ORIGINAL ACRST-3124

OFFICIAL TRANSCRIPT OF PROCEEDINGS

NUCLEAR REGULATORY COMMISSION

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

Title: **THERMAL-HYDRAULIC PHENOMENA**

TRO4 (ACRS)
RETURN ORIGINAL
TO BJWHITE
M/S T-2E26
415-7130
THANKS!

Work Order No.: **NRC-1434**

LOCATION: **Rockville, MD**

DATE: **Tuesday, August 8, 2000** **PAGES: 1 - 37**

Closed Session pages: 38-389

ANN RILEY & ASSOCIATES, LTD.
1025 Connecticut Ave., NW, Suite 1014
Washington, D.C. 20036
(202) 842-0034

DISCLAIMER

UNITED STATES NUCLEAR REGULATORY COMMISSION'S

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

AUGUST 8, 2000

The contents of this transcript of the proceeding of the United States Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, taken on August 8, 2000, as reported herein, is a record of the discussions recorded at the meeting held on the above date.

This transcript had not been reviewed, corrected and edited and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

***

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

***

THERMAL-HYDRAULIC PHENOMENA SUBCOMMITTEE MEETING

SIEMENS S-RELAP5 CODE FOR

APPENDIX K SBLOCA ANALYSIS

***

Public Meeting

***

Nuclear Regulatory Commission

Room T2-B3

Two White Flint North

11545 Rockville Pike

Rockville, Maryland

Tuesday, August 8, 2000

The above-entitled proceedings commenced at 8:30 a.m., pursuant to notice, the HONORABLE GRAHAM WALLIS, Chairman, presiding.

ANN RILEY & ASSOCIATES, LTD.
Court Reporters
1025 Connecticut Avenue, NW, Suite 1014
Washington, D.C. 20036
(202) 842-0034

ACRS COMMITTEE:

DR. GRAHAM WALLIS

DR. DANA POWERS

DR. THOMAS KRESS

DR. ROBERT SEALE

APPEARANCES:

DR. NOVAK ZUBER

MR. PAUL BOEHNERT

MR. JERRY HOLM

MR. LARRY O'DELL

MR. KEN CARLSON

MR. JOE KELLY

MR. R. LANDRY

MR. JIM MALLAY

DR. CHOW

MR. GENE JENSEN

MR. KEN GREENE

P R O C E E D I N G S

[8:30 a.m.]

CHAIRMAN WALLIS: The meeting will now come to order. This is a meeting of the ACRS Subcommittee on Thermal-Hydraulic Phenomena. I am Graham Wallis, the Chairman of the subcommittee.

ACRS members in attendance are Drs. Tom Kress, Dana Powers and Robert Seale, and we expect the arrival of consultant Novak Zuber.

The purpose of this meeting is for the subcommittee to begin review of the Siemens Power Corporation S-RELAP5 thermal-hydraulic systems code. The subcommittee will gather information, analyze relevant issues and facts, formulate and propose positions and actions as appropriate for deliberation by the full committee. I should also add that the committee will ask a lot of relevant questions.

Mr. Paul is the cognizant ACRS staff engineer for this meeting. The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register on July 13, 2000.

Most of this meeting will be closed to the public to discuss information considered proprietary to the Siemens Power Corporation.

A transcript of that is meeting is being kept and the open portions of this transcript will be made available, as stated in the Federal Register Notice.

It is requested that speakers first identify themselves and speak with sufficient clarity and volume so that they can be readily heard. Clarity in this context includes clarity of exposition.

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

Now, I think this is an important meeting, these codes are what we rely on to make predictions for reactors that have never been tested under the conditions that are predicted in the codes. So we are really looking forward to today.

The committee is much less familiar with the code that Siemens folks, so we are going to have ask a lot of questions in order to clear things up for ourselves. We are looking forward to your presentation. Please go ahead.

MR. HOLM: Good morning, my name is Jerry Holm, I am Manager, PWR Product Licensing for Siemens, and the purpose of today's and tomorrow's presentation is to discuss the Siemens S-RELAP5 code for PWR Appendix K Small Break LOCA Analysis. I am going to talk about the agenda and Siemens' future use of the code S-RELAP5.

I will talk about -- I have got two pages for the

agenda, the first for Tuesday and the second for Wednesday. We have readjusted the agenda a little bit from what we presented to you before based on our preparation and what we thought made the most sense for the actual sequence. We have the same information but in a slightly different order.

Leading us off today after my discussion of the agenda is going to be Larry O'Dell, who is going to talk about the development process and history of S-RELAP5 at Siemens. Larry is also going to talk about the code control process and the application control process, or how we control the use of the code at Siemens. These last two items have been a topic of discussion at the ACRS before. My discussion and Larry O'Dell's are in the vein of background information.

