ATTACHMENT 1

Memorandum to James E. Lyons, Director, New Reactor Licensing Project Office, from John T. Larkins, Executive Director, Advisory Committe on Reactor Safeguards, dated May 1, 2003, regarding a statement by Dr. Susan G. Sterrett

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

May 1, 2003

MEMORANDUM TO: James E. Lyons, Director
New Reactor License Project Office
Office of Nuclear Reactor Regulations

FROM: John T. Larkins, Executive Director
Advisory Committee on Reactor Safeguards

SUBJECT: STATEMENT BY DR. SUSAN G. STERRETT

Attached is a statement made by Dr. Susan G. Sterrett (Assistant Professor, Department of Philosophy, Duke University) before the ACRS on April 11, 2003, regarding the level of detail of AP1000 design review. Dr. Sterrett expressed concern regarding whether the NRC verifies or asks for proof that the system fluid parameters reported in the AP1000 design certification application (and used in the analyses reported in topical reports) are actually justified by design details, as opposed to the systems designs at the conceptual stage.

Attachment: Statement by Susan G. Sterrett

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Draft of Remarks by Dr. S. G. Sterrett

501st ACRS meeting, April 11th, 2003

Rockville, MD

I'm Susan G. Sterrett. I am currently a professor at Duke University in Durham, North Carolina. I should perhaps mention that, prior to my academic career, I worked as a design engineer in the commerical nuclear power plant industry, including as a fluid system designer on the AP60 in the mid nineties. I am making these remarks as a member of the public, unaffiliated with any organization.

I'm here today because I have some questions about the NRC's review of the AP1000. Put briefly, my question is whether the NRC verifies or asks for proof that the system parameters reported in the AP1000 design certification application (and used in the analyses) are actually justified by a detailed design, as opposed to the AP1000 system designs being at the stage of conceptual system design or justified only by preliminary equipment sizing calculations. I'd like a few minutes to explain the relevance and the significance of the question.

According to the rules under which the AP1000 is being licensed by the NRC, the level of design information required in a design certification application is, with a few explicit exceptions, the level of information that was required at the operating license stage under the previous two-step licensing process. I think this requirement makes sense, too, inasmuch as what the NRC is licensing in approving the AP1000 is an actual plant design that is certified to be constructed and operated.

In following some of the AP1000 licensing activities via the NRC's website, I have noticed that much is often made of the similarities between the AP1000 systems and the AP600 systems. This can be misleading: the performance of the various fluid

systems in the plant -- that is, the flows, temperatures, and pressures that obtain at various points within a system are affected by many kinds of differences in a plant design. As I am sure everyone here realizes:

--- Anytime a system flowrate changes, pressure drops in the system will change.

--- Likewise, anytime the pressure at some point in a system changes, flowrates in it or some other system can be affected.

--- Thus, even for those systems that are exactly the same physically speaking (i.e., same pipe size and layout) for the AP1000 as for the AP600, there is still the question of whether there are differences in the inlet or outlet pressures in a system or piece of equipment to which it connects. Different inlet or outlet pressures will result in differences in fluid system performance.

For example, suppose the main steam system pressure is different on the AP1000; then, on the AP1000, there would be a different driving head for lines connected to it than there was on the AP600. So, even if the system hardware and layout of a system connected to the main steam system, say, is exactly the same on the AP1000 as it was for the AP600, the resulting values of major fluid system parameters -- e.g., the mass and volume flowrates and the pressures that result -- could be quite different. Obviously the effects on things like the flow capability of relief valve piping and valve arrangements would need to be looked at. Accomodating these changes could require resizing piping or control valves in order to achieve the flowrate claimed for the system.

I've given the main steam system as an example, but the general point holds for every system in the plant. To infer from the fact that the hardware and layout on an AP1000 system is exactly the same as on the AP600, to the conclusion that the performance is the same, is incorrect. The various AP1000 analyses now under review are only as valid as the assumptions made in them about the performance of the plant systems.

What does this point mean for the review of the AP1000 design, which makes frequent appeal to the certified AP600 design? In many aspects of the safety analyses, the NRC has been very alert to the differences between the AP1000 and the AP600. The point of my examples is that this awareness ought to be extended to plant fluid system performance, specifically, that some reassurances should be sought that the fluid system design details for all the plant systems have been properly attended to, and that, given that the level of detail required at this stage is supposed to be the same as that at the operating license stage, these should not be just preliminary sizing calculations. I worry about the complacency with which the AP600 design is referenced in justifying the AP1000 system designs.

The AP1000 is sometimes referred to as an uprating of the AP600 design. Of course this would be significantly larger than any uprating that the NRC has licensed so far, and of course it differs from most upratings in that there is no AP600 operating experience to draw upon. To the extent that thinking of the AP1000 as an uprating of the AP600 is appropriate, however, it would make sense to require that all the plant system reviews that would be required for an extended power uprating be performed for the AP1000. As there is now a draft review standard for extended power uprates that could be used to guide such a review of the AP1000 (RS-001, dated December 2002), this seems a natural thing to do. I wonder whether there has in fact been a review of this sort for the AP1000. So let me ask: has there?

For those systems whose layout is finalized at this stage of the AP1000 design certification application, there should be formally signed-off engineering calculations justifying the claims that the AP1000 system flow, temperature, and pressure parameters will actually be achieved using the AP1000 equpment and layout. These are often referred to as fluid system "proof-of-design" calculations. I gather from the NRC's approval of the use of DAC (design acceptance criteria) for structural piping analysis on the AP1000 that there may be some systems for which the layout details will not be completed until after design certification. For those systems, what is needed as far as ensuring proper fluid system performance is to provide layout criteria related to the piping flow resistance, so that the fluid flowrates claimed for the system will actually be achieved. Such criteria are commonly called "L/D criteria" and are considered part of the fluid system design. In fact, for the Westinghouse standard plant designs licensed under the previous two-step process, L/D criteria were provided for various fluid systems prior to construction so that the architect engineer could properly perform the piping layout. As I see it, at least this level of design detail is required at the time of the DCD submittal.

Why not just rely on the ITAACs (Inspections, Tests, Analysis, and Acceptance Criteria) to provide such reassurance? Certainly the ITAACs and other operational tests provide a checkpoint where some deficiences in the plant design would show up. However, I trust that it isn't the intent of ITAACs to relieve the designer of the responsibility of the engineering design work of designing the plant systems so that the system parameters crucial to safety are achieved. Certainly increasing the number of surprises encountered during plant testing is not part of the intent of the new one-step licensing process! I assume that everyone agrees that the intent of design certification is to provide confidence that the certified design will result in fluid systems

that meet their stated functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

In conclusion, I am asking whether the review of the AP1000 design has included ensuring that the design details upon which the analyses that the ACRS has been reviewing depend, have in fact been attended to. In particular, I think it is clear that L/D criteria should be provided at this stage for systems whose layout is to be finalized at a later date, and "proof-of-design" calculations be provided for those whose layout is determined at this stage. Otherwise, there is no assurance that the analyses you are reviewing so carefully and thoughtfully apply to the plant design you are certifying.

