Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
Thermal-Hydrualic Phenomena Subcommittee
OPEN SESSION

Docket Number: (not applicable)

Location: Rockville, Maryland

Date: Thursday, January 15, 2004

Work Order No.: NRC-1252 Pages 179-222/322-379

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

SUBCOMMITTEE ON THERMAL-HYDRAULIC PHENOMENA

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THURSDAY,

JANUARY 15, 2004

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., Dr. Graham Wallis, Chairman, presiding.

COMMITTEE MEMBERS PRESENT:

GRAHAM B. WALLIS, Chairman

RALPH CARUSO, ACRS Staff

F. PETER FORD, Member

THOMAS S. KRESS, Member

GRAHAM M. LEITCH, Member

VICTOR R. RANSOM, Member

STEPHEN L. ROSEN, Member

JOHN D. SIEBER, Member

ACRS STAFF PRESENT:

AMY CUBBAGE

JIM HAN

WILLIAM KROTIUK

RALPH LANDRY

SHANLAI LU

MARCOS ORTIZ

DAN PRELEWICZ

MUHAMMAD RAZZAQUE

UPENDRA "KUMAR" ROHATGI

JOE STAUDENMAIER

ED THROM

C O N T E N T S

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

MS. CUBBAGE: Mr. Chairman, I think we could open now for the conclusions.

DR. WALLIS: We now can open. What you are now going to say is open to the public. Yes. Okay. We're now in open session. Thank you very much. It says "Proprietary Information."

MS. CUBBAGE: I overruled him.

MR. LU: Yeah, that's Microsoft issue. Thanks for Bill's presentation. Actually, that was -- the containment model was built to support us, and without that model we cannot do the calculation. I just want to give a quick summary and jump into the conclusions and funding.

We ran about 28 independent analysis cases. All we gave to you as a presentation this morning, as Ralph said, was a snapshot. Okay. We ran many sensitive cases to nominal base case provided by GE, and we did change a lot of parameters and analysis scenario, and added the feedwater system, assuming forfeit available for MSLB.

We identified many issues through this review process, and reiterated with the document reviewers, and then we issued many RAIs. Okay. At this point, all major issues have been resolved, and

our conclusion based on our confirmatory analysis, we believe that for the most limiting ECCS LOCA TRACG is capable to analyze that. And also, it has the capability to analyze the peak containment pressure for my MSV LOCA case. It's bounding and realistic too.

New issues to be resolved before FSER, I think that's lumping, and to point it out, since we still have that update --

DR. WALLIS: Let's go back to this conversion here.

MR. LU: Okay.

DR. WALLIS: TRAC is capable of analyzing and calculating. Of course it is, that's what it does.

MR. LU: Yes.

DR. WALLIS: But what you really have to say is that it does it in some adequate or good enough way. I mean, it's capable of analyzing. That's what it does.

MR. LU: Oh, yes.

DR. WALLIS: So first say something qualitative about the quality of this work, what it does.

MR. LU: Okay.

DR. WALLIS: Shouldn't you just say within acceptable accuracy, or with an acceptable uncertainty or some --

MR. LU: Yes.

MR. ROSEN: Or as badly as TRACE?

MR. LU: TRACE is good too.

MR. ROSEN: Or as good as TRACE? Well, you don't know. They go through the same -- similar answers, but they both could be wrong. Right?

MR. LU: Okay. Yes, that's --

MR. ROSEN: I'm just asking a very serious question here.

MR. LU: Sure.

MR. ROSEN: And then the serious question is if two things give you the same answers, does that mean that answer is right?

MR. LU: If you look at the code we are using right now, that's the reason I want to mention right at the beginning, the reason we want to use CONTAIN Code, the model containment, which provides the feedback to your pressure vessel could model the PCCS, and also model the GCS pool, which calculated the gravity-driven pressure there, which is totally different from TRACG Code, totally different numeric scheme, totally different physics model. And also, if

you look at the TRACE code internally, it's totally different from TRACG now. There is now AIA. There is no small core memory and mapping to the large core memory.

MR. ROSEN: And so those two give you the same answer, and I say that's a coincidence.

MR. SIEBER: It's the test data that makes the difference.

MR. LU: Yes. But at this point, we cannot really say TRACE is the code, which calculated results, and based on the results we gave the position. We did not do that. We used TRACE as a tool to give us the --

MR. ROSEN: Hold on.

MR. LU: Okay.

MR. ROSEN: You're too close to this. The serious question here is if two methods give you the same answer, you conclude that the answers must be right. I conclude that it's a coincidence, but to avoid that you have to benchmark with some third method, or something that's incontrovertible, maybe along the lines of your gravity preservation.

MR. LU: Right.

MR. ROSEN: That these answers are both correct, or physically reasonable. You have to peg

this somehow.

MR. KRESS: When you benchmark a code, you normally do things like run it against analytical solutions, easy things. You do all that to each code. And also, if you have two current and they're independently developed by independent people, and they give pretty much the same answer, that's not exactly -- I wouldn't say that's coincidental. My first impression was not -- that's not a coincidence.

DR. WALLIS: But it could be just a simple problem, and everybody is going to get the same answer.

MR. KRESS: It could be that.

DR. WALLIS: It could be that, in fact, this thing works so well that's insensitive to all these assumptions, and just two buckets of water with a pipe, and all this other stuff is --

MR. KRESS: And that's probably pretty much the case for this nice reactor design.

DR. RANSOM: Well, you have to couple that with the assessment that's been done, which gives you assurances that again these things are correct physics. In fact, I don't know - can't you derive some information from your PSTF comparison in terms of whether or not this is conservative or unconservative?

MR. LU: Yes, that's I think the last line. There is proper application precision needs to be provided, and I think that's -- I forgot exactly. Proper application procedures are needed. That means the -- I'll tell you the truth. I don't really believe that every single -- no code can really mechanics remodel what's happening inside of the suppression port, the stratification, condensation very well. There is no code where it can do that. That's the reason --

DR. RANSOM: You said that they were bounded or --

MR. LU: Yes, we were bounded.

DR. RANSOM: Then I think that's a little more conclusive, if you can say that. From some of the assessment it does appear to be conservative.

MR. LU: Yes, you're right.

DR. WALLIS: But you can't just make this statement. You've got to say something else.

MR. LU: Okay.

DR. WALLIS: You get in trouble here. I'm sure Ralph is going to word it right. If you start saying things like TRAC is capable of analyzing HS LOCA with acceptable accuracy and uncertainty, then I'm going to come right back and say what's your

measure of accuracy and what's your measure of uncertainty.

MR. ROSEN: And I'm going to come back and say something like you need to put in there, and it is benchmarked against hand calculations that are incontrovertible, and can reproduce those hand calculations.

MR. KRESS: Well, that's almost implied in there.

DR. WALLIS: Well, it is capable. I mean, it doesn't say anything. I'm capable of running a mile, but I couldn't race a mile, so I mean, there's all kinds of things.

MR. KRESS: I agree with you on the way it's worded.

MR. CARUSO: I'm not sure it's implied. I thought Ralph actually explained it yesterday, and we're forgetting this, that they're using the CSAU methodology to do this. And the CSAU methodology is what contains all these elements that you're talking about. There's comparison against data, the validation of the models, the interval experiments, the interval experiments against data, the reasonable test.

MR. ROSEN: Reasonable test.

MR. CARUSO: That is all in that whole thing.

DR. WALLIS: So you can say TRACG meets all the criteria CSAU --

MR. CARUSO: That's what they should be. And I'm not going to say this for them, but that's what I would expect them to say.

MR. SIEBER: Well, that's the way the SER is written.

MR. CARUSO: That's what the SER says.

DR. WALLIS: Okay. So it's just that the slide is --

MR. LU: But this summary is really a summary for the part we are -- for the staff independent analysis part. It's not the final summary for the entire --

DR. WALLIS: Well, we all know that -- we knew that three was true before we even walked into the room. Now the question is, is it acceptable? Are there some features of it which are acceptable? You have to qualify it and say there's other features that are not, and so on. It's not a simple matter.

MR. LU: I agree. But the reason I did not get into that, because that is the only part of the analysis we can derive that conclusion. This is

only part of the evidence I provide to you. And the document review, and other part TAPD, which is a part of the review process too, so that's the reason I don't want to jump that one yet. And Ralph will give you the final conclusion after I finish my part.

DR. RANSOM: Well, another part of this is the use of the PUMA data, which should provide another assessment for whether or not these are reasonable. And I'm wondering, does the NRC plan to do that at any time?

MR. LU: From NRR side, we don't have any plan. But Research has planned to benchmark their TRACE Code, assess their TRACE Code.

MR. KROTUIK: This is Bill Krotuik. I'm currently in the process of using the coupled TRACE CONTAIN Code to analyze PUMA tests. I'm in the process of doing that.

DR. WALLIS: The old SBWR?

MR. KROTUIK: The old SBWR.

DR. WALLIS: I think that would be a good thing to do, definitely.

DR. RANSOM: Although, they've run tests I think now with the new coupling, I think. Right? So it more appropriately simulates the ESBWR?

MR. KROTUIK: Yes. The new coupling is

the update of the old coupling that was used for the AP1000, and now it has valves reverse flow and it determines whether it's liquid flow only, for gaseous flow, or two-phase flow. There's a lot more logic to it right now.

DR. RANSOM: The AP1000, what was that about?

MR. KROTUIK: Well, in other words, there was a coupled TRACE CONTAIN analysis done on the AP1000, but that was -- on those type of plants you're only looking about flow in one direction, but now we can look at the possibility of getting flow in either direction, which added more logic to the coding.

MR. LU: Anyway, the PUMA data will be helpful for --

MR. LANDRY: If I may, this is Ralph Landry from NRR again. With regard to PUMA, the PUMA facility, as we've said throughout the presentations, is a facility that is being designed and operated to provide confirmatory information to the Office of Research. We have not asked General Electric to participate in calculation of the test data, because one, the tests were not expected to be done before we were planning on being done with the code review. And two, because we are not aware of the QA Program, and

if the QA Program matches the requirements that we would impose on an applicant using test data for assessment purposes. If there's not a QA Program in place that would meet Appendix B requirements, we cannot impose use of those data for assessment, and judge the licensing applicability of the methodology against those data. That's the very reason we have stated that PANDA-P test cannot be used for assessment purposes, so there are multi-faceted reasons why PUMA is not being used for assessment of the applicant's code, but it is going to be used for assessment and confirmatory analyses with an NRC code.

DR. RANSOM: That's all you'd want, I think. But it provides a cascading of conclusions, you know. If you conclude that TRACE is okay, and TRACE agrees with TRAC, then you can conclude something about what TRACG is capable of.

DR. WALLIS: But, Ralph, this is an NRC-sponsored experiment, PUMA. It's conceivable to me that you approve TRAC and say it's wonderful based on QA experiments and all that, and then someone makes a comparison with PUMA and says wait a minute. TRACG is way off.

MR. LANDRY: But we're not running TRACG against PUMA.

DR. WALLIS: But when you do.

MR. LANDRY: But we won't.

DR. WALLIS: You refuse to do it?

