one establish, to some reasonable degree, that the system is likely to operate, start the clean-up operation sooner?

MR. COLLINS: Well, even if we were to give approval for the submerged demineralizer system now, it would not be operational till mid-March, anyway, and that's about the same timeframe which we expect to finalize the environmental impact statement in.

MR. KERR: So the system could not start operating immediately, even if all approvals existed?

MR. COLLINS: No, right now it could not. It's not nearly that completed. I'm sure that if they went to a three-shift operation and a seven-day work week, they could escalate that schedule. But I don't think that -- and if we saw a potential problem and the probability increasing, it certainly could be done.

MR. KERR: It certainly seems to me that it would be a good idea to get that water out and start the clean-up operation as soon as feasible. I wouldn't say as soon as possible, but --

MR. COLLINS: I think that is the mode in which Metropolitan Edison is trying to operate, based on their own financial constraints, which are serious at this time.

MR. KERR: Are the financial constraints holding up the installation and testing of the water clean-up system?

MR. COLLINS: No, that's one of the programs that has been continuing. That is included in the programs they are continuing to install, that system.

MR. KERR: Well, I misunderstood a recent letter from Mr. Snyder, I guess, because I had thought I was seeing something that told them that they could not begin operation of the clean-up until the environmental impact statement was completed; and to me, that implied they were about ready to begin operation, but they were being prohibited therefrom.

That apparently was not the sense of it.

MR. COLLINS: Mr. Snyder was saying the NRC will not consider approval or disapproval of the system until the impact statement has been completed, and we were very cognizant of the fact that they are proceeding to install that system, and we are continuing to do our formal review, and we are continuing to do our technical evaluation with regard to the operation of the system. But if an emergency exists, the Director of NRR does have the authority to initiate operation of that system, or any other treatment system to handle the removal of the water.

We have also requested Metropolitan Edison to submit to us a contingency plan for removing the water in the event that that particular system were not available. We have just received the response, and it is under evaluation at the present time. I just received it yesterday.

CHAIRMAN PLESSET: Paul?

MR. SHEWMON: Two questions:

One, where is this filter you were talking about?

MR. COLLINS: It's on the letdown system. It's the letdown filter. As you come out through the letdown, through the filter, through the demineralizer, and into the makeup tank.

MR. SHEWMON: Okay. Completely different question:

Will we hear today about the problems of getting this waste off the site, or what you have accumulated for the wastes and potential deterioration of the resin beds, or what the schedule on that is?

MR. COLLINS: Well, let me say that we are continuing -- let's differentiate those two types of wastes. There is the combustible, the normal waste that is accumulated, as far as the decontamination, and that waste that is being put in 55-gallon drums and wooden boxes, and that's continually being shipped to Richland. With regard to the EPICOR, the resins that were generated in the EPICOR-II system, we are processing 500,000 gallons of water. They are being stored in the concrete storage facility on the island.

Last November the Commissioners issued an order to Metropolitan Edison, telling them that the resins must be solidified. At the present time, Metropolitan Edison is prepared to go out for quotations to several vendors for a system to solidify the second and the third stage resins. So that program is underway.

Now with regard to the resins from the first stage, from the higher activity, the Staff does not believe that because of the high curie per cubic foot loading, that they should be taken to a shallow land burial ground. We are investigating with the Department of Energy alternative ways of disposal of those resins, and those negotiations are continuing. We are looking also at various solidification methods for those resins.

MR. SHEWMON: Even if they were solidified, you wouldn't want them there because of the high activity level, or because of the high activity level you weren't sure they would solidify?

MR. COLLINS: The latter. Both of them. If once they are solidified, they will be shipped, the second and third stage resins will be shipped to --

MR. SHEWMON: Let's talk about the first stage.

MR. COLLINS: The first stage resins, right now the major effort is tied to identify the resin mixes themselves, because they were -- they are not all uniform. The vendor did change various resin beds with various mixes, and it is incumbent upon us to try to determine what those variations are, so that we can then proceed in a more intelligent way to try to understand how we might solidify those. Or maybe you don't want to solidify them, maybe you want to try to remove those reactivity concentrates, and then solidify them.

MR. SHEWMON: That's already pretty concentrated.

MR. COLLINS: It's pretty concentrated, yes. Some of those beds were loaded up to as high as 1200 curies of activity.

MR. SHEWMON: Do they degrade with that kind of activity sitting on the shelf?

MR. COLLINS: We have a program underway at the present time, Metropolitan Edison does, to sample the contents of two lines. What they actually will be doing is trying to pull off some of the water that had already been dewatered. We want to go back now and try to dewater them again, and see if we can get some water off of there, take a look at it and see if there has been any appreciable change in the pH from the time it was put in there until the present day. And then, of course, do a chemical analysis on that. There are corrosion studies underway. We hope to get some gas samples off the top of those resin lines and see if there has been any degradation of the resin itself and gas formation.

On top of that, we intend to send to the first stage resins, we intend to send several donors to one of the Department of Energy laboratories for more detailed analysis of the first stage resins, so that we can then put together a technical report with the Licensee that would establish programs for handling those resins, and also the resins that will be generated from the operation of the SDS, if the SDS is approved.

MR. SHEWMON: The usual resins that are shipped offsite are not solidified; is that right? Say Dresden 2 or something?

MR. COLLINS: At the present time, that's true, but all power reactors were issued a letter last fall which required them by July of 1981 to have systems in place for solidification, and this is consistent with the requirements that are now being placed on them by the burial ground, such as Richland and Barnwell and Nevada. They have also incorporated those requirements into their license conditions. So by mid-next year, all of the resins from all power reactors will have to be solidified.

MR. SHEWMON: Thank you.

MR. COLLINS: The problem that complicates the resins at TMI is that they are both a mixture of inorganic-organic resins. There was a change shortly after the operation of EPICOR-II where we went to using the zeolite mixtures in the first filters for better removal of the cesium and that, of course, is all proprietary information. We are in negotiations with the vendor to acquire that information, and once we have that together, with the information we can obtain from the work that Met Ed is doing, on trying to sample the contents and the information that will be gained from the liners that will be sent to DOE, I think we are going to have a much better handle on how to handle those resins.

It may turn out we don't want to solidify them.

MR. MARK: You mentioned the exposure of the people who entered. In fact, it's going to be lower on later entries.

This is gamma exposure, I presume? Those suits will keep the beta from being a factor at all?

MR. COLLINS: Well, the beta right now is very low inside there.

MR. MARK: All right. Now also the exposure levels are lower than expected. Is it not possible to stick probes through the hole in the wall, for that matter?

MR. COLLINS: We did, through the 627 penetration and the 407 penetration, but, you know, sticking a probe inside, you are only able to get in a few feet inside that wall. But, you know, you are going to experience hot spikes throughout that building, and that's why we saw the range of 400 to 700 at various points.

MR. MARK: I see. What you really saw was 400, but then it turned out to be much higher, and it turned out not to be?

MR. COLLINS: Much higher. We expected it to be in the R range, and it was not. That doesn't say that there doesn't exist in there some areas that may be above that, too, but they did not see them yet.

MR. MARK: Well, the gamma is not a very localized thing.

CHAIRMAN PLESSET: One last question. Mr. Ward?

MR. COLLINS: Well, I actually did on the equipment hatch see some localized radiation.

MR. WARD: John, I was curious about the photograph. You were uncertain about the contents of the drums. Does that mean that the utility people have looked at the photographs and they don't know what was in those drums?

MR. COLLINS: Well, they have -- these -- they are the ones that took the picture and they are the ones that are analyzing them. They do not know for sure what's inside those drums. They are going back and trying to reconstruct what occurred in there just prior to the accident. Nobody for sure can say that's lube oil or transformer oil or water or what.

MR. KERR: Is there any evidence that a distorted drum might have been put in that location initially?

MR. COLLINS: That's certainly a possibility. That's certainly a possibility. But then one would have to conjecture, too, that what caused the door to wrap itself around the pipe --

MR. KERR: No, I think it's quite likely, but I just wondered if people knew that the drum, when it was put there, was in good shape or --

MR. COLLINS: I have seen drums in buildings that have been distorted without explosions. My question is, why was it there to begin with.

MR. SHEWMON: Were they sealed or had they been opened?

MR. COLLINS: I don't know that.

CHAIRMAN PLESSET: Well, I think we have to go along.

Thank you very much.

MR. COLLINS: Thank you.

MR. KERR: It would be interesting to have some sort of schedule. Maybe one exists, if we knew where to look, of about where the clean-up process for the water is going to start.

MR. COLLINS: We have probably been sent this -- the information is contained in the programmatic impact statement, the schedule. That schedule, of course, is going to have to be revised to reflect the cut-back in programs in accordance with Met Ed's spending level at the current time. As a result of those cut-backs, it's going to have a domino effect, and that will be reflected in the program.

MR. KERR: When would you guess the water is likely to be removed, for example?

MR. COLLINS: Well, if everything were to go on schedule and, as I indicated to you, the current schedule is to have it operational by March, and if the impact statement -- action on it is taken by the Commission in that same timeframe, then water could begin processing through the same system in about April or May, and then it would take approximately a year to process that water.

MR. KERR: Now back to my original question: When would you guess that the water is likely to be removed?

MR. COLLINS: I think my earliest guess right now is that it probably could start being removed as early as April or May of 1981.

MR. KERR: Thank you.

CHAIRMAN PLESSET: Well, thank you. We will have to move on now to our next agenda item, which will be consideration of the interaction study at Diablo Canyon Nuclear Plant.

Dave, would you give the subcommittee report?

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Parker fls.

MR. OKRENT: Yes. The agenda showed 30 minutes for the Subcommittee report and I expect to use less. So if I may, I would like to spend a couple of minutes commenting on the material that was brought to my attention Wednesday evening and Thursday morning, which is on a different subject but which I think is important.

We have received two letters addressed to you, one from Dr. Cochran and one from Mr. Pollard. And there are a couple of items in these letters that I would like to make some observations on, if I may.

In the letter from Dr. Cochran he refers to how the ACRS deals with the matter that arose when three GE nuclear engineers resigned, Messrs. Minor, Bridenbaugh, and Hubbard. And he says in his letter that the Committee's treatment of the three design engineers was shocking.

I am going to have to disagree with Dr. Cochran, and I choose to do it this way. I participated in the start of the review of that information. I was obviously not present at all meetings of all working groups, since we had a working group arrangement. However, at all the sessions in which I participated, I would say that Messrs. Minor, Bridenbaugh and Hubbard were treated much more gingerly and with much more reserve than the ACRS in general and I in particular treat the regulatory staff, the utilities or the reactor vendors. That is the first point.

Secondly, if you were to look at the letter dated May 19, 1976, which is entitled "Report of the Review of Statements by Messrs. Bridenbaugh, Hubbard, Minor and Pollard," we find that in fact the ACRS made a considerable number of recommendations for things that the regulatory staff should do based on the points raised by Messrs. Minor, Bridenbaugh, and Hubbard.

These were in fact not dismissed, but looked at in considerable detail, and in many cases supported. So I for one have to disagree with Dr. Cochran's observations. I do not recall whether he was present at any of the working group sessions at which I was present, but I have a feeling that he is somehow misinformed.

While I am talking about Dr. Cochran, I myself have frequently wondered how it is that the NRDC chooses priorities for those public risks that it will emphasize in what it brings to the fore before the Congress and so forth. And as an example, it has been clear to me and to many people for a decade or two decades that hazardous chemical wastes represent a very important public risk. It is not a potential risk. It is not something we might dispose of. It is something that is being disposed of in huge amounts.

The carcinogenic potential from these hazardous wastes is larger than that from a large reactor, and the toxicity is much larger. And I have not found -- or rather, recently, at least in what I observed -- that NRDC has really looked deeply into what the practices were.

And similarly, there are many other public risks where I don't find, at least from what I read, that NRDC has placed what I consider proper public emphasis. And I have on previous occasions indicated that you can do a disservice by placing your priorities in incorrect regions. In other words, if you cause the public and the Congress and so forth to place their attentions in one area and distract them from another one that is more important, in fact you may not be reducing risks.

So at least at the moment, I guess I have reluctantly concluded, based on the information available to me, that as presently constituted NRDC lacks the breadth and perspective to act as a public interest group in my behalf. And I would be happy to learn why I am incorrect with regard to what I have said.

Now, Mr. Pollard, who I think is an able technical person, was invited in the past to appear when we first began looking at the TMI-2 indications in a broad way. We hoped he would come in and give us the benefit of what he thought were things that needed to be improved in safety. I am unhappy to say then he declined to comment.

I think he should reconsider his position. I think for someone like him it is not necessarily in the best public interest to act only in what is primarily a political arena and not to have a technical interchange with a group like the ACRS.

So those are one man's opinions on some letters that were addressed to the ACRS, to Mr. Pollard. With that, I will go on to the item on the agenda.

Mr. Savio has a draft thing that you can look at, and he will have it out right now. And by the way, I ask, if Dr. Siess is going to be here, that he carry on because I have to leave at the end of the day. So if he would see it through tomorrow. All right.

Now, you will recall that as part of the TMI-2 implications, the review, the ACRS tried to look at in a broader way -- and one of the things we asked ourselves was, for example, what would be different in a region having a high seismicity. And we said, well, maybe we have not looked hard enough at seismically induced interactions of non-safety systems; that really, TMI non-safety systems were of interest.

And we raised this question and it was later mentioned in one of our reports to the Commission. The Diablo Canyon group said that they in fact would look at their plant and see whether seismic effects on non-safety systems could interact in a significant way adversely on the ability to shut the plant down, and they instituted a program which they themselves developed. They took an approach which I think is similar to what the Committee recommended might be an approach for Indian Point to do on systems interactions per se.

They first developed a written statement of how they are going to do it, and then they proceeded and have put a very considerable amount of effort into it.

We had a Subcommittee meeting recently -- I have forgotten which month; it may have been last month, October -- in which we heard a partial report on some of the kinds of things that they had found. And of course, we have looked in general at the methodology that they were using.

And in fact, they did find a reasonably large number of potential interactions. And in fact they have made corrections as a result of this.

I think the Subcommittee's impression was that they had done a workmanlike job. But I think it is for the Committee to hear from both the staff and the Applicant whether in fact this has been -- is in good shape now or is likely to be in good shape.

I would propose not to use any more of my introductory time and leave more for the staff and the utility, unless there are questions to me or the other Subcommittee members.

MR. PLESSET: Go ahead, Bill.

MR KERR: I participated in the Subcommittee meeting and I must say I was impressed by what seemed to me to be a very thorough and systematic approach.

MR. PLESSET: Any other comments?

MR. RAY: I support his statement.

MR. PLESSET: Thank you, Jerry.

Well, I think we can now go to the staff. Who is going to initiate that?

MR. BUCKLEY: My name is Bart Buckley. I am the NRC Project Manager at Diablo Canyon. Dr. Thomas is here to describe our results from the systems interaction study.

MR. THOMAS: Good morning. I am Cecil Thomas. I am a member of the Systems Interactions Branch of the Division of Systems Integration.

I would like to take a few minutes at the beginning of this subject to say a few words of introduction, primarily for the purpose of putting into perspective and setting the tone for the presentations to follow. I would like to begin just briefly going over the background of the program of the Diablo Canyon systems interaction program for seismic induced events.

Following my presentation -- following my presentation, PG&E will describe their program.

(Slide.)

And they will show you some pictures of some of the results they have obtained to date, describe their results, and what remains to be done. Following PG&E's presentation, I will get back up and describe our review of PG&E's program in more detail. So this is just basically a way of introducing the subject.

I would like to defer detailed questions about the program and our review of it until the third item.

(Slide.)

By way of introduction, I will briefly review the background of the program, I will tell you the objectives of the program, and describe just very briefly the approach that PG&E used to postulate systems interactions.

(Slide.)

The program was developed as a result of discussions concerning the effect of seismically induced failures on system safety at a November 1979 ACRS Subcommittee meeting. The requirement to conduct this program was subsequently documented in the Action Plan Task II.C.3, which requires the program be completed prior to full power operation.

(Slide.)

The objectives of the program were to establish confidence that, when subjected to seismic events up to and including the 7.5 magnitude Hosgri event, structures, systems and components important to safety will not be prevented from performing their intended safety functions as a result of physical interactions caused by seismically induced failures of non-safety related systems, components and structures.

In addition, the way the program was carried out, the ability of the safety-related structures, systems and components to accommodate single failures was retained.

(Slide.)

The approach used by PG&E in the conduct of the program was to use the walkdown method for postulating systems interactions. In this method, safety-related structures, systems and components were designated as targets. All other -- in other words, the non-safety-related structures, systems and components were defined as sources. Interactions between the sources and targets were postulated by an interdisciplinary team of experienced engineers, which PG&E refers to as an interaction team, during systematic in-plant walkdowns of target equipment.

That is basically what I wanted to say by way of introduction. I thought it was important to establish the scope of the program and to let you know how the program was carried out. I think it will put PG&E's description of their program and the results they have obtained in a little better perspective.

So unless there are any preliminary questions, I would like to turn the program over to PG&E, and we will follow with a description of our review.

MR. MARK: Very good. Are there any questions?

(No response.)

MR. MARK: Will PG&E proceed, then.

MR. HOCH: I am John Hoch, Manager of Nuclear Projects for Pacific Gas & Electric Company.

We would like to repeat, I hope more concisely than last time, the presentation we made to the Subcommittee on safety philosophy and technology -- I hope I have that right -- last month concerning the system interaction program at Diablo Canyon; I guess, more precisely, the seismically-induced system interaction program.

Our presentation is quite brief. I would like to mention, we once again brought with us a number of people that we hope are able to respond to any questions the Committee may have concerning the program. We hope that the program and its completion resolves any residual concerns that the Committee might have concerning the readiness of Diablo Canyon to receive an operating license.

Before we begin, let me mention a couple of I think unique things about the program. As Dr. Thomas mentioned and I guess as Dr. Okrent mentioned in his summary to the Committee, the program was undertaken at a time when the NRC staff was -- I guess I will say -- somewhat preoccupied with the immediate concerns related to TMI -- to Three Mile Island.

As a result of that, the first portion of the program was really undertaken by PG&E without direct involvement from the staff. That involvement later became much more comprehensive, and during the past eight or nine months we have been working very closely with the staff, modifying our program to accommodate their suggestions and requirements.

However, because of the lack of involvement, let's say, in the early days of the program, we felt it necessary and important to bring another element into the program, and that is to obtain an independent -- a body of advice and guidance as independent as possible outside the company and outside the regulatory staff, separate from our usual consultants and company personnel.

Consequently, we proceeded to implement something we called an independent review program, employing an independent review board in an effort to make this board and its advice as independent and free from interference by PG&E as possible. We asked the firm of Keith-Fibush and Associates in San Francisco if they would manage such a review effort, that is, obtain people to serve on this board who are uniquely qualified and brought with them a breadth of experience and background that would provide guidance to us on how to go forward with the program.

Kei` -Fibush did accomplish this. The firm provided Dr. Richard Stewart to be a member of that independent board and manage the board. Other members of the board have been Edward Keith, who is president of Keih Fibush Associates, Dr. Spencer Bush, Battelle Northwest Laboratories, Mr. Weingarten from the Department of Civil Engineering at USC, and Dr. Robert Nichell, who is an independent consultant.

This board has met a number of times, has participated, reviewed our interaction work, both in the office and in the field, has provided a number of suggestions for improvements to the program, things they felt were necessary which we have made every effort to follow.

I want to mention this particularly because the board is represented here today. I believe all but one of its members are present. And I believe these people are, in addition to PG&E people and our consultants, are available to respond to questions from the board.

MR. MARK: Thank you, Mr. Hoch.

MR. HOCH: Let me introduce the gentleman who is going to do this -- the majority of the work here. Our presentation will be given to you by Lew Killpack, who has been the project engineer for PG&E on this particular project on the systems interaction program. He was chosen because of a rather unique mix of talents, character strengths, and maybe even weaknesses.

Lew's background: He comes to us from -- he has had experience in PG&E's quality assurance department. He has had plant operating experience. Most recently, he spent a little over a year as head mechanical resident in our general construction department at the site, responsible for mechanical construction work.

Because of this kind of mix of experience and because of, I guess, the character weakness we'll refer to as an ability to pay attention to detail -- and that is primarily the reason he was chosen to head this project. Lew?

MR. KILLPACK: My name is Lew Killpack, and I am going to talk briefly about the scope, background, organization, methodology, criteria and results of Diablo Canyon's physically induced interaction program. The program was limited to seismically induced physical interactions between targets and sources, and we define "targets" as a system, structure or component important to safety, and a "source" as any other system, structure or component which does not fall in this category. And we consider seismic events up to and incl_ding the postulated 7.5 magnitude Hosgri event.

The purpose of the program was to further eliminate potentially detrimental physical interactions between targets and sources, so that components important to safety would not be prevented from carrying out their required safety function during and after a seismic event.

The program was intended to be centered around on-site evaluation by an interdisciplinary team of our most experienced engineers. It was a hands-on program concentrating on analysis, inspection and walkdowns. The program is an ongoing program in the sense that the lessons learned by PG&E from a systems interaction program will be factored into our standard design and construction procedures, and in addition all future work will be subject to the same on-site evaluation process employed for this program.

Now, the background -- the background specifics of this program are covered in detail in PG&E's submittal and also in the staff's safety evaluation report. So I will not go over all of that.

The organization -- the program was managed by PG&E's Nuclear Projects Department. You can see on this chart.

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The engineers and analysts were assigned to the project from our engineering, construction, operations, and quality assurance departments. Because at PG&E we are our own architect-engineer and constructor, we had a considerable depth of experience and talent to draw from for this program.

We also used several consultants to supplement the program. Robert L. Cloud and Associates were used for overall technical direction; the NSSS vendor, Westinghouse, for systems analysis and NSSS assistance; EDS Nuclear for analysis of the heating, ventilating and air conditioning systems; and also Kaiser Engineers for assistance on piping systems analysis.

Our supervisor of program development was assigned from the quality assurance department. We were desirous of having quality control built into our program procedures and having our program in complete conformance with PG&E's quality assurance program.

Our computerized data base and records retrieval system was managed by an analyst from the records management system. Our systems engineer was a senior Diablo Canyon startup engineer. The site evaluations were performed by a team made up of the technical consultants, the system engineer, the program supervisor, a design engineer from each discipline, a field engineer from each discipline, and other specialists as needed.

The team was large, typically 10 to 13 people, since we were desirous of maintaining an interdisciplinary review as much as possible.

(Slide.)

This is a shot here of part of the team done in the field, to give you an idea of what it was like. There were too many people to get them all in one picture.

Analyses referred by the site team to the general office were performed by PG&E's engineering department and consultants in some cases. All analyses were reviewed by the technical consultant, R. L. Cloud and Associates.

Approximately 50 professional-level personnel were required in the program, and we have present at the meeting today representatives of these different groups -- the independent review board, NSSS vendor, Cloud Associates, our engineering department, and PG&E management -- to answer any questions which you might have.

I would like to talk a little bit about the evaluation criteria now. The evaluation of seismically induced systems interactions and their effect on plant safety rests heavily on experienced engineering judgment.

(Slide.)

The criteria supplement and provide guidelines to make the evaluations as consistent as possible, and also to make these so that they were repeatable and retrievable. The criteria specify minimum requirements for failure modes and effects which must be considered for targets and sources during the evaluation.

The purpose of the site evaluation and the criteria we developed was to identify doubtful cases for further evaluation and to resolve the obvious cases. These criteria were used by engineers with extensive experience, and we insisted on an interdisciplinary evaluation.

The evaluation criteria fell into several general categories.

(Slide.)

The first is source and target contact. This involves impact from falling or vibrating objects, pipe whip, overturning, lateral or vertical movement, missiles, and relative motion between sources and targets.

The second is fluid leakage. This involves hostile gases, jet impingement, flooding, unwanted pressurization, loss of pressure or loss of control, as we think of it, and loss of lubrication.

The third is electrical anomaly, and this includes unwanted open circuit or loss of power, unwanted closed circuit, and unwanted energization.

The fourth category is environmental effects. This includes elevation, temperatures, steam and radiation, et cetera.

The fifth category is secondary or chain reactions, and these may involve any of the previously mentioned criteria where one sources might affect one or more sources, which in turn reacts with a target.

Methodology. Our methodology is discussed in detail in the PG&E submittal and in the staff safety evaluation report. I will not repeat all that. However, I do have a few slides which summarize some of our processes.

An early step of the program was the identification of targets.

(Slide.)

This slide shows the matrix, which is this document right here, and the drawings which we used to identify the targets. The matrix is a checklist for each target item, and it shows information like its identification, location, quality classification, required failure modes with and without power, seismic category, system, subsystem, and such information as that.

The matrix is over 2,000 pages and required about 6,000 man-hours to complete. We already had similar type lists developed for the programs like the Hosgri, but in this particular program it required considerable detail which was not in our other lists. For example, like vent lines from an air-operated valve would have to be on this particular matrix.

Also, we used the drawings in parallel with this and we color-coded all of the target systems on our schematic drawings.

(Slide.)

This slide shows -- illustrates how the drawings and matrix was used in the field. Typically, our systems engineer followed along on the schematic drawings, and we color-coded over the systems as we completed the walkdown or the evaluation, and we used the matrix list as a checklist also, so that we could balance one against the other so we could check to make sure that we had everything that we were interested in.

The evaluations on side generally fell into four main categories. The first is a discrimination of whether or not an interaction could occur or a determination that an interaction could occur but that no safety function is impaired. An example of this might be, say, a piece of half-inch tubing falling on a 16-inch pipe. We determined that the interaction would occur, but that it was of no particular consequence because of the relative masses involved; third, a specific modification is requested; and, fourth, we recommend further analyses.

The analyses conducted at the general office were done by the engineering department and consultants as required. All analyses, field and general office, were reviewed by the technical consultant.

A computerized information management and recording system was used to maintain a traceable system and documentation for our program, postulated interactions, field reviews, analyses, calculations and results are all maintained in an auditable and retrievable form. All documents are microfilmed, and in addition we used this system for such things as sorting the electrical targets and determining conduit and cable tray routings, this type of thing.

This type of system was one which was suggested by the independent review board early in the program and we adopted it. And this is one example of the value of the independent review board. They made many suggestions to us which we incorporated into the program.

Independent audit. Our corporate quality assurance department conducted an audit of the program. It was a technical audit and their auditing included engineers from each of the engineering disciplines, who were engineers who were knowledgeable of the Diablo Canyon plant, but that were not involved in the systems interaction program.