Thank you for listening.

Respectfully submitted,

Dr. Susan G. Sterrett

Duke University

Durham, NC 27708

sterrett@duke.edu
919-660-3054 (office & voicemail)
919-660-3050 (receptionist)

ATTACHMENT 2

Electronic mail to John P. Segala, AP1000 Lead Project Manager, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 8, 2003, regarding a request for accession numbers for Westinghouse responses to draft safety evaluation report open items

From: <sterrett@duke.edu>
To: <jps1@nrc.gov>
Date: 7/8/03 1:34PM
Subject: Request for ML accession #'s for W responses to DSER Open Items

Dear John,

As we discusssed on the phone earlier today, here is an email asking for the ML accession numbers for the letters Westinghouse sent responding to the DSER Open Items.

In addition, I also said that I would send descriptions of the two items we discussed on the phone, and that you could pass them on to the appropriate reviewers:

(i) solar radiation effects on the temperature of the water in the PCCS water tank located on top of the containment building, and

(ii) the question about how the design of the AP1000 was obtained from the AP600. This is an over-arching question that relates to many different systems, but I explained why I thought it was related to DSER Open Item 17.3.2-2.

Since these two items are not going to be discussed at the meeting later this week, I will send the descriptions along in later emails.

Best regards,
Susan G. Sterrett

Assistant Professor
Dept. of Philosophy
Duke University
sterrett@duke.edu

I will be on sabbatical for the 2003-2004 academic year and can be reached at 412-441-4867.

ATTACHMENT 3

Excerpts of the Official Transcript of Proceedings; NRC Advisory Committee on Reactor Safeguards, Subcommittee on Future Plant Designs, meeting held in Monroeville, Pennsylvania, on July 18, 2003; pages 61-69

would imagine.

CHAIRMAN KRESS: Okay. Is this the time for a break now?

MEMBER SIEBER: Yes, it is.

CHAIRMAN KRESS: Before we do that I have been reminded that we have a public citizen here that may want to make some comments, is that right? You may want to introduce yourself.

MS. STARRET: My name is Susan Starret, I'm a professor of philosophy at Duke University. And I think most of you have heard me speak before. Prior to my academic career I worked in the nuclear power industry, including on the AP600 for Ron Vijuk.

The topic I'm going to bring up today is the same as the one last time, it is just that I'm going to tie it, show how it relates to -- do I need to speak louder? Show how it relates to the open items.

If you remember that the question I asked, when I spoke earlier this year to the ACRS, was about the level of design completeness in the systems design. That is, is it a conceptual design of the system capabilities, or is it a final design.

The process of -- this process of going from a completed design, the AP600 to the AP1000, I

think can -- makes it especially difficult to tell, because there is lots of detail there that is inherited from the AP600.

So do you know, you know, was that pipe size designed with that valve design, or is it there because it was there for the AP600 and we just didn't change it, and maybe it needs to be changed, and maybe it doesn't.

So that is the question. And I was especially talking about fluid systems designs, the flow temperature and pressure in the systems.

Now, in the 10CFR52 process, as I understand it, the level of design is to be the same of the DCD submittal, is to be the same level of detail as under the old system, the point in time where an operating license was being applied for.

So that means, basically, the fluid systems design should be done insofar as this is possible. Now, this was a concern that cut across many systems, and so my concern was kind of amorphous at the time, trying to make it a little more specific, and tie it into the open items.

So to make it a little more specific, many of the statements that are making in the DCD are about the capabilities of systems. And so when I looked for

an example, I just pulled out one of your DSER section, section 10, on the main steam system.

I didn't have time to go through all of them. But that was the one I used an example from, the last time I spoke to you. So the review looks like what gets done is, they look at what the claims are for the system capabilities made in the DCD, and then compare them to the standard review plan criteria and say, yes, this meets the criteria.

So my question is, that is fine, but the further question I have is, what -- are you asking the question have the systems been designed, have the design details been done.

So the example I gave last time, just as an example, and it wasn't that I had any reason to have a specific concern, but I just said, for example, the main steam system, one of the changes, whenever you do an upgrade is -- upgrading, usually is that the steam pressure changes.

And so you check things like, okay, that is the driving force for things like the relief valves, and any other lines that use the main steam system pressure.

So I would -- I think that when you do an upgrading you actually check and see, okay, these are

the things that should have changed, or have to be looked at, you have to do new calcs for that, did you do that.

I'm not sure whether those kinds of questions are getting asked. And the approach that you are taking here, where you are taking the standard review plan, you are looking at the claims that are made for the capabilities of the system.

That is the question I have. I honestly don't know the answer, I'm just raising it. Maybe an analogy here is something that was talked about earlier, say, an analogy in the structural arena would be the level of detail for the containment structural design.

For instance, there was a statement in the DCD that the containment meets the ASME code, then when the Staff asks, is the analysis done, the answer was, we thought that was a COL item, as I understand the documents I've read.

And then the NRC's response is no, you really have to do that now, and that is the kind of question, point, I have here. It is just that it is in fluid systems design arena, rather than the structural.

So the next -- I think the response that

was given the last time I brought this up was, well, is this really related to safety analysis, because it looks like for the primary systems, for the primary passive systems, we really do look at the flows and stuff.

Well, I think that a lot of the auxiliary systems, I think it is -- it should be part of the review, because you are approving this design, you want the main steam system to be able to do what it claims it can do.

Some of them might come up in RTNSS, but again, I wonder if the RTNSS review isn't something like the standard review plan review, where you say, well okay, here is what the system is -- the important system is supposed to do. Good, it does it, and therefore the RTNSS review is okay.

Again, the question I'm asking has to do with the claim about what the system capability is, versus whether the design detail is done.

Now, how does this tie into the open items? Well, one open item it relates to is the one about the QA process. That was on slide 7 of Joelle's presentation, where inspection of the implementation of the project specific quality plan at Westinghouse.

So I will just explain why I think it is

related to that open item, and how. The QA process for the AP1000 can't be exactly like the AP600. For example, there have been some organizational changes. I don't know what they all are, but one that has to be different is that the Advanced Reactor Corporation is not involved any more, and they provided some sort of role in guidance, or review, or whatever.

They were involved in every design change. For people that don't know about the AP600, the Advanced Reactor Corporation included people from all different utilities. So you had this involvement of utilities.

Now, why is that important? Well, because I think that how the AP600 information is used, and is partly dependent on -- well, it is going to have to be covered in this process.

And the question of who gets to decide whether a change needs to be made or not, from the AP600, well I think that that is important. I mean, is it at the level of people who are just involved in projects, and they say, these are the things that we've identified, we have to change, so let's go make those design changes.