MR. LANDRY: It's not our responsibility. The TRACG has been compared with a number -- TRACG has been compared against TRACE for a number of calculations. TRACE will be compared with PUMA. Now if we see that we say TRACG and TRACE are doing comparable work, and we say that TRAC - and this is what Vic was just saying - if TRACG - excuse me, too many TRACs here. I'm getting off the TRAC here. If TRACE does an acceptable job of comparison with PUMA test results, we would expect TRACG to do so also.

DR. WALLIS: You are not allowed to run the TRACG which you have against data which you have, which the public paid for? You're not allowed to do that?

MR. LANDRY: Well, we could ask General Electric if they would like to.

DR. WALLIS: You're not allowed to do that.

MR. LANDRY: But we are going to make a determination with regard to TRACG prior to the PUMA material being available.

DR. WALLIS: Well, that's all right. It

may be that they're such good guys, they'll do it anyway.

MR. LANDRY: We're not basing an acceptance of a code on one test facility. Our basis for acceptability is all of this material that we presented the last two days, the material which General Electric presented in July, all the documentation which they have prepared, and the documentation which we have put forward in the draft SER. And what Shanlai is saying here is, his conclusion is a conclusion looking at analyses, confirmatory analyses. Our conclusion overall though, is based on all of this information brought together.

DR. WALLIS: It's based on neglecting the PUMA.

MR. LANDRY: Well, PUMA is not available right now.

DR. WALLIS: But you understand what I'm saying.

MR. LANDRY: Yes, I understand.

DR. WALLIS: It seems very strange to me. I mean, suppose you had something like the Loft Test, very extensive and used for PWRs in the old days, and it turned out that GE - it didn't meet some qualification that GE would require for data or

something, you couldn't use them. It's absurd. That's the case. Someone slipped up and didn't quite fulfill the right QA requirements to meet GE's specs or something, or GE wasn't involved; therefore, you can't use it. Is that the case?

MR. LANDRY: There's more involved in it. That was only one point I was bringing up with it. That's not the only reason.

DR. WALLIS: Well, maybe there won't be any control -- GE are good guys, and they're going to test against everything available. But you're not going to make these data available to the --

MR. LANDRY: I can't speak for the Office of Research.

MR. HAN: This is Jim Han. I was the first PUMA Project Manager. Let me say a few words about the old PUMA data for SBWR. First, it does not meet the Appendix B QA requirement, number one. Number two, during the test we find out the vessel had leakage. Is a long story - okay. So in other words, at this point, I'm kind of in support of what Ralph stated earlier regarding the PUMA test data.

DR. WALLIS: So this failure to meet QA makes it a waste of money to have supported the work in the first place. Is that the case?

MR. HAN: Well, as you know, the University Standard is less stringent compared --

DR. WALLIS: In some ways, it's more stringent.

MR. HAN: And QA, there's one standard. It just so happens when -- this is a long story. When view the PUMA facility we followed the code. For some reason, the material used due to certain limitation, caused the vessel to leak, so later on they replaced the vessel. Okay. That's all.

DR. WALLIS: So this won't happen with the new PUMA experiment?

MR. HAN: It should not happen in the new PUMA experiment because of we already learn a lesson. This is not produced for -- there was a problem with the code regarding either the boiler or the pressure vessel.

DR. WALLIS: Not the thermal hydraulics code.

MR. HAN: No, is not hydraulic -- is not Vic Ransom's fault. Vic was one of the persons in charge.

MR. KRESS: But those kind of standards in the QA are to be sure that you don't have failures in the equipment, and that the equipment works correctly.

It doesn't invalidate the data if everything happens to work well. Can't you still use the data, even though it doesn't meet the QAs?

DR. RANSOM: I would say so. The leaks are rather minor. They were probably equivalent to the control rod drive leaks that we've seen.

MR. KRESS: It looks like it would be a good test.

DR. RANSOM: A fraction of one percent. So I don't think that invalidated the data.

MR. KRESS: That would be my thinking.

MR. LANDRY: Well, yes. The data are still there, but where you get into difficulties, when you attempt to assess uncertainty and establish biases on data that you don't have the providence for, that you would expect for a good uncertainty analysis. And that's the purpose of the QA, to establish the providence on the data to show that we can -- we understand the uncertainty, and we can use those data sets with a confidence level on the uncertainty.

DR. WALLIS: Well, I'm very surprised, because I see in this presentation, and I saw one two days ago, they put up something and they say they compare with Dartmouth data. Now nothing could be worse than the QA that we have at Dartmouth, except

that it meets the professor's standards. It doesn't meet anybody else's standards, and probably never will. So what is it doing ever appearing on a slide?

MR. KRESS: And everybody knows Dartmouth professors have low standards.

DR. WALLIS: Yes, so what is it ever doing appearing here?

MS. CUBBAGE: I'd like to say something. Amy Cubbage. If we felt that there was any deficiency in the data that GE was presenting in support of their design, they would have to do additional testing. We would not rely on NRC tests.

DR. WALLIS: What I object to is rejecting PUMA data, which is obviously far higher classed than anything that I was responsible for that's being quoted here quite a few times in this agency in support of making decisions.

MS. CUBBAGE: I think you --

DR. WALLIS: I'm very surprised that that's the case.

MR. LANDRY: I think that what we have to do is back up a little bit. We're not rejecting the PUMA data. We're simply not requiring the applicant to calculate.

DR. WALLIS: But you can calculate it.

Okay. Well, maybe we should move on from this discussion.

MR. LU: Okay. Issues to be resolved before the final ICR. And I mentioned before, since the minimal thermal margin, they did provide a new version of the code. We need to look at that, and Vic mentioned that it's actually sudden LOCA, break flow, there is a spike. Actually, it was observed through the PUMA. GE will be addressing that. And we also found something inside of the -- remember I mentioned the U-Tube type of lung, 15 second period of oscillation like that, and we did see quite a lot of -- observe collapsed water level inside ring one, inner ring. And we want to have the explanation from GE to say how this will be impacted on the minimum water level. That's the issues needed to be resolved for FSER for this particular part of the review.

DR. WALLIS: I thought there was something mentioned about should it become apparent the core might be exposed, something would have to be done. Is that -- I would like to get --

MR. LU: We never even -- for all the worst case, we never saw that the core was uncovered.

DR. WALLIS: It's just, I seem to remember that that --

MS. CUBBAGE: But you're right, that would be a condition in the SER, but that's not one of Shanlai's conclusions for this part of the presentation.

DR. WALLIS: I do remember right, there was something --

MS. CUBBAGE: You do remember right, yes.

MR. LU: Yes, but that's the reason we want to leave the design and certification review stage. If there is any condition, because right now the design itself is a reference design. It's not a final design yet. Okay.

During the design certification review stage and for long-term ECC LOCA analysis, right now they use fixed boundary conditions, and for the PCC heat changer external surface, which is conservative, but we think that we want to keep using this for their ECCS LOCA analysis, and it's better for them to add additional nodes, so that the mechanics can model the poor boiler situation.

We mentioned in July that there is some nodalization issue related with GDCS pool, which gives a slightly higher pressure because of nodalization. And I think this can be resolved during the design certification stage.

DR. WALLIS: Does it have to do with the gravity?

MR. LU: Yes.

DR. WALLIS: It does?

MR. LU: Yes, it does. But it's not -- we issued an RAI and the response came back, and we got it, and we think that's acceptable at this point. I don't think it's a big deal at all in terms of --

DR. WALLIS: That's a place where you obviously have to use level tracking, because there is a real level in there.

MR. LU: Yes, they do. But also, you want to put a node on top of the water level so that you can accurately calculate the air space pressure. Feedwater operation out of the mass energy release need to be evaluated for a massive E case. Once the feedwater system was -- the design is finished during the design certification stage. And right now, we cannot really check in detail about this input to models for ECCS LOCA and SLB LOCA because it's reference design. And during the design certification stage, what we are going to look for is the design record file to support every number you put into it, the geometry number you put into that input deck, so we need to check that. That's something during the

design certification stage we want to see. Okay.

MR. FORD: Now for my peace of mind, this stage here when you have a detailed design certification review, you take into account combined thermal hydraulics issues, materials issues associated with, for instance, gallons of cold GDCS water hitting a hot irradiated stensial component. This is the issue I brought up earlier on, and no one seems to be shoving it apart and say that's just materials concern. There's a thermal hydraulics materials concern.

MR. LU: You're talking about thermal shock issue. Right?

MR. FORD: Well, thermal shock is one, yes.

MR. LU: Okay. Well, the thermal shock issue obviously is not part of the review scope as opposed to the TRACG application, but that definitely needs to be looked into during the design certification stage as part of a materials problem.

MR. FORD: Exactly, PTS issue. So thermal hydraulics/materials.

MR. LU: Okay. As part of the TH calculation, and TRACG has the capability to put a slab there to model the vessel, actually sensible heat

in the LOCA stage, and then -- and actually, each node you can attach, if you structure, model what you are talking about here.

MR. FORD: I understand that. In the very beginning, the first day Ralph kind of said hey, don't worry, Peter. We'll deal with that later on in the design certification. I don't see it on that list, and I'm assuming that it will be on that list some time.

MR. LU: Oh, yes. This is the analysis part of --

MR. LANDRY: Peter, the answer is yes.

MR. FORD: Thank you.

MR. ROSEN: Before you get off that, my issue, Peter's issues are materials. My issue is operational, which is this 10 to the minus 4 leak rate between drywell and wetwell. Ten to the minus 4 per square meter.

MR. LU: Right.

MR. ROSEN: How many vacuum breakers does this machine have?

MR. LU: Three.

MR. ROSEN: So each of them is one-third of 10 to the minus 4 square meter. Does it matter? What if the leak rate were 10 times, the leakage area

were ten times 10 to the minus 4, what would it do to these calculations?

MR. LU: That's a good question. I think the code can handle that, and I want to show you a slide. Okay. Here it is.

MR. LANDRY: Shanlai, this is Ralph Landry again. If I may, that really is not going to challenge the phenomenological capability of the code. Whether the leak rate is 10 to the minus 4, or 10 to the minus 3, or 10 to the minus 2, what it is going to alter is the calculated result. I don't know how much – we can't address that right now, but phenomenologically, it's not going to alter the capability of the code. And that's what we were trying to address right now - does the code have the capability to represent the phenomenon, so yes or no, does it or not.

MR. ROSEN: I'm asking this question on a slide that says, "Issues to be resolved during design certification review." Shouldn't that issue be resolved during design certification, whether or not the leak rate is –– the peak pressure and temperatures are sensitive?

MR. LANDRY: When sensitivity studies are performed at the design certification stage, yes, that

will be resolved.

MR. ROSEN: It's not on the list.

MR. LANDRY: We are looking at the capability of the code --

MS. CUBBAGE: This certainly is not intended to be a complete list of issues.

MR. KRESS: That's the issues related to his work.

DR. WALLIS: Ralph, your argument, that makes me -- I've been wondering what it is that is at issue here. I mean, TRACG has a framework, and within it there are lots of assumptions. It seems to me that when you bless it, you're blessing both the framework and the assumptions, because if the assumptions change markedly, its ability to predict data changes markedly. You have to take something like this assumption of 10 to the minus 4 as part of the integral thing that you're approving.