After Larry is going to be S-RELAP5 code conservation equations. Joe Kelly is going to give that presentation.

CHAIRMAN WALLIS: I can't believe he is going to take four-and-a-half hours. There are, what, four principles involved? In half-an-hour he should be able to do that. So he had better move along. Really, seriously.

MR. HOLM: We can certainly adjust the pace of the presentation depending on the level of questions.

CHAIRMAN WALLIS: It is going to be agony if we go through every -- we go at that speed.

MR. HOLM: Okay.

CHAIRMAN WALLIS: I want to see how they are used, and I think we have to get on to the constitutive equations, and I would like to move also to the solution methods.

MR. HOLM: Okay.

CHAIRMAN WALLIS: If he can possibly do that, because it is all one package.

MR. HOLM: Okay.

CHAIRMAN WALLIS: We have to understand the whole thing, not just the beginning.

MR. HOLM: Okay. As Joe goes through his presentation and we see how your questions are, maybe we can speed that part of it up then.

CHAIRMAN WALLIS: Well, maybe there is a problem with the conservation equations if you are going to take so long.

MR. HOLM: I don't believe so.

CHAIRMAN WALLIS: Okay. Thank you.

MR. HOLM: Okay. One comment I had is I would like to structure the presentation such that while Joe is giving his talk, we keep our questions to the material he is presenting. I know we have submitted to you a topical report and a lot of supporting information. If we could hold questions that you have developed from that area to this block of time on the agenda. If you have got a lot of

questions, perhaps we can expand the time.

CHAIRMAN WALLIS: I don't think we can do that. I think we are going to ask questions as they come up.

MR. HOLM: As they come.

CHAIRMAN WALLIS: Yes, I think so.

DR. SEALE: We are terribly undisciplined.

CHAIRMAN WALLIS: I think that is the most efficient way to proceed.

DR. SEALE: I was teasing.

CHAIRMAN WALLIS: Otherwise, you know, while you are still trying to resolve one issue, it is appropriate to ask the questions about that. Otherwise, you lose the continuity otherwise.

MR. HOLM: If we can make keep them as directly related to the presentation.

CHAIRMAN WALLIS: We won't get him off track. We will try not to get him off track.

MR. HOLM: Okay. That is the main point. The plan then is after Joe's presentation we will go into issues that are more directly related to the Appendix K small break LOCA use of the code. Ken Carlson is going to be presenting that part, and he has got about four main portions to his presentation, and the schedule shows he will go over the background of the methodology at the end of today.

And then on Wednesday, Ken Carlson again will talk

about the Appendix K small break LOCA methodology itself. We will start off with a short discussion of the important small break LOCA processes, go into the constitutive models and then go into the small break LOCA assessments that we have done on the code.

CHAIRMAN WALLIS: I have a question for you. We got a lot of paperwork, we got a whole box full of paperwork, and some of us read enough of it to have questions about it. Now, if we look at something like say the programmer's guide, are we ever going to get a chance to ask questions about that? I think it would be good if we had some spare time at the end when we can perhaps visit some of these other questions which have come up in our reading that you may be wishing to address, but sometime we would like to have some answers.

MR. HOLM: Okay.

CHAIRMAN WALLIS: Unless there is some other time we are going to meet to discuss them or some other process.

MR. HOLM: The way I had scheduled it is to try to do that at this period, but perhaps the 30 minutes needs to be expanded a bit.

CHAIRMAN WALLIS: My experience is the ACRS questions last about as long as the presentations.

MR. HOLM: Okay. We have brought a number of additional people today who I was going to introduce, who

hopefully will be able to answer questions that we haven't made a presentation for. Just going through their names, we have --

CHAIRMAN WALLIS: That is where the good, the straight answers.

MR. HOLM: We have Jim Mallay, who is Director of Regulatory Affairs for Siemens; Dr. Chow, who is one of the co-developers for S-RELAP5; Gene Jensen and Ken Greene. Okay. And while they aren't going to be presenting, they will be available to answer questions.

And the last introductory slide I have is to just give a picture of our vision of the use of S-RELAP5 at Siemens. S-RELAP5 was actually developed as part of our realistic large break LOCA methodology development program, and we used the word "realistic" rather than "best estimate" for the code. This effort is --

CHAIRMAN WALLIS: In a previous meeting we were told it was an evaluation model, not a best estimate code.