What is the process? I really don't know what the process is. But one thing you might think is

natural is to say, well, when the engineers who signed off all these AP600 reports and designs, did they -- are they part of the process in making this change from the AP600 to the AP1000, did they get to say, okay, yes I agree that the AP600 design fits for the AP1000?

I really don't know what the process is, but I can't -- I don't think it makes sense to say that we are going to use the same as the AP600, because it seems to me new kinds of questions arise.

I think that is all I have to say.

CHAIRMAN KRESS: Does anybody want to respond? It seems like a question to the Staff.

JOE: We have no comments at this time, I think.

MS. STARRETT: Okay.

MS. STAREFOS: I think on behalf of the Staff, we have had some stakeholder interface on certain issues, and we intend to try to address the concerns, and we plan to do that in a public forum.

MS. STARRETT: Okay.

MS. STAREFOS: And possibly a letter of some sort.

CHAIRMAN KRESS: When will this public forum be?

MS. STAREFOS: A letter, a publicly available letter to respond to some of these issues.

MEMBER WALLIS: Will the letter give specific examples, or just generalities?

JOE: I think she has a general overall concern, and she is giving specific examples to try to point out what her overall concern is. So I think we are going to try to address the overall concern.

MEMBER WALLIS: But not make specific examples?

MEMBER SIEBER: Well, I don't think these examples are totally accurate, but the concern is still there. For example, steam pressure in the main steam system is a function of what P average is.

I said the specific examples don't exactly fit, when you upgrade, or up the power of reactor, the steam pressure is a function of T average. And what goes up is steam flow, so you have to size the line to accommodate the flow.

Relief valve setpoints don't change, but relieving capacity must change, because you have more stored heat.

MR. CORLETTI: Sure.

MEMBER SIEBER: So even though we might not be totally accurate in the way it is presented,

the point is that you have to consider all these things, as you go through the design process for the auxiliary systems.

And so from that standpoint I accept and understand the --

MS. STARRETT: Okay, fine. The question is a question about level of detail. In other words, you can easily size a valve, and then you say, well, what about the actual layout of the line, do I get the flow I need.

MEMBER SIEBER: Thank you.

CHAIRMAN KRESS: Okay, I guess now would be a good time for a break.

(Whereupon, the above-entitled matter went off the record at 10:07 a.m. and went back on the record at 10:30 a.m.)

CHAIRMAN KRESS: Let's come back to order now. At this time, Warren, you are up.

MR. BAMFORD: We are going to pick up the presentations again. My name is Warren Bamford, I'm a consulting engineer here at Westinghouse, and I deal with cracks, and almost everything.

I was involved in leak report break in the original presentations to you folks back in 1983 and '84, when we --

ATTACHMENT 4

Electronic mail to John P. Segala, AP1000 Lead Project Manager, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 19, 2003, regarding comments on NRC inspection of quality assurance procedure covering AP1000 design process

From: <sterrett@duke.edu>
To: John Segala <jps1@nrc.gov>
Date: 07/19/2003 1:07AM
Subject: Comments on NRC inspection of QA procedure covering AP1000 designprocess

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project
cc: Jerry Wilson, NRC, Senior Policy Analyst

Subject: Concerns Raised at ACRS Meeting 07/18/03

Regarding my comments made at Friday's ACRS meeting (07/18/03), as I did not know which open items were going to be discussed beforehand, I did not have time to prepare my remarks as well as I would have liked. Thus, I will try to get a letter to you by the end of next week describing the concerns I raised, so that you have something more specific and detailed to address.

I actually did bring the QA question up previously, with Jerry Wilson via email last July, and did discuss it with Larry Burkhart (then the AP1000 Project Manager) later last year in conversation. I think your suggestion to address it via more formal means such as a letter is a good one. I will forward the emails that I sent to Jerry Wilson (and which he subsequently forwarded to Larry Burhkhart) from last year to you later today, just so you have a record of those previous informal interactions.

However, I will also incorporate the content of the emails in the letter I expect to get to you by the end of next week.

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University, Durham, NC 27708
sterrett@duke.edu

During the 2003-2004 academic year I will be on sabbatical. The best phone number at which to reach me during that time is 412-441-4867.

CC: <jls1@nrc.gov>, <jxc1@nrc.gov>, <JNW@nrc.gov>

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Sat, 19 Jul 2003 01:06:46 -0400
Received: from pohl.acpub.duke.edu (pohl.acpub.duke.edu [152.3.233.64])
by smtp-gateway ESMTPœ id h6J3oVpO016057;
Fri, 18 Jul 2003 23:50:31 -0400 (EDT)
Received: from godzilla2.acpub.duke.edu (godzilla2.acpub.duke.edu [152.3.233.43])
by pohl.acpub.duke.edu (8.12.9/8.12.9/Duke-5.0.0) with ESMTP id h6J3stxD021849;
Fri, 18 Jul 2003 23:54:56 -0400 (EDT)
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla2.acpub.duke.edu (8.9.3/8.9.3) id XAA19204;
Fri, 18 Jul 2003 23:54:54 -0400 (EDT)
Date: Fri, 18 Jul 2003 23:54:54 -0400 (EDT)
Sender: sterrett@duke.edu
To: John Segala <jps1@nrc.gov>
cc: jls1@nrc.gov, jxc1@nrc.gov, JNW@nrc.gov
Subject: Comments on NRC inspection of QA procedure covering AP1000 design process
In-Reply-To: <sf0b4617.022@nrcgwia.nrc.gov>
Message-ID: <Pine.GSO.4.53.0307181906340.9071@godzilla1.acpub.duke.edu>
References: <sf0b4617.022@nrcgwia.nrc.gov>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII
X-Virus-Scanned: by amavisd-milter, Duke University (http://amavis.org/)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project
cc: Jerry Wilson, NRC, Senior Policy Analyst

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However, I will also incorporate the content of the emails in the letter I expect to get to you by the end of next week.

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University, Durham, NC 27708

sterrett@duke.edu

During the 2003-2004 academic year I will be on sabbatical. The best phone number at which to reach me during that time is 412-441-4867.

ATTACHMENT 5

Electronic mail to John P. Segala, Joelle L. Starefos, and Joseph Colaccino, AP1000 Project Management Team, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 19, 2003, regarding forwarded electronic mail from Susan G. Sterrett, to Jerry N. Wilson, NRC, dated July 10, 2002

From: <sterrett@duke.edu>
To: <jls1@nrc.gov>, <jxc@nrc.gov>, <jps1@nrc.gov>
Date: 07/19/2003 12:59AM
Subject: AP1000 Review/ 10 CFR Part 52 Process (fwd)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

Here is the email in which I asked the questions about the maturity of the design (by which I meant the level of design detail) and about the QA process governing the AP1000 design. This was sent last July.