MR. LANDRY: And at the final stage it will be, because there are a number of sensitivity studies that must be performed for final approval of a design. At that point, those assumptions will have to be demonstrated to fall within the phenomenological capability of the code as reviewed. Now if those assumptions produce phenomena that are outside of the

range as reviewed, that will reopen review of the code.

DR. WALLIS: But suppose the code had a condensation coefficient in this PCC system which was calculated using a completely wrong equation, you would flag that as an RAI. You'd make them correct it before you approve TRACG, which is the details you're checking, as well as the structure of the code.

MR. LANDRY: That's correct.

DR. WALLIS: And this is detail too.

MR. RAO: Graham and Steve, I've done extensive -- Ralph is absolutely right. We'll answer it then, but let me give it a short answer right now. We've done extensive testing of the new vacuum breaker. We did reliability testing. We threw grit at it, we threw sand at it, and all the rest of it, we've checked it for leakage. There's a whole report that's been done on that. We can make that available to you also separately, but the answer is, this is backed up by testing and evaluation.

MR. ROSEN: Well, I'm very glad to hear that, Atam. I mean, I would like to look at the report, but I really need to broaden my concern so that you understand it. The vacuum breakers could be the source of the leakage, but there could be others.

There could be a crack in the concrete. There could be a test valve, a test port between the wetwell and the drywell which is normally capped, which someone leaves the cap off. You know, I don't know the design detail, so maybe there's nothing like that, but just think about it generally. Something causes there to be more bypass between wetwell and drywell, then you assume this very small bypass. And I'm asking if that happens, does it invalidate all of these good answers?

MR. SHIRALKAR: This is Bharat Shiralkar. Let me add something to that. Sensitivity studies have been performed by increasing the leak rate ten times as large as what the design criteria is. And the PANDA tests were performed with leakages ten times as large as the specified leakage rate. The effect of that leakage rate was small, but obviously, you cannot increase that indefinitely. But certainly a factor of 10, we've analyzed. We found no significant degradation.

MR. RAO: Let me carry it one step further. And if you want to consider leakages even way beyond that, originally we went in with the vacuum breaker design without a valve. Now we've thrown in a valve also, which you can -- if one of those vacuum breakers is deemed to be leaking, you can shut it off.

Okay. So again, it will all be covered in the design certification phase, but I do want you to feel comfortable that we are looking at that. We have looked at that, and we are addressing it.

MR. ROSEN: So what was just said was that a factor of 10 leakage, we won't repeat phenomenologically what happens, do you end up slowing down the response, or do you end up higher pressures?

MR. RAO: You increase the bypass exchange to the wetwell without going through the PCCS and, therefore, you increase the pressure. It may increase it by say half a PSI or something.

DR. WALLIS: But does that matter?

MR. RAO: No.

DR. WALLIS: Well, if it's too big a bypass then the steam will all go that way instead of going through the condenser.

MR. RAO: And that's when --

MR. SIEBER: You can calculate it.

DR. WALLIS: You need to have a Delta P to drive flow through the condenser.

MR. ROSEN: So it goes back to the question of how good is the construction and operation, and maintenance, the tech specs will reflect these requirements.

MR. RAO: It will reflect all that. This is an important factor. We've included it in the consideration. It's not one that we're ignoring, but I just wanted to give you a short answer. There are answers to all of the different things once it goes beyond 10 percent, it will be low and stuff like that.

DR. WALLIS: Thank you very much, Shanlai.

DR. RANSOM: Mr. Chairman, how does ATWS fit into the design certification?

DR. WALLIS: Ask these guys.

DR. RANSOM: Pardon?

DR. WALLIS: Ask the staff. You're asking the staff, I take it, not me.

DR. RANSOM: Okay. Ralph, how does ATWS fit into the design certification?

MR. LANDRY: At the present time, we have reviewed the capability of TRACG to perform main steam line break, the GDCS line break in the ESBWR design. We have not reviewed the applicability of TRACG to AAOs, ATWS, or Time Domain stability. Those reviews will be conducted in the next phase of the pre-application review during the next year. When we complete that review, we will be able to then extend safety evaluations, which we are prepared on the LOCA applicability to also say applicability to AOOs,

applicability to ATWS, and applicability to stability. Right now, we are very narrowly focused in our safety evaluation report on only LOCA. Okay?

MR. KRESS: Didn't we look at the applicability of the AOO?

MR. LANDRY: For the operating.

MR. KRESS: For operating -- not for --

MR. LANDRY: Not for ESBWR. We looked at the applicability to the AOOs, or the operating fleet in the United States, BWRs 2 through 6, specifically excluding ABWR. Now this is a little different when we get into ESBWR because the core design is significantly different, and the core design can alter the AOO transient. So when we look at the AOOs for ESBWR, it is with the actual ESBWR core design. That is where we have to postpone the AOO review. General Electric had originally said that they wanted this review for LOCA and AOOs, but they had a proxy core, I guess we could call it, a pseudo-core at that point, and we looked at it and said wait a minute. The core that you're talking about is a foot different in height than what you have in this material. That's going to have a significant alteration on the kinetic response, so we had to postpone the review of the code's applicability to AOOs until we received the

actual core design, because those events are very dependent upon the design of the core. So right now, this review has drawn the conclusion that based on the review of the TRACG computer code - now that means everything we've discussed in the last two days - the testing program, the PIRT, scaling, uncertainty analysis, and our own calculations, we have concluded that the TRACG computer code is applicable to LOCA ECCS and LOCA CONTAINMENT in the ESBWR design; that is, and we've been even more specific. We've stated that the LOCA is the main steam line break and the GDCS line break, and with this acceptance, it is permissible to continue on to the design certification stage.

Now during the design certification stage, we have listed a number of confirmatory items in the SER. We have two pages of confirmatory items that must be checked out. We have listed extensive conclusions addressing each of these items, and this is only the bottom-line conclusion, so that when we get to the design certification stage, we will then have further assurance that yes, indeed, the phenomena which we have seen occur in these analysis to-date will be bonding the phenomena that would occur in the actual design.

DR. WALLIS: Now can I ask you something here? There are two things that I wonder about here. One is, what do you mean by the code? And the other, what do you mean by applicable? The code is not just the structure of the code. It's also all the assumptions made about it, like a mixing here, or 15 degree something or other, or various assumptions made about the non-condensibles, whether they come in late or early, and so on, hideout regions and so on, which can be played with by the user of the code, as I understand it.

So now when you mean code, do you mean the code together with all the assumptions which were reported to us, and to you by GE in the way in which they use the code? Is that what you mean by the code, or do you just mean the code as a structure into which one can put assumptions?

MR. LANDRY: We're looking at the computer code with the assumptions that have been made for this review.

DR. WALLIS: Okay. So it includes the code and the assumptions and the noding.

MR. LANDRY: I was just going to go to that.

DR. WALLIS: Okay.

MR. LANDRY: We also recognize, and this is a requirement that goes outside the actual statement of the SER. The SER doesn't have to state this. This is an automatic requirement. When they get into the actual plant calculation, for the actual plant calculation they are required to do a certain number - or I shouldn't say that - they are required to do a number of sensitivity studies and nodalization studies, time-step sensitivity studies, assumption sensitivities, demonstration of single failure, these items that we have talked about in the past two days. All those different combinations and permutations haven't been discussed looking at the code structure itself. Those have to be brought into the actual plant calculation, but when they do that, they then have to demonstrate that the phenomena predicted are within the range of the phenomena as reviewed. So if you go outside, such as you find a condition for which you go into transition boiling, now we have to go back and we have to re-review that.

DR. WALLIS: So Saha-Zuber correlation they used for pool boiling, boiling initiation and so on, is a fixed thing in the code. It's not going to be tweaked by sensitivity calculations.

MR. LANDRY: Correct.

DR. WALLIS: There are some other things in the code which are going to be tweaked in sensitivity calculations.

MR. LANDRY: A number of -- yes. Yes, those --

DR. WALLIS: The things which are correlations, particularly those with names to them, are unlikely to be tweaked any more. Is that right?

MR. LANDRY: Right. That's correct.

DR. WALLIS: They're frozen in some way?

MR. LANDRY: They're frozen in that the code user, as we heard Charlie Heck explain earlier, it does not have the capability to change those.

DR. WALLIS: Without going into the code itself. Right.

MR. LANDRY: They're using in what computer terminology is a bound executable.

DR. WALLIS: Okay.

MR. LANDRY: You can't go in and you can't change those.

DR. WALLIS: Okay. But you can change the leakage rate, leakage hole for the vacuum breaker.

MR. LANDRY: Right.

DR. WALLIS: You can.

MR. LANDRY: Because that's a modeling --

DR. WALLIS: So there's a stack of things which you can access -- you've got access to certain things.

MR. LANDRY: Right.

DR. WALLIS: So what's you're approving is the code to which you don't have access, which you cannot tweak any more. That's what --

MR. LANDRY: That's correct.

DR. WALLIS: And then applicable, I have the same problem. And, of course, it applies, but how well does it apply?

MR. LANDRY: Well, it applies in that from the calculations which have been provided from the assessment cases which have been provided, and our own calculations, we have seen that the code does not predict core uncovery, and they have --

DR. WALLIS: I think you really ought to have some gates here or criteria you ought to say, sufficiently representative, accurate and so on, to be useable enough that we can proceed, or something. Say something about the characteristics of it, which are acceptable. It seems to me --

MR. LANDRY: We'll go back and --

DR. WALLIS: I don't know what the Committee feels about it, but it seems to me it's got

to say something about the characteristics.

MR. ROSEN: I mean, I don't know what less you could say then applicable.

MR. LANDRY: We can go back and --

MR. ROSEN: It's sort of okay. I mean, I don't -- I mean, applicable is absolutely the minimum word one could possibly use from the English language to say -- and I agree with Graham 100 percent, that what you've seen here, what we've seen in the last day and a half is a whole lot more than applicable. It's kind of okay. You know, it --

DR. WALLIS: It met some criteria.

MR. ROSEN: It tends to reproduce, and even preserves gravity, thank goodness, Albert Einstein.

MR. KRESS: Well, if I were GE's people, I would be happy with this conclusion. Are you aiming your rewording at another audience?

DR. WALLIS: Well, it just says nothing. We know it's applicable. I mean, the principles of thermal dynamics are applicable, and --

MR. KRESS: Well, it tells me to feel free to go ahead and use it until they find out something is --

DR. WALLIS: Well, the real thing is that

we've made decisions it can be used.

MR. KRESS: Yes.

DR. RANSOM: Well, it's consistent with the philosophy laid out in CSAU. The part that hasn't been defined is the uncertainty.

MR. ROSEN: I think you're cheating GE, is what I think, with the word applicable. They've really done more than just convince you it's applicable.

DR. WALLIS: I think they want something more of an endorsement, which says that it's a good code. It's acceptable for this, this, and this. And you're not going to go back and again and question it. They'd probably like something more definite.

MR. LANDRY: They might want us to go back and say this is the greatest thing since sliced bread, but we're regulators.

DR. WALLIS: Maybe the public deserves some sort of indication that it's more than just applicable. Again --

DR. RANSOM: It would be nice if you could say it was 95 percent probable that it's within 10 percent of the actual data, or something like that.