MR. HOLM: For the topical reports that we have submitted now, which is small break LOCA, this is an Appendix K use of the code, and we have thrust our presentation today first to talk about the conservation equations in S-RELAP5, which are basically applicable to all the uses of the code, but then we have cast the rest of the presentation specific to its use for small break LOCA and as

an Appendix K model.

CHAIRMAN WALLIS: You want it to evolve to be a realistic model?

MR. HOLM: Yes. Though the sequence, as I think Larry will talk about, is that we developed it to be a realistic model, but our first submittal of it is for an Appendix K application. And then we have also got a second topical under review right now to use it for non-LOCA methodology.

CHAIRMAN WALLIS: It is sort of hard for me, reading the documentation, to tell whether it is Appendix K or a realistic model.

MR. HOLM: The submittal, what we submitted as a topical report, is a description of the methodology and the assessment of the report for small break LOCA. And then at the request of the NRC, we submitted some additional information that in the past we haven't normally submitted, which is the S-RELAP5 correlations and models document, programmer's manual and user's manual. Those three documents were actually developed as part of the realistic LOCA program and, since they form of basis of it, were done before the completion of that program.

Our decision to use S-RELAP5 for these other uses is a recent one, probably in the last three years we made the decision that we were going to move to one code. And

then as part of that decision, we also made the decision that we would, after finishing it for the large break LOCA work this year, we would then in the future go on to developing and assessing the code for BWR applications.

The motivation behind this vision is I would say twofold, one, quality and, two, efficiency. By focusing our efforts on assessments and development for one code, we think we can do a better job than if we focus it on three or four codes.

With that, I will turn it over to Larry O'Dell.

CHAIRMAN WALLIS: Thank you very much.

MR. HOLM: You're welcome.

CHAIRMAN WALLIS: Before you start, why is the history important? When we read the documentation, we don't really know the history, we just evaluate the documentation as we see it.

MR. O'DELL: I think the only reason for providing the history is to try to make the relationship between S-RELAP5 code and particular the RELAP5 Mod 2 code and RELAP5 Mod 3, because there is a connection between those codes.

CHAIRMAN WALLIS: I think we need -- if you could tell us the most important things we need to know, because I am trying to grapple with the question of why the history matters. In our assessment we haven't -- I don't know what

my colleagues feel, I have certainly haven't taken much account of history. I don't want to have to dig into history in order to figure out why something is in the code.

MR. O'DELL: No, and I don't think that that is the intent here at all. I think the intent here is to simply build the relationship between S-RELAP5 and the other codes.

CHAIRMAN WALLIS: It has parents and grandparents.

MR. O'DELL: Right. And I think the other part of the presentation is, at least in looking at previous transcripts of the ACRS, there was an interest in, you know, what is a "frozen code" version and how do you define it. And I want to make sure that we are all on the same wavelength.

CHAIRMAN WALLIS: It is a bit like Henry VIII, to evaluate him, we don't go back to William the Conqueror.

MR. O'DELL: Exactly. Exactly.

Okay. As Jerry indicated, I am Larry O'Dell, Manager of U.S. and Far East Research and Technical. I have got three items on introduction agenda. One of them is the S-RELAP5 development process and history, and, as I indicated, the intent here is to show the connection between the S-RELAP5 code, the RELAP5 Mod 2 code, and RELAP5 Mod 3, then briefly I wanted to go through the code control process that is followed at SPC for controlling the development of

codes, and then go through the application control process as to how the applications of those codes is controlled.

As I indicated, the objective here is to provide a common understanding of the S-RELAP5 code development process and to demonstrate the relationship between S-RELAP5 and the other RELAP5 code versions.

CHAIRMAN WALLIS: Did SPC develop S-RELAP5 or did they send it out to be done by some contractor?

MR. O'DELL: No, we developed it in-house from the RELAP5 Mod 2 version.

CHAIRMAN WALLIS: Thank you.

MR. O'DELL: And this is the only reason unrelated history slide. We did start with RELAP5, in early 1981 we obtained RELAP5 Mod 1, Cycle 25 from INEL. The initial application of that was to the main steamline break analysis. We did modify that version of the code to address the now specific requirements, and there was a NRC submittal made in 1984.

We then switched from basically Mod 1 to RELAP5 Mod 2, Cycle 36.02. We obtained that version of the code from INEL in 1985. The initial application of that code was a small break LOCA analysis, and, again, we modified the code to address the analysis-specific requirements and, following those modifications, we renamed the code to ANF-RELAP.

We received a SER for the small break LOCA in 1988. We then moved the main steamline break methodology to ANF-RELAP. Again, we modified the code to address analysis-specific requirements, we moved those modifications from Mod 1 to Mod 2 and received a SER in 1988.