Susan G. Sterrett
sterrett@duke.edu

---------- Forwarded message ----------
Date: Wed, 10 Jul 2002 23:53:58 -0400 (EDT)
From: Susan G. Sterrett <sterrett@duke.edu>
To: Jerry Wilson <JNW@nrc.gov>
Cc: sterrett@duke.edu
Subject: AP1000 Review/ 10 CFR Part 52 Process

Dear Jerry,

Thanks for your reply. The document you pointed me to was in fact the one I was trying to locate.

Since you wrote 10 CFR 52, asking you might be the best way to find out the answers to the questions I have about how the AP1000 review process is going to work (or is intended to).

Here are the two main things I am wondering about the process:

---

1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in

fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?

---

2. I wonder about the QA program covering the engineering design processes. The AP1000 design processes cannot be exactly the same as for the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case. Here's why I think it is a very important issue:

The AP1000 DCD claims that many of the AP600 documents are applicable to the AP1000. The crucial question is, who (in Westinghouse) makes the determination that a particular AP600 document does in fact apply for the AP1000? It seems to me crucial that the same engineering functional group (preferably the same individual engineer) that was responsible for producing and signing off the document for the AP600 pass judgement on its applicability to the AP1000. Is there a guarantee of this? If not, I suggest that there be such a requirement and that it be made explicit.

Otherwise, there is a gigantic loophole that can be used to circumvent the whole intent of the quality assurance provisions covering the engineering design process -- i.e., otherwise, individuals in other functional groups such as marketing, licensing, or project management, can circumvent the engineering process by simply stating that a certain AP600 engineering report or design document applies to the AP1000. (I don't think I need to explain the conflict of interest involved were this to be permitted.)

If you think it appropriate to pass this on to others in the NRC, please feel free to do so. (Although the policy on public participation says that members of the public are always free to call or email staff, I don't see the email addresses online.)

Thanks,
Susan G. Sterrett
sterrett@duke.edu

On Mon, 8 Jul 2002, Jerry Wilson wrote:

> Susan - I remember our previous conversation and I'm happy to answer your questions on Part 52. In SECY-02-0077 the NRC staff sent a proposed update to the Comission for its consideration. The Commission has not completed its voting on the proposed rule yet. If the Commission appproves publication of a proposed rule, then it will be sent to the Federal Register for publication and it will include an opportunity for comment on rule.
> You can see the changes from the current Part 52 to the proposed rule on the NRC web site. Select Current Rulemakings, then
> Draft Rule Text for Comment, then
> Draft Rule Language for Part 52, then
> Rulemaking Text and other Documents, then

> Draft Proposed Rule Language (5/8/02). The comment period for the draft language has closed.
>
> The AP1000 application has been docketed and is currently under review by the NRC staff.
The process for this review is as set forth in Subpart B of 10 CFR Part 52.
> Jerry Wilson
>
>
>

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Sat, 19 Jul 2003 00:59:16 -0400
Received: from gibson.acpub.duke.edu (gibson.acpub.duke.edu [152.3.233.8])
by smtp-gateway ESMTPœ id h6J3uspO016125;
Fri, 18 Jul 2003 23:56:54 -0400 (EDT)
Received: from godzilla2.acpub.duke.edu (godzilla2.acpub.duke.edu [152.3.233.43])
by gibson.acpub.duke.edu (8.12.9/8.12.9/Duke-5.0.0) with ESMTP id h6J41E0C019438;
Sat, 19 Jul 2003 00:01:18 -0400 (EDT)
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla2.acpub.duke.edu (8.9.3/8.9.3) id AAA19225;
Sat, 19 Jul 2003 00:01:13 -0400 (EDT)
Date: Sat, 19 Jul 2003 00:01:13 -0400 (EDT)
Sender: sterrett@duke.edu
To: jls1@nrc.gov, jxc@nrc.gov, jps1@nrc.gov
Subject: AP1000 Review/ 10 CFR Part 52 Process (fwd)
Message-ID: <Pine.GSO.4.53.0307182346590.18982@godzilla2.acpub.duke.edu>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII
X-Virus-Scanned: by amavisd-milter, Duke University (http://amavis.org/)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

Here is the email in which I asked the questions about the maturity of the design (by which I meant the level of design detail) and about the QA process governing the AP1000 design. This was sent last July.

Susan G. Sterrett
sterrett@duke.edu

---------- Forwarded message ----------
Date: Wed, 10 Jul 2002 23:53:58 -0400 (EDT)
From: Susan G. Sterrett <sterrett@duke.edu>
To: Jerry Wilson <JNW@nrc.gov>
Cc: sterrett@duke.edu
Subject: AP1000 Review/ 10 CFR Part 52 Process

Dear Jerry,

Thanks for your reply. The document you pointed me to was in fact the one I was trying to locate.

Since you wrote 10 CFR 52, asking you might be the best way to find out the answers to the questions I have about how the AP1000 review process is going to work (or is intended to).

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> Draft Rule Text for Comment, then
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> Draft Proposed Rule Language (5/8/02). The comment period for the draft language has closed.
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> The AP1000 application has been docketed and is currently under review by the NRC staff.
The process for this review is as set forth in Subpart B of 10 CFR Part 52.
> Jerry Wilson
>
>
>

ATTACHMENT 6

Electronic mail to John P. Segala, Joelle L. Starefos, and Joseph Colaccino, AP1000 Project Management Team, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 19, 2003, regarding forwarded electronic mail from Jerry N. Wilson, NRC , to Susan G. Sterrett, dated August 13, 2002

From: <sterrett@duke.edu>
To: <jxc1@nrc.gov>, <jls1@nrc.gov>, <jps1@nrc.gov>
Date: 07/19/2003 12:59AM
Subject: Re: Followup on Questions: AP1000 Review/ 10 CFR Part 52 Process(fwd)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

Here is the response from Jerry Wilson to the questions I asked in the July 10th 2002 email about a year ago. -- Susan G. Sterrett

---------- Forwarded message ----------
Date: Tue, 13 Aug 2002 14:10:13 -0400
From: Jerry Wilson <JNW@nrc.gov>
To: sterrett@duke.edu
Cc: Lawrence Burkhart <LJB@nrc.gov>, Marsha Gamberoni <MKG@nrc.gov>, Richard McIntyre <RPM1@nrc.gov>, Theodore Quay <TRQ@nrc.gov>
Subject: Re: Followup on Questions: AP1000 Review/ 10 CFR Part 52 Process

Dear Susan - I apologize for not answering your questions sooner. With regard to question #1, the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design and construction activities [#1(iii)].