This team of engineers did a number of things.

(Slide.)

They performed a sampling walkdown to gather data, and they performed an audit of walkdowns by the systems interaction team. They performed on a sampling basis separate analyses to verify that previous analyses conducted by the team were correct. They reviewed program documents and they reviewed completed modifications.

In summary, for Unit 1 it appears that approximately 1400 potential interactions were documented. Most of these were not significant in terms of safety. I do have a few examples of some of the ones that had some significance. I can show you some pictures of some of these.

(Slide.)

On this one, the target is this condensing pot right here on the steam generator. It is used for steam generator water level. And the source would be a substructure platform like this. This substructure was seismically qualified by analysis. It also was modified to accommodate lateral and vertical movement which might occur.

There is a little bit of a depth perception problem on this slide, because this condensing pot is actually located about a foot above this beam here. And the initial design had considered relative movement between the two items.

But under our program we have increased margins of safety as much as we could, and this is an example of the types of things we did to make sure there would be no interaction in the event of a seismic event.

(Slide.)

On this one, the target is this route valve right here, a nitrogen connection to a main steam loop; and the source is the railing. This is before the fix. We fixed this by just cutting out a piece of the railing there.

(Slide.)

On this one the target is this motor-operated valve, power and control cable that you see here in this flexible conduit; and the source was this trapeze hanger assembly. You see the rods going up here. They went way up. And we postulated lateral movement where this or the pipelines could contact this conduit. So the fix in a case like this was to redesign the support.

Here the target is the steam connection right here.

(Slide.)

It is on the steam supply to the auxiliary feed pump. This is a drain cap which has been capped off here and here, since it is an abandoned test connection of some sort. And we postulate this line here, if unrestrained, could move vertically upward and impact this line. So a fix in a case like this is usually by restraining the source.

(Slide.)

Here the target is the charging pump suction line right here; and the source is this monorail system here for a small crane which is used to service equipment like the pump and motor. This monorail is located only a few inches from the suction line, and you notice it is hung by rods. So it is possible to move in a lateral direction.

We found a number of things like this that were seismically qualified in terms of vertical loading and in terms of it not falling, but having excessive lateral movement. And these monorails are a good example of a number of interactions where they have a possibility of interacting different pipelines or components. The fix on it is to restrain the monorail so it does not have excessive lateral movement.

(Slide.)

On this one, the target is a restrained line on the safety injection system. It is an accumulator test line right here, this small line. And the source is this large line. You can see this clevis, and here, as it was welded onto the line here, it was in very close proximity to this target line here, the lugs and clevis. The resolution involved moving this left-hand line support down several inches.

(Slide.)

On this one the targets are these control panels;

and the source is this battery-operated beam light, which was not on seismic mountings. In general, all of these lightse are mounted seismically. This was an extra one of some sort that was not seismically mounted. So the fix on that was to upgrade the mount to a seismically approved mount.

(Slide.)

Here the target is this tank right here. This is a component cooling water surge tank. The source is this large antenna up here. We postulated this falling onto the tank because the mounts here were not seismically qualified -- not seismically qualified mounts.

(Slide.)

Here are some conduits and cable trays. Incidentally, the colorgrams here and the colors denote the safety-grade conduits and cable trays. I showed this because the cable trays were very significant to us because they required so much analysis. That is, the non-safety-grade cable trays. And we were not able to qualify these on a generic basis, as we had hoped originally, because we found that the details varied throughout the plant somewhat.

So we presently have a testing program underway where we are individually analysing various types of cable trays throughout the plant, and we are finding generally that they are qualified. But there are some number of modifications that are necessary, particularly the longitudinal seismic braces having spacing wider than they should.

(Slide.)

Here the source is the primary water storage tank, the little tank on the end here. All of the other tanks were formally seismically qualified during the Hosgri program. This tank was not. There would be a number of different targets. It could be one of the other tanks or systems inside of the building here.

We are currently analysing this tank now, and we think that it probably will qualify. If not, then there will have to be some sort of a modification.

MR. BENDER: Did you look at the level indication for that tank?

MR. KILLPACK: Yes, we did.

MR. BENDER: What sort of approach did you use in determining that it was seismically qualified?

MR. HOCH: The tank in question is not a category one tank, so the question of its level is immaterial. However, level for the other tanks, the safety-related tanks, was examined from the standpoint of level indications and are seismically qualified.

I guess I am not --

MR. BENDER: That is all right. You presumed that if the level indicator was seismically qualified, including its connecting lines --

MR. HOCH: That is right. We did not look at it any further.

MR. BENDER: -- that that was good enough?

MR. HOCH: Yes.

MR. BENDER: Did you look to see whether there was any redundancy in the system? Is one level indicator seismically resistant or seismically qualified?

MR. HOCH: Let me clear that up, I think, by seeing that in this particular program, once we determined that something was indeed category one seismically qualified, this program had really nothing else to do with it other than to consider it as a potential target. We were only looking at things which were not --

MR. KILLPACK: We were looking for the non-safety category. For example, this tank is the only tank in the non-safety category --

MR. BENDER: That is all right. It was more a matter of curiosity. Thank you.

MR. KILLPACK: I have a number of other slides. But maybe for the sake of time I will not go through all of them. I think this will give you an idea of the type of things that we were finding that were significant.

Of the 1400 which we documented, I would say less than a third of these required some sort of modification. And out of those where we did make modifications, in many cases we made the modifications simply because that was easier to do than the analysis to determine whether or not there would be interaction. It is much easier to put a seismic brace on something than to go through all of the analysis.

Most of the modifications were minor, strengthening type things, particularly with the substructures. At Diablo Canyon all of the main buildings are already seismically qualified. But with some things like stairwells and platforms that were not specifically qualified, we just went in and upgraded that, rather than do a lot of analysis and "what-iffing."

That basically summarizes our program. Are there any questions?

MR. PLESSET: Any questions? Yes, Mr. Ward?

MR. WARD: The cost of the fixes as opposed to the cost of the analysis -- did the analysis cost you more than the actual physical fixes?

MR. KILLPACK: The physical fixes are much cheaper, I think, because of the time involved. The analysis might take two weeks and the fix might take one day. The cost of the materials involved is minimal. it is mainly labor you are talking about, time.

MR. HOCH: That is a generality, I think, Mr. Ward.

MR. KILLPACK: The construction department may disagree.

MR. BENDER: I believe you said you expended 6,000 man-hours on this efort.

MR. KILLPACK: That was only for that list, the matrix. We expended something like 50 man-years for the engineering effort, the analysis and the walkdown. And that does not include the construction department's efforts.

MR. SHEWMON: Would you convert those to the same units? If you're going to use man-hours in one --

MR. BENDER: I don't mind.

MR. SHEWMON: I do.

MR. PLESSET: That is a good point.

Jerry?

MR. RAY: Do I understand correctly that where you made modifications you then had walkdowns of those modifications to make sure that in modifying you did not introduce new hazards?

MR. KILLPACK: That is correct. Our procedure requires us to go back and walk down the fix, just as we would any other modifications, to make sure we did not introduce further interactions. And in addition, modifications in the future will be addressed. For instance, as we perform some of these last few TMI fixes, we go in and look at them according to this criteria. It will be a continuing program.

MR. PLESSET: Mr. Ward?

MR. WARD: Are you going to be able to have any feedback to your design standards for this sort of thing?

MR. KILLPACK: We think so. The lessons learned from this program we will just have to write into our standards, so that not all of these things can really be addressed when you are making a drawing, but some of them can. And as a matter of fact, already the engineers are looking at these criteria and trying to address that.

But it appears like a walkdown is probably necessary when you check some types of things that you just cannot do up in the office.

MR. BENDER: You are suggesting this has to be done after the plant has been constructed, generally?

MR. KILLPACK: That was our feeling. From sitting up in the office and looking at the drawings, you just don't see these things. You really have to get down in the field.

For example, what we find in one reactor coolant pump we did not find on the other, and we are expecting Unit 2 to be different from Unit 1, although they are basically identical plants. A lot of these are things that are a function of the construction and exactly how things are placed.

MR. BENDER: I hesitate to ask you to speculate on this, but this was a narrowly constrained kind of survey, and it would seem to be very effective.

MR. PLESSET: What do you mean, "narrowly constrained," Mike?

MR. BENDER: It was intended to look at interactions that might arise from seismic events largely, and it included fluid reactions and things of that sort. But I would have to ask myself, what kind of walkdown would you need to look at other kinds of interactions that might have to be addressed, like steam releases and things of that sort. Could you do it the same way?

MR. HOCH: Well, let me point out, we already did as part of an earlier program for pipe break outside containment, we already did go through this walkdown procedure with breaks postulated at locations as required by the staff's criteria. Even though the program -- you are correct in it being narrowly constrained. We did not overlook anything we found during the course of the program, whether or not it was related to the program.

And there were a number of instances where things were discovered, such as a missing bolt, that might well have been found during a subsequent walkdown or preoperational inspection, but were documented and taken care of as part of this program.

MR. BENDER: Well, I am probing and I admit to probing, but --

MR. HOCH: Let me make a couple of general comments in this area, if I can. I think it follows what Lew said. I think if I had to characterize the difficulty or problem that is most apparent, that probably resulted in a majority of the potential interactions, it would be really the interdisciplinary coordination problem. And that is really difficult to factor back into your design process, but it is something we are trying to do.

The kinds of things we have seen, the architect's design of a platform -- you saw an example of this -- the mechanical engineers and instrumentation control people have put a level instrument on the side of the steam generator. The two groups do different things, and that interdisciplinary thing does not always come together, so that Group A sees what Group B is doing and evaluates what that might do to their design.

That is probably the biggest area, I guess the most common area, of generating these kinds of things.

MR. BENDER: Well, I think you are hitting at the principle I was trying to at least explore. I could envision doing this kind of thing to deal with the sprinkler system, to deal with pipe breaks as you have done, to deal with lube oil releases, to deal with things that might happen during maintenance operations, where you have to bring in special equipment from the outside, just to speak to what the potential hazards were.

And I am not -- don't misunderstand me. I am not proposing that you do these things at this stage of the game. I am trying to find out whether some kind of procedure that dealt with things on a broader basis could be done at the same time you are doing this. I guess the answer is yes.

MR. HOCH: The answer is definitely yes. And certainly, after essentially completing this program, I think it is our feeling that probably the most useful and most cost effective way of accomplishing this is with a program that includes a field evaluation and field inspection program as part of it, rather than sitting in the office and attempting to look at drawings and brainstorming what possibilities exist.

The finished plant is certainly a far better depiction of what the finished plant looks like than a set of drawings.

MR. BENDER: Thank you.

MR. MARK: The word "walkdown" has been used frequently. I have a vague picture of it. A half a dozen people go into something like the deisel generator room. How long does it take? How long do they spend?

MR. KILLPACK: It varied depending on how many targets. But in general, it was very, very slow and tedious, and it would be more like 10 or 12 people. By the time we got through general office, engineering types, steel engineers, consultants, you would have a large group. And it was very tedious and slow, because there are so many things to consider.

And I think if we had been doing a very broad kind of a program, we could not have done it. It was almost too much as it was, as narrow as we had this. And if we had not been able to narrow this program down as a result of many previous programs, I think it would have been very, very difficult. It took us almost a year to get through this.

MR KERR: Was this the first time some of these people had ever seen a reactor?

MR. KILLPACK: No, we had nobody there unless they had been the ones who had designed the reactor. These were our very senior, experienced people.

MR KERR: I did not mean the drawings for one. Was it the first time they had actually seen a reactor, some of them?

MR. KILLPACK: No, absolutely not.

MR. HOCH: Let me point out something I think we mentioned. I think the person you saw with the thick glasses in some of the slides he showed has been at Diablo Canyon on startup for what, six or seven years.

MR. KILLPACK: We had nobody --

(Laughter.)

MR. HOCH: Our startup group at Diablo Canyon has been active, trained, and involved in startup operations for about seven years.

MR. KILLPACK: We picked the engineers who basically had done the design and were familiar with the systems in the plant, so we could point to a line and say, what is that and where does it go and what is in it; is it safety-related, is it seismically qualified, what is the safety code.

These people had all of the answers, and those are the people we used. Like our instrumentation engineer, who has been on the project since the beginning, is sitting right behind you. He was there or one of his staff was there. If we saw an instrumentation line, we expected him to know everything about it.

And the same thing, we had an electrical engineer, in addition the engineer who installed it, who built it. How was this built, what kind of anchors. And it would have been very difficult without this kind of information if we had to go and look it all up. Even having these experienced people, very tedious, very time-consuming.

MR. HOCH: Let me point out a potential difficulty that relates to the long startup period, and that is, the farther down the road we go, the more we are asked to be dealing with people that have not had the background, have not had the experience. We are beginning to start to see a thinness in our engineering ranks of people who actually participated in the design.

In a few more years, I would expect most of those people will be gone. It really makes sense to get this procedure over, I think, while the people with the experience, with the knowledge, are still alive.

(Laughter.)

MR. PLESSET: Mr. Ward?

MR. WARD: One other question. You said the cable trays were a particular problem, and I think you said you assessed those by a testing program rather than analysis. Could you say just a little bit about that?

MR. KILLPACK: On the class one cable trays, which are already seismically upgraded, they were all very much the same, and we could analyze a prototype or test a prototype.

And on the class two, the details -- although they were built essentially the same, they had not gone through these normal programs. And what we found was that the details varied from area to area. You know, they looked generally the same, but the joints might be different, there might be different spacing between the seismic supports.

So what we have had to do is go down with our department of engineering research and vibrate these and determine what their damping and their resonant frequency and their rigidity and these types of things are, because it seems to vary throughout the plant. And we cannot do it on a generic basis.

And we are finding that they are generally qualified, but we cannot prove it because they are all different. So it takes a testing program to do this. And this type of testing is very time-consuming. They sometimes will spend several days on one cable tray with their vibrating before they really have good data and we know exactly what we have with that cable tray.

Of course, we have some minor modifications as we go along. This testing program is under way right now, so I don't really have a feel for how much modification we are going to run into. We basically are going to upgrade the cable trays.

Here again, the analysis of what happens when you break these cables, even though they are non-safety, is very difficult. Basically, our philosophy throughout, most of the plant is seismically qualified; we are just doing the rest.

MR. PLESSET: Dave, do you have a question?

MR. OKRENT: A comment and maybe a question. The broader question of systems interaction, not necessarily seismically induced, is something the staff is developing an approach on. I think it is in the Action Plan. And in that regard, I would say Diablo Canyon is not unique.

We had a little bit of discussion at the Subcommittee meeting about how they looked at possible electrical effects. I wonder if you could make any comment in that regard? What we heard here are physical. I mean, I think you have, if I recall correctly, a basis for thinking that electrical effects were handled.

MR. HOCH: Why don't you begin and we will kind of fill in behind you, Lew.

MR. KILLPACK: The electrical effects is a sticky problem, and I think I just sort of stated what our philosophy was: If we can upgrade all of the cable trays and conduits in the plant, we did not have to worry about it. And that was basically our approach.

We of course looked, as we were doing the walkdowns, we looked -- we had many targets that were cable trays and conduits, and we were looking for things like, can this -- ca[illegible] get an open circuit or can something affect the power to that valve, and that sort of thing. But in general our approach was, I think, to eliminate the possibility of there being an interaction with any of our electrical --

MR. HOCH: Let me see if I can reword that. At an earlier meeting, I believe a year or so ago, when you posed a series of 13 questions and we came in and did a not too adequate job, I think, of answering those questions, because they were really representative of maybe a broader series of questions you had, one of the kinds of questions you were asking was, have we looked at non-qualified electrical conduits and postulated the conduits would break and perhaps be inadvertently reconnected in combinations that might create some problem for us.

And I think what Lew has just said, if I can rephrase it a little bit, is if we can show that, insofar as non-qualified, non-category one, if you will, trays, conduits, and cables, if we can show that they do not fail, even though not constructed to the same rigorous standards as safety-related ables and conduits, if we can show that they do not fail, that they are not reasonably expected to fail, I think -- I believe we have answered that question.

I think the other part of the answer, the answer to your question, the presumption of failure, does indeed become very difficult. It becomes a problem of analyzing countless combinations of events.

MR. RAY: As I recall it, though, at the Subcommittee meeting I think there was some discussion of the mechanical stability of the switch gear mounting and that sort of thing.

MR. HOCH: I don't remember talking about that, but we certainly can.

MR. RAY: I think that might be significant, because you could move the switch gear.

MR. HOCH: Everything, of course, safety-related has been rather carefully qualified as far as the Hosgri analysis and qualification program, the combination of analysis and a lot of testing of all safety-related electrical equipment at Diablo.

This is Tom Crawford. He may recall what you are referring to in the Subcommittee meeting.

MR. CRAWFORD: What we did to -- I guess the thing you are really referring to is the problem of, how do you really know what happens if a relay chatter switch causes a valve to go closed which is really supposed to be open or something like that. And what we did is, we went through and, in doing our original analysis, we determined which systems had to be functional regardless.

If we could get a certain number of systems, a certain pressure boundary intact and operable with no failures, then we could guarantee that, regardless of what happened to anything else, we had no problems. But we had to ensure integrity of the systems and operability of those systems, so that, like for example, if you had a safety injection test line, the test line itself has no safety function and it has an air-operated valve that isolates it out, you have to ensure that that air-operated valve does indeed close and no, relay chattering in the control room does not operate that air-operated valve.

Once you establish that air-operated valve is closed, then you don't worry about air-operated valves downstream of that.

So what we did is, we very carefully went through our entire system and went on a single-failure criteria basis and made sure that we had isolated all the required systems and everything required to make that occur is seismically qualified.

Okay, both from a physical point of view and also -- from a physical point of view, you know, each device itself is qualified and there would be no interactions with it. Now, the one thing -- the only place where we had something where we did not outright qualify the device is if the control room gear -- we did that test by similarity. In other words, the relay looks the same. If it was Class 1 or non-Class 1, we don't use two different flavors.

So that is exactly how we dealt with the issue, and then we just did not worry about control systems interactions beyond those boundaries.

MR. BENDER: I guess I am sort of inclined to comment again about the point raised earlier about looking at other things. In view of the fact that the regulatory staff is looking down the road to other interactions, and in view of the fact that seven years have gone by and most of us which that we would stop here, it just seems to me that it would be prudent to do a little looking ahead yourselves and be sure that, in the process of doing this, you have dealt with all the things that are likely to come down the road, so that there is a fairly good chance that we can draw the line somewhere, because God knows we've spent enough time on it.

MR. PLESSET: Yes, Steve?

MR. OKRENT: Mr. Chairman, one of the reasons why I raised the electrical problem, I think at Diablo Canyon they found it necessary to qualify certain things to seismic Class 1 that would not ordinarily have been so qualified, in order to accomplish what we just heard. And I raise this not so much as a point for Diablo Canyon, but as one that needs, let's say, thought: What is the situation? What if anything needs to be looked at for other plants?

At Diablo Canyon they started to look at it and, so far as I can tell based on hearing, that they have in fact tried to deal with the matter. But it is less clear where plants in less seismic an area stand in this regard, and my inclination is to agree with what we heard; to try to analyze it wire by wire is not easy.

So at some future time, not for Diablo Canyon, I think we will probably want to hear what the staff thinks about this. And I don't know, maybe the Electrical Subcommittee ought to put this on their list as something to follow, or the seismic group can handle it, one way or the other.

MR. PLESSET: In any case, I think it is not unreasonable to make a positive, even complimentary, remark to the Applicant.

MR. OKRENT: I did at the Subcommittee meeting.

MR. PLESSET: Oh, okay. We can do it on behalf of the full Committee.

MR. OKRENT: I thought in fact I said here I thought they had done a workmanlike job.

MR. PLESSET: Yes.

I think maybe we can move to the staff.

MR. THOMAS: Mr. Chairman, I would like to make an additional remark in support of the Applicant. One thing that has not been brought up this morning that the Committee may find of interest is, equipment such as valves with required or assumed failure modes, powered by air or non-vital power, were looked at very carefully by the Applicant in this program.

If a valve had a required or assumed failure mode, the Applicant looked at that valve and looked at the power to it, whether it be air or electrical power, and did in effect a mini-failure modes and effects analysis to make sure there could be no seismically-induced physical failure to that power supply, whether it would be air or electrical power, that would prevent that valve from obtaining its required or assumed failure mode.

So in effect, with those valves the Appplicant defined as targets those air lines or electrical power lines to the valves and included them in the list of targets, and assured that they could not be adversely interacted by failure of non-safety-grade equipment. So I had not heard this mentioned, but it was one step further that the Applicant took that I think is maybe a step in the direction that Dr. Okrent was taking. Certainly it does not go all the way, but it is, we think, a good first step.

MR. PLESSET: Thank you.

Yes, Paul?

MR. SHEWMON: I don't follow this very carefully, but could anybody -- would anybody care to speculate or tell me where Diablo's power is now?

MR. PLESSET: The plant itself?

MR. SHEWMON: They have been starting up for a few years here. Are they on line?

MR. PLESSET: No, no. The appeals panel -- let me see if I understand it. The appeals panel has not yet come back with their decision. Is that correct, Mr. Hoch?

MR. HOCH: Why don't I -- if you want a summary of that, why don't I ask Mr. Norton to give it for us.

MR. PLESSET: Let's make it brief. But fine, it has been brought up.

MR. HOCH: He, I am sure, could summarize much more readily than I the process of licensing. In summary, no, we don't have an operating license. We began -- after TMI we were either number one or two in line as a, quote, unquote, "near-term operating license." And now we are, I don't know, number five, I guess. It is something like that.

The plant and the process we have been talking about today, the interaction program, are essentially complete and can be made complete in a very, very quick fashion.

MR. NORTON: Dr. Shewmon, in answer to your question, we just finished seismic hearings again last week on Imperial Valley -- I guess it was two weeks ago, Imperial Valley '79 earthquake.

We are starting hearings on Monday on the security plan. That is before the Appeal Board. We have motions to reopen on emergency response pending before the Licensing Board. There are motions to reopen pending on Class 9 accidents before the Licensing Board.

There is the low power testing license. There are contentions to be filed by Governor Brown et al. on the low power testing license by December 3rd.

MR. SHEWMON: These are primarily contentions brought in by your friends in California, not your friends in Bethesda or wherever, is that right?

That is right.

MR. SHEWMON: Thank you.

MR. PLESSET: Thank you.

MR. BENDER: Mr. Chairman, I think it would help to clarify a bit more where we stand: Assuming that you get through all of these appeals which you may go through, what else would be left in your view to receive an operating license? What do you think is going to need to be done?

MR. NORTON: I think nothing. Once we get through the appeals, we should go. But when that is going to happen --

MR. BENDER: What does the regulatory staff think?

MR. BUCKLEY: There are a few items that need to be confirmed. For example, we plan on going out to PG&E December 2nd and confirming their management improvements that have been made since about six months ago. They reorganized their organization. We plan a two or three-day trip out there.

MR. PLESSET: Has fuel been loaded?

MR. BUCKLEY: No, sir. It is at the site.

MR. PLESSET: At the site, okay.

MR. BUCKLEY: The fuel -- it has been there since 1975.

MR. BENDER: Is there a written statement anywhere of what is needed to get to the operating license stage for this plant?

MR. BUCKLEY: No. The supplement number 9 wrote off on all non-TMI items for lower power. And supplement 10 wrote off on the TMI items for low power.

There are several outstanding items that needed to be resolved, but they are of a managerial type.

MR. BENDER: Is it unreasonable to suggest that such a list would be appropriate?

MR. BUCKLEY: It is not unreasonable. I could prepare one.

MR. BENDER: I think it would be useful to the Committee to know.

MR. THOMAS: Isn't there a list in the SER somewhere?

MR. BUCKLEY: Yes.

MR. BENDER: I am not clear. Are you saying that supplements 9 and 10 contain all that is left to be done?

MR. BUCKLEY: Yes, sir, to the best of my knowledge. Essentially, all of them have been done. There were two items that needed to be confirmed, that is all. They are of a minor nature.

MR. BENDER: I think if you could provide it to us I would at least be enlightened. I don't know whether the rest of the Committee would be or not.

MR. BUCKLEY: I can get that for you.

MR. PLESSET: Let's get back to our agenda. I think the staff is going to give us some summary comments on this. Would you do that?

(Slide.)

MR. THOMAS: Okay. I will briefly summarize the NRC staff review of PG&E's systems interaction program. To begin with, I would like to point out we used a team concept in reviewing the program. Our team was composed of five members, three members from the Systems Interaction Branch. I am one. The other two were Don Lasher and Leo Gregarian. We had a representative from the Mechanical Engineering Branch, Joel Page, and we had a representative of Lawrence Livermore Laboratory, our consultant for our review, and Mr. Wang is here from Lawrence today.

Our review was essentially conducted in two parts. First of all, we had an in-house review of PG&E's program as described in the documentation, and also results that were provided to us up until the 1st of August.

Secondly, we conducted an on-site audit of PG&E's program. We actually went to the plant and spent three days in June and did an audit. I will describe that in a little bit more detail in a minute.

(Slide.)

Our in-house review. This slide summarizes the major elements that we looked at. Primarily we looked at the scope of the program, we looked at the scope of the equipment to be considered as targets, and the scope of the interactions that were considered in the program. We looked at the organization established to implement the program, specifically the overall organizational structure, the responsibility, the reporting requirements of each of the elements of the organization, and especially the composition, independence and scope of review of the independent review and audit teams.

We looked at the methodology that PG&E used to implement its program. Specific areas that we looked at were the initial office activities, the field walkdown activities. A very important part was the office-based technical evaluation.

I would point out that all of the findings and recommendations of the interaction team were reviewed back in the office during the inter-office technical evaluation phase.

We looked at the modifications, the criteria for making the modifications and assuring that the modifications themselves did not create new systems interactions. We looked at the independent audit and review function and the information management system to assure ourselves that all of the information developed during the course of the program was maintained in an auditable and retrievable manner.

(Slide.)

We spent a lot of time reviewing the criteria and guidance that PG&E used to evaluate the interactions, particularly those associated with the failures and sources, the postulation of interactions, the evaluation of the postulated interactions, and the resolution of postulated interactions.

And we reviewed resaults obtained after August 1, 1980, because this was about the time we had to draw the line and write our safety evaluation report. We were particularly interested in the number of actions that were postulated, the type of interactions and the resolution, the means by which PG&E resolved the interactions.