We then applied the code ANF-RELAP to the non-LOCA transients and received a SER in 1992 for that methodology.

Now, the process that has been followed at SPC is we received the code in the base code and associated models were developed at INEL. Significant code benchmarking had been performed by a large number of different organizations on various code versions. We accepted the base code and associated models when the code versions were first brought into house. By that I mean we did not perform at that time any model-by-model verification or validation process.

The initial SPC code changes primarily were driven by licensing requirement for analysis of interest, main steamline break and small break LOCA, and acceptability of the code was demonstrated by comparison to integral test facilities, and we believe that that approach was consistent with the licensing expectations at that time, as demonstrated by the TMI action items.

The S-RELAP5 development was initiated from the ANF-RELAP for the PWR realistic large break LOCA project, as Jerry indicated. And as he also indicated, the current two

topical reports, one for the non-LOCA methodology and one for the Appendix K small break methodology of the code -- or the methodologies asked are under review.

The S-RELAP5 code verification was been performed where we would define verification as the process of ensuring that the coding and the documentation are consistent. We have gone through that process.

CHAIRMAN WALLIS: You mean the typos in the documentation are duplicated in the coding?

MR. O'DELL: I would not mean that. I would mean that the models that are indicated in the coding, I believe are consistent with the models that are in the codes. So the code and the documentation have the same models.

CHAIRMAN WALLIS: I don't think this committee has ever looked at the code, but we do look at typed equations, and typos do occur. So, we always wonder what happens in the real code.

MR. O'DELL: Well, I would hope that those typos aren't in the real code, and I don't believe they are.

The verification process identified models which deviated from the original model correlation references. Some of the models were modified to be consistent with the original references, some were not. The decision here was based on results of assessment calculations that are performed with the code. The current code documentation we

believe is consistent with the code.

CHAIRMAN WALLIS: How do you make sure the code is consistent with documentation? Someone goes not line by line, but syllable by syllable.

MR. O'DELL: Well, they basically go into the code, what we did here is we used both our in-house staff, people from Duke Engineering Services, some people from INEL to look at the various models within the code. They took the documentation. They went and looked at the way the coding was inside the code and did the check against --

CHAIRMAN WALLIS: Checked off every line then.

MR. O'DELL: Well, yes, for each of the major models and stuff in the code.

CHAIRMAN WALLIS: Are we ever going to look at those lines of coding? Is there a chance to do that?

MR. O'DELL: I believe the NRC has the code.

CHAIRMAN WALLIS: I would hate to have to do that, but it would be interesting to do a spot check.

MR. O'DELL: I wouldn't want to do it either. The code validation has been performed in support of the code development process. We have what we call a standard code test suite, it is developed and maintained so as we move from one version of the code to the next, that test suite continues to be run. It is composed of both integral and separate effects tests.

The test suite for S-RELAP5 was developed to support the realistic large break LOCA project. It includes tests from LOFT, FLECHT/SEASET, CCTF, UPTF, THTF, Marviken, GE Level Swell test, MIT Pressurizer test and Bennett Tube tests.

CHAIRMAN WALLIS: Was someone going to tell us about the philosophy here? One philosophy is to simply say, here is what available, we will run the code. The other thing to do is say, here are features of the code we need to test, and then say that this test is specifically used for testing this feature of the code, and so on. That is a more systematic approach. When I looked at the various documents submitted, I used that approach. I said, look at this test, what does it actually really challenge the code to do? And I would hope that sometime you might tell us that in the next two days.

Some of these tests really don't challenge the code at all. Some of the challenge it much more. And I think you should be aware of that when you making the comparisons.

MR. O'DELL: Well, and that is exactly true. What we have done in the realistic LOCA project, we have put together a very significant test matrix, okay, where we have gone in and said, okay, this is what -- we have tried to go through and say this is what we need to test, these are the

tests that are available that we can get information and run. And we have tried to go out and get that data which is in and of itself time-consuming, as it turns out, and not easy to do.

CHAIRMAN WALLIS: That is what should be said. I mean if there is a real shortage of tests to test some particular part of the code, that should be pointed out, not covered up in some way. Maybe the NRC are the ones who want to be aware of that. And I think you as professionals also have to be aware of that, you know, sort of stick your neck out if you have something in the code which has not really been tested.

MR. O'DELL: I understand. Again, outside of the realistic LOCA project, though, SPC has continued to rely primarily on integral assessments for the non-realistic methodology validation.

CHAIRMAN WALLIS: Non-realistic is a very interesting adjective.

[Laughter.]

MR. O'DELL: I would agree, okay. Not the best choice of words.