MR. ROSEN: Well, now you're --

MR. KRESS: Yeah, that's impossible.

DR. RANSOM: But that's probably --

MR. ROSEN: Perhaps someplace in-between the Ransom categorization, characterization and --

DR. WALLIS: Well, you could say the way that you sort of do in the university. You could say it's met all the requirements for the degree. It's met all the requirements of the staff at this stage.

MR. KRESS: Well, that's pretty much what Ralph Caruso was saying, it meets all the requirements of the CSAU.

DR. WALLIS: That would be okay. You say met all the requirements. We have checked, and it meets all the requirements of the CSAU process, or something that gives more authority to the statement.

MR. LANDRY: We'll take this into consideration, and we'll look at the wording and see if we can't make a nicer wording. But General Electric hasn't weighed in. They might be perfectly happy with that conclusion too.

MR. ROSEN: They'd be happy to get on the airplane and make it back to California. They're happy with the last line.

MR. KRESS: Acceptable to proceed, yes.

DR. WALLIS: Acceptable to proceed is what they're happy about.

MR. SHIRALKAR: We've got a couple of presentations we are asking for a little more than Ralph has here.

DR. WALLIS: So is it time to move on to GE's presentation then? And, Ralph, you can stay around, so you can come back again.

MR. LANDRY: I wouldn't miss it for the world.

MR. LEITCH: Ralph, let me ask a question that I think is beyond the scope of what we're talking about here, and it may be in the design certification phase; but I'm a little concerned about how the flow gets started through this reactor in normal operations. In other words, you're sitting there with no flow at all, no heat, just sitting there and you start pulling rods. And I guess I see the possibility of some instability, some dynamic things going on, some oscillations going on. Is there a code that you plan to use that looks at that particular phenomena? In other words, how do you get from -- I'm talking about zero up to 5 percent power or something like that. I mean, once it gets going, I think I can understand the validity of the Ontario Hydro kind of test, but that starting point in that test was you had the flow. And I guess what I'm saying is, the very

beginnings of this, how do we get started and get flow established in a uniform manner without locally overheating or damaging the fuel? Those kinds of issues are somewhat troublesome to me.

MR. LANDRY: I think, Graham, for the complete answer, I'd like to defer that to General Electric. But for items such as stability, that's still -- that's going to be proposed to be TRACG. We have not had that material submitted to-date. We've had some preliminary discussions with General Electric on it, but we have not seen the material to-date. That will be next summer.

MR. LEITCH: Okay.

MR. LANDRY: But as far as the actual start-up operation, how they plan on starting up a natural circulation machine, that I would defer to the applicant.

MR. ROSEN: Can I add to that? I'm going to climb on your question. At some point during the scenario you just went through, someone's got to start up the feedwater system, and it seems to me that in addition to getting passed the point of adding heat and generating some steam, at some point you're going to have to turn on the feedwater system, at a very low level, just a trickle.

MR. SIEBER: Just turn it on a little bit.

MR. ROSEN: So maybe, Atam, you could talk about some of this.

MS. CUBBAGE: How about we let GE take the floor, and start their presentation.

DR. WALLIS: These are not safety issues, are they?

MR. ROSEN: Yes, they could be. I'm much more worried about this plant from a safety point of view, between zero percent and 5 percent, than I am between 95 and 100.

DR. WALLIS: Well, you turned on your coffee percolator and it worked. It's very similar.

MR. ROSEN: It's got some other things in it than black coffee.

MR. LANDRY: Well, let me say what I've had to say to the reviewers the past year and a half. Let's keep focused. If GE wants to talk about this, this is a design certification or design issue, but I've had to pull the people back repeatedly and say okay, let's stay focused. Are we talking about a design certification issue, or are we talking about a code phenomenological issue?

MR. ROSEN: Good luck.

MR. LANDRY: We are right now reviewing

the phenomenological capability of the TRACG code for LOCA. Are we getting outside of that range?

DR. WALLIS: I think we are getting outside. Are we ready to move to GE?

MR. LANDRY: I am.

DR. WALLIS: You're going to stay around. Ralph, you're going to stay around.

MR. LANDRY: Yes, sir.

MR. RAO: We're assuming it's closed session.

DR. WALLIS: Yes, we can make it a closed session. We will now move to a closed session. You want to check that all the spies are gone, or whatever, member of the public.

(Whereupon, the proceedings went into Closed Session.)

DR. WALLIS: Now are you going to tell us anything you didn't tell us in the wonderful presentations you gave us previously?

MR. RAO: I'm just going to put these skip-throughs on, and I wanted to show you a couple of things. While I'm putting this on, I want to say that we are now part of GE Energy, no longer GE Power Systems.

DR. WALLIS: Do you get more money because of that?

MR. RAO: No. It's -- we're here for all your energy solutions. Okay. First, I do want to thank -- you know, we've had an extremely productive and useful discussion with the staff. It's been a very open discussion. All of the stuff didn't come out in the meetings and the presentations. There are some excellent questions. We provided answers. We believe we provided answers to all the RAIs.

I've been working on licensing issues for a long time, and I have not had such a good interaction with the NRC as I've had on this program. It was really -- they were trying to find out what we've done, and like I said, it didn't all come out in the charts, but it was a very thorough and detailed review. They did find a lot of -- some things that

did embarrass us, but again, the interesting thing out of this interaction in this review has been that it's almost anything you do to the design, the answer is the core does not uncover and it's got a lot of margin in the design, so that was the good thing that came out of it, the bottom line out of that.

DR. WALLIS: That may be true whether we use TRACG or not, so I guess we're talking about whether or not TRACG --

MR. RAO: Right.

DR. WALLIS: It may well be that by some much simpler analysis you could reach the same conclusion.

MR. RAO: You could reach the same conclusion. But the purpose of this exercise was to go through the rigorous process. Okay. I mean, Bharat and Bob presented the rigorous process that we through. We've gone through the rigorous process. We always had the good feeling that the results would come out okay, so really what we are asking -- basically, what we are doing out here is a couple of things. I want you to appreciate what we are doing in the overall program in terms of trying to get certification for this plant.

We're basically doing a step-wise program,

little different than what the other suppliers are doing. You heard from AECL earlier about their pre-application review, part of the AP1000 pre-application review. The difference that we are trying to achieve in our pre-application review is actually closure of some of the issues, safety evaluation reports, approval of the methods. Okay? So we are not just looking for guidance on some of this stuff. We are looking for safety evaluation reports and closure, so there is a difference.

And basically, the objective of that is to simplify the DCD review, so take all of these things out of the review during the design certification, do it beforehand, get all the methods out of the way beforehand, get all the testing done beforehand. So there is a difference in what we are proposing here, and what the others are doing.

And, of course, one of the things that has happened over the years is that GE is focusing on ESBWR as the plant of choice in the U.S., and we are putting all our energies and efforts into trying to make that as the plant that would be the one the utilities would choose.

Basically, what we are doing again, like I said, we're using TRACG in combination with the

application methodology document. It's not just the TRACG code, it's the methodology also that goes with it. And basically, what we were trying to say out here - the process that we've gone through, all these sensitivity studies, all these comparisons to the codes, the interactions with the NRC, with the review by the consultants, after all that is said and done, the key question is what is the important - what came out of that?

What came out of that, at least what our view of what we heard in all the presentations was generally, the staff does agree that the code can be used for this application. There are no parameters that seem to indicate that there would be any core uncovery in this plant, and the TRACG computer code is applicable for this use.

The next step that we're asking for is if that is, indeed, the conclusion, we would like to get approval for that. And I think you've heard that. I believe the staff has to go through certain processes to do that, but I think you, as an Advisory Committee, can definitely, hopefully come to that same conclusion that we came to, that the code is ready for approval and for use, given the combination with the application methodology, which was part of the

process.

Again like I mentioned, the design process is a step-wise process. The design certification is a step-wise process. What I've shown out here is what our certification schedule is for the -- this is our wish list for the design certification schedule. We are in discussion with the staff on this schedule. Basically, we made our first request in early 2002, made our first sets of submittals in August, 2002. And the NRC has been reviewing those submittals. And what we are looking for is an SER in March of this year on the plants and safety system methods. That's what you heard today.

Along with these submittals, we had also submitted the application methodology for the AOOs, and it is basically, we're going to use the same methodology as we used for the operating plants. It's no different. Okay? And the reason this got separated from that was because there was one set of RAIs where the NRC wanted the transient analysis for the actual current configuration of the ESBWR. Fair question, and we just got delayed. We focused on the other stuff, and we will get back to them by the middle of February, and we're looking for a supplement to that SER to cover AOOs.

Subsequent to that, so this is where we were when we first started. And then along came the request from the utilities for -- they wanted to start considering building plants in the U.S.

MR. ROSEN: That's not a bad thing, necessarily.

MR. RAO: A damn good thing, but we had a schedule where we were going to get an FDA in 2007. Okay. It did not fit in with their schedule for making a decision, so we heard that everyone liked this plant, but somehow we were off the overall schedule on the FDA. So we scratched our heads and tried to figure out what is the best way to try to move that date in, and we came up with this approach of trying to some of these items into an earlier review. Instead of doing the design certification review all as one package, move some of them in earlier, some of the long lead items - okay - and some that can be easily broken out.

For example, you know, you heard about the SER on the plants and safety system. Okay. The other one we thought we could move in earlier was the Stability and ATWS, again get approval for those methods. And then all that would be left then would be basically looking at the systems. Okay?

Now when you look at the systems, when you looked at the single failures that we are talking about - okay - it's not a complex set of single failures. The actual reviews of the PSA, the reviews of the systems and buildings, that's what I call the systems and buildings, that's in the traditional sense the design certification submittal, or the application.

MR. ROSEN: You jumped over some things a little too easy for me. You said if you're looking at single failures deterministic kind of approach that we've typically taken, I think you're going to find that the core stays covered, and the plant is very robust, and there's lot of margin. So you're going to meet the typical single failure criteria fairly easily. It's when you get into the PSA, when you start saying well, we're going to fail everything. You know, we're going to take this down to everything fails, and you know we're going to see just how bad that can be, and recognizing, of course, that when we do that, the probability gets tiny. But we're going to do that just as a PSA does. It's a severe accident space. And so there, you know, it's more complicated because your models aren't as good, and I don't know. I mean, I haven't heard much about that.

MR. RAO: You haven't heard much about that, but the reason we are confident, I'll just give you again a 30,000 foot - I'm not trying to duck the issue - if you saw, you see it on one of my other charts - we've never said that the probability will be tiny. We've always said it will be about the same as that for an ABWR. Okay. Remember, that's 10 to the minus 7. Vessel failure is 10 to the minus 8. Anyone who tells you that they can get lower than that is smoking something that's not legal anyway.

MR. ROSEN: Well, of course. But nevertheless, I have maintained all along that the value of doing this is not so much the final number. It's about understanding the phenomenology.