Of interest here that relates a little bit to the following discussion was, we found it interesting that the interactions that were postulated by PG&E tended to fall in a finite number of categories. It was not necessarily the interactions themselves we thought were important, but as far as possible application to other plants. But certainly the categories of interactions that they discovered certainly could apply to any plant, and we think this is important. And I will talk about that a little bit later on, on where we go from here.

We think these categories are things that possibly, in the future when we work toward developing regulatory guidance for future applicants ane licensees, • that they can use, in their program look at the particular areas as opposed to particular interactions.

(Slide.)

In June our team conducted a three-day audit at the Diablo Canyon site. The objectives of the audit were to continue discussions relative to our review of the program, to review the progress made to date by PG&E, to observe their walkdown technique and examples of postulated interactions, and to conduct our own independent walkdown to see how we could do, and to compare the results of our effort with those of PG&E.

For our own independent walkdowns, we looked at four different areas. First of all, the turbine-driven auxiliary feedwater system. We looked at the steam supply piping, the electrical power supply to the turbine motor-operated throttle valves, and to the pump discharge piping.

We looked at the pressurizer relieve tank rupture disks to see if those disks popped or got in any kind of trouble. We looked at the containment isolation and purge system isolation valves. And we looked at the 125-volt DC battery room.

And of interest, these four items questioned previously came up, on how long it took to do the interaction walkdown. I think we had four people on our team. It took us the better part of a day and a half to walk down the safety-related equipment associated with these four elements. So it takes quite a bit of time.

It is of interest to note, too, that we postulated a number of interactions associated with these four elements, and after our independent walkdown we compared those with PG&E. We did not know their results beforehand and it turned out we duplicated their list exactly.

I don't think this speaks necessarily so well of us as it does to the method. We spent a lot of time. We were very deliberate, scratching our heads a lot. And there was a lot of discussion during the walkdown. And I think it shows that the method is a viable method of postulating physical interactions.

(Slide.)

As far as our findings, we believe, as a result of our review -- which, by the way, I think Bart mentioned, is documented in supplement number 11 to the Diablo Canyon safety evaluation report, that is, NUREG 0675 -- as a result of our review as described in that report, we concluded that PG&E's program provides reasonable assurance that the safety-related equipment will not suffer loss of capability to perform its intended function as a result of physically induced or seismically induced physical interactions caused by the failure of non-safety-related equipment.

And further, the capability to accommodate single failures in the safety-related equipment is retained. On those bases, we concluded that PG&E's program was acceptable. I emphasize "program" because we really approved their program.

I&E, the Office of Inspection and Enforcement, will follow up on the completion of their program during the normal course of their inspection activities. And following the completion of the program for each unit, PG&E will provide to us a final report that will summarize -- contain information on all the interactions that were postulated and how they were resolved and any supporting analyses.

This is, in effect, a quick overview of our review. We can answer any specific questions. Now, if there are none, we can move --

MR. PLESSET: There are two, and I think we will allow that number.

MR. THOMAS: All right.

MR. PLESSET: Bill?

MR KERR: I am impressed by your description. It seems to me it was a good program.

Do you think there would be any practical way of estimating the risk reduction that one might achieve by such a program?

MR. THOMAS: Practical, no. There were perhaps -- there was such a spectrum of interactions found. Some of them were negligible. Some of them were considered -- well, maybe it could interact, maybe it could not. These would be very difficult to quantify.

Perhaps if you looked at the biggest ones, maybe the biggest two or three, those that stood out, it might be possible. I am not sure it would really be worth it, because the approach taken by PG&E was to prevent this from happening to start with. We really did not do a cost-benefit --

MR KERR: No, I know you did not, and it maybe impossible. But both of you have committed significant resources to this task with the belief, which I share, that you have thereby reduced risks. There are a lot of ways of reducing risk, I expect. I just wonder if it would be possible to choose among this as compared to others, on the basis of some estimate of how much risk retention one achieves.

This is not meant to be critical of the program at all. I think it is a good program.

MR. THOMAS: It could be done. I am not sure you would want to spend too much effort in doing it. I would emphasize in the future, on Indian Point for example, the Applicant is taking an approach similar to what you are describing. He is looking at systems he considers to be more high-risk in terms of they would -- through loss they might have a greater impact on the plant, the ability to take the plant to shutdown and maintain it at shutdown.

So he is at least -- in discussions we have had with Indian Point, the Applicant is apparently taking the approach that the equipment to be looked at will be selected on a basis of some sort of a preliminary risk basis.

MR KERR: Thank you.

MR. PLESSET: Steve.

MR. MOELLER: You indicated that the interactions themselves could be grouped into several broad classes. Several times you mentioned the number of actions postulated. Could you give me an idea of what numbers you are talking about? How many broad classes were there?

MR. THOMAS: Surely. Just a second. I have a slide I can show you. This information is in the supplement 11 of the safety evaluation report.

(Slide.)

This slide shows the categories of interactions and the number of interactions in each category that were postulated up until August 1. And I think PG&E can correct me. It probably can be scaled up fairly proportionately to what we found there.

MR. KILLPACK: That is true. They are coming in at about the same rate.

MR. THOMAS: There are about a dozen categories. The first category, structural grates, platforms and handrails, represented 199, really, the three categories that showed the most, electrical light fixtures and pipe and structural grates.

And then there were half a dozen categories that had probably, oh, significant fewer. And then there were a few that had relatively few. And you have what, twice that many total interactions now?

MR. KILLPACK: Yes, that is correct.

MR. THOMAS: So we feel these categories can really apply to any plant. The particular type of interaction that was postulated in each category probably would not apply directly, but the categories certainly are areas that we feel in the future other plants should take a look at. And we are trying to come up with ways in which a program might be implemented for other plants.

MR. PLESSET: Can that lead into your part 2?

MR. THOMAS: Beautiful lead-in.

(Slide.)

MR KERR: The response is: "Yes. Maestro?"

(Laughter.)

MR. THOMAS: Okay. The next plant on our agenda is Indian Point. The requirement or the recommendation to conduct a systems interaction program for Indian Point 3 originated with the ACRS in 1979. The Committee has a letter out on that that suggests perhaps they look at some different interactions or different potential interactions in maybe somewhat different ways than Diablo did.

We are working with the Indian Point applicant now to come up with an acceptable program for looking at systems interactions. We have met with the applicant a couple of times. We have had some discussions.

The applicant has, I think, engaged a number of consultants to propose a program. We have been doing some thinking on our own. To date we have not come to agreement on what should be included in the scope of the program. We certainly think it should include, as a minimum, the walkdown method as shown so viable by PG&E.

It would also include some use of operating experience and some other method to maybe look at functional interactions. I believe the Committee referred to them as connected systems, interactions resulting from connected systems.

There are a couple of methods we are looking at now that may prove viable. One would be called dependency analysis, where you look at support systems, such as lube oil systems, air, electrical supplies, space and component cooling, and so on, and look at the effect of failures of these so-called support systems on the safety systems.

We are also looking at the possible application of failure modes and effects analysis on shared systems and on connecting systems. And there are some other methods we are looking at.

We are not really ready to say now what we are going to require. We want to see what the applicant will propose as a result of his discussions with his consultants. And we will get together, and I will show you the schedule for this program on the next slide.

San Onofre we understand is doing a seismic upgrade of its previously non-seismically qualified, non-safety related systems, somewhat analogous to what PG&E has done. I understand they had some discussions related to their auxiliary feedwater systems yesterday.

Our branch has taken the lead in determining what has been done with regard to systems interactions, especially seismically induced systems interactions, on this program. We are just now getting started. We are going to see what has been done and what can be done and what has been done by the applicant, also, as far as determining systems interactions.

The applicant has indicated that he is looking at possible interactions using the walkdown method as used by PG&E. But this will be another point that we will be looking at.

We are also in the process of developing regulatory guidance to be used in the future by plant applicants and licensees. I will show you this schedule for accomplishing this on the next slide.

And then, finally, we are going to, as a result of information that we obtained from Diabl . from San Onofre, and from Indian Point, and in the development of the regulatory guidance, we are going to apply this to a pilot study of maybe six plants. The plants have not been selected. They will probably be selected some time toward the middle of the year.

We will use these plants as guinea pigs for our systems interaction proposed program.

(Slide.)

This slide just barely shows the schedules for accomplishing some of the things I talked about. The first item is the Diablo Canyon program -- I know it is difficult to see -- the Diablo Canyon program, which is in effect completed as far as the staff review is concerned. We have an ongoing program we call a state-of-the-art review of systematic methods for identifying systems interactions. That is continuing.

We have involved the efforts of a number of laboratories. We have discussed this program with Dr. Okrent's Subcommittee a number of times. We are shooting for early in '81 coming back and informing the ACRS on the results of those studies.

In effect, we have asked three laboratories to provide us with their opinion of methods that could be used to diagnose the systems interactions.

The Indian Point review is depicted in this slide. It shows the program being initiated by the licensee in the middle of December of this year. We understand that it has slipped a couple of months, primarily as a result of conflicts with TMI-related requirements. So we have to coordinate our efforts in NRR to decide priorities and get this information back to the applicant. But we expect the schedule will slip a couple of months.

It had originally called for issuance of the safety evaluation report at the end of fiscal year '81. That will probably also move back a couple of months. And then, following issuance of our safety evaluation report, we plan to come back and discuss our findings with the Committee.

Our regulatory requirement development program is scheduled to begin some time in the next month or so and continue over -- continue for the next year or so, with the aim of being able to issue some sort of final regulatory guidance in September of '82. We would expect to have a draft out maybe in mid-'81. And we would expect to coordinate this effort substantially with industry. And we will hope to be able to issue some sort of final guidance at the end of fiscal year '81.

MR. BENDER: I have to say that, while I am sympathetic to the idea of it taking a long time, it seems too long to wait until the end of 1981 to essentially know what might be required. Is there any way of getting something in the way of a preliminary list of things that have to be considered in systems interaction that those people that have licenses and those people that are thinking about getting licenses could use as a basis for planning?

MR. THOMAS: Yes. As a matter of fact, as a result of the completion of the Diablo program, we intend to work with the Division of Project Management and the Office of Inspection and Enforcement and at least issue some sort of an information bulletin that would make licensees at least aware of the types of interactions that were found -- the categories of interactions found on Diablo, that would reference supporting information so they could go and find out more about this, and hopefully look out for this same sort of thing in their own plant.

We have not really decided how we are going to do it or what we would require in response from it.

MR. BENDER: I think that is a useful first step. But it is not as far even as I would have envisioned going for the first phase or preliminary phase of it. In fact, I think many of us believe that the systems interactions questions are less important in the areas of seismic response than in some other places. And I think it would be useful just to know what the list is of kinds of matters that have to be dealt with in the systems interaction review.

Seismicity, higher protection, steam line breaks, some other things we know about. But I do not think that we have enough of a list yet. And I sure would like to see more of one than I have seen so far.

MR. PLESSET: Dave?

MR. OKRENT: In the case of possible seismic effects related to systems interactions, it was PG&E that took the initiative to formulate a program which, so far as I can see, was a good program. Is it your opinion that Indian Point 3, for example, are unable to formulate a sound program, or that they have not put the resources to formulating a sound program on their own, or that the environment is such that they think they are supposed to wait for you to tell them what to do? Or just what is it that leads to the situation were there is not a program yet? And you know, it is still somewhat in the future. Can you give us your perspective on this?

MR. THOMAS: Yes. I think two of the factors you mentioned are the most important. First of all, Indian Point has apparently been impacted very heavily as a result of a number of things that have come up post-TMI, both with respect to siting and post-TMI requirements. We know for a fact that the manpower is really strapped, so to speak. This is one thing we have noted that has slowed them down a lot.

Secondly, Indian Point is going to have to go -- is going to have to consider a number of types of systems interactions beyond that required for Diablo. They are not only going to have to look at seismically-induced systems interactions, but we would envision the walkdown approach to consider things like pipe whip, fire and so on, that we have been talking about today.

In addition, we want them to look at some functional interactions, and as of yet there is really not -- no method has really proven practical yet. There are plenty of methods out there. As we know, the Sandia report used fault tree and event tree approaches.

If you just jump into this head over heels, it is really not practical, and you have to have some way to decide on how you are going to apply it. We are also looking at a number of methods. I mentioned dependency analysis. This is something we are looking at in-house and trying to develop a means that can practically be applied that we can get some useful results out of in a reasonable period of time.

And to some extent they are looking to us for guidance. I think those are the two prime factors for their rate of progress.

MR. OKRENT: Well, I guess I would have assumed that, had Indian Point or Zion or the industry chosen to treat the general question of how to look at systems interactions as seriously as PG&E chose to do for the seismic part on their plant, that an approach could have been developed long before this. And although right now Indian Point 3 has been indicated as a plant on which the ACRS at least has recommended such a study be done, I have to assume that one is interested in knowing that there are not major detractors to safety in all the plants.

So I guess it is not clear to me why the delays are necessary, and I guess I must say it is not clear to me why the industry itself has not taken a more active role similar to what PG&E did.

As a side comment, I would suggest when you look at your first six sites, so-called, on that site, that you include Limerick as a candidate.

MR. THOMAS: Any further questions?

MR. PLESSET: I guess not. I just wanted to remark that I had the impression that Diablo Canyon found this independent board very useful. Have Indian Point people considered this sort of thing, since, as you say, they are very short on their own personnel? I just wondered.

MR. THOMAS: They have not gotten that far yet, actually. But I would point out that the staff agrees that having some sort -- especially in a somewhat subjective type approach, that the capability for independent review the staff believes is very important. So we will strongly encourage that Indian Point have a similar organization. I a not ready to say it would be totally independent of PASNY. It may very well be part of the quality assurance program. But we feel the capability to look independently at what at interaction team does is very important.

MR. PLESSET: Any final comment, Dave?

MR. OKRENT: What happened at Indian Point 2 in the last month? Would you call that a potential system interaction, where they got some water into the containment?

MR. THOMAS: I am not familiar enough with what happened. I have been out of town for the last two weeks.

MR. OKRENT: I would, in fact. I guess I had thought that the staff tried to pick up the flooding question and the effect of water from non-safety systems almost a decade ago. So I was somewhat curious.

MR. PLESSET: Any other comment from the staff before we -- I guess not.

Well, I want to thank you, Mr. Hoch, for your presentation.

MR. HOCH: Could I make just one comment?

MR. PLESSET: Yes.

MR. HOCH: I think we said this at the Subcommittee, but I will be presumptuous enough to say it again and suggest to the Committee that, since you did bring this matter and your concern up on Diablo Canyon, your residual concern -- I believe it was in a letter from the Committee to the Commission it was mentioned, I believe, that it would be appropriate if you are -- if our program does indeed put that residual concern to bed, it would be appropriate to address it in a similar manner, I guess, and formalize its disposal.

MR. PLESSET: I think this is already in the works. Isn't that right, Mr. Subcommittee Chairman?

MR. OKRENT: Yes. I think in fact that PG&E said they were going to do this before we ever put a comment in writing. We did, I believe, suggest that in a general sense, not directly, but Diablo Canyon -- seismic effects on non-safety systems -- probably our letter on TMI-2 final report or something, I guess.

But nevertheless, I believe it is at least the Subcommittee's plan to propose to the Committee that a letter be considered at this meeting.

MR. PLESSET: I think that is correct.

MR. OKRENT: Dr. Siess is supposed to act for me in that regard.

MR. PLESSET: It is already up to draft two, so it is --

(Laughter.)

MR. PLESSET: Thank you again.

I will now call for a short break.

(Recess.)

AFTERNOON SESSION

(1:20 p.m.)

MR. PLESSET: Let's come to order and proceed with our agenda item, Revision 2 to Reg Guide 1.97.

Dr. Siess, will you take over as Chairman of the Subcommittee.

MR. SIESS: Gentlemen, I'm going to have a moderately long Subcommittee report, which I hope will be compensated for by perhaps reducing somewhat the length of some of the other presentations, or perhaps even reducing the number of questions.

I wish I had the time to go through the history of Reg Guide 1.97, but that would take the full two hours. But let me do take a minute to remind you that it was first issued in December of 1975 and it was instigated by recommendations coming from this Committee about instrumentation to follow the course of an accident. And in its original form there was a requirement that each licensee or applicant would perform detailed safety analysis of postulated accidents, including LOCA and ATWS and a number of others, to determine the parameters that should be measured to follow the course of that accident, their ranges, their accuracies.

It referred to a couple of contract studies that have been made for the staff, one by Battelle - Columbus and one by Battelle - Northwest Labs, as helping them in that type of thing. And then they were to go on and specify the instrumentation needed.

There was something in the guide about quality level, about environmental qualifications by Reg Guide 1.89 with regard to isolation, et cetera, et cetera. This is strictly a forward fit, no backfit required.

Essentially nothing was done. Revision 1 in August of 1977, about two years later, was in some ways similar. The first requirement was the same, make detailed analyses of the accident, except now it specified the accidents in chapter 15 of the PSAR. Again it referred to the Battelle studies. There was a regulatory position about selectin the instruments.

But there was a new position added, Position which said, in addition to what you get out of these, we want certain extended range instrumentation, and this again had been culled out specifically by the ACRS.

And in the two years since '75 we frequently mentioned the extended ranges, and this was for containment pressure, radiation inside containment, reactor coolant system pressure, and something about measuring radiation release through identifiable release points, and then a whole lot of other criteria.

There was not much progress made by anybody performing the detailed safety analyses and coming up with instruments that would be needed or useful in following the course of an accident. The industry was not doing very much, nor was the staff.

Incidentally, Revision 1 was also a forward fit. The letter accompanying it to us said it was the intention to backfit it to all operating reactors. Later on they said, well, at least backfit the Position 3C, the extended range stuff. But there really was not much done.

Now, after Three Mile Island -- after the Three Mile Island Unit 2 accident, to put it crudely, I guess the staff and the industry finally realized what we had been talking about. And the staff started talking about implementing the Reg Guide. And in fact the Action Plan or the Lessons Learned Report called for the high-range instruments, and they are part of the Action Plan, and they are being called for now.

About that time, it became clear to the staff that the rest of the guide, the way it was written, did not get them anywhere. And so they essentially went about deciding which instruments should be provided. Before the guide had asked each person -- each Licensee to perform the detailed safety analyses and come up with a list. The guide was essentially revised and the staff came up with the list.

I did not say the staff performed the detailed safety analysis, but there was some work that was done by contract at some stage.

The industry, various segments of it, have also performed some of those safety analyses and come up with lists. And one of the problems, of course, has been that different people have come up with different lists.

Now, that is just enough background to tell you where we thought where we roughly are. But in August of this year, the Committee first began to -- that was not the first. We had previously reviewed Revision 1 -- Revision 2, I am sorry.

Revision 2 was reviewed in August at the Regulatory Activities Subcommittee meeting that I fortunately or unfortunately, depending upon your viewpoint, was not present at, and it was discussed -- presented to and discussed by the full Committee at the August meeting. The Committee did not concur in the recommendations of the Reg Guide at the August meeting and sent a letter to Mr. Dircks, I believe it was, saying why.

Now, there is a status report in tab 9 in which Sam has summarized what is in the letter, and the letter is also included for your information. But let me try to summarize what the Committee said.

First it said the guide in its present form is confusing and should be clarified. And some of the clarification could come out by eliminating what was referred to as a myriad of footnotes and cross-references.

There were three comments that are all related having to do with the scope of the guide and its relationship to other instruments and the systems -- I mean, to other systems in which the instrumentation will be used. Now, that is going to come up very frequently in this discussion and in the presentations. So let me explain what I think the Committee meant. I know what I mean.

There are instruments in the control room which this guide addresses. In addition, there are the SPDS, Safety Parameter Display Systems, the information that is transmitted to -- or the instruments that are in the technical support center, the emergency offsite support facility, the EOF, and the nuclear data link. And I am going to lump those things, the SPDS, the EOF, and NDL, under the heading of NUREG-0696, which is the -- I think it's the title of 0696, "Functional Criteria for Emergency Response Facilities."

0696 represents, say, the other uses in the emergency system. The other comments from the Committee -- there were three related to that. We said, either reduce the scope of the guide and explain the relationship between these instruments and the 0696 facilities, provide a listing to clarify the relationships between the instruments and the guide and the various emergency facilities. And it also had a comment about the requirements in the Action Plan and the requirements in 1.97.

There was a recommendation that some other instruments that had been culled out in NUREG/CR-1440, which was a contract study, that should be evaluated to see whether there should be additional instruments incorporated into the guide.

There was a comment regarding the requirement for thermocouples in BWR's, and a careful examination of thermocouples in BWR's should be made and this should include consideration of a number of in-core thermocouples; and it said additional efforts should be made toi resolve major differences between NRC and industry. And "industry" in that context I believe was intended to mean the American Nuclear Society writing group preparing a national standard, the ANS Working Group -- Writing Group, I think they call it.

So it was not approved in August and it was sent back to the staff. The staff has gone to work on this, and we learned in a Subcommittee meeting on Wednesday what the staff has accomplished. And we heard from various people, their opinions of what the staff had accomplished. We had an all-day meeting most of which was devoted to this. Those present beside myself were Bender, Kerr, Carbon, Mathis and

Ray, and we had three consultants present, Zudans, Lipinski, and Caton.

We have gotten comments from the consultants, and none of them felt it necessary to stay over to today to transmit their comments to you. But I will.

The document that we had prior to the Subcommittee meeting was called Revision 2, Draft 3, dated October 6th. At the Subcommittee meeting we were given Revision 2, Draft 3, October 30, which included quite a few changes, some in response to the comments they had received, and additional changes were made as a result of discussions at the meeting.

And you have had placed on your chair while you were having lunch the document that is now dated November 6th, 1980, Modified Draft 3. And I have not seen it myself.

The staff took the ACRS recommendations seriously, as they always do, and have done or tried to do everything that we said was unsatisfactory that needed to be done. In tab 9, following a copy of our letter to Mr. Dircks, there is a letter of transmittal from Guy Arlotto which summarizes what they did, and Sam Duraiswamy has summarized that on page 2 of the status report.

The staff has gotten together with the ANS Writing Group and tried to resolve as many of the differences as they could, and they have resolved quite a few. The staff has made a very serious attempt to simplify the guide, clarify it. They eliminated one table completely, with some 20 or 30 footnotes. There are two remaining tables, each of which has a fair number of footnotes. Nobody can figure how to get rid of those. They have eliminated a lot of the cross-references they had in the previous guide, six levels of qualification, environmental and other qualifications, seismic, and they reduced that to three. They have simplified it.

They were told to do something about the scope and the relationship between instruments in the guide and what is required in the other facilities, and they have done that be limiting the scope of the guide to instruments needed by he operator in the control room. They make no reference to other uses of those instruments or to what is required in the other facilities.

And this is a very important point, that they have tried to respond to the ACRS concern by simply saying: These are the instruments that we think are needed to follow the course of an accident, and the first place you need those instruments is in the control room. Now, where else you need them is not their job.

0696 does not tell you what instruments you need in all the other facilities. And there is in the NRC now a group called -- if I can find it -- Nuclear Data Integration Group. This is Group No. 47, Coordinating Group No. 47 or 48 or 50 of the staff, of which there are myriad. It is an inter-office group, the staff of NRR and Research, and they are trying to decide what instruments should be provided in the various facilities.

NUREG-0696 says that those instruments in Reg Guide 1.97 constitute a minimum set to be provided in the other facilities. There may be more, but as near as I can read it, between 0696 and inside NRC, which is explaining 0696, that says the nuclear data link and the emergency operations facility and the technical support center will all have access to these instruments on a call-up basis.

I am not sure I know what it means. Apparently they won't be dials or recorders, just a computer. I don't know. Somebody said at the Subcommittee meeting that that was not right, that people -- licensees would decide themselves or propose what instruments should be there. But that has been contradicted by something else. We will address this later, I assume.

At the Subcommittee meeting we had presentations by four people representing three groups. We had a presentation from the AIF, the Atomic Industrial Forum, and from NSAC, who had done work for them, reporting on -- chiefly discussing the instrumentation to be provided at the emergency facility and studies they have made of what is needed where.

Most of those studies were made since August. We had a representative speaking for the American Nuclear Society Writing Group explaining the differences between the guide and the standard. That is, you know -- maybe Mr. Ward doesn't, but everybody else should be reminded anyway -- the guide does except major portions of the proposed standard, takes exception to a significant section, and replaces that by certain other criteria.

There are differences. There are three kinds, basically. The guide requires certain instruments that the standard does not. There are two whole categories, D and E, that are not covered by the standard. So there is no argument there. They are in the guide.

But within the Class B and C, Types B and C, there are some instruments required by the guide and not by the standard, and these are not random. These are groups. They are instruments, backup instrumentation that the staff thinks ought to be in those lists, and it is categories that are in there.

There are still arguments -- or differences, I should say -- and the arguments follow between the qualification categories. These are qualifications for design and environment between the two documents, many, many fewer than there were previously, and there are some arguments still going on on ranges of instruments. And a couple of those we may want to hear about today. We'll probably hear about many of them.

But we had a presentation by a representative from Stone & Webster who had read the guide carefully, and had a number of suggestions and a number that the staff immediately picked up on, that that is a good one, we will fix it up, and some they had already fixed up.

The residual concerns that exist, some in the industry I will mention and some in the Subcommittee. The concerns that the industry has are the differences between the proposed standard and the guide: which instruments are included, certain qualification criteria, and ranges. Some people felt -- I think Mr. White of the ANS group -- that another round and they might eliminate all of the differences.

Now, I do have to point out that the changes that were made from August until now were all made in the Regulatory Guide. They were not made in the standards. There were some changes made in the proposed standards, but they are not substantive to our discussion. They were made in sections of the standard that the guide does not endorse, the guide replaces. So they are not substantive.

But they did think that another round and they would get closer together. My personal opinion, for what it is worth, is I think we have the differences down almost to irreduceible minimums for something like a Reg Guide. And I personally am not sure that we have to have that kind of complete perfection in a Regulatory Guide. It is a guide. People can argue about it. If it does turn out that there is something wrong about it, the staff usually can be convinced.

There are differences on qualification, criteria, range. All of these things still exist.

The Forum people and some of the others, their thoughts were expressed, are still concerned about the relation between the Reg Guide 1.97 instrumentation and the instrumentation readouts or callup capability in the other emergency response facilities. The Forum people would like for us to back up completely and start over working with industry in developing this whole spectrum of instruments. And this disturbed me a little bit, because they were in effect saying: Don't work with us; don't work with the ANS. And I am not sure that they meant that. But they said, let's start over.