CHAIRMAN WALLIS: That is the kind consultants might use.

MR. O'DELL: Yes. For a conservative methodology.

Both the current non-LOCA and small break LOCA

submittals are not realistic or best estimate methodology with no associated need to quantify uncertainties. The current submittals rely on the demonstration that the overall methodology is conservative, where methodology is defined as the combination of code and specific code model selection, plant nodalization and associated application process with clearly identified conservatisms.

CHAIRMAN WALLIS: That is, of course, difficult. I mean if you take some conservation principle and apply it to some control volume and make assumptions, I have not the slightest idea how you know if those are conservative or not.

MR. O'DELL: Well, when I am talking about conservatisms here, I am primarily talking about biases and stuff that are required by the Standard Review Plan.

CHAIRMAN WALLIS: When you start putting in -- you know, every time you make an engineering model, you make assumptions, and they introduce biases.

MR. O'DELL: And that is where we go and look at the integral assessments, again with the goal of looking at how does the code predict the data, is it predicting it conservatively?

CHAIRMAN WALLIS: Oh, so, your conservative is in some of integral way when you compare with data, it is not, you know, each assumption.

MR. O'DELL: Exactly.

CHAIRMAN WALLIS: This is biased in conservative way.

MR. O'DELL: Exactly.

CHAIRMAN WALLIS: So, therefore, it is only conservative for a particular application. If used for something else, it might well not be conservative.

MR. O'DELL: That's correct.

CHAIRMAN WALLIS: That is correct. Thank you.

MR. O'DELL: The code changes that were implemented to create ANF-RELAP from RELAP5 Mod 2 consisted of the addition of the Moody critical flow model, the Appendix K requirement. There were changes made to the heat transfer and CHF correlations. A new mixture level model was added. Again, this was in response to the small break LOCA review process on the original methodology. A new CCFL model was installed, and the Baker-Just metal-water reaction rate correlation was installed in the code.

CHAIRMAN WALLIS: I am trying to remember if this is the code which has the Baker-Just model with the exponent, the wrong sign, so that everything goes the wrong way. Maybe we will get to it. I think it is.

MR. O'DELL: Okay. I would look at Dr. Chow for that, I am afraid.

CHAIRMAN WALLIS: It is one of those typos.

MR. O'DELL: Okay. Again, the changes that were made to ANF-RELAP for the non-LOCA and steamline break transients was to extend the Biasi CHF correlation to the steam generator secondary and the Moody model for breakflow was modified to get steam-only flow out the break. These two changes related to the steamline break and there were no specific changes made for the non-LOCA transients.

CHAIRMAN WALLIS: So these are somewhat cosmetic changes really?

MR. O'DELL: Yes.

CHAIRMAN WALLIS: Or do they make a big difference?

MR. O'DELL: Pardon?

CHAIRMAN WALLIS: Do they make a big difference for some transients?

MR. O'DELL: I don't think they made any large differences. A good part of them were, particularly, the Moody, the Baker-Just, et cetera, are things that were required in order to meet the licensing requirements with the model.

And then the code changes that were added to ANF-RELAP to create S-RELAP5 include the multi-dimensional capability. We added the two-dimensional capability to the code. We reformulated the energy conservation equations to reduce the energy errors. The numerical solution of the

hydrodynamic field equations were modified. The state of steam non-condensable mixture was modified. This was to get around code failures when the nitrogen came out of the accumulators. The hydrodynamic constitutive models were modified. There were modifications made to the heat transfer models, choked flow model. Counter-current flow limiting correlation was replaced again. The component models were modified and there was new fuel models added. The fuel models consisted of approved ROD X-2 code, is a conservative fuel design code and a best estimate ROD X-3 code.

And we did incorporate some models directly from RELAP5 Mod 3. The code structure of S-RELAP5 was modified for code portability, very similar now to the structure of RELAP5 Mod 3, and we incorporated the reactor kinetics package, control systems and trip systems for RELAP5 Mod 3 and to S-RELAP5.

In summary then, from this part of the presentation, I have believe I have shown the relationship of S-RELAP5 code to both RELAP5 Mod 2 and to Mod 3 and the development process that has been followed at SPC for the S-RELAP5 has been described.

CHAIRMAN WALLIS: At this point we have nothing to evaluate until we see what you actually did.

MR. O'DELL: That would be correct. Yeah, this is

just again an overview process to provide you the background.

The next part of my presentation will deal with the code control process. The objective here is to demonstrate that SPC's code control process is consistent with current software standards and QA practices, and to define SPC's interpretation of a "frozen code" version.