Question #2 - in addition to the NRC's technical review of the DCD, the staff plans to inspect Westinghouse's implementation of its design control program for the AP1000 design in the future [see page 4 of the letter from Mr. Lyons (NRC) to Mr. Cummins (W), dated July 12, 2002 in ADAMS (ML021930037)]. I have cc:d Mr. Quay and Mr. McIntyre with this response. They are responsible for reviewing Westinghouse's QA program - Jerry

>>> "Susan G. Sterrett" <sterrett@duke.edu> 08/13/02 10:40AM >>>

To: Jerry Wilson, Senior Policy Analyst, NRC
From: Susan G. Sterrett, Assistant Prof. of Philosophy, Duke University

Dear Jerry,

Below is an email I sent on July 10th, with questions about how the 10CFR Part 52 process is supposed to work for the AP1000. I thought of them as straightforward questions about process, rather than about specific technical issues, thus, that you would be the most knowledgeable person as far as how the process is supposed to work. (As I haven't dealt much with

the NRC, though, I am on a learning curve with respect to your organizational structure, so let me know if that is not the case.)

Can you answer these questions, or refer me to someone who can?

I do feel it is important that the answers to them be unambiguous to all involved, including the public. (I am asking as a member of the public, but not affiliated with any organization.)

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(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?

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the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case.
Here's why I think it is a very important issue:

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The process for this review is as set forth in Subpart B of 10 CFR Part 52.
> Jerry Wilson
>

>
>

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Sat, 19 Jul 2003 00:59:16 -0400
Received: from heinlein.acpub.duke.edu (heinlein.acpub.duke.edu [152.3.233.9])
by smtp-gateway ESMTPœ id h6J40PpO016185;
Sat, 19 Jul 2003 00:00:25 -0400 (EDT)
Received: from godzilla2.acpub.duke.edu (godzilla2.acpub.duke.edu [152.3.233.43])
by heinlein.acpub.duke.edu (8.12.9/8.12.9/Duke-5.0.0) with ESMTP id h6J44kRA028568;
Sat, 19 Jul 2003 00:04:46 -0400 (EDT)
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla2.acpub.duke.edu (8.9.3/8.9.3) id AAA19243;
Sat, 19 Jul 2003 00:04:46 -0400 (EDT)
Date: Sat, 19 Jul 2003 00:04:46 -0400 (EDT)
Sender: sterrett@duke.edu
To: jxc1@nrc.gov, jls1@nrc.gov, jps1@nrc.gov
Subject: Re: Followup on Questions: AP1000 Review/ 10 CFR Part 52 Process
(fwd)
Message-ID: <Pine.GSO.4.53.0307190002370.18982@godzilla2.acpub.duke.edu>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII
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>

ATTACHMENT 7

Electronic mail to John P. Segala, Joelle L. Starefos, and Joseph Colaccino, AP1000 Project Management Team, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 19, 2003, regarding forwarded electronic mail from Susan G. Sterrett, to Lawrence Burkhart, NRC, dated September 15, 2002

From: <sterrett@duke.edu>
To: <jxc1@nrc.gov>, <jls1@nrc.gov>, <jps1@nrc.gov>
Date: 07/19/2003 12:59AM
Subject: Note to Larry Burhkhart Sept. 2002 titled 'Thanks for RAIs'

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

Here is my note to Larry Burkhart, clarifying my question. It seems my question was misinterpreted as being about piping analysis, and in this email I explain the issue to Larry, as a preface to the forwarding him the Sept 2002 email I initially sent to Jerry Wilson -- Susan G. Sterrett

---------- Forwarded message ----------
Date: Sun, 15 Sep 2002 16:21:36 -0400 (EDT)
From: sterrett@duke.edu
To: Lawrence Burkhart <LJB@nrc.gov>
Subject: Thanks for RAIs

Dear Larry,

I have looked over the RAIs, and don't see any that address the question I asked Jerry Wilson about paying attention to fluid system performance in doing the piping layout. The RAIs do mention thermal-hydraulic loads, but that isn't what I meant; thermal-hydraulic loads are still related to the mechanical loads on the piping and concern the piping structural-mechanical analyis.

What I meant is the fluid system performance -- flowrates, pressures and temperatures that are achieved by the combination of driving head and fluid piping resistance. The fluid piping resistance is affected by the piping layout. In an email to Jerry Wilson, which I put you on cc for, and which I will send immediately after this one, there is more explanation. The bottom line is that even though the piping layout isn't final, the piping resistance criteria ("L/D criteria") for the AP1000 should be computed and provided at this point. In that email, following this one, there is also an explanation as to why the L/D criteria for the AP1000 will be different in many cases from the AP600.

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I imagine that there are people at the NRC whose reviews will address this, perhaps on a system-by-system basis. And whether or not the L/D criteria (piping resistance layout criteria) differ much for the AP1000 vis a vis the AP600 for a particular system may be a design detail. However, the overall point that L/D criteria for the AP1000 should be

calculated at the DCD application stage is a plant-level issue. It's a very general point. In the email that follows, I explain why I think it is a policy issue about the new licensing process.

I am asking these questions as an individual member of the public, unaffiliated with any organization.

Sincerely,
Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
Durham NC 27708
sterrett@duke.edu
919-660-3054 (office)
919-660-3050 (receptionist)

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Sat, 19 Jul 2003 00:59:16 -0400
Received: from heinlein.acpub.duke.edu (heinlein.acpub.duke.edu [152.3.233.9])
by smtp-gateway ESMTPœ id h6J4AcpO016305;
Sat, 19 Jul 2003 00:10:38 -0400 (EDT)
Received: from godzilla2.acpub.duke.edu (godzilla2.acpub.duke.edu [152.3.233.43])
by heinlein.acpub.duke.edu (8.12.9/8.12.9/Duke-5.0.0) with ESMTP id h6J4F1RA002293;
Sat, 19 Jul 2003 00:15:01 -0400 (EDT)
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla2.acpub.duke.edu (8.9.3/8.9.3) id AAA19297;
Sat, 19 Jul 2003 00:15:01 -0400 (EDT)
Date: Sat, 19 Jul 2003 00:15:01 -0400 (EDT)
Sender: sterrett@duke.edu
To: jxc1@nrc.gov, jls1@nrc.gov, jps1@nrc.gov
Subject: Note to Larry Burhkhart Sept. 2002 titled 'Thanks for RAIs'
Message-ID: <Pine.GSO.4.53.0307190009340.18982@godzilla2.acpub.duke.edu>
MIME-Version: 1.0
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To: <jxc1@nrc.gov>, <jls1@nrc.gov>, <jps1@nrc.gov>
Date: 07/19/2003 12:59AM
Subject: Sept. 2002 email-- Piping Layout L/D Criteria for Fluid SystemPerformance (fwd)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

Here is my reply to Jerry Wilson's answer to my two questions. This was last September. In it, I explain why the question I raised is not answered by the considerations he gave in response. -- Susan G. Sterrett

---------- Forwarded message ----------
Date: Sun, 15 Sep 2002 16:46:21 -0400 (EDT)
From: sterrett@duke.edu
To: Jerry Wilson <JNW@nrc.gov>
Cc: LJB@nrc.gov, MKG@nrc.gov, sterrett@duke.edu
Subject: Piping Layout L/D Criteria for Fluid System Performance

To: Jerry Wilson, Senior Policy Analyst, NRC
cc: Larry Burkhart, AP1000 Project Manager, NRC
Marsha Gamberoni, Deputy Director, New Reactor Licensing

Subject: Piping Layout L/D Criteria for Fluid System Performance

Dear Jerry,

In a previous email, you responded to a question I asked regarding whether proof-of-design calculations of fluid system performance were performed for the AP1000. This email is to (a.) clarify the question I was asking, and (b) explain why I think L/D criteria is an issue of policy regarding the 10CFR52 design process, not merely a minor design or schedule detail.