We started around this thing, I think, at least four times, and I was not -- well, the Subcommittee I don't think is particularly receptive to that approach. The Subcommittee has a number of concerns that we think should be aired. One has to do with the other uses. And some of our consultants expressed that concern. Some of the members did.

I will come back to that. But it's something for you to think about.

There is a requirement in the guide to measure radiation exposure in the environments, not releases but exposure, at some undefined distance, at some undefined interval, but with an immediate and continuous readout. This information would be used in some not clearly defined way as far as the guide is concerned, but obviously to be used for determining emergency actions off-site.

It occurred to us that this was a very large step in the emergency planning, emergency action process. And there was quite a bit of discussion about this. There was an industry representative who thought it was excessive or impossible to do if you went very far off. The staff did not think they wanted to go very far out. They did not know quite how far they wanted to go.

It is a very open-ended requirement that could end up costing as much as everything else put together, depending on how it is interpreted. That is not what bothered us so much as the concept of using instrumentally to determine exposure rates, say, at exclusion distance, to take actions further downwind. And we asked the staff to discuss this further before the Subcommittee and make a presentation on that particular thing, on both the rationale, et cetera.

And I suggested that this should be at a higher level than seems to be appropriate within NRR. NRR is involved in this. This is just not all Standards Development people. And most of the discussion on this was coming from NRR people. So we invited anybody up to Harold Denton's level to come in and explain this use of this particular implementation, keeping in mind that one of the ACRS' objectives when we asked for instrumentation to follow the course of an accident was to provide information that would be useful in determining when to take measures offsite and what measures to take. And this is clearly in that category, although some of the instrumentation may be offsite.

We got into a discussion about the range of the instrumentation to measure hydrogen concentration and oxygen concentration in inerted and non-inerted containments. The industry complains about 30 percent versus 10 percent. And we got so far into a discussion of that and ran out of people that knew the answers.

Walt Butler, who sat through most of the meeting, but by the time we got to this Walt had run out on us.

(Laughter.)

I don't blame him. I would have run out too if I hadn't been Chairman.

(Laughter.)

So Walt is here. He was accused of being responsible for those, so if he would explain them or defend them, as the case may be. BWR thermocouples in-core or core exist thermocouples. The term "core exit thermocouple" had been used up until the time we wrote the letter in August. That letter said considerations should be given to a limited number of in-core thermocouples.

The staff announced, I can say rather proudly but I am not sure that is proper, that they had reached agreement with GE on in-core thermocouples, and the guide calls for these now. Before it said unresolved. What the guide calls for is two to four thermocouples in each quadrant of the core, located at a distance of one-fourth to one-third of the height below the top of the core.

These are to be installed in these thimbles traversing the in-core probes or whatever you call those things. This raised quite a few questions. One was, would they tell you anything, which was not exactly a new question. Industry has been asking that for several months.

Another was, did they need -- they were not core exit, they were down in the core. Do you really want to know what is happening up there? Walt Lipinski had questions about this. I think Caton thought they weren't worth a dime.

Sam, I don't have Caton's -- okay, fine, it is here. And besides, the Committee had said that a careful examination of their use should be made or studied. And we asked the staff if they had made a careful examination, and they said, no, but GE had.

So we asked them to invite GE in to present the results of their careful examination at this meeting. And I understand that GE will not be here, but that somebody from staff will be here to explain what GE did. So we plan to have presentatio on the -- the staff will make a brief one explaining what they have done.

We want to hear -- we have asked the ANS representative to comment on the differences. The other people have made oral presentations, did not see any need to repeat them before the full Committee. Walt Butler is here to answer the question about the hydrogen range, and there will be somebody from staff to explain how they arrived at the in-core thermocouples.

Now, Walt Lipinski raised a question as to whether ATWS was one of the accidents we were supposed to consider, and he said if it is the range on the neutron flux measurement is not large enough. It turns out on the BWR it has been revised to say now to use the average power range monitor, and that does go to 100 percent. So that is high enough, he thought.

But the PWR still says something like up to 5 percent on neutron flux. He says in an ATWS that is not good enough.

And in neither type reactor does the reactor coolant system pressure go high enough. For the PWR it goes to 1500 -- I mean, it goes to 3,000, I think, and for a BWR to 1500 psi.

MR. OKRENT: I thought the way it was worded was there was a footnote saying, we have not decided how high this should be.

MR. SIESS: We got that decided between the last meeting and this one.

MR. OKRENT: They have decided?

MR. SIESS: You have the latest copy.

MR. OKRENT: All right. Well, I am thinking of the last copy that was sent to me.

MR. SIESS: On the pressure?

MR. OKRENT: On the pressure. It still had a footnote saying they needed to decide the primary system pressure.

MR. SIESS: We will look it up. But it does not go as high, I think, as the calculated peak ATWS pressure before mitigation installations. I am not really sure about that. But this was a point Walt raised. He raised it -- we spent a lot more time talking about neutron flux than about pressure.

MR. OKRENT: I did not understand what you said about neutron flux. You say it goes to 5 percent?

MR. SIESS: The wording in the table originally said -- oh, my gosh, it got changed back. For a BWR it originally said 10^{-6} and 5 percent full power. Then they changed it to 10^{-6} and 5 percent full power, but in parentheses "source monitored at APRM." APRM goes to 100.

It now says 10^{-6} at 100 percent full power -- for peak -- for a boiler. For the pressurized it now -- that is on page 20A. Pressurized water reactor, now it says 100 percent. It got changed overnight.

MR. OKRENT: Is there another variable that goes to a higher neutron flux?

MR. SIESS: Ask the staff. I don't think so.

MR KERR: There has to be, because trip is not 100 percent.

MR. OKRENT: Exactly.

MR. SIESS: We have to make a distinction, gentlemen, between instruments and Reg Guide 1.97.

MR. OKRENT: Let me be quite specific. In terms of Reg Guide 1.97, is there a need to have an instrument that goes above 100 percent full power or not?

MR. SIESS: Walt seemed to be satisfied at 100 and we did not get a chance to explore that in that much detail. He was mainly interested in getting it over 5 percent. I think when he got it up to 100 he sort of relaxed.

He mentioned that you can get a peak that goes to 150 or 200 at ATWS, but it comes back down again very fast.

Does the staff want to try to address that one later or do you want to try to settle it? If you think you can settle it, try to do it now.

MR. ROSENTHAL: I think the actual instruments would go to 150 percent of full power. I can't see at this point mandating additional hardware be installed.

MR. OKRENT: I am curious, I must say. What is the position on pressure now? For a Westinghouse plant, what is it you are asking?

MR. SIESS: Just a minute.

MR. ROSENTHAL: 3,000 psi.

MR. SIESS: Page 36 --

MR. HINTZE: the footnote is there that it may be revised upward after the studies are complete.

MR. OKRENT: I want to ask a question in that regard.

MR. OKRENT: For a boiler you have 1500 and no footnote.

MR. OKRENT: Will you revise it upward on a Westinghouse plant if they calculate 3100 or 3200, or will there be some other judgmental basis or what?

MR. WENZINGER: In the case of 3,000 pounds -- excuse me. Had it been calculated, I would estimate that we would probably raise the range to in the neighborhood of 35000.

MR. OKRENT: I must say, I would have thought you would take the primary system up to what you think is a failure pressure on some kind of not too accurate reading, because I for one do not think we are able to foresee, you know, all the situations in which we might be interested in pressure. And to tie it to what somebody has calculated in some particular sequence strikes me as going exactly in the opposite sphere from which this whole thing is inspired, namely the original problem with everything was for the design basis event and it did not measure anything beyond it. And now you say, well, you have sort of a new design basis for these instruments, namely what they calculate in ATWS with a little margin.

Pressure, it seems to me, you really ought to have a range, as I say, that goes up to --

MR. SIESS: Let me just --

MR. OKRENT: Perhaps you should go well above 150 percent, because --

MR. SIESS: Let me just point out that in Revision 1, Position 3C, which was the extended range instrumentation, the staff had already agreed they were going to implement that, remember? Item C, reactor coolant pressure three times design pressure.

MR. OKRENT: I don't have any problem with three times.

MR. SIESS: That may not be quite as high as your rupture pressure.

MR. OKRENT: It is in the ballpark, sure.

MR. SIESS: It is not one and a half.

MR. OKRENT: Exactly, it is three --

MR. SIESS: It is not one and a half. So we backed off from that. And frankly, I cannot see that much difference between 3,000 psi and 1500. You don't have either one now.

MR. BENDER: I would like to at least take a minute to challenge the suggestion that Dave has. There are some places where you in fact will want to have the range of the instrumentation very large, and containment is perhaps one of them. But it does not make much sense to put in instrumentation that will measure a very high pressure when you know the only time that that pressure will occur is if there is a very short interval of time in which that pressure is imposed.

I am concerned about putting in developmental types of instrumentation or specialized types of equipment to take care of the very rare accident, when the operator really cannot use that instrumentation for any purpose. The high pressure coolant pressure measurement is one of those things.

MR. SIESS: I would like to suggest that that is one item I want the Committee to discuss, but I had sort of hoped we would discuss it after I finished with my Subcommittee Chairman's report.

MR. PLESSET: Okay. Go ahead, Chet.

MR. BENDER: I will hold back.

MR. SIESS: I want to go on to one item I mentioned before. That is the scope of the guide and the relation of these instruments to the emergency response facility situation. At the Subcommittee meeting I tried to limit the scope of our discussion, with the simple objective of getting through in one day to what was in the guide, that is, a selection of those instruments -- those parameters and the instruments, ranges, et cetera, that are necessary to follow the course of an accident without regard to how those instruments would be used, other than that they would be in the control room and the idea that some of them will be tied into the SPDS, which also will be in the control room.

What came out in the discussion, I obviously could not limit it to that. My gavel was not long enough. And what came out in the discussion was, there are concerns in the industry, there are concerns from Walt Lipinski and others, that the qualifications of these instruments may be changed by lead time into external facilities, that the way they are hooked up to external facilities, to a computer or not to a computer, the way isolation is provided, et cetera, et cetera, could change the reliability of the instruments in the control room itself.

And I suggested at one point that we might get around some of those and still be able to keep Reg Guide 1.97, which does list the necessary instruments, separate from these other questions by simply advising the staff that the implementation date for Reg Guide 1.97 should not be set independently of the implementation -- of the decision regarding the other uses of these instruments. That is, that the implementation date should be set so that people have the entire picture of how these instruments are being used before they start ordering or designing them.

It is a little late for that, because some of them have been required by letters and orders. But that is not new. That may or may not be a suitable solution.

The Committee apparently at the August -- not apparently, because I read the transcript. The Committee at the August meeting did address all these interfaces, interconnections, et cetera. And I would propose you want -- you might want to continue that discussion, but consider the possibility that, by simply not requiring people to start soon on implementing this, that they might be able to work this thing out.

That inter-office committee is supposed to come up with some answers. And according to inside NRC memoes from reliable sources, it says it is expected to have something out in one to three weeks. It did not say one to three weeks from when, but that is enough.

So I would like to propose the following: that we have a brief presentation from the staff -- they can make it as long as they want, and they will -- that we hear from a representative of the ANS standards-writing group, and that -- that is Mr. Ed Wyatt -- and then that we at least discuss the question of the BWR thermocouples, or at least open that to discussion, because I think the Committee will want to. If you don't want to, that is your business.

If we discuss the hydrogen emission range and get that rationale, since it was not settled in the Subcommittee and it seems to be of some interest, and we discuss the requirements for the use of the environs radiation exposure instrumentation; and then that we discuss this integration into the 0696.

Is Warren Ramos here? We have somebody -- do you represent the inter-office coordinating group.

MR. RAMOS: Yes.

MR. SIESS: They can address those things. The staff can address that question and we will take it up as it comes. That was Lipinski's concern, and I think all of Lipinski's concerns are included. He was interested in the ATWS condition, neutron flux and pressure. He had concerns about the in-core thermocouples and what they would indicate about cooling of the core over its entire height. And he was particularly concerned about the use of computers in integrating all of these systems, the possibility where you have it hooked up so one failure would knock everything out.

Those are all within the scope of the things I mentioned. Does that sound reasonable?

MR. MARK: Okay.

MR. SIESS: I apologize for the length. That is a factor of about 20 to one on the time that the Subcommittee took. Oh, yes, and Bill Coley made the presentation on the AIS study which addresses all the instruments -- needed instrumentation and miscellaneous uses, and he did not request time for making a statement at the full Committee meeting, but he is here and if questions come up about that he will be very happy to answer them or to make a short presentation.

So so we have people available on almost any subject -- no, I will not say that.

(Laughter.)

I would like to just remind the Committee of something we have been fussing at the staff for -- I won't say months or years -- but about getting this thing out. And the last six months we have been the delaying factor and not the staff.

MR KERR: I would say that is a very charitable view.

(Laughter.)

MR. SIESS: In favor of who?

MR. MOELLER: In terms of the Reg Guide, I have looked at it, but I need help on certain details. When we met with the RSK group and talked about instrumentation, they talked about, to the extent possible and where practical, they located instruments outside of the containment, so that not only would they not be harmed by the environment after an accident, but they could be repaired.

Is there any of that kind of thinking in this guide?

MR. SIESS: I don't believe there is explicitly. We will let the staff answer -- make a note of it and answer it as part of their presentation. There are qualification requirements.

MR. MOELLER: Right.

MR. SIESS: The ones that are in a potentially hostile environment must be qualified. Obviously, you can move them out of that environment, but an instrument must be qualified for whatever environment it is. It might be this room.

MR. MOELLER: Well, they do address it indirectly on page 3. But I just wondered if they promoted --

MR. SIESS: It is not all that simple. You've got to have -- you have sensors that have to be --

MR. MOELLER: The sensors do have to be.

The second question was, is the reliability and accuracy of the instruments addressed in his guide?

MR. SIESS: Accuracy is not addressed in the Reg Guide. That is addressed in the standard which is endorsed by the Reg Guide. If you don't have a copy of the standard, we will get you one. We just did not look at the details of that, and I think the staff is satisfied with the standard addressing accuracy.

MR. MOELLER: What about reliability?

MR. SIESS: The qualification categories essentially define levels of reliability. There are three categories. The lowest is simply not Class 1-E instruments, but good commercial -- good grade commercial instruments. That is the lowest category. The others are progressively higher, up to seismic 1-E and so forth, and presumably that controls reliability. I say presumably. We don't have that much proof, I guess.

MR. MOELLER: At the same time, presumably someone is looking at LER's and feeding back the information on the performance of instruments into this. Why I mentioned that --

MR. SIESS: No, I wouldn't --

MR. MOELLER: I said presumably.

MR. SIESS: I would not begin to presume that.

MR. MOELLER: We were talking about hydrogen and oxygen measurements, and I will repeat what I think I said recently. I just looked for one week at the LER's and I may have hit a vintage week, but there were six reported failures of hydrogen monitors just in the group of LER's.

MR. SIESS: Incidentally, for certain instruments -- and I am not sure about hydrogen -- redundancy is required. There are certain parameters where diversity is required, to so-called backup instrumentation, and these are all addressed in the categories.

MR KERR: Were there six failures or six LER's?

MR. MOELLER: There were six LER's.

MR. SIESS: There might be one failure.

(Laughter.)

MR. SIESS: Mr. Chairman, I have not asked the other member of the Committee. I think we might well ask the other members of the Subcommittee for comments; Mr. Bender, let's say, as to the scope, for one thing. Shall we do that?

[illegible]: Please.

[illegible]S: I will take them in the order I have them on my list. Mike?

MR. BENDER: I think Chet did an admirable job of summing up what was discussed. I want to add a few points that I have a slightly different perspective on, rather than standing there and -- first of all, there was a lot of discussion of the question of what is meant by "qualification." And while the staff allows and provides for redundancy and considers to some degree repairability and the diverse use of informational sources, and even deals with the question of when to isolate safety-related from non-safety related equipment, the people that are on the receiving end and have to apply the standard do not have any perceptible rationale for how to make those decisions.

I think you have to conclude it is going to be a cookbook and those people that are going to have to deal with it are going to have to deal with it as a cookbook. My own perception of that is it will lead to a lot more instrumentation than is needed and a lot more complication in the system than is desirable.

But that is something that the Committee will have to judge. It probably will be worked out in the application of the guide. It would have been helpful if the guide had spent more time trying to develop that rationale.

With regard to the instrumentations themselves, I think we have to recognize some of the most important requirements involve developmental types of instrumentation. We do not yet have anything that indicates unambiguous coolant level in the reactor pressure vessel. But that is one of the most important instruments to be included in this thing.

We don't yet have the instrumentation that defines radionuclide content in the primary coolant system or in the containment, but we do know that we can get something. But that is still to be defined.

And thirdly, I think there is the matter of real time response of instrumentation that is external to the containment If it is to be used to trigger emergency actions. Those three things may be the most important areas where we need instrumentation to follow the course of accidents.

A lot of the other instrumentation is essentially instrumentation that is already in the plant, and the issue is likely to be more whether you can rely on that instrumentation without some redundancy or some improvement in its qualifications. And recognizing that the instrumentation exists in the operating plants and is designed in others, we are going to have to deal with the question of what the impact would be of asking for a massive change in the qualification requirements.

With regard to the real need of the instrumentation, I wanted to offer some thoughts that I have concerning what might be our criteria for judging these things. First of all, there is a need to have instrumentation to trigger emergency response, and that has to do with what perhaps is getting out of the containment or what has gotten into the containment.

Secondly, there is the question of what instrumentation is needed to provide guidance to operators in unanticipated accidents. Now, if we put too much into this area we may wind up inundating the operator with information. And as a matter of fact, the Ohio State review of this thing suggests the only way it could be done is by adding some kind of computer to analyze the information. And we will have to think about whether that is a useful option or not.

Thirdly, there is the question of how much instrumentation is needed to evaluate the extent of the accident as it progresses. We may want to know how fast the pressure is rising in containment. We may want to know how fast pressure is rising in the primary coolant system. It is not clear to me that we need to know the peak pressures in either case, as long as the operator knows enough to be able to diagnose his actions.

There was some discussion yesterday at the fact that some instrumentation is needed for the purpose of deciding whether to start up again. I would argue that that is an unnecessary or undesirable characteristic of this instrumentation, because we will never know what we need to assess the damage and it is unlikely that we could put in the kind of comprehensive instrumentation that might be considered.

A last point I want to make is that we really need to make sure that we don't overwhelm the operator or the control boards with excessive instrumentation. The criticism that was made at TMI was partially that he had too much information to deal with. I think we have to recognize that these requirements may multiply the number of instruments he has to look at and evaluate, and I think that that ought to be considered.

And that is all I want to say.

MR. SIESS: Okay. Bill?

MR KERR: I consider this version of the draft

Regulatory Guide a decided improvement over previous versions. I would hope that we could give approval to it with minor modifications, not because it is in a form I want to see final, but I think it is far enough along that with reasonable wisdom in its application it could be used.

I have some reservations, as some of the other Subcommittee members did, about the thought that has gone into the specification of dose rate instrumentation offsite. It seems to me if we can persuade the staff -- maybe indeed I have not looked carefully and they have changed it. But if I could persuade them to put that somewhere else, the quality of the work might be enhanced some.

I have no further comment.

MR. SIESS: Max?

MR. CARBON: I think the summary and the added points have both been excellent, and I guess I have nothing worthwhile to add.

MR. SIESS: Charlie?

MR. MATHIS: One question, I guess. This did not come up in the Subcommittee meeting, but a disturbing bit of information in the little epistle called "Inside NRC." In the latest issue of that, where it discusses 1.97, it mentions this is a minimum listing of instrumentation required, and that additional parameters may be called up at a later date. And that to me then is an open-ended situation, if that is true, and I would like to hear some more about it.

MR. SIESS: Okay. Jerry?

MR. RAY: No additional comments. I think he did an excellent job in summarizing a very difficult topic.

MR. SIESS: You have a copy of Caton's comments, and I summarized Lipinski's for you. And Zudans' again was concerned about the use of the SPDS.

That completes the Subcommittee report, Mr. Chairman.

MR. PLESSET: Chet, is it your view that the NRC should proceed next?

MR. SIESS: Do you have a question?

MR. OKRENT: I have two questions. Is it the Subcommittee's impression that somewhere on the plant now there exists something that will measure the power approximately if it goes to 150 percent or 200 percent or 300 percent or to 100 percent or 500 percent?

MR. SIESS: I don't think the Subcommittee can answer that, Dave.

MR KERR: If you can answer it the way it was posed, which was is it the opinion of -- isn't that what you said? It is not my opinion that one can measure 400 percent of operating power.

MR. OKRENT: So in other words, if they had a transient, the ATWS or something else, do we know at what power level you would no longer get a reading on the computer or on some permanent record?

MR. SIESS: Let's ask the staff.

MR. OKRENT: Okay. That is one question I have. Do you want to deal with that now. I have a couple of other questions, but that is fine. Let's ask the staff.

MR. WENZINGER: Okay. Dr. Okrent, if you are speaking of neutron flux and measurement of power levels through that mechanism, to the best of our understanding the range of those instruments is generally limited to 150 percent of power, 150 percent of full power.

MR. OKRENT: And that is limited by what?

MR. WENZINGER: The range of the instruments that are currently installed. Principally the current measuring capability of the ion chambers and the associated electronic switch is, for that power level, on the order of a milliamp or so.

MR. OKRENT: That depends on the full range of instrumentation trying to measure accurately at 20 percent or whatever, and it can go up perhaps too high before it gets excessive. In other words, it is not impossible -- not necessarily difficult to design something that could tell you.

MR. SIESS: You asked if it was there.

MR. OKRENT: Right. I am trying to understand. Okay.

Now, is it thought that if a transient were to occur in which the power went above this power level, 150 percent, that such information would not be of interest to the shift technical advisor or the people back at the instrument center or back at the facilities headquarters? Not while it is occurring. I am not talking about on-line, because I am assuming that at that power level it is not a steady state situation.

MR KERR: That is another Reg Guide. This is only for following the course of the accident for the operator.

MR. OKRENT: There is another Reg Guide?

MR KERR: Must be.

MR. OKRENT: I don't think so. It's thought that this -- there is no way in which such information might have an impact on what you thought should be done and what the status of affairs was, or so forth? I don't fully understand what the staff's thinking is.

MR. SIESS: You are hypothesizing that you have a record that shows that the flux meter went off scale, came on scale. And the question is: Would knowing where it went to affect how you managed the accident?

MR. OKRENT: And what you did thereafter.

MR. SIESS: And what you did thereafter.

MR. OKRENT: I can perceive things where I would be interested. I don't know if the staff would.

MR. SIESS: Is there a caucus going on back there?

MR. ROSENTHAL: Surely one of the functions --

MR. SIESS: Identify yourself, please.

MR. ROSENTHAL: Jack Rosenthal, ICSB.

Surely one of the functions of the guide is long-term verification. And we did envision scenarios in which, in order to take long-term action, one would like to know if a scenario is involved. An example at TMI-2 was the decision on whether to depressurize or not, and that was influenced by the fact that the thermocouples were somewhere reading superheated conditions long after the temperature was low.

We did not pick up -- we did not address extended range on power, but we do have diagnostics of the condition of the core in terms of radiation releases, et cetera.

MR. OKRENT: Well, I must say I think one is apparently neglecting an opportunity to get information that under some circumstances I think could be quite interesting, quite relevant to some of the decisionmaking in the minutes or hours after the actual power spike occurred. So that is a personal opinion.

On pressure, again, do you not foresee any reason why you might not be interested -- let's talk about an example, a PWR -- whether or not it reached 4,000 or 4800, in other words, if it went off scale at either 3,000 or 3500 and, let's say, came back? Do you think that might not have a bearing on some of your thinking with regard to recovery from a situation?

I am not going to try to explore the question to --

MR. SIESS: We discussed that in the Subcommittee and we were told that recovery is really not a concern.

MR. OKRENT: I mean recovery down to cold shutdown when I say recovery. In other words --

MR. SIESS: Okay. It was addressed previously.

MR. OKRENT: I don't mean recovering the plant now. Are there no circumstances where you think having the thing go off scale and come back on has been a possible significant disadvantage?

MR. ROSENTHAL: I can imagine one in which it would be useful, as follows: You would like to know if you are in an incipient failure mode and if you suffered a severe pressure pulse. You see that you are at some point maintaining now some system integrity, but you are concerned that because of prior events you are in an incipient failure mode. And then your actions as far as how fast you want to do something else might change.

MR. OKRENT: I think that is a fine example. In any event, thank you for giving that example. And I think one could equally well find one -- anyway, it is my impression it is not developmental to make these measurements. I don't think they have to be made very accurately. In my opinion, we are interested in 10 percent accuracy, perhaps, at that point, not 1 percent, if I can pull a number out of thin air. I will leave it at that.

MR. SIESS: What I propose, Mr. Chairman, let the staff start off, and then I think if you would let the representative from the ANS Working Group make some comments, it would be appropriate, Ed Wyatt, because this is tied closely to the proposed standard and that was an issue last time. And much of the staff's effort has been in that direction.

And then we can explore with representatives of the staff present particular issues that the Subcommittee culled out and others the Committee may bring up.

MR. PLESSET: All right.

MR. SIESS: I would not object to a break before we start.

MR. PLESSET: How does the Committee feel? Okay, we'll take a break, yes.

(Recess.)

MR. PLESSET: Will you go ahead?

MR. WENZINGER: Good afternoon. My name is Edward Wenzinger. I am chief of Reactor Systems Standards Branch in the Office of Standards Development.

It has been my experience to have dealt with this Regulatory Guide for quite some time now. Mr. Hintze of my staff has been with us since the beginning.

I will try and go quickly through the recent history of this guide. Dr. Siess has told you about the ancient history and some of the more recent modern history on this guide, and I will just summarize that.

Draft 2 of Revision 2 of Reg Guide 1.97 was reviewed by the Regulatory Activities Subcommittee on August 6th and by the full Committee on August 7 of this year. They referred the guide back to us to consider your concerns and you outlined these in the Chairman's letter dated the 13th of August. The ACRS concern in part will be detailed, with the guide's technical provisions and particularly the major differences between the staff and the industrial representatives who commented on the guide.

In an attempt to resolve this concern, we met with members of the American Nuclear Society, the Atomic Industrial Forum, the Nuclear Power Engineering Committee, and the IEEE, some fellows from the Ohio State University and others, where differences were discussed. This took place on September 5 at NRC headquarters.