Again, our control processes are documented in EMF-1928, which is the "Engineering/Research and Technology Work Practices." Specifically, it is Work Practice 104, 121. The basis for the approach is the NUREG/BR-0167, the ASME standard on requirements for computer software in nuclear facilities, and two ANS standards, one on documentation and the other on guideline for verification and validation of scientific codes.

CHAIRMAN WALLIS: Do these requirements require that someone who signs the document read it?

MR. O'DELL: Yes.

CHAIRMAN WALLIS: Because one of these documents, I was tempted to say that -- I did, I wrote it down, but I am not going to say exactly what I wrote down. It was signed by several people, but I thought I found a lot of typos in the equations, and I just wondered how that happened. Maybe we should get to it. But that should be one of the things that shouldn't happen.

MR. O'DELL: Well, I would agree with that.

CHAIRMAN WALLIS: Maybe I am wrong, it is just that if I read it, six people who knew what they were doing read it, they would presumably have caught this long before I did, if they are typos. Maybe we need to clarify that at some point.

MR. O'DELL: Yes. And I think as we go through the models and stuff, hopefully, we will get to that.

Within our control systems we have what we call a USE code classification. These are codes with broad applicability for use in product design and engineering calculations, and they are documented in what we call a software development record. And these include mechanical, neutronic and safety analysis or thermal-hydraulic codes.

We believe the USE code classification meets the "frozen code" version. It is documented in theory, programmer's and user's manuals. There is verification and validation performed on those. A formal QA review is performed, a formal release to engineering application organizations, and the code is then stored in our Code Management System, or CMS system, in a read-only format. It ensures the use of the latest code version and it automatically archives the code so that you can retrieve it at any point in time in the future.

CHAIRMAN WALLIS: Now, the way in which the

scientific and engineering developments are often given QA is by publication, and they are out in the world and anybody reads them. And I think one trouble with the codes is they are proprietary, so that they are not out there in the world, so you don't have the kind of exposure that lets you get feedback that might be helpful about things like confusing definitions or typos or whatever. So you have to do an especially good job yourselves.

MR. O'DELL: Well, and I believe we attempt to do that with respect to the code from the standpoint that we do have formal processes. There is an entirely independent review done.

CHAIRMAN WALLIS: So you pay some consultant or someone to check this thing out?

MR. O'DELL: We have used consultants in the past, and we have done it inside.

CHAIRMAN WALLIS: Withhold their payment until it goes by the ACRS?

[Laughter.]

MR. O'DELL: Well, that is something we hadn't thought of. It might not be a bad idea, though. I don't know how many takers we would get on that, though, that is what worries me.

CHAIRMAN WALLIS: Well, you should get many that are capable people.

MR. O'DELL: Well, most of them work for dollars, you know. If it doesn't come in and they have to wait for it, they may not appreciate that.

The software development record documents the development of a new USE code version, identifies the parent USE code version, contains the references. A software quality assurance plan is to put together at the initiation of the project. Software requirement specification, and, again, both the quality assurance plan and the software requirements specification involve the applications people to make sure that the final product will meet their requirements.

There is also the design, software design description which is we believe contained in the theory or models and correlations document, and the programmer's manual and user's manual. There is a software verification and validation plan put together that states what the requirements are from the -- you know, actually how well it has to compare to the transients or the assessments.

Then there is a software verification and validation results report that is put out. Again, any of these two things would aim at the standard test suite of cases for the code, plus any additional tests that have to incorporated to address the model changes.

There is independent quality assurance review

performed, and then a final code released to applications. And should there be any restrictions that come out of this process, that is included in the code release to applications.

Okay. In summary of this then, I believe I have described the SPC process for controlling the code development, provided a definition and described the required documentation for a USE code, and we believe the USE code classification meets the "frozen code" version.

CHAIRMAN WALLIS: Now, this code is developed over how many years?

MR. O'DELL: Well, --

CHAIRMAN WALLIS: Not going back to RELAP. I mean you mentioned 1980s and so on. But what we are looking at today, with its modifications and all the checks you have just described, has been done in, what, in the last five years or something?

MR. O'DELL: No, it has been longer than that.

CHAIRMAN WALLIS: So some memory has been lost, I mean someone may have developed something and then left the company, and someone else has to figure out what he did.

MR. O'DELL: I think almost all of the development on this code has been done by Dr. Chow.

CHAIRMAN WALLIS: So we still have the same people?

MR. O'DELL: Yes. Okay. And my final topic was the application control process. The objective here is define SPC's approach for controlling how a specific licensing analysis is performed. This includes the development of the code input decks, the plant nodalization, et cetera, selection of the code options, and compliance with approved methodology and associated SER restrictions on that methodology.