MR. RAO: And we will do that. And the reason we are confident that it will be an easy review is because we did a detailed PRA for the SBWR. In terms of the system designs and things that affect the PSA, there are very few systems that have changed that will affect the paltries - okay. So that's why -- so we will get to that. And I'm not trying to minimize that. That's why, exactly for the reason, we pulled out severe accident PSA. And we said that is an item that usually takes longer. Okay. So what we -- let's move that earlier. Let's start discussions with the

staff earlier so that, that's what we're saying here. Start discussions with the staff end of `04/early `05, in that area. Okay? So that once we submit the SAR and the DCD - okay - in the middle of `05 - okay - we've already been talking with the staff on what we're doing in the severe accident PSA. That then the review by then will have got this SER too, on Stability and ATWS. We'll already have got all this stuff out of the way. We would have got approval of the use of TRACG for LOCA and CONTAINMENT. And when the staff will primarily focus on the systems and the issues that --

MR. ROSEN: Right. And I think you should recognize, and I know you do, that that's a little loop for -- in terms of -- for the staff, in terms of thinking about those issues at the licensing stage for a plant. You know, typically the staff has spent a lot of time thinking about PSAs with utilities who are operating one of 100 plants out there. It was an afterthought, and a lot of that work has been about looking at these issues in the context of an operating plant. Here, they'll be looking at the same sort of issues, but in the context of a plant and design certification, and that's a little different. And that will have different impacts in the iterations

between you and the staff, and with us.

MR. RAO: We fully understand that. You know, the approach has been to try to make it easier for the staff also. Okay? And at least from our perspective, I think -- I hope Amy will back us up. We've tried to make it easier for the staff, and we --

DR. WALLIS: You know, I understand all this, but I'm not quite sure that the Thermalhydraulic Subcommittee has anything to say about it.

MR. RAO: No. I'm just telling you what's coming down the pike.

DR. WALLIS: All right. I mean, I think you may want to move on.

MR. RAO: Okay. The only --

MR. ROSEN: The RA Subcommittee will have some interest in it.

MR. RAO: No, the only part that is important -- Graham, the only part that is important for the Thermalhydraulic Committee is, it does rely -- this whole approach ultimately does rely on getting early SERs, and --

DR. WALLIS: The actual words that you get at the end of the SER is what you're after.

MR. RAO: Right. Right. And that is important to the overall process. Schedule and

reality of making things happen are important. Again, what -- the first two SERs are focused on getting approval of the methods, and for all of these things is what we're talking about. And basically, also, there is a footnote in all of those approvals, which is that no additional testing is required.

DR. WALLIS: What you're after is not having to do any more work on TRACG, and not having to run any more tests.

MR. RAO: Yes. Some of these things you've heard, and I will try to keep this -- I'll try to answer as many of the questions as I can quickly. We won't have time for too many. We have used this as reference. You cannot approve a method without a reference design. Okay. So, you know, an approval of a method doesn't come without something in context. And this is what the reference design has been. I do want you to notice the asterisk out here, that one of the advantages we have of doing some of this methodology, we have the opportunity to optimize the design. We are improving the design as the methodologies are being improved. We expect some minor changes within the 5 or 10 percent range for some of these parameters that are shown with an asterisk.

DR. RANSOM: No diesel generators, I guess.

MR. RAO: Yes. No, safety grade diesel generators.

DR. RANSOM: So you don't need it for any loss of slight power.

MR. RAO: No.

MR. ROSEN: They have diesel generators but not safety grade.

MR. RAO: Not safety grade.

DR. WALLIS: In a complete blackout the plant just runs itself, and the operators don't know what's going on, or do they have batteries so that they can tell what's going on?

MR. RAO: They have batteries they can tell. There's instrumentation.

DR. WALLIS: But they can't open and shut valves because they don't have enough power.

MR. RAO: They've got enough power with the batteries. There are banks of batteries, and you will have power. Okay. You need power for instrumentation, you need power for valves. The basic design figure, you know, is -- this water out here is about 1,000 cubic meters --

MR. CARUSO: Run out of battery -- your

battery has gone dead.

DR. WALLIS: Switch on your diesel generator, you'll be okay.

MR. RAO: I can talk loud enough. Okay. I'll use this as a pointer. The key thing to notice out here is this volume out here is about 700 cubic meters up to the top of the active fuel. And the volume in the three pools, these are the GDCS pools, is about 1,100 cubic meters.

DR. RANSOM: I thought you said there were four.

MR. RAO: No. There are four divisions, meaning there are four sets of valves and lines. And one of these pools has two lines coming out of it.

DR. WALLIS: One is bigger than the others, is it?

MR. RAO: They're about the same size.

DR. WALLIS: So you're saying if you sheared off the bottom of it, just dumped all the inventory of water, you'd still be above the core.

MR. RAO: If you sheared off the bottom of the vessel you'd have -- you won't have to wait for Bush's Mars Mission. You'd have this landing there right now. You don't want to do that.

DR. WALLIS: But you were saying earlier

that if all the water dumped into the sump, which is so big because you have control rods and things down there, it would still come up --

MR. RAO: You would fill it up to the top of the active fuel, more than the top of the active fuel actually, because that's about 1,100 cubic meters, thereabouts. And in part of our optimization process, we are actually increasing that volume a little bit. And also, there's enough water out here, if you don't have those pools available, the suppression pool can also drain there and not uncover any of the vents. Okay. That's part of the criteria.

Okay. You've got the PCC vents and the normal vents. Otherwise, it's a fairly simple design. You know, there's nowhere else that the water can go. It's fairly elementary. This shows not to scale, we still haven't fixed it, Chairman, and one of these days we will get --

DR. WALLIS: We talked about that.

MR. RAO: Yes. But this shows some of the valves and the lines. It doesn't show all of the lines. This GDCS line, each line basically splits into two, and you've got two lines connected to the vessel. Okay. So each one are what we call the four divisions. There are four lines that come from the

pools. Then they split into two when they inject into the vessel.

DR. RANSOM: Two of them come out of one pool, I guess.

MR. RAO: Yes. Right. And this is what's called the equalizing line that provides the connection between the suppression pool and the core also, so this is an additional source of water makeup.

DR. WALLIS: Is the core really as tiny as that in the overall --

MR. RAO: It's only 3 meters tall. It really is sitting much lower in the vessel.

DR. RANSOM: What is the purpose of the PCCS drain tank?

MR. RAO: WE might remove this as part of the optimization. Okay. It was a nice one to have that, you know, before the pressure comes down, you want to make sure that during the initial blow down that some gets condensed. Okay. When the pressure comes down, then you can put it directly back into the vessel. It was a nice thing to have. It doesn't necessarily help too much. It takes up a lot of room.

MR. SIEBER: It looks like it's there to make sure you have water --

MR. RAO: No, it's not a necessary piece

of equipment. It's not necessary. It was just a nicety that we put in there, and we're finding that it's actually more of a hindrance. It takes up a lot of room, there's extra valves and stuff like that.

MR. ROSEN: It may come out is what you're saying.

MR. RAO: WE'll probably take out the tank.

MR. ROSEN: How long is the fuel actually? You say 3 meters, the active fuel length is 3 meters?

MR. RAO: Yes. Three meters is the active fuel length. The typical active fuel length is 3.7 meters, so it's 10 feet versus 12 feet.

MR. ROSEN: Only 10 feet.

MR. RAO: Yes. You need the shorter fuel because it's got a lower pressure drop with natural circulation. It helps to have slightly shorter fuel. The -- let's see. What are the other questions that might have come up in some of the questions? I think that's --

MR. LEITCH: This is not a complete system. This just shows the passive safety systems?

MR. RAO: It just shows the passive safety systems.

MR. LEITCH: It's still reactor water

cleanup, for example, is there?

MR. RAO: Right there. Good strawman there. It has the reactor water cleanup system. Okay. The reactor water cleanup system, even though it's shown outside the building, it actually is in this part of the building, of the reactor building. Okay. There are two trains of reactor water cleanup system. They also function as the normal shutdown cooling system, so what you've got now is a full pressure decay heat removal system, which from PSA point of view has got to be a big help.

DR. RANSOM: Where is it, grade level on that?

MR. RAO: Grade level is somewhere around here. You'll probably see that on the next chart.

MR. ROSEN: Did you say RWCU is actually in the CONTAINMENT?

MR. RAO: It's in this compartment. The CONTAINMENT is this boundary. Okay?

MR. ROSEN: Okay. So it's not in the CONTAINMENT.

MR. RAO: It's not in the CONTAINMENT, but it can be in a pressure bearing compartment if we want to make it part of that pressure bearing.

DR. WALLIS: Grade level is variable. You

could vary it more if that were desirable.

MR. RAO: It just costs money, yes.

DR. WALLIS: It would cost money, but you could -- no reason the grade level has to be there.

MR. RAO: Well, we'll show you on the next chart, which shows the actual drawn to scale.

DR. RANSOM: Where is the steel liner of the CONTAINMENT?

MR. RAO: The steel liner of the CONTAINMENT, this is steel lined containments all here, all the suppression pool, this area is all steel lined. Okay. This shows the PCCs, the ICs, the automatic heat sync is the atmosphere ultimately. The water evaporates from there. What's shown out here is a line where you can connect a fire truck to provide water makeup, one of the questions that Graham had. Let's see, what are the other things?

You can also provide makeup to these pools through what's called the fuel and auxiliary cooling system, which I think is shown somewhere here. Okay. The terminal island looks pretty much like any terminal island, and it's -- the only difference is you have a direct contact feedwater heater, which provides additional -- it helps during the transients. You might hear about that when we talk about AOOs.

This shows the evolution of the containments in the reactor building. We move the spent fuel out to a separate building, grade level is about here. You'll see that better actually on the next building.

MR. SIEBER: I think that's where you can show where the containment boundary is.

MR. RAO: Yes, this is the containment boundary here. The tubes off the PCC heat exchangers also are part of the containment boundary. Okay.

MR. SIEBER: So if you have a LOCA inside, at the upper part of the --

MR. RAO: If you have a LOCA inside containment, let's look at this one. Okay. If you have a LOCA out here, this shows the containment boundary. Here's the red. Okay. This part is the drywell. Okay. So this part does get pressurized. Okay. We fully anticipated that the NRC would be talking about suction strainers. No, that's a big --

DR. WALLIS: We'll eventually. This distorts the drywell. In fact, the wetwell is not so tiny compared with the drywell, as one might think, is it?

MR. RAO: Yeah. They're about the same volume roughly. The air space volume is about the

same. One thing we did change on the SBWR was move the GDCS pool. This used to be open out here. Okay? Now we put the wall all the way up to the top. Okay. So no insulation or anything else can now be flying into the GDCS pool, so that's a side benefit that came out of the -- yes. We did that for -- what we did do was we -- this gives us additional wetwell volume, so it allowed us to reduce the design pressure. The SBWR design pressure was 55 PSIG, which was 10 PSIG higher than ABWR. We could theoretically go down to 40 PSIG, but our designers told us there was no added value to that.

DR. RANSOM: The steel containment liner, can you inspect that, or is it buried in the concrete?

MR. RAO: It's on the outside.

DR. RANSOM: But how could it be when you go around the suppression pool, and --

MR. RAO: It's like the pool liners.

DR. RANSOM: Well, then you have to go over the walls. How do you -- do you set the concrete wall on top of the liner?

MR. SIEBER: Yes. It's like the BWR, you put the liner up first and pour concrete around it.