In spite of the length of this email, the two points are simple; I am just including the text of the things I reference to avoid any possible ambiguity.

(a) Clarification of Question Re: Calculations Supporting Fluid System Performance

To recapitulate, the question I asked (July 10) was:

"1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the

flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?" [excerpt from email of July 10, 2002 Sterrett to Wilson]

In your response (August 13) you explained why proof-of-design calculations for fluid system performance were _not_ expected to have been performed at the time of DCD submittal:

"With regard to question #1,
the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design andconstruction activities [#1(iii)]. "
[excerpt from email of August 13, 2002 Wilson to Sterrett]

I would like here to clarify my earlier question: by "proof-of-design calculations", I was referring to proof-of-design calculations for fluid system performance, rather than to piping design calculations. By "piping design calculations", I assume you are referring to calculations concerning things such as piping stress, fatigue and mechanical loads. But, of course, the proper flow performance of fluid systems sets another kind of criterion: that is, in addition to the criteria that aim to ensure that the structural/mechanical behavior of the piping is acceptable, piping layout activities also have to take into account criteria that ensure that the piping flow resistances will result in the flows through the system called for by the fluid system design (and for which the design of numerious interfacing systems may take credit). In addition, pressures (and, sometimes, temperatures) in the system at various key points, such as at heat exchangers and control valves, are influenced by the piping layout. And here i am including normal system operation. Your response to the question of whether there have been proof-of-design calculations for fluid flow performance was that you did not expect them to be done, because the piping layout wasn't final.

However, if the piping layout isn't far enough along to permit proof-of-design calculations to be performed, the calculations related to fluid system performance should still be done -- the only difference is that they would result in piping fluid flow resistance criteria, or "L/D criteria."

From your response, I wasn't sure if "L/D criteria", or piping fluid resistance criteria were included in the DAC. After looking at various meeting transcripts and the RAIs regarding DAC attached to the meeting notice for September 9, 2002 (Reference 3), it doesn't appear to me that the "L/D criteria" are addressed in these places.

So, the question is whether L/D criteria have been provided for the AP1000 fluid systems. Even if the piping layout for the AP1000 were _exactly_ the same as the AP600 layout, new L/D criteria would need to be calculated for the AP1000. For, anytime the design flowrate for a system changes, the L/D criteria need to be re-calculated, since piping flow resistances vary with flowrate. Even for those systems, if any, where the fluid flowrate of the system is exactly the same for the AP1000 as it was for the AP600, there is still the question whether there are differences in the inlet or outlet pressures -- i.e., in the pressure in the system or piece of equipment to which it connects and from which the fluid enters the fluid system or to where it discharges. Hence the fluid flow performance would be different for the same layout. Thus, the layout criteria would differ between the AP1000 and the AP600 for cases where a system's inlet or discharge pressures differ. (An example here of such a difference in the AP1000 is the significant change in main steam pressure: obviously L/D criteria will be different between the AP600 and the AP1000 for the inlet piping to the steam relief valves, for example.)

Thus, to rephrase the question in my July email:

"(i) Are there supposed to be signed-off, L/D criteria and supporting calculations, (using the AP1000 fluid system functional requirements and equipment parameters) for the system flows and pressures reported for all the systems in the AP1000 DCD submitted? Or, L/D criteria for the piping associated with the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves,etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?"

This is the question I have now, given your repsonse that you did not expect "proof-of-design calculations" to be performed due to the fact that the piping layout is not final at the DCD application stage.

(b) Previous process versus new 10CFR52 process

It is simply good common sense to provide L/D criteria for the preliminary

piping layout, in order to have confidence that when the final piping layout is in fact completed, the design will be such that the fluid performance functional requirements of the system are in fact met, avoiding major changes to the preliminary layout. As you may be aware, this is the process that was followed on the Westinghouse standard plants.

As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

Certainly the ITAACs and other operational tests are going to provide a checkpoint where deficiences in system performance are found, but, I trust, it certainly isn't the intent of the new 10CFR52 process to increase the surprises encountered during operational testing! I assume that everyone agrees that the intent is to have confidence that the certified design results in fluid systems that meet their functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

Thus, it seems clear that the L/D criteria should be provided at the DCD submittal stage in the 10CFR52 process. It's an issue of policy because, otherwise, the 10CFR52 process would result in the NRC certifying a design for which there was less confidence in the design than existed under the old process at a comparable stage.

It would be great to hear the answer that L/D criteria for all the AP1000 systems have in fact been calculated and provided, but, in any case, I look forward to your reply. As with my previous inquiry, I am asking these questions as an individual member of the public, unaffiliated with any organization.

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University , Durham, NC 27708
sterrett@duke.edu
919-660-3054 (office)
919-660-3050 (receptionist)
919-660-3060 (fax)

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Sat, 19 Jul 2003 00:59:16 -0400
Received: from pohl.acpub.duke.edu (pohl.acpub.duke.edu [152.3.233.64])
by smtp-gateway ESMTPce id h6J454pO016244;
Sat, 19 Jul 2003 00:05:04 -0400 (EDT)
Received: from godzilla2.acpub.duke.edu (godzilla2.acpub.duke.edu [152.3.233.43])
by pohl.acpub.duke.edu (8.12.9/8.12.9/Duke-5.0.0) with ESMTP id h6J49RxD025031;
Sat, 19 Jul 2003 00:09:27 -0400 (EDT)
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla2.acpub.duke.edu (8.9.3/8.9.3) id AAA19278;
Sat, 19 Jul 2003 00:09:26 -0400 (EDT)
Date: Sat, 19 Jul 2003 00:09:26 -0400 (EDT)
Sender: sterrett@duke.edu
To: jxc1@nrc.gov, jls1@nrc.gov, jps1@nrc.gov
Subject: Sept. 2002 email-- Piping Layout L/D Criteria for Fluid System
Performance (fwd)
Message-ID: <Pine.GSO.4.53.0307190006520.18982@godzilla2.acpub.duke.edu>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII
X-Virus-Scanned: by amavisd-milter, Duke University (http://amavis.org/)

Date: July 18, 2003

To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

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Subject: Piping Layout L/D Criteria for Fluid System Performance

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As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

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questions as an individual member of the public, unaffiliated with any organization.