Agreement was reached in several areas which brought the views of the commenters and the NRC staff into sharper focus. For example, the guide was modified to focus on monitoring requirements, control room operating personnel, definition of design basis accident events, as in the ANS standard.

We also had a follow-o. meeting, September 25 and 26 in Denver under the auspices of ANS, and a detailed review of the Type B&C variables was made during this meeting. Additionally, the Atomic Industrial Forum has developed independently of this effort a list of variables needed by the control room operator and a preliminary version of this has been reviewed and considered.

Reg Guide 1.97, this review and comparison did include the Type D and E variables in the guide. It is believed by the NRC staff that the major differences between the staff position and the people who commented on the previous versions of the guide have been resolved.

Incidentally, you were sent on August -- excuse me, October 15 -- a copy of the guide, and between then and now there have been some revisions made. You have a copy of the version that is accurate as of yesterday, as a result of comments received in between October 15th, the Subcommittee meeting, and as a result of the Subcommittee meeting this past Wednesday.

About 99 percent of the changes that have been made in the guide since it was sent to you on October 15 have been changes in the list of variables. The ANS standard that is endorsed by this guide, ANS 4.5, is currently in the final stages of development by ANS, has been approved by the Nuclear Power Plants Standards Committee of ANS, is expected to be approved for final publication momentarily. And it is expected that this final publication would take place around the first of the year.

With regard to the ANS -- excuse me. With regard to the ACRS comments, there were roughly seven in number. If you like, I would go over those individually and give you roughly what our response was to them. I will assume that you would like to hear about that. I will keep my remarks brief, though.

The first comment had to do with the scope of the guide and reducing it. We have in fact reduced the scope of the guide to concentrate on the needs of the control room operator.

The second comment had to do with checking with the NRC Action Plan. We have done that. There were nine variables explicitly culled out in the NRC Action Plan having to do with TMI and those are included in the guide.

The Committee requested that additional clarity and guidance be given to avoid confusion in footnotes and cross-references. And we have in fact, as the Chairman of the Subcommittee noted, done considerable work in that area. We have in fact deleted one of the tables. We have removed a number of cross-references, and tried to make the relationship between ANS 4.5 and the guide much clearer.

The Committee referenced NUREG report CR-1440 and urged that a study be completed to assure important variables that needed to be measured are not overlooked, and we had in fact previously looked at the recommendations in this report and we did make some changes in the guide as a result. This was reported to you at the last full Committee meeting on this subject.

Another comment recommended --

MR. OKRENT: Excuse me. Were you therefore suggesting to us that you completed that part of the matter?

MR. WENZINGER: As far as reviewing that issue of that report, yes, that is correct.

The next comment was careful consideration of the need for BWR core exit thermocouples be made. We have an individual here from the NRC staff who can address that, and he will as a separate matter following my presentation.

The next comment was, the Committee believed that additional efforts should be made to resolve major differences between the NRC staff and industrial representatives. We have in fact done that. The Committee believes that the guide should be ready for publication by the end of the calendar year, or else this matter should be identified as an unresolved safety issue.

We believe that it should be issued by the end of this year and would like for it very much not to become an unresolved safety issue. With your assistance, we will accomplish that.

(Laughter.)

MR. OKRENT: Could I come back to the question that we were just talking about? In fact, I very much don't want that to keep you from getting this out this year. But I guess I am less than convinced at the moment that I know that the look at other accident scenarios has been sufficient to know that we may not be missing some important information that is not all that hard to get if you have thought about it beforehand.

So it seems to me you are sort of dismissing our comment on the basis that you have looked at it already before and told us about it, and in fact why did we even bother putting the comment in the letter. And in fact, I thought we had heard that you had looked at it, but it was not clear at the September meeting how you knew it was not useful to try to pursue some of the things that were recommended in the report and were not in the guide.

And also, this was illustrative. I did not think that report was intended to be the be-all and end-all. I am trying to ascertain whether there is some intent - if not this year in connection with this version, which you might in fact get out this year -- whether there is some intent within the group responsible for this to see whether there are other potentially important plant status parameters or whatever.

MR. WENZINGER: Dr. Okrent, yes, there may well be. This report was only an interim report. The work is still continuing, and it is my understanding -- and the rest of the staff can correct me if I am wrong -- but I believe the actual work on CR-1440 will not be completed until early next calendar year.

We will in fact be sensitive to the work that comes out of that, and if there are additional recommendations that have not been included in the Reg Guide they will certainly be considered for inclusion in the next revision. I do not expect that this will be the last revision of Reg Guide 1.97.

MR. OKRENT: Okay, thank you.

MR. WENZINGER: I think Mr. Hintze feels like it is his life's work.

(Laughter.)

Let me also mention that we have in fact gotten comments from the ANS and from the AIS, and certainly have

ANS people speak for themselves, but our reading of what they said was I think summarized by the following: that they felt we made considerable progress -- and I agree -- and that the number of differences are fairly small -- and I agree with that also.

They have also commented on the ranges of a few variables. We have, I think, come to a reasonable agreement on some of those. Some we have agreed to disagree. On Type C, design and qualification category, I think we have a basic disagreement there. We believe that the Type C variables that monitor the status of the various boundaries to the release of fission products should in fact for the key variables be made to be redundant. The ANS I believe disagrees with that. I will let them speak for themselves on that.

The ANS at the moment does not include the potential for breach of the fuel barrier, or for the potential for the breach of the principal primary pressure boundary.

BWR in-core thermocouples there was some dispute on. And again, we will speak on that later. There are scope differences between 1.97 and 4.5. And in fact, if you talk merely about the numbers of differences, this is where the greatest number of them lie. The ANS does not include the Type D and E variables, and we in fact do. The ANS does not include backup or verification variables, and we do. And the greatest number, again, lies in those.

ANS in fact did point out one or two omissions that we had in the guide, and we have picked up those omissions.

With regard to the AIF listing, as far as the numbers are concerned, if you just look at the bottom line numbers it looks pretty good. In fact, in the case of the boiling water reactors, Reg Guide 1.97 has roughly 54 variables, and AIF had 55. That was 13 in the B and C categories, 24 D's, 6 E's.

It is not quite that good, though, as far as agreement is concerned. There are 45 of those variables, however, that are common among the AIF and the staff list.

In the case of the PWR the numbers are 56 and 56 for 1.97 and AIF respectively, and 47 of those variables are common.

Mr. Chairman, those are the extent of my prepared remarks. If you would like to ask questions, I would be glad to answer them if I can. I think the most useful way to do this would be to take the specifics that were brought up by Dr. Seiss.

MR. SIESS: Yes. I had thought we might hear from Mr. Wyatt just to get the perspective. But if there is no objection, Mr. Chairman, Walt Butler would like to get out of here. He has a very narrow range of expertise in this particular case. So I would like to suggest that we take up that measurement.

Now, there have been -- go on up to the lectern, Walt.

Let me call the Committee's attention to the issue on page 23 on Table 1 for the BWR's and on page 40 in Table 2 are the measurements we are talking about, and they have been changed since the Subcommittee looked at them. The questions may have gone away, but I think if Walt could give us a little explanation it just might settle it.

MR. BUTLER: I hope to limit this to no more than five minutes, to go through the rationale a little bit. The monitors for hydrogen and oxygen concentration inside containment was considered from the perspective of this background.

(Slide.)

There always was a requirement for hydrogen monitors by 10 CFR 50.44, combustible gas control, which requires that hydrogen concentrations be limited to less than 4 percent in a non-inerted containment. If the hydrogen concentrations go above that number, other measures are needed such as inerting. And if you inert, we define inerting as oxygen concentration being below 4 to 5 percent, and that number is in the technical specifications.

We now come to the availability of the TMI Action Plan, where in item II.B.7 of the Action Plan it requires that certain analyses be done. Those were done in a preliminary way and recorded in SECY-80-107, which the Committee has already heard.

And let me just flash this one up.

(Slide.)

80-107 is the report that contains this curve, and I will get back to that one later.

(Slide.)

Item II.B.8 of the Action Plan calls for rulemaking proceedings on degraded and melted cores. When that rulemaking proceeding is completed, we expect to have acceptance criteria for licensing purposes, and it should cover the instrumentation requirements associated with hydrogen and oxygen concentrations.

And finally, another item in the Action Plan is Item II.F.1.6, which requires hydrogen monitors, but not in the final draft -- it does not in the final draft specify range or accuracy or time response. While working on Item II.F.1.6 with the industry, we had some feedback and we learned that hydrogen monitors are not readily available if you want to measure them above 10 percent concentration. They have to work at it.

One technique would be to use the dilution technique. In general, the active elements of these instruments have to be located outside containment, and you have to use pipelines, maybe 1,000 feet of pipeline, to draw the suction from the correct locations. Accuracy is degraded when you increase the range. If you go from 10 percent range to 30 percent range, you lose some amount of accuracy.

And I guess when we specified the range in this Regulatory Guide, we took into account in a judgmental way the disadvantage of having a very broad range of hydrogen concentration.

And finally, we understand the response time for these monitors to be fairly slow. Nevertheless, we believe they are fast enough for the kinds of operator action that we have in mind that would result from this information.

MR. SIESS: Are these instruments basically a thermocouple and a heating wire or what?

MR. BUTLER: There is a variety of them. That is one where you have combustion or recombination of hydrogen on the surface, and then you measure the temperature of that.

MR. SHEWMON: I was thinking simply of conductivity meter like an old Pirani gauge in a vacuum.

MR. BUTLER: That is another one, where you put the hydrogen in solution and you vary the conductivity of that solution. The other is a catalytic device where you recombine it on the surface and the surface heats up and you measure that increase, and it is callibrated for hydrogen concentration.

MR. SHEWMON: Thank you.

(Slide.)

MR. BUTLER: Regulatory Guide 1.97 provisions we feel are reasonable compromises, considering the present state of the staff's requirements relative to degraded core, is summarized in this table. They are essentially the same in your latest version, but in a different form. I think it is more readily understandable in this form.

For containment type PWR, large dry containment, we would recommend a range of zero to 10 percent. For the ice condenser containment, which is about one-half the size of large dries, we would recommend a range of zero to 30 percent, recognizing that hydrogen mitigation systems are required for the ice condenser. Generally, we would hope you would burn the hydrogen before the concentrations get much above 10 percent, but locally you might have some higher concentrations, and we think that that range would be enough to pick up locally high concentrations.

For Mark I and Mark II BWR's, they will all soon be required to be inerted. They are essentially all inerted now, and in that event, since they are small containments, we would propose a range of zero to 30 percent for hydrogen. Now, that will not cover all the hydrogen you can get out if you have a substantial amount of metal-water reaction. But we think if you measure more than 30 percent, you know generally you are in a pretty sorry state of affairs.

And with respect to the inerted containments, it would be sufficient to monitor the oxygen content, making sure that you continue to stay in the inerted mode by use of the recombiners, et cetera. And for that reason, we show on the right side there the O_2 range of zero to 10 percent.

And finally, for the BWR Mark III, which at this time is not required to be inerted, we would propose zero to 30 percent, primarily because its containment size is about 1.5 million cubic feet. It is relatively small. At this time we don't require an oxygen meter. On the other hand, if at a later time they decide to inert the Mark III's -- we don't think it is likely, but if they did -- then we would have an O_2 monitor as well.

MR. OKRENT: Before you take that one off on the BWR Mark I, as an example, if you had 100 percent of the cladding reacting, about what would you expect the percent to be?

MR. BUTLER: It will appear on here. If you had 100 percent -- this is the Mark I-Mark II curve -- you would have about 70 percent concentration of hydrogen.

(Slide.)

MR. OKRENT: All right. Now, suppose you are sitting there as shift technical advisor or at the incident center or back at whatever is the operational command post for the utility and you have an inerted BWR containment and it reaches 30 percent and goes off-scale. Do you think that you would not be interested in knowing, has it gone to 60 percent, assuming it might, or in principle it might even exceed 70 percent under other circumstances, other things interacting?

Don't you think that this could be a relevant parameter?

MR. BUTLER: It probably is. There would probably is -- there would be an interim in determining exactly what the hydrogen concentration is, and we believe for that occasion you can rely on the grab sample. It takes longer.

MR. OKRENT: How long is "longer"?

MR. BUTLER: I suspect on the order of hours.

MR. OKRENT: You think you would be content, sitting there at the incident center, to wait a couple of hours, say, please take a grab sample? Tell your inspector, please ask them if they can take a grab sample. He says: Okay, I will call you back in three hours with the result.

Do you think that would be fine? Would it?

MR. BUTLER: I think that there are many other instruments that they could rely on for understanding the general status of the core. I think that that the background information that I provided here indicated that there was a general limitation on the availability of instruments, and you make a prescription at this time that was real broad, we think would be nonconstructive.

MR. OKRENT: What is another one that will tell me that 90 percent of the cladding has interacted?

MR. BUTLER: Well, I guess you would have process instruments on the reactor. It depends primarily on the particular scenario you come up with. If you are working with a small break and you still have the primary system pretty much intact, you would have your pressure, your temperature instruments providing some information.

MR. OKRENT: I must say, at the moment I have a little bit of trouble going from some kind of gas or steam pressure and temperature in the primary system measurement and translating that to the amount of cladding which has undergone metal-water reaction. If you can tell me how I would be interested.

In fact, I can envisage a situation where those things stay almost constant while the amount of cladding interaction has been changing drastically. Can't you?

MR. SHEWMON: Dave, you feel that what the operator would do under these conditions would be considerably different if there was 40 or 80 percent hydrogen? Is that right?

MR. OKRENT: I think it affects a variety of things. I think first, at the moment to me the most direct measurement I can think of of the state of the fuel in the degraded situation, because it is harder to go from a radiation measurement. It would be nice if you could do it from a radiation -- you would have to take isotope to isotope and take it apart and know how much has gone out. I think that is much harder.

So to me this is the best handle you have on the state of degradation. It is imperfect, but by far the best. And if something came, you know, that you did not have ready, that you were ready to use, you would have a better feeling for what it was you were putting the water on or whatever.

And it also might affect the possible other actions that were available. So I myself would like very much to know what the hydrogen concentration is in the containment. And again, I do not want a very high accuracy, but if you can do it by dilution technique and tell that it is at 70 percent, I would give that away --

MR. PLESSET: I think other people want to make a comment.

MR. SIESS: Dave's question brings out, I think --

MR. PLESSET: Let's get Kerr's comment.

MR. SIESS: This relates specifically to that question.

MR KERR: So does mine, I think.

MR. SIESS: I wanted to explain something about the way the Committee might think about the question before we go on any further.

MR KERR: You are going to explain how the Committee might think. Okay.

(Laughter.)

MR. SIESS: I might suggest something to you, because it is going to come up again. I think the way this thing is put together has certain deficiencies. If you look on Table 1, you will find that the hydrogen measurement comes under the heading of containment. And Walt's presentation is thinking about it under the heading of containment. And Dave is thinking about it under the heading of fuel cladding, and it does not appear there.

The thinking of the staff in putting this together was not looking at hydrogen concentrations as a measure of the state of the fuel cladding. I don't know how many places there are like that, but I think it is important.

MR. OKRENT: If you went through the various accident scenarios, some of which are done in that report

IMAGE EVALUATION
TEST TARGET (MT-3)

6"

MICROCOPY RESOLUTION TEST CHART

IMAGE EVALUATION
TEST TARGET (MT-3)

6"

MICROCOPY RESOLUTION TEST CHART

that was referenced and which we recommended a couple of years ago that they do -- the general study, I think, was actually a recommendation that Lewis proposed, that they look at recommendations, see what might be interesting to do and so forth.

Then I think you arrived at some additional parameters that are relevant. And I am trying to give an example, and I think it is a real one, where in fact it would be of some real interest to know that you were beyond 70 percent.

MR. PLESSET: Do you want to make your comment now, Bill, unless Siess has told you what you are thinking?

MR. SIESS: I did not want to tell Bill what he is thinking. I wanted to point this out to the Committee.

MR. PLESSET: You will get a turn too, I promise.

MR. LAWROSKI: The question that Dave is raising --

MR. PLESSET: Let Bill make his comment, please. He has had enough trouble with the other members.

MR KERR: Mr. Butler, I don't know whether you are in the part of hydrogen that ignites hydrogen or in the part that does not ignite hydrogen. But it strikes me that if Professor Okrent is going to use this as an indication of clad condition, we might rethink our hydrogen igniters, because I believe that if we use these we probably make this indication of clad damage much less accurate than would otherwise be the case.

MR. OKRENT: Not in the inerted BWR.

MR KERR: There is discussion -- and I believe Mr. Gilinsky has suggested -- that igniters be installed in BWR containments and ice conde-sers, and perhaps even in large containments, what are probably Mark III's. I think there was another instrument there that would be helpful. The containment has pressure instruments and temperature instruments, and if you have a lot of hydrogen, noncondensible, you are going to have drywell and wetwell pressures that are very high, like about 100 psi gauge.

The operator, when he gets a temperature measurement, will have to know that there was a substantial amount of noncondensibles. And with some analysis he can then estimate how much hydrogen was pumped into that containment.

MR. PLESSET: Dade, did you want to make a comment? Then Steve.

MR. MOELLER: Something along the lines of what Dr. Okrent was asking about the hyd ogen monitors. I have a similar question on the oxygen monitor. Now, if it is inerted, the oxygen concentration is probably somewhere between zero and 10 percent. If it is not inerted or you have lost your inerting, the oxygen concentration would be

20 percent.

And I might want to know how far or how much of my inerting I have lost. So I did not understand there why you did not have zero to 20 percent for the oxygen range.

MR. BUTLER: Well, we believed if you have containment integrity, as you should whenever you are in operating modes, in inerted containments the oxygen concentration should be below 5 percent.

MR. MOELLER: Let's say I wanted to know when it is safe for my workers to enter. I want it up near 20 percent.

MR. PLESSET: That is not --

MR. MOELLER: Get a separate instrument for that.

MR. BUTLER: They would have their own instruments. In fact, they do have oxygen monitors, non-safety-grade, that go up to that range.

MR. MOELLER: All right. Thank you.

MR. OKRENT: But it is not too hard to envisage a scenario where the oxygen has moved above 5 percent.

MR. SIESS: Please keep in mind that this Reg Guide addresses specific, special, qualified instrumentation.

MR. PLESSET: Steve?

MR. LAWROSKI: About Dave's concern about how to get hydrogen concentration measured, I don't know why --

whether or not you could modify the synthesis gas analyzers, which are 75 percent hydrogen, 25 percent nitrogen, for synthesis of ammonia. People must be measuring concentrations in those plants. Has anyone -- there is a lot of it made.

MR. BENDER: I still think we have to think about the fact that the operator has a limited amount of information to absorb, and trying to put every kind of instrumentation on it that we can think of, just because it would be nice information to have, is not going to be very helpful.

MR. OKRENT: If you are willing to say "very nice information" under those circumstances. I don't think it is nice.

MR. BENDER: It makes very little difference to me whether I know it is 30 percent or 90 percent. I know there is a lot of clad damage and the difference in the actions I can take is somewhere near to zero in the short-term. In the long-term I might want to know something different. But under the circumstances there are lots of other things I have to worry about as well, and why should I concentrate on this one parameter?

MR. SHEWMON: On that scale, three hours for a grab sample might not be unreasonable.

MR. BENDER: Right.

MR. PLESSET: Any other questions?

MR. BENDER: Two sample lines would be a help. I would like to think about those things.

MR. PLESSET: Any other questions for Mr. Butler?

MR. SIESS: Walt, on that last figure, just one quick question. When Dave asked you what percentage of the clad would be oxidized, you referred to that. Is that clad percentage on that figure or is it total metal-water?

MR. BUTLER: It is metal-water percent of the active element of the clad, the clad which contacts the fuel.

MR. SIESS: There is other zirc in the core, is there not?

MR. BUTLER: Yes. It is not considered here.

MR. MARK: 90,000 pounds.

MR. BUTLER: In a BWR it is around 90,000 pounds.

MR. MARK: That is not all cladding.

MR. BUTLER: Yes, it is.

MR. SIESS: The interim rule says 75 percent of the clad, not 75 percent of the zirc.

MR. BUTLER: That is correct.

MR. SIESS: I was trying to --

MR. SHEWMON: Are the can walls zirc, for example?

MR. BUTLER: Yes, and they are not included in these numbers. There is a lot more zircaloy in the core, in the plenum chamber, as well, that are all excluded from these analysis.

MR. PLESSET: This is percent of clad on this abscissa here?

MR. BUTLER: Yes.

MR KERR: Have you or do you plan to make any estimate of the probability of reaching these various percentages? I mean, for example, are you going to estimate the probability of reaching 10 percent compared with 70 percent clad reaction, metal-water reaction?

MR. BUTLER: Our view at this time is that is something that cannot really be responsively calculated, because we are talking about terminated accidents, terminated meltdowns, where you depend on operator actions, and the timing is very important as to when you are able to arrest the accident.

So one cannot really come up with a believable set of numbers on probabilities.

You have the original composition of the air in the containment.

MR. SHEWMON: If it went straight up, it would be 150 percent -- the concentration would be 150 percent.

MR. MOELLER: But the bottom curve for PWR dry is roughly a straight line.

MR. SHEWMON: Yes. But I think basically, as you get above 50 percent, then the other component which is in there starts influencing the change in percent per increment of hydrogen.

MR KERR: Or vice versa.

MR. MOELLER: Okay, thank you.

MR. PLESSET: Thank you, Mr. Butler.

Could we go on with the staff?

MR. SIESS: I think we ought to hear from Mr. Wyatt.

MR. WYATT: My name is Ed Wyatt. I am the coordinator of fuel cycle licensing with NUS Corporation, Rockville, Maryland. I am also the chairman of the ANS 4.5 Standards Management Committee. One of the writing groups under that Standards Management Committee is the ANS 4.5 Writing Group, which has developed the ANS 4.5 standard.

The standard is, as Mr. Wenzinger said just now, ready to go to the American National Standards Institute for approval. There is some very fine points that have to be cleared up. But I understand in talking to the chairman of the Nuclear Power Plants Standards Committee today that he hopes to finish that up today and send it forward.

As stated earlier, the ANS 4.5 Writing Group has worked with the NRC for the purpose of reducing the number of differences since the August 7 ACRS meeting. The differences that remain based on the October 8 version of Reg Guide 1.97 have been sent to the chairman in a letter from the chairman of the Nuclear Power Plant Standards Committee.

I have gone over the charts in that letter and modified them based on the standard which -- based on the Reg Guide, excuse me, that was given out Wednesday. There are now, instead of the 26 mentioned in the letter, only the 23 variable differences: 6 under the Type E variables, 17 under Type C variables.

As indicated earlier, they can be quantified as differences in range, differences in the type of philosophy in categorizing, and differences in content. Many of the variables in the Reg Guide do not appear as indicated in the standard. For Type B variables there is only one difference in range. For Type E there are three Reg Guide variables that are not in the ANS standard. There are two Type E variables in the Reg Guide that are, at least for one type of reactor, that are not in the ANS 4.5. Type C variables, there are seven which represent a difference in philosophy on categorizing.

As mentioned, the ANS standard does not call for single-failure for Type C variables. Three of them are differences in range, including one that is listed in the philosophy on categorizing standards. Nine are variables required by the Reg Guide but not required by ANS 4.5. One of these includes a category, philosophy of difference for a

PWR and one that is not required for a BWR.

That summarizes it. Let me quickly run through the differences as modified by the draft of November 6th.

(Slide.)

In the Type B variables, under neutron flux, the Reg Guide range, it is now up to 100 percent. It was greater than 5 percent in the earlier version. ANS 4.5 upper limit is .1 percent. This represents a definite difference in philosophy.

The 4.5 writing group believes that to accomplish and maintain the critical safety functions, in this case reactivity, that the .1 percent is all that is needed.

MR. OKRENT: Is there elsewhere a requirement on neutron flux in ANS 4.5 draft? Is there some other place where you have a requirement for measurement under neutron flux?

MR. WYATT: No, sir.

MR. OKRENT: So in your opinion .1 percent power is adequate knowledge and you don't see, for example, a basis for going above 100 percent? For example, we talked earlier about 150 percent.

MR. WYATT: Right. The purpose in the standard, as indicated by the definition of Type B parameters, is to accomplish and maintain the critical safety functions.

MR. OKRENT: No. I know that that is the

purpose. But I am asking in terms of instrumentation to follow the course of an accident, and I do not want to constrain the discussion to a subset of the problem. So if ANS 4.5 thinks they are only addressing part of the problem and the rest of the problem should be addressed elsewhere, then I will not ask the question.

But if you think you've addressed the entire problem of instrumentation to follow the course of an accident, then my question is relevant. Which is it you have done?

MR. WYATT: The philosophy is to -- instrumentation for only the control room operator. There are other standards being developed. For instance, I have a Writing Group 4.6 which is looking at monitoring instrumentation. Their first task is to develop a standard for the purpose of giving criteria for instrumentation to rebuilt an event that happened, in other words to recreate -- reconstruct the accident.

This will probably, although I have not seen the draft yet, this will probably have in it wide-range instrumentation, things of this nature.

MR. OKRENT: So you think this information might be of interest in reconstructing it for Kemeny Two, but it would not be useful during the course of the event; is that it?

MR. WYATT: The Writing Group feels this is the proper instrumentation for the purpose of the event.

MR KERR: Is there any way you could briefly reconstruct the logic that led to .1 percent as a cutoff?

MR. WYATT: I could not do it myself. We do have in the room here one of the fellows from the Writing Group. I am not sure. Dave, can you speak to this point?

This is Dave Summers from Consumer Power.

MR. SUMMERS: Dr. Kerr, the answer is not going to be quite palatable. It was kind of a negotiated settlement with the staff at the time. We later, in Denver, came up with a different number, which is the 5 percent which has been changed subsequently. But that is the development.

MR KERR: Thank you.

MR. SIESS: I thought your criterion was shutdown amount; am I right?

MR. SUMMERS: Correct.

MR. WYATT: That is right, that is correct. In other words, to know that you are in a safe condition, to know that the reactor is in a safe condition.

MR. SIESS: And if it is shut down, it is by definition less than one-tenth of one percent is safe, and greater than one-tenth of one percent is not safe.

MR. WYATT: That is correct. Action has to be taken. You have to go look at something else to make sure

-- to look after the safe condition.

MR. SHEWMON: If it is greater than the .1 percent there are other ways to determine what the power generation of the core is?

MR. WYATT: Yes. One could look and see if the rods are in place, yes.

The second item has to do with control of position and soluble boron concentration sample. As it is now listed, the Reg Guide specifies these variables. ANS 4.5 does not require them because they are verification variables which are not included in 4.5.