CHAIRMAN WALLIS: You select the code options on what basis?

MR. O'DELL: The code option selection comes about from the methodology development process and in these particular cases would be based on the requirement of trying to demonstrate conservative performance of the code on the assessments.

CHAIRMAN WALLIS: So in that case, you would take the least beneficial options and see how they did?

MR. O'DELL: I wouldn't say the least beneficial option, because the least beneficial option --

CHAIRMAN WALLIS: Conservative.

MR. O'DELL: It may be conservative.

CHAIRMAN WALLIS: Make the worst assumptions and see what happened.

MR. O'DELL: I would agree with that. On the other hand, you would like to at least be able to pick up

the trends and stuff in the assessments, okay. And if you go through a process where you take nothing but the worst combinations of everything, then you do a very poor job of predicting.

CHAIRMAN WALLIS: Yeah. Maybe we will get to that when we talk to someone else. But my impression is that codes get tweaked till things look good, instead of being tweaked in order to find out when things get bad. And I wonder which is the right philosophy.

MR. O'DELL: I would say in the tweaking process, okay, you pass through several of those kind of points.

CHAIRMAN WALLIS: Yeah, but you show to us is the best or the worst?

MR. O'DELL: It is still conservative relative to the assessment data.

CHAIRMAN WALLIS: Well, we will get into that question later. At least the other members of your team have heard it.

MR. O'DELL: Okay. SPC uses analysis guidelines to control the performance of licensing analysis. They are developed based on the NRC approved methodology. It covers the codes to be used, like I indicated, the plant input model development analysis flow. It requires applications and regulatory affairs management approval and sign-off. The regulatory affairs is basically the tie-in to make sure

we are in agreement with the NRC approved methodology and the SER restrictions.

The code input guidelines define the plant component nodalization, for example, reactor vessel, hot legs, pumps, pressurizer, steam generators and ECCS.

CHAIRMAN WALLIS: Where do we find that?

MR. O'DELL: Pardon?

CHAIRMAN WALLIS: Where do we find that? I never saw it in all the paperwork that came me, a picture of a reactor vessel or anything.

MR. O'DELL: Well, this is, like I said, the code input guidelines. These guidelines are developed based on the final approved methodology that goes to applications. Okay.

CHAIRMAN WALLIS: Yeah. But all the documentation that came describing the model and the programmer's guide and all this stuff never told me what problem you were addressing or had pictures of these things, or so on.

MR. O'DELL: Well, that would be in --

CHAIRMAN WALLIS: It would have helped a great deal if someone had put that upfront.

MR. O'DELL: Well, I think that is in the methodology documents, the methodology submittals.

MR. KELLY: This is Joe Kelly from Siemens Power, and I will just break in for a second, because the analysis

guidelines were something that I was not familiar with and were a very pleasant surprise for me when I moved into working in industry. Rather than a generic user guideline, you know, that is a very large document that no one reads, these are very short but very specific user guidelines for each type of transient. So if you are doing a main -- there is a document for a main steamline break, and it will say that this component should be noted this way. And they get very specific.

For example, in one of them for the downcomer, it says the downcomer should have seven axial nodes, node number 1 is from the top of the nozzles to the top of the hot leg, node number 2 covers the span of the hot leg, and so on. And they are also very specific about what options should be turned on and all the various different parts of the system, and also what biases should be taken on things like neutronic coefficients.

And so just one of these, they are fairly small, but they are very specific for each type of transient.

CHAIRMAN WALLIS: So it has seven nodes because eight nodes gives a different answer?

[Laughter.]

MR. KELLY: I didn't work with the guidelines, so I don't know. You'd have to ask.

CHAIRMAN WALLIS: That's nice to know. You're

telling me something that's completely new to me. Thank you.

MR. KELLY: Yes, it was new to me, too, and it was also very refreshing. And part of that is that the assessments also have to be run under the same guidelines as the analysis would be run under, and that, of course, is the way that it should be done.

CHAIRMAN WALLIS: That gives me a good feeling and a bad feeling; a good feeling in that you're being very specific about it, the bad feeling, that if you have to be so specific, what happens if I do something else?

Okay.

MR. O'DELL: Okay, again, as Joe just indicated, it defines the code options to be selected, defines the control systems and defines the trip systems to be used, and, again, requires an independent QA review check, and that independent QA review check includes a check back against the guideline to make sure that the guideline was followed in performing the -- in the development of the code input.

Again, as Joe indicated, it covers the specific Standard Review Plan analysis. It describes the event to be analyzed, describes the analytical methodology being applied.