Susan G. Sterrett
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919-660-3050 (receptionist)
919-660-3060 (fax)

ATTACHMENT 9

Electronic mail to John P. Segala, AP1000 Lead Project Manager, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 24, 2003, regarding transmittal of letter addressing question on the effect of heat from solar radiation on the concrete shield building and on passive containment cooling system water storage tank contents

From: <sterrett@duke.edu>
To: John Segala <jps1@nrc.gov>
Date: 07/24/2003 12:18AM
Subject: Letter re: PCS and heat of solar radiation

Dear John,

In my previous email (below), I promised to send descriptions of the two items we discussed on the telephone on July 8th. I did not realize that you would be mentioning DSER Open Item 17.3.2-2 at the July 18th meeting, or I would have been better prepared. I am sorry I was not more fully prepared, but I hope the interaction was helpful. It was nice meeting you and Joelle Stefaros.

Attached to this email is a letter in pdf format describing the concern listed as item (i) below. I also have included the text of the letter following this email, so that you can see what it says should there be any problem opening the pdf file. Please let me know if you do have any problem opening the pdf file, though.

I hope to complete the letter describing item (ii) by the end of this week. However, the emails sent earlier to Jerry Wilson and Larry Burkhart, which I forwarded to you, give a good general idea of what the content of that letter will be.

Please let me know if you have any comments, questions, or suggestions.

Thank you,

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
Durham NC
sterrett@duke.edu

(text of attached letter follows the text of the previous email)

Previous Email:

>
> >>> <sterrett@duke.edu> 07/08/03 01:34PM >>>
>
> Dear John,
>
> As we discusssed on the phone earlier today, here is an email asking for
> the ML accession numbers for the letters Westinghouse sent responding to
> the DSER Open Items.
>
> In addition, I also said that I would send descriptions of the two items
> we discussed on the phone, and that you could pass them on to the
> appropriate reviewers:
>
> (i) solar radiation effects on the temperature of the water in the
> PCCS water tank located on top of the containment building, and

>
> (ii) the question about how the design of the AP1000 was obtained from the
> AP600. This is an over-arching question that relates to many different
> systems, but I explained why I thought it was related to DSER Open Item
> 17.3.2-2.
>
> Since these two items are not going to be discussed at the meeting later
> this week, I will send the descriptions along in later emails.
>
> Best regards,
> Susan G. Sterrett
>
> Assistant Professor
> Dept. of Philosophy
> Duke University
> sterrett@duke.edu
>
> I will be on sabbatical for the 2003-2004 academic year
> and can be reached at 412-441-4867.

Text of attached letter:

Department of Philosophy
201C West Duke Building
Duke University
Durham, NC
sterrett@duke.edu

July 23, 2003

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Question on AP1000 Containment Systems/
Effect of heat from solar radiation on concrete shield building and on PCS (Passive Containment Cooling System) water storage tank contents

The purpose of this letter is to put into writing a question about the AP1000 safety system design that I discussed on the telephone with you (John Segala) a few weeks ago. I am asking this question as a member of the public, unaffiliated with any organization.

The topic is the effect of the heat of solar radiation on the Passive Containment Cooling System (PCS); the question is whether (and if so, how) the heat of solar radiation is taken into account in the AP1000 design of the Passive Containment Cooling System.

Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, it seems to me that its effect on:

(i) the temperature of the concrete shield building, whose walls form the air passages relied upon for the efficacy of cooling by the PCS, and
(ii) the temperature in the PCS water storage tank.

ought to be addressed by the AP1000 design. The effect will vary with geographical location (e.g., the relevant coefficients tend to be larger for sites near the equator than for those far away from the equator) and will depend upon the surface geometry and the properties of the material and/or the surface coatings used.

I do not see this accounted for explicitly in the DSER. However, it is clear that, unless it is shown to make only a negligible contribution, this heat source is relevant to the design of the safety features of the plant. As described in the DSER, for long-term cooling after a design basis accident, the PCS uses the water in the PCS water storage tank and the passage of air in the spaces between the primary steel containment and the concrete shield building to cool and depressurize the containment. It is the means by which heat is transferred from the reactor to the ultimate heat sink in the event of a design basis accident. The question does not arise for operating PWR plant designs, since those designs do not use the method of containment cooling employed on the AP1000.

If in fact the effect of the heat of solar radiation is not determined to be negligible, the assumptions regarding PCS water storage tank temperature and PCS efficacy in heat removal used in the AP1000 PRA (Probabilistic Risk Assessment) Report should also be examined to see if the heat of solar radiation was taken into account.

I look forward to your reply. Should you wish to contact me, the best way is by email at sterrett@duke.edu.

Sincerely,

Susan G. Sterrett
Assistant Professor
Department of Philosophy
Duke University, Durham, NC

References: 1. AP1000 Draft Safety Evaluation Report (DSER)
Section 6.2 "Containment Systems"

(in Chapter 6 "Engineered Safety Features"
ADAMS accession number ML031671499)
June 16, 2003 (available on ADAMS 07/01/03)

CC: <sterrett@duke.edu>

Department of Philosophy
201C West Duke Building
Duke University
Durham, NC
sterrett@duke.edu

July 23, 2003

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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Effect of heat from solar radiation on concrete shield building and on PCS (Passive Containment Cooling System) water storage tank contents

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I look forward to your reply. Should you wish to contact me, the best way is by email at sterrett@duke.edu.

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(in Chapter 6 "Engineered Safety Features"
ADAMS accession number ML031671499)
June 16, 2003 (available on ADAMS 07/01/03)

ATTACHMENT 10

Electronic mail to John P. Segala, AP1000 Lead Project Manager, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 30, 2003, regarding rules for public participation

From: <sterrett@duke.edu>
To: John Segala <jps1@nrc.gov>
Date: 07/30/2003 12:15AM
Subject: Statement at ACRS Meeting

Dear John,

Since we last talked, I looked further into the rules for public participation. One new thing I learned was that the NRC policy does not cover ACRS meetings; they have their own policy.

After consulting w/ Med El-Zeftawy, it seems the best thing to do about putting my thoughts into a letter is to file it with the ACRS as a statement. It will then be attached to the Summary of the meeting.

I don't know if you will get it automatically or not, but, if not, please let me know so that I can send you, Joelle Starefos and Joseph Colaccino a copy. Is this satisfactory by you?

On another topic, may I ask, have you any thoughts about the letter I sent you about the heat of solar radiation and the PCS design?