DR. RANSOM: So it is not inspectable then. Is that right? How can you if you pour

concrete on it?

DR. WALLIS: The concrete is on the outside.

MR. RAO: The concrete is on the outside. The steel --

DR. RANSOM: It can't be on the outside, and still have these pools inside the containment.

DR. WALLIS: It is the wall of the pool.

MR. GAMBLE: You go inside the pool. You drain down the pool, and you go inside the pool, and the wall is in the pool.

DR. RANSOM: Well, that means it must go up over the wall somewhere. Somehow it has to go through the walls.

DR. WALLIS: You go through that wall there where --

MR. RAO: It goes up through there. Okay.

MR. LEITCH: How about the dryer separator pit, where is that?

MR. RAO: That's on the next couple of charts. This basically shows what simplification has happened in the design. Basically, we got the reactor vessel. This is where the reactor water cleanup systems are and the hydraulic control units. Okay. And those are the only real water systems that are

left.

DR. WALLIS: When we make a presentation to the Full Committee, it would be very useful to have some of these figures out right at the beginning and have them available so they can refer to them, but not spend a lot of time describing it.

MR. RAO: Okay. We will make these available.

DR. WALLIS: That's very, very useful.

MR. RAO: In color and bigger.

DR. WALLIS: And to scale.

MR. LEITCH: What about the chimney, does that have to come out, or can you --

MR. RAO: No, the chimney stays in.

MR. LEITCH: You refuel through that.

MR. RAO: Refuel through the chimney.

DR. RANSOM: What are the added structures around that? Is that for security?

MR. RAO: Okay. This is the refueling floor. Okay. This was a structure that we added post 9/11.

DR. WALLIS: It looks like another containment.

DR. RANSOM: Right.

MR. RAO: Okay. We added that post 9/11.

We are waiting to find out what the DVD requirements are, and we will adjust that accordingly.

DR. RANSOM: Is that concrete?

MR. RAO: It's not defined. We've allowed space for it. We have a separate refuel, spent fuel storage is now essentially at grade elevation, most of it below grade. You've got inclined fuel transfer. It doesn't have the challenges of the Mach 3, where the inclined fuel transfer opens out into the containment. This is outside containment, the top end, so you can move stuff during normal operation. So it's operationally a much easier, and a nicer piece.

MR. CARUSO: Where does all the steam go that evaporates off of the ICS and the PCGS?

MR. RAO: There's a chimney out here, and it goes out of the building.

DR. WALLIS: So if you see steam coming out of this thing, it's probably had a LOCA, or --

MR. RAO: It takes about eight hours or so before that pool heats up. It takes a while. There's a lot of water there. And, you know, there's a cooling system that can cool that pool. You don't have to let it steam. I mean, we probably normally wouldn't expect it to steam, but in case, for 72

hours --

DR. WALLIS: Once you've opened the -- whatever you call that, ADS, then it's going to steam.

MR. RAO: Well, no. Even then it won't. Eventually. If you have power, you can cool it.

MR. ROSEN: The operators are not going to let the pool go --

MR. RAO: Yeah, they won't let the pool boil. Yeah, you can cool that pool.

MR. ROSEN: As long as it's dark and there's no moon.

MR. RAO: But the thing to notice is, it's actually a fairly simple system. There's pools of water. Here's the suppression pool area. This elevation is where the GDCS pools are. This is the main steam lines, and these are pools up on the refueling floor. And the systems that you're talking about is reactor water cleanup, hydraulic control units in this area, and the fuel pool cooling system in the basement of the spent fuel storage pool.

You asked about batteries, lots of batteries, at least banks of batteries. There are four separate divisions of --

DR. WALLIS: What does this have to do with the assessment of TRACG?

MR. RAO: Nothing. I was trying -- I'll jump through it real fast. I just wanted -- okay. Not much. I just wanted to be responsive to your questions.

DR. WALLIS: Well, it's very interesting.

MR. RAO: These are the hatches for the ICPCCs, and this is the refueling floor. And you can go in there and access --

MR. ROSEN: Are they -- would they normally be radioactive? I mean, you've drained them down --

MR. RAO: Not the --

MR. ROSEN: Is that the normal -- you know, normal operation.

MR. RAO: The IC could be, but not the PCCC.

MR. ROSEN: No, but the IC would be normally used --

MR. RAO: For isolation.

MR. ROSEN: If you had an isolation.

MR. RAO: Yes.

MR. ROSEN: So you put reactor water through it. Right?

MR. RAO: Pardon?

MR. ROSEN: You've had reactor water go

through it.

MR. RAO: Steam, yeah.

MR. ROSEN: And steam, so it might be contaminated.

MR. RAO: Yes.

MR. ROSEN: So if you want to maintain it, you drain the pool down, you take those big end valves off the end of the --

MR. RAO: Yes, and you can take the pieces out. These are the hatches for the Ics.

MR. ROSEN: Now the picture you had with the cartoon character that showed -- this was the --

MR. RAO: PCCS.

MR. ROSEN: Those were the PCCS. Does the IC look like that?

MR. RAO: It looks exactly like that. The only thing was we only tested one-half of it, because of the steam supply limitations.

MR. ROSEN: So it's got headers high and low.

MR. RAO: Exactly. It looks exactly like that.

MR. ROSEN: Just like that.

MR. RAO: It looks exactly like that, except it has a few extra valves. You'd rather cut it

out, but there is access, and we've allowed for access at this elevation. Okay.

This chart shows what we are doing in the overall analysis. We are going to use TRACG for all the applications, except for some of these out here, so it's going to be basically used for all the ESBWR analysis that we're talking about. You saw this one, and what we are looking for is basically approval of the application methodology. Okay.

You heard what we said earlier. I will skip of these. You heard these. I did want to show some of these pictures out here. This guy is really having a good time. He's getting old now. He's been at this for 20 years, and he's glad that it's finally over. He's got a mustache, no beard. We allow mustaches. Okay.

This is a full scale test of the depressurization valve. This is what it looks like. This on the top right hand is the vacuum breakers.

MR. ROSEN: Show me which is --

MR. RAO: The vacuum breaker, it's inside out here. Okay. This is that piston that I talked about. Okay. These are the four arms which open out to the wetwell. This is where the drywell is. I mean, this is the wetwell out here, and the drywell is

on these --

MR. ROSEN: What do the arms do? I don't get it.

MR. RAO: They discharge into the drywell. This is sitting on the diaphragm floor.

MR. GAMBLE: This is Bob Gamble. Those are to give you a large protected surface area for flow. There's no active parts in those arms. The valve is in that center vertical cylinder. Those just give you a large flow path out into the drywell where you could potentially have debris and things.

MR. ROSEN: Okay. So the non-condensibles come up through the middle and go out these four arms.

MR. RAO: Yeah, they go out through the four arms. It's on this floor, on this diaphragm floor, there are three of them. It's the drywell/wetwell pressure. These are the drywell here. Okay. And the flow comes up through here. It lifts the plate and it goes outwards horizontally.

MR. ROSEN: How big across is that? You said 20 inches across the opening. This is a big thing.

MR. RAO: This is big.

DR. WALLIS: It's been tested --

MR. RAO: The whole thing is from here to

there. From here to where you are. I think all the arms combined.

DR. WALLIS: It was tested in many cycles of up and down.

MR. RAO: It was tested in many cycles.

DR. WALLIS: You put sand in there.

MR. RAO: We put sand in there. We put all kinds of stuff in there to try to -- and we then checked the leakage. There's a whole report on that one. We can make that available to you also.

DR. WALLIS: Way different than what's in the operating BWR.

MR. RAO: Yes. It's way different. It's a lot better. This is that heat exchanger that we talked about. This is the PCC. The steam comes up the middle and goes on both sides. What we tested for the IC was just one-half, because the steam flow was limited. And it looks exactly the same because when we first started the design, the IC/PCC were the same design.

MR. ROSEN: Now those are just headers, inlet and outlet headers that are bolted with bolted flanges.

MR. RAO: This one?

MR. ROSEN: No, next to the guy who is

standing there.

MR. RAO: This one?

MR. ROSEN: Yeah.

MR. RAO: Yes, these are just flanges.

MR. ROSEN: And if you take that flange off, you removal all the bolts --

MR. RAO: You can go --

MR. ROSEN: It's just a header. Right?

MR. RAO: Yeah, it's just a header.

MR. ROSEN: Is it a safety header?

MR. RAO: Yes. Okay. You've seen these with actual -- okay. This was what Bharat was talking about. You've seen these before. And basically, what we are asking right now is approval of TRACG for ESBWR analysis and, you know, we want to keep that guy smiling and laughing that we had on the cartoon earlier. And we basically, you know -- I think you folks have heard these presentations before. I'd like to invoke Dana's comments when I first talked to the Full ACRS Committee almost three or four years ago. He said that -- I said if we make our submittals to the NRC. He asked us how soon would we expect approval. I said two weeks. He said well, bring them something and show it to them, and they might do it. And I do want to say that the one-year that the staff

has had to review this has been remarkably fast, and we are really pleased with that review and the response. And we hope that the ACRS can endorse the idea of closure on at least --

DR. WALLIS: If we're being asked to respond in two weeks --

MR. RAO: Well, Dana said the staff would do it in two weeks. I assumed he said the ACRS would do it in a couple of days.

MR. ROSEN: Anything the staff can do in two weeks, we can do in two days.

DR. WALLIS: Now the ACRS acts as a whole committee, not as a subcommittee like this one. And you guys, I take it, are going to show up in the February meeting.

MR. RAO: Yes.

DR. WALLIS: And we have something like two hours total for everything. And I think one of the things we need to know is how is that going to work out, because we've had two days here, plus the various meetings we've had with GE beforehand. How are you going to put all the information in two hours, one of which will be taken up with questions, so you have one hour, all of you, staff and --

MR. RAO: Staff, yes. We'll have to --

DR. WALLIS: I take it's going to be mostly the staff presentation.

MR. RAO: Right.

DR. WALLIS: Three-quarters staff, something like that. Three-quarters staff.

MS. CUBBAGE: We have not set the agenda. WE certainly would take your recommendations.

DR. WALLIS: I think you have to think a lot about that agenda.

MS. CUBBAGE: I'm sorry?

DR. WALLIS: You have to think a lot about what that agenda should be given what we've heard here.

MS. CUBBAGE: Yes.

MR. ROSEN: Well, let's start with what they want. If they want a letter, right?

MR. RAO: ACR.

MR. ROSEN: You want a letter from ACRS.

MS. CUBBAGE: The staff, yes.

MR. LANDRY: That says yeah, we think we agree with you that it's applicable.

MR. FORD: Well, I think that's the first thing they've got to decide, applicable or is it going to be approved.

MS. CUBBAGE: And I just wanted to back up

a little bit and clarify from the staff's perspective. It may have appeared to the Committee that there was a disconnect between what GE was asking for, and what we were saying in our evaluation, but I just wanted to make it clear that from the beginning, the staff has had an understanding of the purpose of the review, and GE's desire for approval. And that was the framework in which we approached this review. And maybe here during the meeting we didn't express ourselves clearly enough on what our conclusions were, but our intent was that it was applicable and approved.

DR. WALLIS: So your intent is to go along with what GE is asking for?