It defines the regulatory criteria and

requirements, including an SER restrictions. It defines the codes to be used, defines the calculations to be performed; the specific cases that are to be run, the analysis assumptions, which includes any required input parameter biasing, equipment and trip status.

Then it details each of the calculation steps, and finally identifies the key input and output parameters that have to be displayed within the calculation notebook for QA review.

It also defines the quality assurance review requirements which include a documented review of the key analysis elements, key input parameters, key output parameters, and, again, the check against the specific analysis guideline to ensure that it was used and followed correctly.

In summary, then, I think I have provided SPC, a description of SPC's process for controlling codes development and performing analysis.

This includes the relationship of the S-RELAP-5 Code to both RELAP-5 Mod 2 and Mod 3. It details the development process followed for the S-RELAP-5 code, given the definition of, at least SPC's definition of a frozen code version.

And, in conclusion, I believe that I have demonstrated that SPC has processes in place to control both

code development and code application in the performance of a licensing analysis.

I hope that I have demonstrated that analysts do not have the freedom to modify codes or their application to improve analysis results.

That's all I had for today.

CHAIRMAN WALLIS: How much are you locked into then? You're locked into the code and the noding and everything?

MR. O'DELL: Yes, that's the intent of the guidelines.

CHAIRMAN WALLIS: Well, what does the user do that you haven't already done?

MR. O'DELL: He basically executes the plant-specific analysis, and documents that analysis.

CHAIRMAN WALLIS: So if his pipes are of a different length someplace, he has to put that in?

MR. O'DELL: Right, that goes in with the -- yes, I mean, it's a plant-specific plant model that's put together.

CHAIRMAN WALLIS: Well, the impression that I get is that the main part, sort of the cooling system, hot leg, cold leg, all that stuff that you've already done, doesn't get touched at all?

MR. O'DELL: I don't know what you mean by doesn't

get touched at all. But, I mean --

CHAIRMAN WALLIS: You give me the impression that you're specifying all the noding and the options and so on.

MR. O'DELL: Yes.

CHAIRMAN WALLIS: Ahead of time.

MR. O'DELL: Yes, that's specified. The analyst simply takes -- you know, if you look at -- let's say we were to get a new plant that we had to do an analysis for.

The first step would be that you would take the input guidelines, you'd go develop the plant model, okay, which is basically the input, nodalization, et cetera.

CHAIRMAN WALLIS: Now, you're going to give this source code to the NRC?

MR. O'DELL: Yes, they have it.

CHAIRMAN WALLIS: So if they want to run nine nodes instead of seven, they can do that?

MR. O'DELL: Yes.

CHAIRMAN WALLIS: And that may be a good thing to do. Thank you.

MR. GRUSO: Dr. Wallis, this is Ralph Gruso from the staff. I'd also note that Larry mentioned these code input guidelines and the analysis guidelines.

As part of the review, we are also spending time at the site where the work is being done.

Although we have not received copies of the code

input guidelines, they could be audited as part of our review, and I anticipate we'll probably do that at some point during the review.

CHAIRMAN WALLIS: Thank you. Have you done your one-hour presentation in half an hour?

MR. O'DELL: Looks like it.

CHAIRMAN WALLIS: Let's keep going at this point at the same speed. Thank you very much.

MR. O'DELL: At this point in time I'll turn it over to Joe Kelly.

CHAIRMAN WALLIS: Joe, maybe we have a break after 35 minutes or something, whenever is good?

MR. KELLY: That's good. And has been stated, one of my tasks here today is to describe the --

REPORTER: Use the microphone.

MR. KELLY: Sorry. Is that okay?

MR. BOEHNERT: I guess that now we have to discuss closing for proprietary material. Joe, when should we do that?

MR. KELLY: Well, some of my slides, the bulk of my slides are non-proprietary.

MR. BOEHNERT: Okay.

MR. KELLY: But there are individual examples here and there that are. And so I guess that would be Jim or Gerry Holm to decide.

But I think the plan was to have it closed now; is that correct?

MR. HOLM: Yes.

MR. BOEHNERT: Okay, then we'll need to close the session. We'll go to a proprietary transcript, and Siemens people need to validate that anybody here that you don't know shouldn't be there, has to leave. NRC people, of course, can stay.

I didn't say that very well, but you know what I mean.

[Whereupon, at 9:18 a.m., the meeting proceeded into closed session.]

REPORTER'S CERTIFICATE

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

NAME OF PROCEEDING: THERMAL-HYDRAULIC PHENOMENA

PLACE OF PROCEEDING: Rockville, MD

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

Jon Hundley

Official Reporter

Ann Riley & Associates, Ltd.