Cold leg temperature is specified in the Reg Guide as category three quality. ANS 4.5 does not require this variable, again because of the same reason.

Coolant level of the reactor, in the October 6 version of the Reg Guide that was still an open issue. I assume that is no longer true, looking at the November 6th version of the Reg Guide. Again, ANS does not specify a range.

PWR level sensing is a relevant item with the NSSS vendors. ANS 4.5 does not require this measurement. The Writing Group also believes that the quality category one appears to be inconsistent for the verification purpose. As I mentioned before, we do not believe that a high quality is needed for many of these instruments.

(Slide.)

Continuing with the Type P variables, BWR core thermocouples are not required by the standard, but are required by the Reg Guide. PWR core exit temperature, the Reg Guide states this is a verification purpose, whereas the standard presents this as one of the two options for a key variable.

Degree of subcooling, the Reg Guide states this is a verification. The standard does not require this.

You notice the next three are deleted because the Reg Guide and the standard are now in agreement on these three issues.

MR. OKRENT: Can I ask you the same question I asked the member of the staff: Is there any scenario you can envisage in which the pressure in the PWR went above 3,000, went off scale for some period of time, and came back on, where you think it could be relevant to know just what the pressure did? And I do not mean to reconstruct it some weeks later.

MR. WYATT: There may well be, such as high pressure events, modeling up of the reactor where you are generating energy still. Again, the purpose here is accomplishing and maintaining the shutdown situation, and that is why the pressure ranges were chosen in the standard.

MR. KERR: Excuse me, but I am puzzled by the last statement, because I did not realize that you would want to go up to 1500 psig in a shutdown situation.

MR. WYATT: Oh, no, we wouldn't. This is an indicator and it is just a wide enough range of indicators so that you can accomplish the problem. You know where you are and you can accomplish the problem -- accomplish the shutdown.

(Slide.)

Turning now to the Type C variables --

MR. OKRENT: At the Sequoyah simulator, if I am not incorrect, if you run the ATWS transient, what happens is it goes up to 3,000 and goes off scale on the simulator. And the operator just sees it goes off scale, or I guess he doesn't know quite what. I guess he doesn't know what the calculations predict, 2980 or whatever they predict. It must leave him wondering, I imagine, if they run that in training.

MR. SIESS: Did they?

MR. OKRENT: They did for my class. I don't know what they routinely do.

MR. WYATT: Certainly if something like that happened in a reactor situation and it ran off scale, the operator would know he has to take some action pretty quick.

MR. SIESS: Would the action be any different if it was 3,000 psi than if it were 1500? Has anybody worked that out?

MR. WYATT: No, I do not think so, in that detail. 3,000 would be, say talking about a PWR, which is normally at about 2,000 or 2250 --

MR. SIESS: I was talking about a BWR.

MR. WYATT: Oh, a BWR.

MR. SIESS: Because the limit is now 1500 on the BWR.

MR. WYATT: Yes, it is. And if he saw it heading up toward 1500, he would know he would have to take some action, and so I really don't think range makes much difference. It is an indicator to tell the operator to take action to get it back into the safe mode.

MR. SIESS: Do you think he gets a stronger indication by going off scale on a gauge that reads to 1500 than he would simply going to 1500 on a gauge that read to 3,000?

MR. WYATT: I would guess that if I were an operator, either one would push me into immediate action.

Again turning to the Type C variables, radioactivity concentration, radiation level in the circulating primary coolant system, the ANS 4.5 requires only a single measurement rather than category one as required by the Reg Guide, because again of the philosophy that the Writing Group has that Type C instruments should meet category two only, not category one, because they are only extended range barrier monitoring instruments. That is the philosophy and that will appear throughout here.

Accent sampling of the primary coolant. The standard provides no range, whereas the range in the Reg Guide is specified to be one of two values. The Writing Group believes that it should be the lower of these two.

BWR core thermocouples. The Reg Guide states requirements now. It did not previously. The standard does not require the measurement, because the standard differs in scope from the Reg Guide in that it requires detection of actual fuel clad breach, but not the measurement of a potential breach.

PWR core exit temperature. Again, it is specified in the Reg Guide but not in the standard; the same reason.

BWR reactor coolant system temperature. The Reg Guide specifies quality category one and the standard does not require the variable. Again, the standard requires the detection of an actual breach, not a potential breach. Reg Guide 1.97 specifies category one for PWR reactor coolant --

MR KERR: Can you tell me why you think it is not important to measure a potential breach?

MR. WYATT: The Type C parameters in the standard are looking only at a potential containment breach. Generally speaking, potential breaches in clad and the core

-- the coolant system -- are normally covered by the Type A
parameters, because that Type A parameter is for the most
part based on chapter 15-type accident analysis.

MR KERR: So the reason is that there are other
ways of measuring the potential breach and you just don't
want to do it with Type C variables?

MR. WYATT: That is right.

MR. SIESS: You said Type A, did you not?

MR. WYATT: Yes. The Type A variables are those
that are from preplanned events and require preplanned
action.

MR. SIESS: Not requiring automatic action. That
is the qualification.

MR. WYATT: Yes.

MR. SIESS: The definition in the Reg Guide is
different from the one in the standard. It does not differ
in that sense, though, right? It is the one --

MR. WYATT: No. The Type A and Type C definitions
are different between the standard and the Reg Guide.

MR. SIESS: Because at the Subcommittee meeting we
asked for examples of Type A parameters and I did not recall
getting any that said, you know, these substitute -- these
supplement another Type B or Type C.

MR. WYATT: Let me turn to Dave Summers for that.

MR. SUMMERS: With regard to potential breach, the

Writing Group had the philosophy that the last barrier is what we were intending to monitor. We did address the concept of measuring the other two barriers. But what it basically came down to is we felt, although functionally this may be desirable, we did not think we could come through. We could make a promise, but we did not think we could come through with monitoring the potential for a fuel clad breach.

There was quite a good deal of discussion whether the reactor coolant system potential for breach should be included. Again, it was just the final decision not to include that, but to look at the final barrier in terms of radiological consequences.

MR. SIESS: That is a different answer than Mr. Wyatt gave.

MR. WYATT: Okay. I am accepting Mr. Summers' answer.

MR. SIESS: Fine.

MR. WYATT: When I was talking about the Type A, basically it was under the idea that chapter 15 analyzes events for the purpose of determining whether there will be a breach on one of these two systems. And that was my reference to chapter 15.

I guess that pretty well takes care of this particular slide.

(Slide.)

The primary containment area radiation is specified in the Reg Guide but not in the standard, because the standard looks at only key variables.

Containment sump water level is specified as category one in the Reg Guide and is only a single measurement in the standard.

Suppression pool water level is not required by the Reg Guide -- not required by the standard, but is required by the Reg Guide.

BWR drywell pres..re and PWR containment pressure are considered category one in the Reg Guide, whereas the standard requires only a single measurement channel.

Effluent radioactive activity, noble gas from condenser air removal system exhaust, is in the Reg Guide but not in the standard.

(Slide.)

Under Type C variables, again reactor coolant system pressure is category one in the Reg Guide and requires only a single measurement channel in the standard. That is also true of primary containment pressure. And as well as containment or drywell concentration also, the standard specifies a zero to 10 percent range in the hydrogen concentration, considering that to be adequate for the function.

The oxygen concentration is listed in the Reg Guide. The standard as originally written -- it will be deleting this as a key variable.

The Reg Guide lists effluent radioactivity, noble gases from identified release points. The standard does not require that particular variable.

(Slide.)

Environs radioactivity exposure rate is listed in the Reg Guide with particular ranges.

MR. SIESS: That range is 1 millirem to 10 rem. It got changed again.

MR. WYATT: Okay. Okay. At the time of the review, these were the ranges. It got changed by the November 6th draft.

The Writing Group still believes the five decade range should be adequate.

MR. SIESS: Actually, you are advocating a larger range, I think, than the staff now has.

MR. WYATT: That is --

MR. SIESS: You have 1 millirem to 10^{2}. They have it 10^{4}, the staff has 10^{4}.

MR. MOELLER: One to 10,000.

MR. WYATT: We have it 10^{-3} to 10^{2}.

MR. MOELLER: One milli-r to 10,000 r.

MR. SIESS: When you say "they," would you plese indicate who you mean, Dade?

MR. MOELLER: The Reg Guide. The staff on page 23 says 1 millirem to 10 r.

MR. SIESS: This is environs radioactivity exposure rate. What page are you on?

MR. MOELLER: 23.

MR. SIESS: One millirem to ten rem. And he has one milirem to 100 rem. Am I not right?

MR. WYATT: Yes.

MR. WENZINGER: That is one of the items we specially identified for separate discussion.

MR. SIESS: I am trying to see where we are now. This is the first instant, I think, they had a larger range than you had. I like to catch those.

(Laughter.)

MR. WYATT: Incidentally, there are some indications that it might be difficult to do this particular job. Some information has come to light and the Writing Group will be looking further at this particular parameter.

MR. SIESS: When you find yourself more conservative than the staff, you decide you had better take another look at it. Something is wrong.

(Laughter.)

MR. WYATT: That is not it.

The last two items are the fact that Type D and E parameters are in the Reg Guide and not in the standard, as earlier discussed.

Basically, those are the differences. I would just like to conclude my remarks by saying that, as indicated earlier, the Reg Guide and the standard are much closer, and we feel much happier about that.

MR. SIESS: And actually, many of the differences could be grouped as a basic difference in philosophy or scope. So there are not that many individual differences.

MR. WYATT: That is correct.

MR. PLESSET: Can we go back to the staff now?

MR. SIESS: Unless there are questions of Mr. Wyatt.

MR. PLESSET: Any more questions of Mr. Wyatt?

(No response.)

I guess not. We can go back to the staff.

MR. SIESS: There are three items I thought we should take up, and one was the BWR in-core thermocouples, one was the environmental radiation exposure monitoring, and one I would like to see last, I think, is the other uses to be made of the instruments outside the control room.

I propose the BWR thermocouples as being responsive to a specific request by the ACRS. I suggest we take that up next. I have already told you what is in the guide, and the staff, Mr. Johnson, is going to tell us how they arrived at it.

MR. JOHNSTON: My name is William Johnson. I am chief of the Core Performance Branch in the Division of System Integration. I am going to try to answer some of the questions that arose yesterday.

As I understand it, the concern was whether a thermocouple placed in the instrument string would be able to sense a temperature rise that took place inside the channel box. And we have had numerous discussions with General Electric since your last meeting. There have been some reports that GE has passed on to us in which calculations were made. I am going to refer to several of these. I think they will provide a satisfactory answer to the question.

First I want to show that there are two vugraphs actually shown to you at the last meeting, and the point that I want to make is that the -- looking just at these curves here. This is the mid-plane temperature.

(Slide.)

This is fuel temperature at the mid-plane. The following is the temperature risk of a bypass thermocouple located also at the mid-plane. The delay is on the order of 100 seconds. So that is the difference in delay between the thermocouple and the bypass sensing a temperature rise that is taking place in a fuel rod inside the channel box as GE has calculated it using best estimate analysis.

MR. SHEWMON: Can you tell me again the difference between those two dashes, the straight line and the one that curves upwards?

MR. JOHNSTON: This is the fuel temperature, the dashed line. This is with the core spray on, so you don't get the cooling or quenching of that thermocouple that is sitting in there, and with the core spray the thermocouple does not heat up.

The question was, if you were boiling down, which means no core spray, what would be the difference or the delay, if you like the lag, in the sensing of temperature rise. And the same general calculation was shown in the slide which was also provided to you last time. Again, it shows the same order of magnitude of delay in time of sensing it.

I think that answers the first part of the question that was raised. In fact, under conditions of loss in coolant level, you can detect in a reasonable amount of time the temperature response that is going on inside the channel box.

(Slide.)

This is a point -- a one-level calculation. The discussions we have had with GE have resulted in the placing of the thermocouples at two elevations within the channel box, so that you have the opportunity to see the temperature change.

This vugraph is a calculation that was made as a part of research programs with the channel -- with the channel module of the TRAC BWR version. And it has the capabilities of calculating the temperatures and a variety of things of that sort. This is not calculated -- what I am showing you here is not a calculation that was made for a BWR, but actually for severe core damage problem in the power burst facility.

But it does show there is analytical capability to calculate the temperature inside a shroud as a function of elevation at any particular time. This is one particular time cut, but it shows that we can distinguish the shroud wall temperatures. And I suggest that if you can -- if you know that the shroud wall is warming up -- as we have already indicated, if the shroud wall gets hot the thermocouple gets hot. The thermocouple inside the train can see that temperature.

MR. PLESSET: What is this telling us? Are there measurements involved here?

MR. JOHNSTON: These are calculations. I am merely saying, we have analytical capability to show --

MR. PLESSET: How do you know the analytical capability is any good? I mean, compared with what? I mean, you can calculate numbers if you have a computing machine, I guess.

MR. JOHNSTON: My point was, I think we have sophisticated enough computing machinery that we can work this kind of a problem. That was all I meant to communicate.

MR. PLESSET: How do you know the answer is correct?

MR. JOHNSTON: The answer will be determined when the test is run, because there are thermocouples spread all through these portions of the test facility.

MR. PLESSET: Has the test been run?

MR. JOHNSTON: That test has not been run. The test was run in the NRU just this week, in which over 35 runs were made in doing heat transfer studies. Those I think -- they may or may not have been reported to the ACRS yet, but similar calculations were made for that test using the same code and the same analytical capability that predicted temperatures -- the predicted temperatures fit very closely.

The other bottom line is that the other fuel quench is much more rapid --

MR. PLESSET: I think we ought to see that some time.

MR. JOHNSTON: That is not part of this

discussion.

MR. PLESSET: Oh.

MR. JOHNSTON: The other kind of calculations that can be made again will show the temperature as a function of time.

(Slide.)

Again, we can calculate fuel rods, we can calculate shroud temperatures as a function of time, and that is simply additional types of capability.

General Electric in September provided us with copies of what it called NEDO-247208, which is a response which is prepared as part of the Bulletins and Orders Section, which required that the various vendors make calculations of events that might occur in a reactor beyond chapter 15. And GE has supplied a whole series of calculation, and I have extracted certain portions of them.

I am not going to go through very many of them, but just to give you a summary of the kinds of cases that they calculated, they calculated systems in which there are breaks in both the liquid side and in the steam side of the BWR. They have done it with core spray and depressurization working. They have done it with one coolant injection pump working, with the depressurization working. They have done it with these things not working and so forth.

And what I want to show very quickly are a series of vugraphs in which the water level as a function of time is calculated.

(Slide.)

And then I want to show you the response that they calculated of fuel during that same time period.

(Slide.)

And what you see is that the -- well, the water is still going down. You will notice number two is the water level measured outside the shroud, and number one is the water level calculated inside the shroud of a BWR. And this curve here is the cladding temperature rising.

And the point I wish to make is that the calculation was terminated at 2,000 F., but at the time they terminated their temperature calculation the water would be continuing to drop in the inside of the shroud. And one would expect the temperature would be continuing to rise. And the value of being able to make this kind of calculation or make the measurement that we propose to make I think is evident here.

MR. KERR: I am losing something here. You are showing me a relationship which is a calculated relationship between the cladding temperature and the water level?

MR. JOHNSTON: That is right. As the water level drops and the cladding is exposed, it heats up.

MR KERR: What I would be interested in seeing is a relationship between thermocouple temperature where the thermocouple is out between the shrouds and water level.

That comes later, perhaps.

MR. JOHNSTON: There is a correlation betwe n the temperature that would be measured --

MR KERR: Could you raise that?

MR. JOHNSTON: My first vu-graph was to show that the temperature of the fuel is followed fairly closely by the temperature of the thermcouple located in the instrument train.

MR KERR: And that curve, which is -- let's see, channel --

MR. JOHNSTON: This is the temperature of the fuel. This is the temperature measured by a thermocouple located in the instrument train outside of the channel box in the space where the instrument tube is located. My point is, there is not a long time delay.

MR KERR: Those are measurements.

MR. JOHNSTON: Those are seconds.

MR. PLESSET: Those are not measurements. These are all calculations.

MR. JOHNSTON: These are all calculations.

MR. SIESS: What does that tell you about the temperature of the fuel at a higher level than the thermocouple?

MR. JOHNSTON: This does not tell you anything. This was a calculation made at mid-plane.

MR. BENDER: By following that temperature, you can keep track of whether you are losing water in the core.

MR. JOHNSTON: That is right.

MR. BENDER: That is basically what you are saying. How much time lag was there?

MR. JOHNSTON: About 100 seconds' time on that scale.

MR. BENDER: Thank you.

MR. CARBON: This is assuming you are losing water at the elevation of the thermocouple, of course.

MR. JOHNSTON: Or below.

MR. CARBON: Or below.

MR. JOHNSTON: Or below. And what I am showing in this sequence of calculations is that there are a number of events in which the water does continue to drop in the core, and accompanying that, I have the other curve that shows the temperatures of the fuel beginning to rise. The purpose of ths instrumentation would be to follow that.

The event that is modeled there, as you see, is a suction line break with one LPCI available and recirculation pumps on.

MR KERR: Are these calculations made with Appendix K models?

MR. PLESSET: I think they are best estimate models.

MR. JOHNSTON: These are best estimate models. They are made with the CHASTE code, but they have modified it to put in decay heat. They have modified heat transfer to steam. There is one other modification.

MR. PLESSET: These were made by GE?

MR. JOHNSTON: These were made by GE. This is a NUREG that we received in September.

MR. PLESSET: These calculations aren't necessarily very good.

MR. JOHNSTON: No, but the issue is not whether they are good or not. What I am trying to demonstrate to you here is that I presume they are consistent among themselves, and what they do show is a family of events which results in the water level dropping and a corresponding increase in the clodding temperature which I suggest we can measure with a thermocouple.

I am further trying to suggest that there are a number of cases in which the temperature rise of the thermocouple is relatively early, and the water will continue to drop for some period -- numbers of minutes even after the thermocouple temperature that they calculate is off scale, or above the limit of their calculation, I should say.

And we have this for -- I have examples that they provided us, both for cases in which the coolant in which the break is on the coolant side of the plant and cases in which the break is on the steam side of the plant.

MR KERR: Would you expect that the temperature of the thermocouple, if it is going up, say, that there is water not very near the thermocouple, or would it be an indication of water level in what sense would you --

MR. JOHNSTON: The thermocouples as we discussed it with General Electric would be placed at two elevations in the core in the instrument string, so you would see -- essentially, you would get two sets of terms of thi^ sort displaced in time, and related to the amount of the core --

MR KERR: Let me say I have a thermocouple at Level 30 and the temperature jumps drastically. Does that mean the water has just at that point dropped below the thermocouple, or that it has dropped below the thermocouple by six inches or a foot or --

MR. JOHNSTON: Well, all I can show is more calculations, but there is a delay. These kinds of calculations answer something of that question. This is a calculation made of a boil down and what this shows is the temperatures at different elevations. This is the top of the core. This is one foot, two foot, three foot, so that what this tells you is, the temperature versus time at any particular elevation in the core.

Now, from doing these kinds of things for the appropriate power distribution on decay heat and so forth, you can suggest that if I have a thermocouple located at, say, three foot down from the top, if the core began to uncover at time zero, I would have seen a temperature rise of about 500 degrees in this particular example, in 16 or 17 minutes.

MR KERR: Where is the water level? Where is the water level relative to that temperature?

MR. JOHNSTON: The water level in 33 minutes -- it is dropping at about one foot every four minutes.

MR KERR: But pick a --

MR. JOHNSTON: This is about four feet from the top, and the temperature is rising clearly at the two-foot level, so there, there is a two-foot difference in that particular example, depending on what kind of resolution you want to have, the one-foot level took about six minutes.

MR KERR: I am not asking a very good question. I am trying to find out whether I can tell by looking at the thermocouple temperature where the water is.

MR. JOHNSTON: If you have an analytical model to go with it, you should be able to. The fact this is involved in the TMI Action Plan 2F2, PWR measurements.

MR. PLESSET: PWR, this does not sound too good to me.

MR. JOHNSTON: The same answer to the question as far as chemist-y is concerned.

MR. PLESSET: Isn't this what Caton was concerned about, Dr. Siess?

MR. SIESS: I think it is. Let's assume I am not interested at all in where the water level is, but I am interested in whether the core is being cooled, and my concern is that the clad or the fuel and the clad are heating up in, let's say, the top two feet of the core.

Now, the Reg. Guide says therocouples between one-third and one-half the distance d wn. A third would be four feet, right?

MR. JOHNSTON: That is not a specified elevation, yet. That is an approximation.

MR. SIESS: Let's assume they are four feet down for the moment. Now, is that thermocouple reading -- I am the operator. Does it tell me when the clad is heating up in the top two feet of the core or just when it is heating up at the thermocouple?

MR. JOHNSTON: When it is heating up at the thermocouple. You will see no change in the thermocouple temperature indication if it is at the four-foot level until the water has boiled down to the four-foot level, and about another six inches beyond that.

MR. SIESS: So if I am interested in whether the core is being kept cool, this really only tells me when or whether the bottom two-thirds of the core is being kept cool, right?

MR. JOHNSTON: That is correct.

MR. BENDER: It is something even different from that. It seems to me what you can learn from that is what is happening if you have flow going in and out of the core, and if the situation is one in which the main steam isolation valves have closed but you don't have any loss of coolant accident associated with it, what does that thermocouple tell you?

MR. JOHNSTON: I am not sure I follow the question entirely.

MR. BENDER: What I am saying, if there is nothing going into the core, and nothing going out, what we are trying to do is find out whether the water is becoming superheated --

MR. JOHNSTON: The water will already be superheated under those -- oh, superheated, you mean, the pressure is rising?

MR. BENDER: The main steam isolation valve closes and you don't have any way to get anything out. The question that is being developed is --

MR. JOHNSTON: If you have already partially uncovered the core, you will be seeing something like this on your thermocouple. If you have uncovered to the point of that thermocouple, it will be rising in temperature. If your thermocouple is still covered, you will be reading the water temperature. If it is going a superheat, you will be reading a superheat water temperature.

MR. BENDER: Now, the question is, does that temperature tell me enough so I know before fuel damage occurs that fuel damage is going to occur. In the PWR's we are looking for something to tell us whether we have lost enough water in the core to cause fuel oxidation, and the same question has to be addressed here.

MR. JOHNSTON: All right. I think the answer to that is, yes, it will, depending on where the thermocouples are placed in the string. If the thermocopules are placed near the top of the string, when that level of core has been uncovered, the thermocouple will begin to change temperature, and you will know that you are exceeding the boiling water -- the temperature of the saturation of the water, and the temperature of that -- that that thermocouple will see can be calculated.

MR. BENDER: Is that soon enough to do something about it?

MR. JOHNSTON: I have indicated here that it took something like half an hour in this particular case before temperatures were reached that were high enough to begin to rupture the cladding. By that time, the coolant was already down something like six feet down.

MR. BENDER: But that is not the same case we are talking about. I am talking about one where the main steam isolation valves have closed, and there is no flow going out of the core.

MR. JOHNSTON: The temperature in the thermocouples are still going to rise if there is fuel uncovered, and you will see it.

MR. BENDER: If the thermocouples were high enough, I suspect they might, but it is a matter of where they are.

MR. JOHNSTON: The thermocouples are sitting right next to the shroud. We have shown that the shroud warms up. We have shown that the thermocouples will see the shroud if they warm up. If the thermocouple is one foot from the top of the core, and it starts to warm up one foot from the top of the core, however you got to that stage, the thermocouple will see it, and it will continue to rise in the circumstance you describe, because there is no cooling going on in that region.

MR. SIESS: Let me try to explain the concerns --

MR. CARBON: Why don't you put the thermocouples at the end of the fuel element. Why is it a third of the way down?

MR. JOHNSTON: We suggested two elevations.

MR. CARBON: Why not one of them right at the very exit? That, I think, is where you are going to get -

MR. SIESS: Let me try something. I was not at the August meeting, but I can tell you what the concerns were that came out of the Subcommittee, and I think I knew what they were before. There were two concerns expressed by people at the Subcommittee meeting. One was that the thermocouple in the guide thimble, what the relation was between that temperature and the temperature of the clad, and there has been some curves presented.

The other question was, if the thermocouple is below the top of the core, what does it tell you about the condition of the core at the top?

Now, this whole discussion started with the PWR core exit thermocouples, which measured the temperatures not right at the top of the core but somewhere above that at Three Mile Island that were giving information that was ignored, and which would have been very useful information, and I believe all the initial discussion about BWR thermocouples again were core exit thermocouples. People were thinking about the same kind of thermocouples, same kinds of locations that you have in the PWR's.

The in core thermocouples, the first reference to that is in the letter, and apparently as a result of the discussion in August, there was something about, we cannot put them up here, but maybe we can put them in the thimble, which would be in core, and the letter said something about study that, and basically the question that came up at the subcommittee is that if you do use in core thermocouples, how does that tell the operator something about the temperatures of the portions of the core above that, assuming he wants to know whether that clad is burning or not.

MR KERR: In fact, the question was a little broader than that. It was, how does that tell the operator anything useful?

MR. PLESSET: That is a broader question.

MR. JOHNSTON: I think I tried to answer the question by showing this curve. If you put it down in the instrument string, you can measure it.

MR. SIESS: Are you saying -- Let me try this. I am looking at my thermocouple reading, and it stays down at some normal temperature. Does that -- saturation temperature. Does that assure me as operator that I am not getting any core oxidation anywhere?

MR. JOHNSTON: It depends on where the thermocouple is located.

MR. SIESS: It is four feet down from the top of the core. I will put it there. One-third of the core height down.

MR. JOHNSTON: No, it will not guarantee that you are not exceeding saturation temperatures anywhere in the core.

MR. SIESS: Now, if I do see high temperatures, I know I have a problem, but if I don't see high temperatures, I don't know I don't have a problem.

MR KERR: That was not the question you asked. You asked if he was sure, one, he was not seeing fuel damage. He said it would not assure you that it was not exceeding saturation temperature. And the two are quite different.

MR. SIESS: Let's start over again. I --

MR. JOHNSTON: It will not -- No, there is on way. If the thermocouple is sitting in water because we have designed it four feet down underneath the water, there is no way it is going to tell you the temperature that is going on inside the fuel assembly.

MR. SIESS: The four feet is not arbitrary. It is taken in the footnote in the table which is the Reg. Guide we are reviewing and have been asked to concur in.