MS. CUBBAGE: Our intent is that we have concluded that we can approve TRACG for these applications.

DR. WALLIS: So you're going along with what GE is asking for. There's going to be no more work on TRACG, and no more tests needed?

MR. RAO: No, there obviously -- you know, the staff identified some items that needed to be done. There are all those caveats, and all that go with it. The only word was about approval, and I think we are in the same boat.

DR. WALLIS: So there might be some

further modifications to TRACG?

MR. LANDRY: I think what we may end up doing - we haven't worked out the exact words yet. We were trying to work out a good sounding conclusion for the SER. What we may do is fall back on the regulatory terminology. We may say something to the effect - I don't need to be quoted on this - that TRACG is acceptable and approved for reference FAR. Use those regulatory words, that it's approved and acceptable for reference, et cetera. So that's the normal terminology we use with a topical report, that it's approved for reference, and that may be the terminology we have to fall back on. We were trying to be a little more creative in our wording this time, but maybe what we have to do is just fall back to the old position, the old statements.

MR. FORD: For a non-lawyer, could you tell me what something is approved for reference?

MS. CUBBAGE: That's how we typically would approve a topical report. We approve it for reference in a future licensing application, so that it basically says that the staff has concluded - it depends on what the topical report is for, but that it can be referenced, and that that part would not be re-reviewed as part of the licensing application.

MR. FORD: All right. So GE comes along with --

MS. CUBBAGE: Design certification application.

MR. FORD: Design certification, it used TRACG for a LOCA or GDCS --

MS. CUBBAGE: Right. And as long as they've used it within the range of applicability.

DR. RANSOM: Is that the same as what was done for -- the same kind of approval?

MR. LANDRY: Yes. We said that the code was acceptable for reference in appropriate designs. But there we said they had to provide certain information, or since this was a general code, they had to for this specific application provide the nodalization and the proper sensitivities, and the proper verification that the plant parameters, et cetera, et cetera, were within the range of those assumed, or the generic calculations that were performed. Now this is a little different case because it's a code specifically for one specific design, so we're not saying all those same words in this conclusion.

DR. RANSOM: I'm wondering how does the nodalization come into play here? You're approving

the way that they applied it?

MR. LANDRY: Here that they can reference the code, but when they apply the code to the actual design, then they must meet all the rest of the requirements of 50.46, requirements which state that they have to do proper sensitivity studies, because we have not reviewed it with reference to the exact hardware design. So now when they have the exact hardware design, they must demonstrate that they are nodalizing the proper manner, and so forth.

MR. FORD: I think it would be very useful at the very beginning of your two hour meeting, that it is very clear as to what we're supposed to be considering, and the caveats. And then go through the argument as to why you come to that conclusion. To tell us up front what you're wanting us to approve.

MS. CUBBAGE: So basically start with our conclusions, and then go into the basis.

MR. LANDRY: This is the focus of the review, and where we're trying to go. Here's how we get there, and here's the conclusion, which try to keep the focus where it should be. Thank you.

MR. FORD: I think the other aspect, it must be brought up at the very beginning, is what their acceptance criteria are.

DR. WALLIS: I think you need to think a bit about that, you know, what's the basis for accepting, why did you accept?

MR. FORD: Well, to use their -- GE's --

MR. LANDRY: We also heard pretty clearly the Subcommittee's recommendation that we focus more on figures and curves, and less on words.

DR. WALLIS: Well, I like the summary that GE gave, which they had a matrix of all the phenomena, and how the various experiments supported the phenomena. And then they had a matrix of how the various results enabled them to assess the uncertainties in all these variables, and so on, how this fed into the uncertainties that eventually come out of their calculation in the level, in the chimney. That seemed to be a logical sequence of events. I don't know if that's the way you felt. They went through the CSAU process, but I mean, that's okay. We know they did that, but what's the sort of the real substance of what they discovered and used in doing the process? And I think that is the substance of what they discovered and used, the data, the derivation of uncertainties, the use of uncertainties.

MR. SIEBER: It sort of brings to mind a question that I had all along, having once been a

licensing manager. The tendency is when you do tests and experiments, and compare them to the analysis, you make the comparison and you say this parameter agrees pretty close. This one agrees pretty close, and you do uncertainties. And then all of a sudden you look and you say, but this one doesn't agree very close. Should I tell them? Were there instances where you had secondary parameters that you really didn't report that made you scratch your head, but say, you know, I'm not exactly sure that this is consistent with the tests that we ran. Do you understand my question?

MR. FORD: What are you hiding?

MR. SIEBER: Well, you don't hide it from the staff, because generally speaking, they want to see your results, and so when they look at them, it's there, so why bother hiding, you always tell them. But the question is, do you know of any instance where your analytical results from TRACG are inconsistent with any part of the test data?

MR. GAMBLE: I have just one minor comment on that. I don't know that it's an inconsistency, but we've displayed with you here the lack of ability in many cases to get the timing of non-condensible movement. I mean, that's the type of thing where there were large differences, and we've managed those

through a bounding approach, but they're not --

MR. SIEBER: That's sort of a subtle thing though, because it depends on very small forces, so the timing would seem to me, is not particularly important. But that's the kind of thing I think people need to look at individually to make sure that there is nothing out there that would invalidate a general conclusion that you would draw from an analysis of the transient or accident statement.

MR. SHIRALKAR: This is Bharat Shiralkar. I think we made it a point to make a listing of the limitations and instances we did not predict things well, and why that was, we thought, okay. There's a separate section in our assessment report.

MR. SIEBER: Well, that's part of the CSAU, actually. But I think that's an important part of doing this kind of work. It's important for the staff, it's important to the applicant. And it's important for us.

DR. RANSOM: I had a question I meant to ask earlier to GE, and that is, what are the largest challenges, I guess, that you faced in application of the code to this, or what are the weakest places? I mean, you've been at TRACG for what, 15 years I guess, and gone through a lot of evolution from the TRAC PD-

1. I'm wondering in this application, what are you considering to be the major challenges?

MR. SHIRALKAR: Well, that's a tough question to answer, I think, but it turns out that this system is so forgiving that you can do a lot of things that are dumb and still end up in the right ball park. Because it's ultimately governed by just a few parameters, you have so much water in the system. The transport of non-condensibles, for example, it's hard to track or calculate. You hit that several times, and we don't handle mixing and stratification very well. And we've had to come up with processes to handle that, but that's probably been our biggest challenge, the mixing and transport.

DR. RANSOM: And when you say it's very forgiving, I guess you're like the three-volume system that you used for some of the work. It had the essence, I guess, of --

MR. SHIRALKAR: No. I'm saying, for example, take the instance of PCC heat transfer. Even if you're off somewhat on the PCC heat transfer, typically you have excess capacity after say three or four hours. And so if all that it does, is it holds up -- if you're off on a prediction, it just holds up a different amount of non-condensible in the

condenser, but it doesn't change the heat removal.

DR. RANSOM: All right. I think that's been everybody's biggest fear, is that the non-condensibles would somehow stall the condenser, and that it wouldn't work. But I think that's been pretty well dispelled.

MR. SHIRALKAR: The condenser works amazingly well. It's self-regulating and purges, and holds non-condensibles from all the decay.

DR. RANSOM: We did with modeling the SBWR, had problems with levels in the wetwell. You know, when levels cross boundaries in the nodalization, some strange phenomena happened, water packing being one of them.

DR. WALLIS: That's where level tracking is supposed to work, to save you from that.

DR. RANSOM: Hopefully eliminate some of that. I don't know. You don't see problems like that in the code?

MR. SHIRALKAR: No, I think our level tracking is working very well. There is no pressure spiking, or water packing issues.

MR. ROSEN: There was one question that Graham Leitch asked that wasn't answer. Take us through a normal start-up.

DR. WALLIS: That's not a safety issue. Not a TRACG that was applied to LOCA, sort of irrelevant to this.

MR. SIEBER: This analysis doesn't apply to that.

DR. WALLIS: I think it's interesting, but it --

MR. SIEBER: Sooner or later we'll get to that. It probably just doesn't apply to the application --

DR. WALLIS: I think we need to sort of wind our meeting. And I had three things. One really is advice for these folks on the presentation to the Full Committee. And one is any -- sort of how do we prepare a draft letter, and the other one is, are there some action items that need to be addressed between now and then? On the latter one, I think that Shanlai agreed to clarify some of these level gravity conservation things with Vic Ransom.

MS. CUBBAGE: Yes, I have that.

DR. WALLIS: I think that GE agreed to clarify the matter of regime transitions in the chimney, and how long it took to go from first or whatever it is to turbulent, or whatever the regime is in the chimney. I think that you agreed to do that.

MS. CUBBAGE: I have that one, as well. Yes.

DR. WALLIS: I think that there was an agreement to try to quantify, not just say that CONTAIN is different from TRACG, but give some quantification about the fact that the deviation is reasonable in terms of --

MS. CUBBAGE: Yes, we have that.

DR. WALLIS: Do you have some other action items you picked up from this? I intend to read the transcript too. I think it's an important issue. I'd like to go read the transcript and see if I -- I'm sure I said some stupid things, but apart from that, get some substance from the transcript. Now do you have some other action items that need to --

MS. CUBBAGE: There is the issue that Ed Throm was going to take a look at his conclusions about 100 percent steam. We talked about that.

DR. WALLIS: Yes, 100 percent is really not the right word to use. Right. That's right.

MR. LU: I just have a quick question. I thought that Charlie and I went through that, Graham, with you during the lunch hour. Is that still something you need us to prepare to resolve that issue?

DR. RANSOM: On the hydrostatic --

MR. LU: Yes.

DR. RANSOM: Well, I certainly like to see something on what we discussed.

DR. WALLIS: All right. And then I'm going to read this Ontario Hydro report, and there's a Wilson report or something too, which you're going to get for me. Is there anything else that the members need between now and February in order to complete their study of evidence?

MR. ROSEN: I thought I was promised a look at the qualification report for the vacuum breakers. I don't know whether I need that for February, but --

MR. RAO: We can get a copy of that, the whole test report.

MR. LANDRY: All that material should have been on one of the CDs that we provided to you over a year ago.

MR. ROSEN: Maybe if you could point it out to me. I have the CD.

DR. WALLIS: Now on the presentation to the Full Committee, it seems to me that you're going to boil down the presentation we have heard here. There's going to be sort of an overview from staff

about what they're being asked to approve, what they are approving, the CSAU process and so on, but the question I have is, who is going to give what I call the convincing evidence? And we started off yesterday, and you started off giving the kind of usual regulatory presentation, which doesn't tell you anything about the nitty gritty. And then we said okay, we wanted to hear the nitty gritty. I think we heard a lot of that today. How are you going to put that across to the Full Committee? Because if you just do the regulatory stuff, then I guess the only thing that the Committee can do if you don't tell them the nitty gritty, is to turn to the Subcommittee and say well, did you get into the details, and are you satisfied?

MR. LANDRY: As Amy said, we haven't worked out the agenda for the meeting yet. That will come out as we develop the agenda, how we're going to break out the presentations.

DR. WALLIS: Maybe it would help, I guess Ralph or somebody here, as well, about the --

MS. CUBBAGE: Yes.