MR KERR: You did this to me earlier, and I am going to do it to you.

(General laughter.)

MR KERR: Is there some way that one can predict the temperature above the water when one knows that one has boiling water in a fuel channel? I am not sure that this is impossible.

MR. JOHNSTON: That is what this curve that I put here does.

MR KERR: As long as I have water at the four-foot level, I think it is impossible to predict what is happening the fuel above that, even though I don't have a thermocouple up there.

MR. JOHNSTON: That is true. That is an analytical function. You can do that if you know where your water level is.

MR. SIESS: Wait a minute.

MR. CARBON: You can only do that on the assumption that you know the rate at which the water level is going down, and you don't know that.

MR. JOHNSTON: Well, you have a variety of ways of having a good handle on that. It can be strictly boil off by decay heat. You have a pretty good idea of what the boil off rate will be. If you couple that with a small break, you know how much material you will get out of the break.

I think that sort of thing will give you a basis for making a calculation of that type if you don't have a direct measurement of it.

MR. CARBON: Yes, you can make the calculation all right, but if the operator is sitting there and he does not know that he is losing water, he has no way of knowing that. He has a thermocouple that reads a normal temperature. He does not know he is losing water.

The top two or three feet has exceeded a temperature. Perhaps he is getting melting of the cladding. He does not know this. Is this not so?

MR. JOHNSTON: That is perfectly correct, and I am not defending -- I don't know where the number got into the Reg. Guide that talks about the elevation of the thermocouple, because that has not been established between ourselves and at GE. Somebody just put something in, and I would suggest we not get hung up on a particular elevation because I can put it at one foot --

MR. CARBON: You cannot do that, can you? Don't these tubes come up from the bottom, and you cannot go to the top?

MR. JOHNSTON: You can put it within one foot of the top.

MR. CARBON: You can put it in one foot?

MR. JOHNSTON: Yes.

MR. CARBON: Why aren't they at that height then instead of four feet down?

MR. JOHNSTON: They have never been at four feet down until somebody pushed that button on a typewriter, is what I am trying to suggest.

(General laughter.)

MR. JOHNSTON: Nobody has decided where they are going to be in any firm way to this date.

MR. CARBON: Wouldn't it be logical to put them as near the exit, as near the end of the active zone of the fuel as possible, even including right at the very end of the fuel?

MR. JOHNSTON: If you are using them for that single function only, that would be true. If you want to also have some ability to monitor the condition of the core afterwards, if there has been some damage sufficient to change the geometry of the channel boxes, then it is better if it is down further.

MR. CARBON: But your first goal is to find out if the core is becoming uncovered, I believe. I think you have just said that, that for that goal you would want the thermocouple just as close to the exit as possible.

MR. BENDER: I think we are putting words in Mr. Johnston's mouth. I believe he really said that initially they had planned to use the thermocouples to monitor the condition of a coolant during some of these loss of coolant accidents, and now we have changed the ground rules on him, and I am not sure that he really understands the conditions under which we are asking the question, and it is unfair.

I believe he is right in saying that they need to look at all the locations where they might look at thermocouples, and if we leave it there, they will sort those out. At least, that is what I would propose to suggest.

MR. JOHNSTON: That is what we plan to do.

MR. CARBON: I would still like to ask my question, though, and I believe it has been answered, but I am not sure. If you want to know as early as possible whether the core is becoming uncovered, you would, would you not, want to put a thermocouple at the exit of the core or as close to it as you could get?

MR. MATHIS: You would look at the water level.

MR. JOHNSTON: I will answer that with a speculation. Let me speculate in a different way than what I have been answering you before. The calculations that have been made previously have shown that if the water level of the core does not drop off more than a foot or two, that you will not get high temperatures at the top of the core, because there is sufficient boiling to do decay heat generation, and other matters, that you will not get a superheated -- an overheated fuel assembly.

It is only if you drop down on the order of several feet that you really get the temperature rises that we are talking about. So I guess I could change my answer, but I don't have any calculations to show you, but I know they have been made because I have had them done.

MR. SIESS: Mr. Chairman, I think it would be worthwhile, since the representative from the Office of Nuclear Reactor Regulation says he does not know where the one-third to one-halfway down came from, I think it would be appropriate to ask the people from the Office of Standards Development whether they know where it came from.

MR. HINTZE: I will take the responsibility for pushing the typewriter key.

(General laughter.)

MR. HINTZE: If we left the "from" out in the transmission from Dr. Johnston -- that is where it came from. We did not mean to specify any specific place.

MR. SIESS: From one-third to one-half means between one-third and one-half, to me. If I go from Washington to Chicago, I am somewhere in between there.

(General laughter.)

MR. SIESS: There is no way I can start in Bermuda.

(General laughter.)

MR. JOHNSTON: The discussions we had with General Electric which we are talking about putting fou thermocouples per quadrant, we discussed two thermocouples would be at one elevation and two thermocouples would be at a different elevation. We have not established what those two elevations will be.

One way to approach that is to make the calculation of the heatup rates for different elevations of water as I have suggested here. I think you will find if the water level only drops a couple of feet in the core for the first 50 -- for the first 10 to 15 minutes after the accident, there will not be a high temperature recorded for those fuel rods in that portion.

It may not be necessary to put a thermocouple in the top couple of feet for that reason.

MR. PLESSET: Let's try to shorten a little bit. Chet?

MR. SIESS: I have no preferences. This was the Committee's question. The Committee has questioned whether core exit thermocouples in BWR's would do any good, and as I say, the staff has reached an agreement with GE and you heard the story. Now, I am satisfied.

MR. BENDER: I want to try one more time --

MR. SIESS: I have learned something. They could be as high as one foot from the top of the core.

MR. BENDER: There are two conditions to be considered. One is the one in which you have continuing flow through the core, and you may be losing coolant because of some kind of loss of coolant accident, and for that one you may very well want the thermocouples down in the core so that you can see what is happening as the fluid level drops.

The other is a condition where you close the main steam isolation valves and there is no outflow, and for that one do you want to know something? Now, Dr. Caton suggested that that might be an important consideration as well, and that it had not been addressed, and I don't know whether it should be addressed. I am just trying to point out that it is an existing question.

MR. ROSENTHAL: I think the correct scenario would be as follows. You turn the core off. You have decay heat being generated. You close the MSIV's, as you should. You are not making up water or removing decay heat from the system. You heat up the water. You lift the safeties, and you are dumping inventory down into the torus. You would like your emergency safety features to function, and keep the core covered with water, with makeup water.

I was coming from the view that the operator would like to be assured that he has water in the core. He has one redundant but not diverse means of measuring water level, and that is the DP cells, and it would be useful to have a diverse means to tell the operator that he does not have water in the core.

MR. PLESSET: I think --

MR. BENDER: It still needs to be clarified, but I think we understand the scenario.

MR. PLESSET: I think it should be left open where one would put those thermocouples.

MR. ROSENTHAL: I apologize for interrupting. We will delete all reference to height.

MR. PLESSET: Okay. Because I think it is possible that we will have techniques which will make more reliable calculations available in the CHASTE code, for example. I think if they leave it open, there is no great harm.

MR. JOHNSTON: I am not sure if I should take more of your time. I have a number of these other calculations.

MR. PLESSET: You might just as well quit while you are ahead.

(General laughter.)

MR. SIESS: There is a question we can ask the Committee. Have you heard enough to know what your position is on this item?

MR. PLESSET: I think the Committee is fairly well satisfied, Chet.

MR KERR: If they are in core thermocouples, we put them somewhere in the core.

MR. PLESSET: Where it will be useful.

MR. SIESS: The next item I think the Committee should here then is some discussion of this environs exposure monitoring. As it stands now, the requirement -- it occurs at two places in each table, because there is some listed under both Type C and Type E. But a perfectly typical one is Page 23, the bottom item, and I will have to have the staff tell me where it is explained, because the table itself does not tellyou how many, and maybe it is not intending to.

Is there something in the discussion that tells you how many of those -- that elaborates on that requirement? Could you give us a page reference?

MR. KREEGER: How many of the detectors?

MR. SIESS: Yes.

MR. KREEGER: I am Bill Kraeger.

We deleted the number of specific detectors in an environs monitoring system as well as changing the range of the detectors in order to reduce the specificity enough to allow for some what I would call innovation in view of the criticisms we got in just very recent days about what the system can do and how it should function.

So, we removed the number and we reduced the range, and we hope that that will enable the industry to provide recommendations of their own. We have several reports which we just received and have just had a chance to look at, one from the Atomic Industrial Forum, some additional comments from Consumers Power.

We also have a paper from Pacific Gas and Electric, Diablo Canyon, proposing an actual system. We have a paper from Germany which proposes a similar system, and the staff has been bombarded in fairly recent days with quite a bit of new information, so we _ e trying to make the writing as it now appears in the document flexible enough to permit innovative proposals.

MR. SIESS: In the Reg. Guide, where it is listed under Type C -- correction -- Under Type C, the heading is Environs Radioactivity Exposure Rate, and under Type E, there is a parentheses that says Installed Instrumentation. Was that just to distinguish it from portable instrumentation that occurs in the next -- fourth item down -- third item down?

MR. KREEGER: Yes. The issue that I was asked to -- go ahead.

MR. SIESS: I guess one of our problems is that we could not get too much information from the Subcommittee meeting as to the purpose of this, and when we -- what we did get . the purpose suggested that the number had to be very large. I will admit the guide does not always tell you how many, but it does talk in other areas about redundancy and diversity, so you have some idea of how many instruments and how many channels.

But as it reads now, it simply says, and I think what you are saying is that they should be able to monitor with installed instrumentation the radiation exposure rate in the environs in a range from one millirem per hour to ten rem per hour.

Is environs defined anywhere in here?

MR. KREEGER: I am not sure that it is. I had discussed with other members of the staff the possibility that we did need an environs definition. Actually, environs is usually used to be site boundary and beyond, although occasionally you will find our regulatory guidance talking about plant environs as if it is within the site boundary.

In this particular case, I believe it means site boundary and beyond. It may be that it should be defined. I think --

MR. SIESS: But in your thinking, in terms of the scenarios or objectives, you think site boundary and beyond?

MR. KREEGER: Yes.

MR. SIESS: And that means that these instruments have to be then beyond -- at and beyond the site boundary?

MR. KREEGER: Yes, sir. You will recall we had originally 16 to 20 stations, one of the criticisms of the industry report was that 16 stations would have neither the accuracy nor the sensitivity under scenarios that you could describe to actually even see the plume under a number of conditions such as an elevated release, certain meteorological conditions. However --

MR. SIESS: Were those 16 stations in a circle at the boundary or were they --

MR. KREEGER: We did not specify where they had to be, because we asked that they do a certain job, that is, that they enabled you to decide, and particularly for an unmonitored release point such as breach of containment or containment penetration, where we had not anticipated release and did not have monitors to the TMI task action plans, lessons learned, and so forth.

We conceived of these as being mechanisms for getting back information that would tell us there was an unmonitored release point venting radioactive material. That is what is specified in the requirement, so to speak. That is what is specified in the requirement for these devices.

MR. SIESS: Where is that in the guide?

MR. HINTZE: This comes under the category of Type C, where you are detecting a potential for or an actual breach of the barriers to radioactive materials release, and the environs monitors was the containment breach from an unidentified source.

MR. SIESS: I understand that. I heard it yesterday -- Wednesday, and I am hearing it now, but if I were reading the guide, where would I find that, that this is related to the unidentified releases?

MR. KREEGER: In a sense, at the head of the table, Type C variables. At the top of the table, it says, those variables that provide indication or indicate the potential for being breached or the actual breach. That is up at the top of the table, Page 22, for example, Page 28, for example.

MR. SIESS: Yes, I know that, but --

MR. KREEGER: But, that is one specification.

MR. HINTZE: It is under the definition of Type E variables, which is on Page 16 and 17. Page 17, Line 3, Item 3, on-site locations where unplanned releases of radioactive materials can be detected.

MR. SIESS: Where is that?

MR. HINTZE: Page 17, Item 3.

MR. SIESS: That is what I wanted.

MR. HINTZE: Line 3, top o the page.

MR KERR: But that is for e E, it says.

MR. SIESS: That is Type C and Type E. If you want to look at Type E, it is on the other page number I gave you, consisting of two categories here, Type C and Type E.

I am trying to find the origin. Process for selecting system operation and effluent release variables should include the identification of, and then for Type D I go down and see, on-site locations for unplanned releases of radioactive materials should be detected, right? Is that the way you read it?

Now, what does on-site location mean? Is that where the release is on-site or the detection is on-site?

MR. KREEGER: The detection is on-site.

MR. SIESS: But Mr. Kraeger, you just said it is at the site boundaries. Does it mean beyond the site boundaries? I am quite confused.

MR. KREEGER: I am sorry, I cannot answer that question. I had not recognized the three --

MR. SIESS: What is bothering me is this. This Reg. Guide has become quite proscriptive. And I don't think we have complained too much about the proscriptive nature of it, because if I go through the history, I know why it is proscriptive, and yet here it is insufficiently proscriptive, and I have not yet found the words that tell me what the objective is to offset the lack of proscription.

I have to locate these, decide how many and where. I either have to have you tell me where to put them and how many, or give me criteria so that I can determine where to put them and how many. I have heard it orally, but --

MR. KREEGER: The purpose of the statement in the table -- it also says, detection of significant releases, verification, release assessment, and the long-term surveillance. For example, Page 30, the last column, the purpose column, under radiation exposure rate devices.

MR KERR: Table 2, Type C.

MR. SIESS: You have a different purpose under Type C than you do under Type E.

MR KERR: On Page 30, I am looking at -- I am sorry. Installed instrumentation. Okay.

MR. KREEGER: Page 41, we have a slightly different wording, too, detection of breach, accomplishment of mitigation and verification.

MR. SIESS: That is the Type C purpose. The other is the Type E purpose.

MR. KREEGER: Right.

MR. SIESS: I guess that is logical.

MR. BENDER: The question that seemed to be hanging around, though, is why do we need so many, and are they really going to be all that effective in alerting the operator to the emergency?

MR. KREEGER: That is what I alluded to by saying we do have a report from the Atomic Industrial Forums NSP study done by Science Applications, Incorporated, which we just received a week or so ago, which says that such a system with perhaps more detectors than we had specified, more than the 16 or 20 that were originally specified, would be only possible potentially if being within a factor of two of saying what the dose rate was under certain conditions, and might in fact if one went to the 16-20 detectors miss the plume entirely for a number of potential scenarios of release, including breach of containment, with a high elevated release.

What we have proposed is that with proper selection of the number and location or what -- what we don't propose in here but what we have left out because we believe it can be appropriately proposed, that with a proper selection and location, a selection of number and location of the devices which might include using the meteorological information for the site that is the annual -- the information about how the meteorology varies with time in the site environs, that you could select an appropriate location and number of devices to be the only method for predicting both the dose rate and that in fact getting some idea about the quantity of release in an unmonitored release path.

That is one that did not go buy the new effluent monitoring required by the task action plan, would not be in a sense seen, at least informatively, by the high radiation containment monitor, and so forth, and in fact the scenario that we have been discussing with Mr. Case and Dr. Ross, and before the first meeting with Mr. Denton, was a scenario in which the event was in progress, the staff had not been available to get monitoring teams out into the environment yet.

The response center was not necessarily manned, and the only person who might be able to see a release on a device might be the operator who was getting feedback from the environs monitoring devices properly placed and with a proper number so that he could alert people to what was happening.

Now, that admittedly requires sophisticated instrumentation and computer usage of that information, but the computers will be there and or mini-computers can be proposed -- have been proposed, in fact, in the Diablo Canyon case, that would analyze such information from such detect rs and would give useful guidance.

MR. BENDER: Well, the question that seemed to be concerning most people was why the need for such careful determination of dose rate, you want to know whether to evacuate or not, and beyond making that decision, what is the urgent need for very careful measurement of dose rates?

MR. KREEGER: I would not characterize this as very careful. In a sense, we are not saying -- We are not proposing that it is any more accurate than these studies. If by careful, you mean accurate. I want to know what it is, though, and if I do not have --

MR. BENDER: Do I need to know it within a factor of two, or would it be all right to know it within a factor of ten or 100? I don't know.

MR. KREEGER: It might be that that would still require, I think -- What we are looking at now is 32 to 40 stations. What we think now would be appropriate is 32 to 40 stations. But without nearly as sophisticated a detection system. It has to be telemetered back or hardwired back, and it has to come into a computerized information analysis device which is also getting data.

MR. BENDER: But I just want to make a simple point. The SAI study said to get within a factor of two you needed a number more than 16. I don't know how many more. I think the Committee would find it useful to find whether you need to know the number to a factor of 10 or a factor of 100 before it tries to make a judgment on whether this scheme is a good one to use.

My suspicion is, a factor of 10 is probably no more than you need.

MR. KREEGER: Looking at the SAI curves, even with a factor of 10, you need --

MR. BENDER: I am not going to argue what it is going to be. It would be nice to know what the accuracy is you are looking for.

MR. KREEGER: The staff considered taking the requirement out entirely. We discussed that with Harold Denton. Harold said that if it took a couple of months to do the appropriate additional analysis by the staff or by contract to determine exactly what was the right number and what was the right accuracy, if you will -- right is a matter of iecisions -- he would be willing to have it taken out and enter another way, like the br.ach technical position, or like an additional regulatory guide, or something like that.

Mr. Case, on the other hand, felt that in our discussion after the meeting of Wednesday, that it was more desirable to leave it in as a relatively unspecific proscription, so that we would have industry still working themselves on what kind of a system was appropriate for getting decision-making guidance.

MR. BENDER: I like Mr. Case's approach, but I think the guide should give that kind of guidance to the licensees.

MR. MARK: I think there might have been a comment from the staff. Perhaps two oi three steps back to clarify something. Is that correct? Excus. me, Bill.

MR KERR: I can't tell whether we are trying to devise something that will enable us, given a significant amount of computer massage, to predict the course and intensity of radiation in a cloud that is ten miles downwind from the site or whether we are just trying to find out whether there is a break in the containment whereupon one goes outside and makes more careful measurements.

Which of these two is one trying to accomplish? It seems to me the instrumentation you use is very different, depending on which one of the two.

MR. KREEGER: I would conceive of both possibilities. I cannot get away from the fact that there are circumstances in which I do not have survey teams available yet and in which this instrumentation starts telling me information immediately, and I can use that with a mini-computer and meteorological data to tell me where that plume is going and what the dose rate is going to be in the worst part of that plume.

MR KERR: And it is conceivable that one would make a decision to evacuate based only on that information.

MR. KREEGER: I do not know that. Steve Ramos is the --

MR KERR: If you would not make a decision based on that, and you have to go out and get some other information, it seems to me that other information is what you make a plume decision on. But if there are situations in which you have to depend on this, and this only, to make an evacuation decision, then it is a different system, and it seems to me a licensee needs to know which of those two objectives, or if you have all of those objectives in mind.

MR. RAMOS: I am Steve Ramos, chief, emergency preparedness branch, and we would not -- and I will probably not make the decision to evacuate based strictly on this instrument. The purpose of the instruments is so that we can give a prompt notification to the state, local, the NRC, based on that immediate reading.

It is going to give us a reading based on the plants that we would have hand-plotted or coming in from a computer to show the operator that he has a high radiation or possibly high radiation level.

Based on that, he would make his notification to the state and local and to the NRC. He would immediately dispatch the shift monitoring teams to go out and verify exactly what that level is.

MR KERR: Suppose that one had a level that was ten times background. Would that be high?

MR. RAMOS: Yes, it would be high. We would go out and check it.

MR KERR: Would you do something different if it were 15 times background than you would if it were ten?

MR. RAMOS: Ten and 15 times background is no different.

MR KERR: What about 20?

MR. RAMOS: Still no difference. You are trying to get a number out of me.

(General laughter.)

MR KERR: I am trying to get some idea of the accuracy you need.

MR. RAMOS: We are not looking for something real accurate. We are looking for something to give us an idea what the level is at that point. That is why we agreed to these various changes.

MR KERR: Can a licensee reading what is in this Reg. Guide get the information which you just gave me? I rather doubt it.

MR. RAMOS: If he will read NUREG-0654, which is the criteria for preparation and evaluation of the plans for emergency plans in conjunction with this Reg. Guide, yes.

MR KERR: As I read this Reg. Guide, the instrument has to be able to read something that has significance from one MR above background to 10 R. Now, if all I really want is something like maybe 8 to 20 times background, I don't really understand the reason for the wide scale.

MR. RAMOS: If I knew that where this instrument was, that it read one-half R, 500 MR, I can lay an isoplat down and determine, based on the meteorological conditions, approximately how much I have at the highest point. It helps me to decide whether or not I have a real off-site problem or not.

Now, we have some curves that we can show you on how we would want to use this.

MR KERR: I am laboring from a situation which I have seen on the curves and so on. So you are telling me there is indeed more information, and the licensee has access to that, and he will read this, and he will say, hey, if you want to design this, go get NUREG so and so. That is one of the footnotes that I have missed somewhere.

MR. RAMOS: There is no footnote in this.

MR KERR: We told you to take the footnotes out.

(General laughter.)

MR. RAMOS: Reg. Guide 1.97 is only for the instrumentation to go into the control room, as the title says. NUREG-0654 is specifically for emergency preparedness, and it says you must have an off-site radiological monitoring system real time to be able to make decisions on giving prompt notification. It is in Reg. Guide 1.97, the requirement -- the fact that in NUREG-0696, which gives the requirement for emergency response facilities, we decided we would use 1.97 as the minimum data base for all of the facilities, making a subset for each one of those facilities.

And if we did not have it in 1.97, we would then have to come up with several other lists. There was no reason to do that.

MR. PLESSET: Dade, I want to point out that we are creeping through this at a snail's pace. I wonder if we could not accelerate things a little bit.

MR. MOELLER: As I understand the reason for the instrumentation here, it is to help the operator in the control room decide whether he has had a breach of containment or yes, indeed, he is having radioactive materials released to the environment, and if it can be used for other decisions, fine.

The question I have on it then, you mentioned Diablo Canyon, in order to tell the operator there whether he is leaking radioactive material into the environment, then I would need these installed instruments out in a perimeter in the Pacific Ocean, because although people are not there and I don't need it for emergency planning, I do need to know whether there has been a breach of containment and whether a cloud is moving the material.

Am I correct, then, that plants located on a seashore or on a lake and so forth, you would expect the perimeter of instruments to go out over a water area.

MR. RAMOS: To answer your question, no. As we in emergency preparedness envision it, this ring -- we don't care if it is a ring or square or star or what have you. The shape, we don't specify in emergency planning documents what kind of a shape it should be. All we say is, you must have a system.

Now, in order to fit a system in correctly, the licensee has got to do a study of the environmental conditions at his particular place to determine where the best location for an instrument has to be. We envisage it would probably be on site close to the plant. You could circle the plant very easily.

MR. KREEGER: I would like to comment that we had speculated that he would also see a breach of containment on other radiation monitors. That is what I was calling an unmonitored breach of containment, but we would not know for sure that it was a breach of containment.

For example, we might see area monitors within the plant go off -- go up, if there was a penetration in containment, that was what was breached. It might be a penetration into some other part of the facility. It might be a penetration to the outside. Since we were coupling the fact that we wanted some mechanism for recognizing unmonitored release of radioactivity or an unmonitored effluent point, that he would expect to have devices at a fairly uniform distribution outside the plant, but we are coupling that with the fact that the most important reason for knowing that is for decisions about people, so that if the wind were blowing offshore toward the ocean, and so forth, we might not be as concerned at that point, knowing that containment had been breached.

So, I could foresee, as Steve said, that you would not instrument the offshore or the beach necessarily, because then you would not care so much -- of course, the wind can always shift, and it can shift pretty fast, but you have things that would then see it as it swung back, and you would be using your isoplat. You would see it as it swung back on shore.

MR. PLESSET: Can we move along? Let's do that.

MR. SIESS: Has the Committee heard enough on this to know what its position is?

MR. PLESSET: Yes.

MR. SUMMERS: With regard to environs monitoring --

MR. SIESS: That is not working. You have to fix it so it works.

MR. SUMMERS: Dave Summers, Consumers Power.

I was a member of the ANS 4.5 group.

MR. PLESSET: I cannot hear you.

MR. SUMMERS: I was involved insofar as being on the committee scoping out the study by Scientific Applications, and I guess I would first like to say that that report at this point in time is a draft report, and it has not had adequate peer review in terms of at the NRC or throughout the industry at this point.

But there is a couple of, I think, pertinent results from that study which indicate that environs exposure rate monitoring is at best an ambiguous indication of breach of containment, and cannot be used for a release assessment. Specifically, if we take as an example the Three Mile Island accident, and I ask Phil Stoddard to correct me if I am wrong, where we had estimated, I believe, 40 percent TID source term and noble gases were released at Three Mile Island, the numbers that we were seeing at Three Mile Island which we could see in an environs exposure rate was in the vicinity of somewhere around 500 MR per hour, was the peak.

We are talking 10 to the 9 curies total noble gas for core inventory. We are talking in terms of a design base accident, 1 percent failed fuel, 3 orders of magnitude lower. If you start looking at all of the classes of accidents which have lower curie releases, it becomes apparent you are not even going to see anything if you get out much beyond 500 meters, and depending on how many you have, you still have the problem for the given accident in what the leak rate is.

Again, if you go back to the design base accident as opposed to Three Mile Island, where you may only have a 1 percent leakage rate out of containment per day or a tenth of a percent leakage rate out of containment per day instead of everything going out in two days, what you can pick up on these monitors decreases drastically.

We have -- I have to apologize. This was just done on the plane coming in from Michigan. It appears that if you couple this with the release, an unidentified release at .00 meters, the range we are talking about, attempting to detect for 1 percent failed fuel is between one-tenth of a microcurie -- excuse me, a tenth of a micro r per hour and 2 micro r per hour at 200 meters.

Although these devices are extremely sensitive, you won't be able to tell between background and the release. As a consequence, as a representative of the ANS 4.5, I informed our chairman we may have to go back and do a little more homework in terms of endorsing this parameter for 4.5, because in summation it is at best ambiguous indication and only applies for a very narrow set of accident scenarios, where there are very severe radiological releases.

MR. KREEGER: That latter point is one that we were perfectly cognizant of during most of the process of discussing this. It is not a high probability situation. The kinds of things that are going on and would cause you to want to have such a system, are low probability, both in terms of an event happening and other things that are coupled with it, such as not being able to get your teams out fast and such things.

In that sense, it is hardly a cost effective kind of proposal, but I think a lot of the things that we are talking about are not.

MR. BENDER: Mr. Chairman, I suggest we know enough to ask for more investigation of the proposal.

MR. PLESSET: I think we can leave it at that. We got your point. I think we can go on to the next item.

MR. SIESS: Okay. This is the last item that I intend to bring up, and this relates to the relation between Reg. Guide 1.97 and the instrumentation defined therein, and NUREG 0696, which relates to the emergency operating facilities, emergency response facilities, the alphabet soup that I mentioned earlier.

In its letter last August, the Committee mentioned this. I will not try to repeat the letter. I have read it three times now, and I don't understand it. But I assume you do. They mentioned the safety parameter display system at the Subcommittee meeting, I think both members of the -- both consultants mentioned that we -- we should go through Tables 1 and 2 of the guide and put asterisks by those items which would be a part of the safety parameter display system. This would not be entirely inconsistent with the purpose of the guide, since that system will be part of the control room.

Other people, industry representatives, proposed that the whole thing be integrated in some way, and that the guide be held up until all of these other questions can be straightened out.

Now, the staff restricted the scope of this to the instrumentation available to the operator in the control room, I think in response to the recommendation by the ACRS that they limit the scope. I don't know how the Committee wants to do it. You can discuss NUREG-0696, and what will presumably be some subsequent guidance from the staff as a result of the nuclear data integration group recommendations, and I think that this committee should discuss NUREG-0696.

We have discussed the nuclear data link. These are equivalent type things. But I don't see quite how we can discuss NUREG-0696 and Reg. Guide 1.97 and still help the staff meet the deadline we have set for the end of the year for Reg. Guide 1.97.

I have looked at it in the light that the staff has determined the instruments that are needed to follow the course of an accident. They have assigned those three categories, and some relationship to their importance as to redundancy, seismic qualification, environmental qualification, and reliability, et cetera, and what uses are made of those instruments outside of the control room is another matter.

As I mentioned earlier, I do think it is important that something be done to not require licensees to rush into implementation of Reg. Guide 1.97 as far as requirements for the other emergency support facilities require changes. And as I said earlier, I thought this co-ld be handled by recommending the implementation of this -- and take that into account.

Now, the implementation of Reg. Guide 1.97 is no later than June, 1983, I assume. I know it is the first of June or the last of June. It is a strange lack of precision there. No later. But a number of the items in here have already been referenced in NUREG-0578, 0660, 0694, 0737, et cetera. And they are to be impleme ed on operating plants or on plants getting licenses before June, 1983, according to that schedule.

So, there are certain things that are on a little faster schedule, but not because they are in this Reg. Guide, but because they have been required by something else. So, basically, if a nuclear data integration group is going to reach a conclusion and the Commission is going to agree on some criteria for the multiple facilities within one to three weeks as predicted inside NRC, then I think the June, 1980, pre-date is far enough ahead.

But if it turned out it got to be June, 1982, before they decided those other things, I would not be too happy about people getting started here.

Now, what does the Committee want to do about discussing the interrelationship between this document which the staff would like to consider complete and the other situation which is still in a state of flux?

MR. PLESSET: Mike?

MR. BENDER: As reluctant as I am to support it, it seems to me that we have to encourage the release of this Reg. Guide. I think it is too pervasive, and it is not so much because they have not settled what is to be done with the off-site instrumentation I am concerned about, but more because I think it has a lot of requirement in it that goes beyond what is really needed for emergency purposes in terms of operator use.

But we need to get something out so that the industry can go with it. I am inclined to believe that we can work on 0696 at some future date, and integrate that with this requirement, and I would be inclined to encourage the release of the Reg. Guide with a few provisos.

One of those has to do with the matter of not going too fast with this off-site monitoring requirement, because it is clearly not as well defined as it ought to be. Secondly, I think some of the in-core instrumentation that has been talked about, the temperature monitoring needs to be understood a little bit better.

Thirdly, I personally think that some of the purposes of the instrumentation go beyond the emergency. They are intended for the purpose of evaluating the plant later on, and even though that is not said directly, I think some of it is being used that way, and I would like to discourage that for the purpose of this Reg. Guide.

MR. PLESSET: Any other comment?

MR. MATHIS: I think that is a good summary.

MR. PLESSET: Chet, do you want to comment?

MR. SIESS: On the basis of what I have heard, I believe that the Committee is ready to recommend concurrence, with certain exceptions, and I have listed four things that we might comment on. One would be some comment regarding implementation, that the schedule consider that. I would expect some kind of comment on the environs exposure monitoring, and the cleanest thing would be to say, we agree with Denton, take the darn thing out and put it in some place later or put it in here later. That would be clean. I can write that paragraph.

The BWR thermocouples, if the staff eliminates the reference to the height, I think that might satisfy the Committee, and we would not have to say anything except, we have not seen the draft that has that out. We can make a reference to it. And if Dave were here, I am sure he would like to see us say something about reactor coolant system pressure, which in Revision 1, position C-3, was three times the design pressure, and it has been reduced to 1.5 times the design pressure.

I would think the recommendation that we revert to what we had before be included in the letter with some comment about accuracy. As near as I can figure it out, in ANS 4.5, we are talking about an accuracy of 10 percent of a span. I am not quite sure if it is a single gauge that reads from zero to 3,000. I assume 10 percent of 3,000. If the are multiple gauges, that is what I think they mean by span, and from what Dave said, I think 10 percent, you know, the span probably would not bother anybody. We might mention that, or we can just ignore it.

MR. BENDER: If it is recommended that the range be increased, I would like to take exception to it and put some remarks in to the intent that --

MR. SIESS: That is your privilege.

MR. SHEWMON: We might even put Dave's motion to a vote.

MR. SIESS: That would be appropriate when we write the letter, I think. I will draft the letter. I will include a paragraph on coolant system pressure and implementation.

MR. RAMOS: Could I interrupt for just a second?

MR. SIESS: Go ahead.

MR. RAMOS: Dr. Siess, in your comment about the high range, based on what Dr. Okrent said, as it is set up now in the technical support center, you are required to maintain a complete record tape of the -- all of the parameters for at least 30 minutes before the incident and then continuously throughout, so you can take that piece of data --

MR. SIESS: I am sorry. Are you talking about -- What are you talking about?

MR. RAMOS: You are talking about wide-range instrumentation.

MR. SIESS: I am talking about reactor coolant system pressure instrumentation to be three times the design pressure rather than 1.5.

MR. RAMOS: Okay. I am saying --

MR. SIESS: If you don't have a gauge that reads three times, I don't care how many minutes you --

MR. RAMOS: I am saying you are going to get that information.

MR. SIESS: Where?

MR. RAMOS: In the TSC.

MR. SIESS: Not if the gauge stops at 1500, you don't.

MR. RAMOS: You take the raw data coming into a computer. All you do is display it on the CRT, and --

MR. SIESS: We are talking about the control room operator. That we settled a few minutes ago. Not the TSC. And we agreed to that.

MR KERR: We are also talking about the instrument, not the display.

MR. SIESS: He is saying you compute it from other parameters.

MR. RAMOS: You can show it, display it, pulling it out and displaying it on a CRT because you have the raw data.

MR. SIESS: How do you get the pressure? What signal delivers the pressure?

MR. RAMOS: I think it is the --

MR. SIESS: The only question is the range, not where you display it.

MR. PLESSET: Do you have something?

MR. COLEY: My name is Bill Coley. I am representing the AIF working group. Yesterday, in a presentation in which we related to the similarity and the parallelism of Reg. Guide 1.97 and NUREG-0696, yesterday, we encouraged that 1.97 identify which parameters are monitored in which facilities.

The subject is not really that simple, though, because there are direct equipment qualification contradictions between 1.97 and the current version of 0696, which means that as a utility, I would implement 1.97 and then later go back and tear some of that out to meet the requirements of 0696.

There also is a basic contradiction between the two documents, in that 1.97 encourages the use of normal instrumentation; NUREG-0696 discourages the use of normal instrumentation.

MR. SIESS: I think those comments are covered by the proposal I made that we recommend there be no implementation until they are settled on all the uses of these instruments.

MR. COLEY: Yes, sir, Dr. Siess. This is, I guess, a summary we wanted to make rather than the unholy alliance that we suggested between the Commission and the industry, is that this would probably be a very good way for the industry and the Commission to get these facilities in operation to make sure they were in concert with each other, and to make sure we did put in the safety improvements in the plant as soon as possible, and I think that would be an excellent approach.

MR. PLESSET: Okay. Well, thank you.

Chet, why don't you go on?

MR. SIESS: I can draft the paragraphs on the pressure implementation. I can draft one on environs exposure monitoring, if it says delete it. I think I can cover them all, at least for a first shot.

MR. PLESSET: The question of the span, I think that could be settled by --

MR. SIESS: I would not -- if my interpretation of span is right, I am satisfied.

MR. PLESSET: I was talking about whether -- the range, I should have said.

MR. SIESS: That is the coolant system pressure. There will be a paragraph in there. You can take it out if you like.

MR. MOELLER: I don't really understand completely the negative response to the environs monitoring, because if we are looking for instruments to help the operator know what is going on to follow the course of the accident, they certainly could help confirm whether there has been a major environmental release.

MR KERR: Our negative response is not to environs monitoring, which I think is necessary, but to the fact -- I don't think enough thought has been given to this yet to incorporate it into a Reg. Guide.

MR. SIESS: In the past, I thought we were relying on monitoring crews out with portable instrumentation, and isoplats, and tower readings, et cetera. The scenario Mr. Kreeger described was the first half-hour or hour or whatever before those people are there, he wants the operator to have something special.

Now, I am still not convinced that 32 to 40, which is twice 16 to 20, and feeding everything into the computer, is going to distinguish between a ground level release and a high plume -- I can't follow it all, but it seems to me the staff is not in that complete agreement.

We did not ask the staff yesterday. We should ask them today whether there are any differing professional opinions. I should not use that term, because a differing professional opinion is a formal designation now, according to the regulations.

MR. MOELLER: I think we have to keep separate the emergency planning side and what we are supposed to be doing here.

MR. SIESS: That was one of the suggestions yesterday, that they take that out and put it in as part of the emergency plan.

MR. MOELLER: In his review of the differing professional opinions, could he comment on this particular subject?

MR. SIESS: We had one between Denton and Case, but that is not really differing --

(General laughter.)

MR. SIESS: At that level, I don't think they classify it --

MR. ROSENTHAL: On the peasant level --

(General laughter.)

MR. PLESSET: That is what we want.

MR. ROSENTHAL: There were several people who felt that the technology problems getting a meaningful signal at a reasonable cost precluded including this device in the Reg. Guide. There were others who felt that it was an important parameter and admitted that we did know how to do it but felt it was sufficiently desirable that we should have some indication of it in the Reg. Guide, in part because the Reg. Guide carries more persuasion or persuasive force than some other documents we might use.

MR. PLESSET: Okay. Well, thank you very much.

MR. SIESS: Very well put. Very well put.

MR. PLESSET: Yes, and we appreciate it.

MR. SIESS: It sounds like Denton versus Case.

(General laughter.)

MR. SIESS: Mr. Chairman, I am through.

Are you sure you don't want to quit while you are ahead?

MR. HINTZE: If you think I am ahead, yes.

(General laughter.)

MR. PLESSET: I think you are relatively ahead, yes.

MR. HINTZE: I just wanted to mention that if you take it out of the guide, you are elininating one of the areas of scope which we had in the guide, and that was to detect a breach of containment to keep the operator informed of that.

MR. PLESSET: Okay.

MR. HINTZE: Just keep that in mind when you make your decision.

MR. PLESSET: The Japanese had this kind of system. They already have this.

MR. SIESS: You can get that without a breach of containment, can't you?

MR. HINTZE: That is true. If the staff monitor has nothing, then you know nothing is happening.

MR KERR: Do these have these monitors --

MR. PLESSET: They have a monitor. It is made in Japan. That is what it says on it.

(General laughter.)

MR. FRALEY: They have a panel in the control room that reads several off-site monitors and alarms.

MR. SIESS: Somebody mentioned yesterday that if the thing had really worked -- this was from the industry -- that they were trying to figure a way to use it to monitor for Appendix I releases.

MR. PLESSET: Is that what you were going to say?

MR. SCARAPA: Yes.

MR. PLESSET: Can you be as succinct as Dr. Siess?

MR. SCARAPA: My name is Joy Scarapa. The systems that you are talking about are installed in Japan. Six utilities -- six utilities will be installing these in the next few months in the United States for emergency planning as well as for Appendix I levels. This would be a range of one micro r to ten r. So, it would cover the original range you had at Reg. Guide 1.97 of 10^{-6} up to 10 r.

This would be with activating alarms and computer printout and diagnostics as an on-line continuous system, so they will be installed at Indian Point, TMI, Diablo Canyon, one foreign reactor and the reactors in Illinois.

MR. MARK: That is the range now wanted in 1.97?

MR. SCARAPA: Yes. That is what our system can do.

MR. MARK: The background is?

MR. SCARAPA: Typical background levels with our unit is about 10 micro r per hour, which would go to 120 per year.

MR. WARD: How are the sensors arranged around the plant?

MR. SCARAPA: It varies with the utility, and they have elected based on their geography and wind direction in some cases 16 sensors in 22 and a half degree quadrants. Others only ten, like Diablo Canyon, because they are on the ocean. They have not monitored the ocean, but have it along the coastline, so that the wind does shift.

If people in San Luis Obispo -- there is a warning if the level is exceeded, and it has alarm levels that can be adjusted by the operator.

So, in that sense, you consider anywhere from a background of 10 r -- you can set it at any level, depending on the utility.

MR. WARD: The plant boundary?

MR. SCARAPA: Yes. Some go out to ten miles. Some go out to site boundary.

MR. BENDER: Can I ask one question? Have you looked at the SAI report?

MR. SCARAPA: Yes, we were visited by SAI to evaluate our system as a viable system for making this type of measurement. I have only heard comments about the SAI report. I have not received a copy.

MR. BENDER: It would be useful to know whether your instrument can do something that is more than --

MR. SCARAPA: They brought out some points about the placement of the sensors and the number of sensors --

MR. PLESSET: I don't think we want to pursue this any more. Thank you very much. We appreciate the little sales pitch or whatever.

Chet, are you satisfied?

MR. SIESS: I am through.

MR. PLESSET: I guess we can then take a break, a short one, and come back for further labors.

(Whereupon, a brief recess was taken.)

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

____

in the matter of: ACRS - 247TH GENERAL MEETING

Date of Proceeding: November 7, 1980

Docket Number: ____________________

Place of Proceeding: Washington, D. C.

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

Davis S. Parker

Official Reporter (Typed)

(SIGNATURE OF REPORTER)

POOR ORIGINAL

NUCLEAR REGULATORY COMMISSION

This is to certify that the attached proceedings before the

Advisory Committee on Reactor Safeguards 247TH GENERAL MEETING

in the matter of:

Date of Proceeding: November 7, 1980

Docket Number:

Place of Proceeding: Washington, D.C.

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

Ann Riley

Official Reporter (Typed)

ANN RILEY

Ann Riley

Official Reporter (Signature)

NRC FUNCTIONAL REQUIREMENTS FOR

NUCLEAR POWER PLANT EMERGENCY FACILITIES

- Safety Parameter Display System (SPDS)
- Technical Support Center - Onsite (TSC)
- Emergency Operations Facility - Nearsite (EOF)
- Nuclear Data Link (NDL)

EMERGENCY RESPONSE FACILITIES

System	Location	Time of Operation	Prime Users	Minimum Data Requirements	Primary Functions
SPDS	Control Rm.	Continuous	Reactor Operators	Subset of RG 1.97	- Monitor safety status of important plant systems - Display overall safety status - Provide alert (signal) if any safety parameter approaches an unsafe condition
TSC	Near Control Room	During Emergency & Recovery Operations	Licensee Mgt. & Technical Support Staff/ NRC Site Team	RG 1.97	- Plant mgt. & tech. support for control room - Additional info source for EOF & NRC - EOF functions until EOF is staffed
EOF	Near Reactor (1-3 miles)	During Emergency & Recovery	Licensee Mgt. & Technical Support Staff/ NRC Site Team plus State Officials & other Federal Agencies	RG 1.97	- Overall mgt. of licensee emergency response resources - Coordinate & evaluate actions having potential environmental impact - Coordinate with local, state & federal agencies - Public information
NDL	NRC HQS	Continuous	NRC Emergency Mgt. Team & Tech. Staff	Subset of RG 1.97	- Monitor & Independtly assess - Advise Licensee - Provide public information

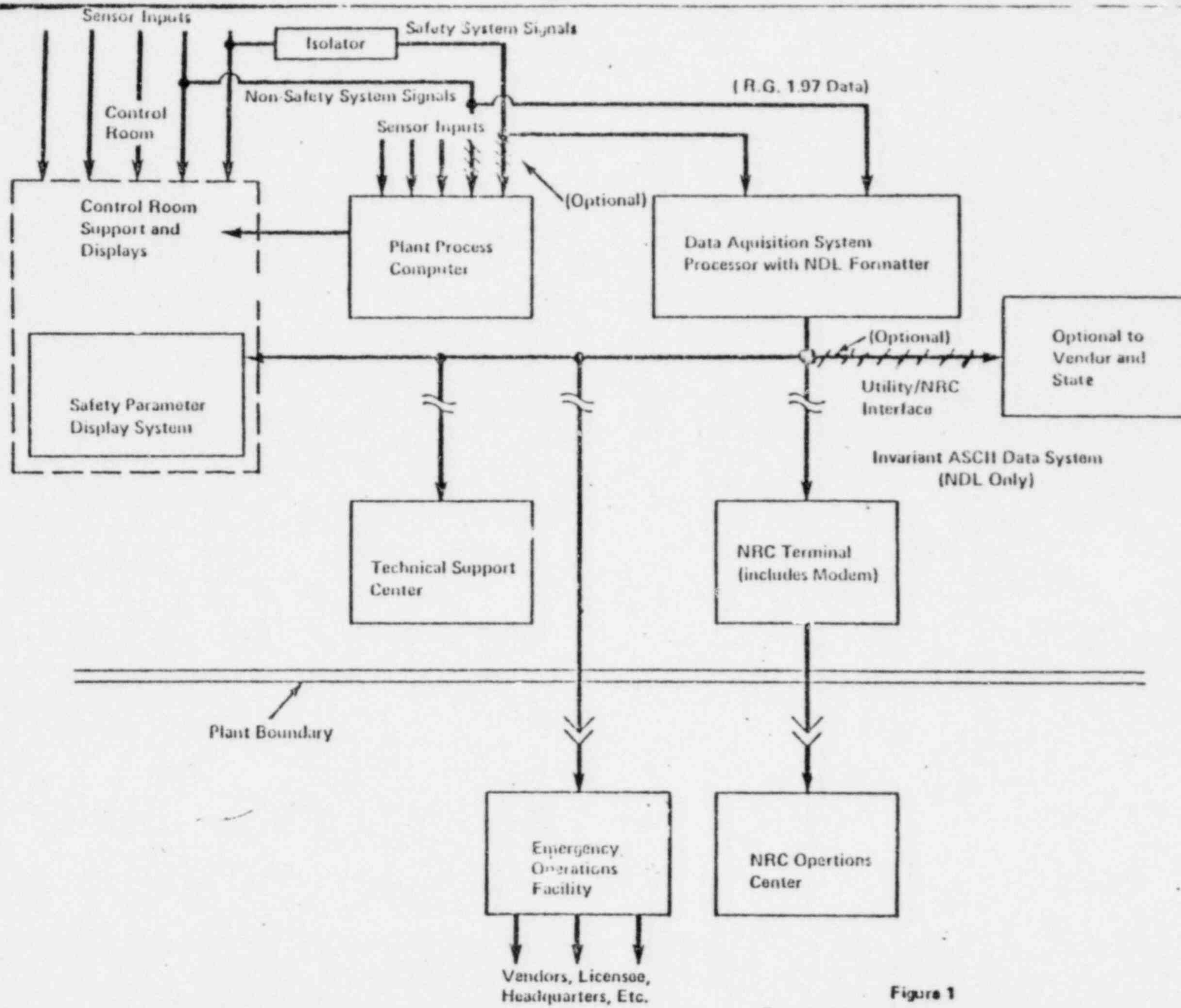


Figure 1
Functional Block Diagram of Data Flow.

MONITORS FOR HYDROGEN AND OXYGEN

BACKGROUND

1. 10 CFR 50.44 AND TECHNICAL SPECIFICATIONS

   . LIMITS HYDROGEN CONCENTRATION TO 4% IN NON-INERTED CONTAINMENTS;

   . LIMITS OXYGEN CONCENTRATION TO 4-5% IN INERTED CONTAINMENTS.

2. TMI ACTION PLAN

   . ITEM II.B.7 RESULTED IN SECY 80-107

   . ITEM II.B.8 CALLS FOR RULEMAKING PROCEEDINGS ON DEGRADED AND MELTED CORES

   . ITEM II.F.1.6 REQUIRES HYDROGEN MONITORS

3. INDUSTRY FEEDBACK

   . HYDROGEN MONITORS THAT HAVE RANGE BEYOND 10% ARE NOT READILY AVAILABLE

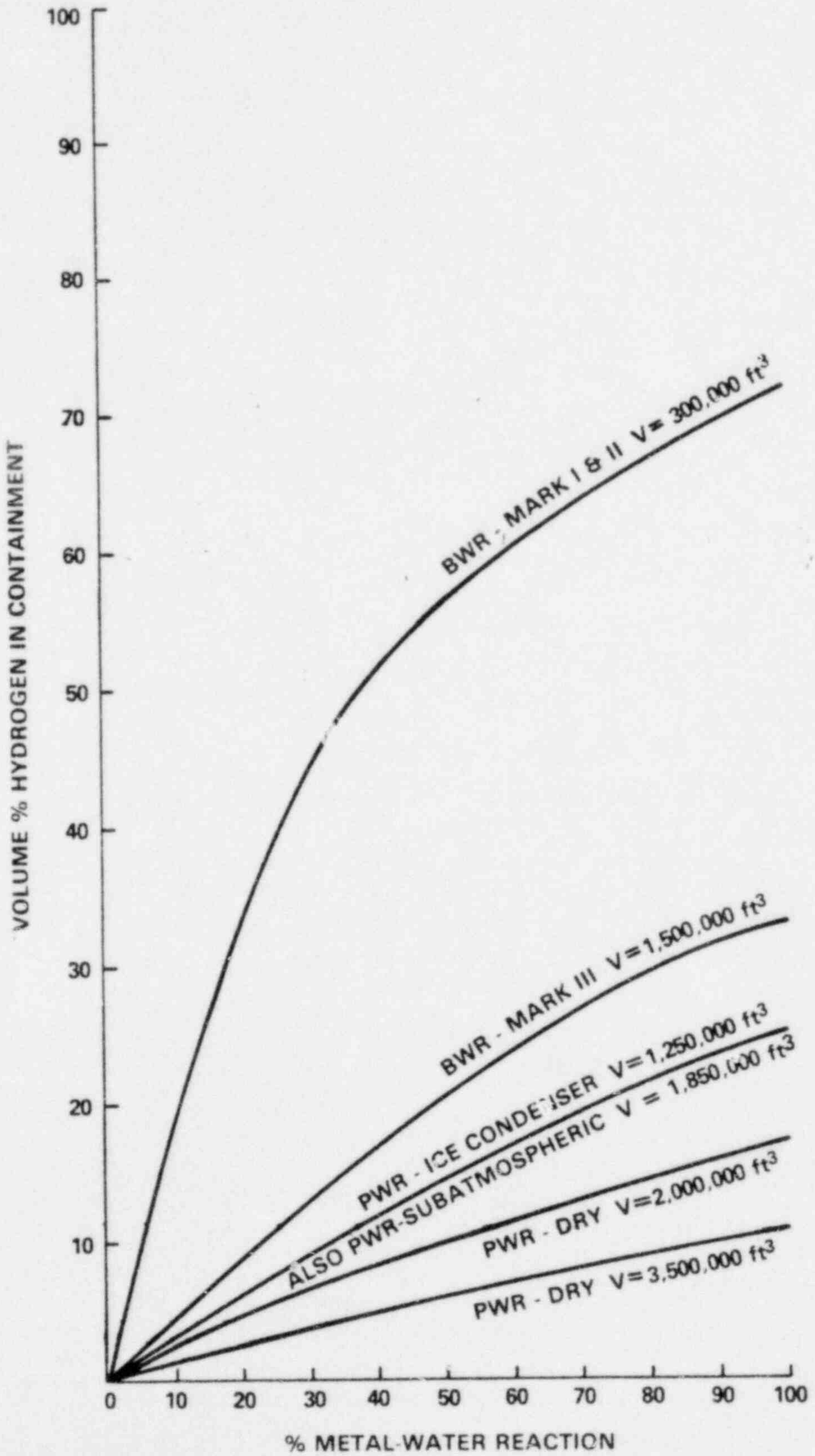
   . ACCURACY IS DEGRADED AS RANGE IS INCREASED

   . RESPONSE TIME TENDS TO BE SLOW

REGULATORY GUIDE 197 PROVISIONS

CONTAINMENT TYPE	H_2 RANGE	O_2 RANGE	REMARKS
PWR - DRY	0 - 10%	-	
PWR - ICE	0 - 30%	-	NEED H_2 MITIGATION
BWR - MK I	0 - 30%	0 - 10%	INERTED
BWR - MK II	0 - 30%	0 - 10%	INERTED
BWR - MK III	0 - 30%	-	NEED H_2 MITIGATION

VOLUME % HYDROGEN IN CONTAINMENT VS % METAL-WATER REACTION



INTERACTION CRITERIA

1. SOURCE AND TARGET CONTACT
2. FLUID LEAKAGE
3. ELECTRICAL ANAOMALY
4. ENVIRONMENTAL EFFECTS
5. SECONDARY OR CHAIN INTERACTION

E

ONSITE (INITIAL) EVALUATION

1. WHETHER OR NOT INTERACTION OCCURS
2. INTERACTION OCCURS BUT NO SAFETY FUNCTION IMPAIRED
3. RECOMMEND A MODIFICATION
4. RECOMMEND FURTHER EVALUATION

INDEPENDENT AUDIT

- PERFORMED SAMPLING WALKDOWN
- AUDITED TEAM WALKDOWNS
- PERFORMED ANALYSIS
- DOCUMENT REVIEW
- REVIEWED COMPLETED MODIFICATIONS