MR. LANDRY: Right. We understand your -- you and I said a few minutes ago, we understand the recommendations of the Subcommittee that we focus more

on --

DR. WALLIS: But you can't do it all. You can't do it all, so how are you going to put it across?

MR. LANDRY: We will work out how we're going to do this.

DR. WALLIS: You're confident that you can do that. You don't need any more advice from this Subcommittee.

MR. LANDRY: I hate to turn down your advice, Graham.

DR. WALLIS: The last thing you need is more advice.

MR. SIEBER: You may be able to streamline it just by having a relatively brief section on what it is you're specifically, you would intend to approve. Secondly, what the code actually is and what it does. And then the comparison of the four or five component tests and the integrated test data, and say these are the applications which we find that the code is suitable for use. And that would be about it. You could cut out a lot of other stuff.

DR. WALLIS: This logical matrix of how the tests address the phenomena and how they established uncertainties. Can GE do that in six

slides or something?

MR. SIEBER: I think they already have the gist of the slides put together as we just saw them.

DR. WALLIS: Yes, but if they did all of this, it would take too long.

MR. SIEBER: Right. But there's only four or five separate effects, and tests out there.

DR. WALLIS: Yeah. I thought Bharat's presentation was very helpful there.

MR. SIEBER: So I think if you went through that with either some graphics that showed variations with time or what have you, or the tables that showed deviations and the degree of accuracy, and then just made the statement. We didn't find any anomaly that had an impact on the use of the code for safety-related purposes in these applications. And I think you'd be there.

MR. FORD: Is that not a logical way to do it, have GE start off.

MR. SIEBER: It's their code.

MR. FORD: What's new about this reactor - I mean, one slide, two slides on that.

DR. WALLIS: If we Atam start, he'll take an hour.

MR. FORD: And then go through the -- and

the staff comes and says what their conclusion is, and then show us how that came to it.

DR. WALLIS: Give good pictures at the beginning so that the Full Committee can visualize what's going on.

MR. SIEBER: I guess the SER is written on the CSAU process, as well as the work you did. On the other hand, I think if you go through all the steps, say we did this to satisfy step one, here's all the PIRT stuff. We did this to satisfy step two, it will take you at least three days to do it all, so I would not go beyond saying there's 12 steps or whatever it is to the CSAU process, and we followed them rigorously for 11, in general for one other, and then just launch into the important areas.

MR. FORD: You can always have the backup slides, should one of the other members who hasn't been here, ask a question.

MR. SIEBER: Yes. Let's hope all the questions have already been asked, and now all it is is Dana and George. And unfortunately, they both ask a lot of questions.

MR. FORD: And Mario.

MR. SIEBER: Oh, Mario. Yes.

DR. WALLIS: I'd like to see George ask

some thermalhydraulic questions.

MR. SIEBER: Peter can't say anything because he's a former retiree.

DR. WALLIS: Well, maybe you were all very clever in the way you organized this. I felt that in the beginning, as is quite evident from the questions asked, that just seeing the sort of regulatory words with no evidence at all, I would have said no way I'm going to approve this. I want to see something definite. And maybe that was your intent, was to get us exercised and keep the suspense up so that we came in today we would then be converted. But I don't think that's the way to go about the Full Committee.

MR. LANDRY: We realize that with the Full Committee we have much less time, and that the presentation needs to be very focused, and very strong in support of the conclusion. So we understand that.

DR. WALLIS: Yes.

MR. SIEBER: Scaling and validation are key issues.

DR. WALLIS: Because I think the problem that the ACRS has had with these is that you have GE, who has worked on this problem for a long time, a lot of man-hours, a lot of expertise. They ought to know their way through this up, down, and sideways, and

everything. They can answer every question. And then they submit something, and the question that we have is the staff comes along, says oh, we've made our conclusions. Everything is fine. But what we really need to assure ourselves about is that the staff knew what they were doing, they knew how to ask the really incisive questions. They knew how to have criteria for saying yes, this is good enough, and so on. That's what we sort of need to assure ourselves about. I mean, it's pretty certain that GE is pretty well-informed about this thing, but did the staff know enough, think about it enough, ask the right questions in order to make decisions, and were the decisions based on guess work or real solid footwork and understanding. I think that's the thing that needs to be assessed. The staff is really the one that's on the spot here.

MR. LANDRY: We'll do our best to make that clear, or make it clearer.

DR. WALLIS: Yes.

MR. SIEBER: You may want to address the thought, you know, when I reviewed this, it seemed to me that General Electric probably spent a fair amount of time trying to decide what testing am I going to do, because I don't want to do one more test than I

have to. And so then I struggled with the thought, did they do enough. And I came to the conclusion that CSAU says use a PIRT process, and you test all the phenomenological things that are going to happen, and the advantage was you used full size devices from a height standpoint which, to me, makes the scaling much -- I have more confidence in the scaling to do that. But there is not a lot of test data there upon which you base your code, I don't think. So my question all along has been, is there enough to justify it. And I guess over the last two days, and last couple of months of reading that I came to the conclusion that there's probably enough, but there isn't much extra. I don't know if anybody else came to that conclusion or not.

DR. WALLIS: I feel a little nervous about approving in every aspect what we heard here about scaling. It seems to me a somewhat dynamic thing where you do something, and then consultants do something better, and they did something better. The scaling thing is probably okay, but I wasn't so confident that it had been really wrapped up.

MR. SIEBER: Well, at least they aren't working with miniature models where you're scaling in dimensions.

DR. WALLIS: Where you can scale something full scale, you see some critical thing, you can scale the -- test it as near as possible to full scale, like the chimney, that's the way to go. Much more convincing than some argument about scaling, something which looks like it but isn't quite like it. Then you have to go through very much more rigorous arguments about why this is okay.

DR. RANSOM: Well, the argument -- I've never quite understood this desire to try to match things exactly, and that's what the purpose of the codes are, to at least scale over some range. And so if you can apply the code and then make the proper adjustments in volumes, heights, whatever, and apply the code to the actual animal, it's a way of scaling, actually. And we did go one step further in PUMA, in that we built what we called an ideal scaled plant, which was a plant scaled down to the same scale as PUMA, and then compared PUMA results to that. And that all fit together fairly well. You know, the full scale SBWR, the ideal scaled SBWR, and then the PUMA results. And you can overlay all three of these with a time scale, of course, because the height was changed. But that, to me, was quite a convincing argument that the methods that are used in the code

are okay, and represent what you're seeing in the experiment.

DR. WALLIS: Well, I'm going to go and look back at the documentation that we were went. I must say, as I said at the beginning, I had a lot of difficulty getting my arms around it. The presentations we heard here have been helpful. I just hope I don't find something in there that I need to question.

MR. SIEBER: Well, there are some choices that were made, particularly in the two-phase flow are in your documentation that I wasn't sure I agreed with until I decided the idea is to be able to analyze and get the answer that looks like the test data, as opposed to having every little piece of logic laid out so that I will accept this.

DR. WALLIS: Well, I would like, rather than trying to summarize and going around the table, although I'd welcome statements by all members now, I would really like each one of you to send me an e-mail, something to help me write a draft letter. You know, when you thought about, what it is you'd like to see in our draft letter, rather than just off-the-cuff comments now, which might be useful to GE and the staff, but for the purpose of writing a letter, I

would really like all the members to write me something on paper, to help me draft the letter.

MR. ROSEN: Electronic advice.

DR. WALLIS: Electronic advise, yes.

MR. FORD: I take it, I'm not allowed to --

DR. WALLIS: You're allowed to write me anything.

MR. SIEBER: We aren't obligated to listen to you.

DR. WALLIS: You aren't allowed to write me anything, okay. So I can send him my draft and say do you agree. Is he allowed to do that? Not even allowed to do that, okay.

MR. SIEBER: We'll let Peter --

DR. WALLIS: Is that okay? Do you folks feel that -- write me some e-mail?

MR. SIEBER: I can do it.

MR. ROSEN: Well, I think I learned a lot more than I can help you with.

MR. SIEBER: Our biggest need is stick to the subject.

DR. WALLIS: Well, I would like to, if I write a letter, reflect the views of the Subcommittee, not my own. And I think the only way I can get those

views is for you to tell me what they are. I think it's probably best -- I think it's an important enough matter that I'd really like to be secure in deciding what to write.

MR. SIEBER: Well, once we sign off on it, they're going to use it.

DR. WALLIS: Yeah, it's going to be an important matter, and I think it's something that -- the kind of thing that the ACRS has pleasure in doing if it's done well. And here's a new reactor that can be born. If we do a good job, it'll be a good piece of equipment.

MR. ROSEN: You get two more shots at this. We get the shot at the other calculations, and then we get the shot at the design certification stage.

DR. WALLIS: Well, the pleasure to me is not in the shooting, whatever the staff may imagine. You know, the pleasure is in the results, or the way we might have influenced events in the long term for the benefit of the public essentially. It's 5:00. Of course, we worked it out to end at 5 precisely. Am I allowed to do that, or does anyone want to have some more words? So the transcript will be available to us, the entire transcript, but GE -- it's available to

GE too.

MR. CARUSO: GE could come -- the transcript will be proprietary. I will have copies, and if they wanted to come in, I could put them in a room and let them see it.

DR. WALLIS: But you can't send it to them, even though it's proprietary --

MR. CARUSO: It's one of these --

DR. WALLIS: GE proprietary data.

MR. CARUSO: It's one of these strange things that if they want it, I'll see what I can do about it.

DR. WALLIS: Okay.

MR. SIEBER: It's a public document. It's just that nobody is allowed to read it.

MR. CARUSO: Well, no. Actually, probably they are allowed to see.

MR. SIEBER: They are, yes.

MR. CARUSO: Probably they are. I mean, I just have to figure out how to do it. That's all.

DR. WALLIS: Yeah. It will probably be useful for them to look it over.

MR. CARUSO: It should be doable.

DR. WALLIS: Okay. May I close?

DR. RANSOM: Is the transcript available

through the NRC site?

MR. CARUSO: It goes on Atam's, but it's only the non-proprietary version that goes on Atam's.

DR. WALLIS: Does it go on the web? It used to go on the web.

MR. CARUSO: Yes.

DR. WALLIS: But that's the non-proprietary one.

MR. SIEBER: But you will find --

DR. WALLIS: So can you get me the proprietary one?

MR. CARUSO: I'll --

DR. WALLIS: Can you send it to me electronically or something, so it's there in a packet and I can get it. I don't have to go through -- I don't want to go through Atam's. I'll never find anything.

MR. CARUSO: I'll put it on a CD for you.

DR. RANSOM: And you'll send me a copy.

DR. WALLIS: Okay.

MR. CARUSO: I'll send everybody a copy.

DR. WALLIS: Okay. That would be helpful I think. Thank you. I have so many CDs at home, I probably -- please put something on it so it's not just a blank CD, and after a while I don't know what

it is. Write on it what it is. Okay? Can I close the meeting?

MR. SIEBER: It's your meeting.

DR. WALLIS: I'd like to thank everybody for their patience and their technical contributions, and the general professionalism with which you have done your work the last couple of days. Thank you very much.

(Whereupon, the proceedings in the above-entitled matter went off the record at 5:03 p.m.)