Thanks very much,
Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
sterrett@duke.edu

On Fri, 25 Jul 2003 sterrett@duke.edu wrote:

> Dear John,
>
> I am still working on the letter. I just want to let you know I have not
> forgotten and that you can expect a letter more clearly describing my
> questions pretty soon.
>
> (The NRC electronic reading room, which I use to view the DSER and other
> items, was for some reason unavailable (at least to my computer) often
> this week and this has delayed me.)
>
> Sincerely,
> Susan G. Sterrett
>
>
> On Fri, 18 Jul 2003 sterrett@duke.edu wrote:
>
> > Date: July 18, 2003
> >
> > To: John Segala, NRC, Lead Project Manager, AP1000 Licensing Project
> > Joelle Starefos, NRC, Project Manager, AP1000 Licensing Project
> > Joseph Colaccino, NRC, Project Manager, AP1000 Licensing Project

> > cc: Jerry Wilson, NRC, Senior Policy Analyst
> >
> > Subject: Concerns Raised at ACRS Meeting 07/18/03
> >
> > Regarding my comments made at Friday's ACRS meeting (07/18/03), as I did
> > not know which open items were going to be discussed beforehand, I did not have
> > time to prepare my remarks as well as I would have liked. Thus,
> > I will try to get a letter to you by the end of next week describing the
> > concerns I raised, so that you have something more specific and detailed
> > to address.
> >
> > I actually did bring the QA question up previously, with Jerry Wilson
> > via email last July, and did discuss it with Larry Burkhart (then the
> > AP1000 Project Manager) later last year in conversation. I think your
> > suggestion to address it via more formal means such as a letter is a good one.
> > I will forward the emails that I sent to Jerry Wilson (and which he
> > subsequently forwarded to Larry Burhkhart) from last year to you later
> > today, just so you have a record of those previous informal interactions.
> >
> > However, I will also incorporate the content of the emails in the letter I
> > expect to get to you by the end of next week.
> >
> > Susan G. Sterrett
> > Assistant Professor of Philosophy
> > Duke University, Durham, NC 27708
> > sterrett@duke.edu
> >
> > During the 2003-2004 academic year I will be on sabbatical. The best
> > phone number at which to reach me during that time is 412-441-4867.
> >
> >
> >
> >
>

CC: <jls1@nrc.gov>, <jxc1@nrc.gov>

ATTACHMENT 11

Electronic mail to John P. Segala, Joelle L. Starefos, and Joseph Colaccino, AP1000 Project Management Team, from Susan G. Sterrett, Assistant Professor, Duke University, dated July 31, 2003, regarding forwarded electronic mail from Susan G. Sterrett , to Medhat El-Zeftawy, NRC Staff - ACRS, dated July 31, 2003

From: <sterrett@duke.edu>
To: John Segala <jps1@nrc.gov>
Date: 07/31/2003 10:20AM
Subject: Re: Public Meeting July 17th & 18th (fwd)

To: John Segala, NRC, AP1000 Licensing Lead Project Manager
Joelle Starefos, NRC, AP1000 Licensing Project Manager
Joseph Colaccino, NRC, AP1000 Licensing Project Manager

Here is what I submitted to Med El-Zeftway to file with the ACRS Meeting Summary Report. The letter dated July 30th is the one that better explains the concerns I raised at the July 17th and 18th meeting of the ACRS Subcommittee on Future Plant Designs. I hope the clearer explanation is helpful.

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
sterrett@duke.edu

---------- Forwarded message ----------
Date: Thu, 31 Jul 2003 09:53:44 -0400 (EDT)
From: sterrett@duke.edu
To: Med El-Zeftway <MME@nrc.gov>
Cc: Sher Bahadur <SXB@nrc.gov>
Subject: Re: Public Meeting July 17th & 18th

To: Med El-Zeftway, ACRS
Sher Bahadur, ACRS

Re: Statements submitted for inclusion in Summary Report for ACRS Subcommittee on Future Plant Designs Meeting held July 17th & 18th in Monroeville, PA

Attached to this email are two pdf files.

--- The first pdf file is "SterrettACRSJuly30th2003.pdf"

This is a longer exposition and explanation of the concerns I expressed in my impromptu remarks at the meeting. It includes a list of references and two attachments, but these are all in a single pdf file.

--- The second pdf file is "SterrettACRSJuly31st2003.pdf"

This is a two-page statement of a new concern that I did _not_ express. However, I would like to take advantage of the provisions for public participation in advisory committee meetings and file the statement. The topic is "Heat of Solar Radiation and AP1000 Ultimate Heat Sink".

I would appreciate it if you could make sure the members of the ACRS Subcommittee on Future Plant Designs are aware of these written statements.

Thanks very much,

Susan G. Sterrett
Assistant Professor
Dept. of Philosophy
Duke University
sterrett@duke.edu

On Wed, 30 Jul 2003, Med El-Zeftway wrote:

> Dear Dr. Sterrett.. yes the summary report will be sent to all ACRS Members. Your file will be part of the records for an open meeting and the AP1000 Licensing Managers will have access to it. However, I suggest that you also send your file to them. Thanks.
>
> Med
>
> >>> <sterrett@duke.edu> 07/29/03 04:19PM >>>
>
> Dear Med,
>
> Thanks, that's very good to hear. I hope to send a pdf file tommorrow and
> to follow up with a signed hard copy.
>
> Does the summary report get sent to all the ACRS Members? What about to
> the AP1000 Licensing Project Managers? [I ask so that I send it to those
> who won't get it sent to them automatically.]
>
> Thanks again,
>
> Best wishes,
> Susan G. Sterrett
> sterrett@duke.edu
>
> On Tue, 29 Jul 2003, Med El-Zeftway wrote:
>
> > Hi Dr. Sterrett, you are welcome to file a written statement with the ACRS regarding any of your

concerns. If you wish you can e-mail me your statement and I'll include it as part of the record for the July 18th subcommittee meeting.
> >
> > Med
> >
> > >>> <sterrett@duke.edu> 07/29/03 12:11PM >>>
> >
> > Dear Med and Sher,
> >
> > Med, thanks for your reply and for working my impromptu request to speak
> > into the schedule.
> >
> > As I did not anticipate that Open Item 17.3.2-2 was going to be discussed
> > at the ACRS subcommitee meeting, the comments I made at the July 18th
> > meeting were impromputu as I had not had time to prepare them. I would
> > like to send a written statement that better explains my concerns.
> >
> > According to the policy on Advisory Committee Meetings (10CFR7.12 (b)),
> > " Any member of the public who wishes to do so shall be permitted to file
> > a written statement with an NRC advisory committee regarding any matter
> > discussed at a meeting of the committee."
> >
> > Can you tell me who to file my letter with, and/or how to do it?
> >
> > Thanks,
> > Susan G. Sterrett
> > sterrett@duke.edu
> >
> >
> >
> >
> > On Mon, 21 Jul 2003, Med El-Zeftway wrote:
> >
> > > Sorry , I did not get your message in time since I was at Westinghouse starting the night of July 15, but I am glad that you attended the meeting.
> > >
> > > Med
> > >
> > > >>> <sterrett@duke.edu> 07/17/03 05:29AM >>>
> > >
> > > Dear Med,
> > >
> > > According to the public meeting schedule, you are the contact for the
> > > public meeting at Westinghouse to be held July 17th and 18th, and hence
> > > the person to be contacted if I intend to attend the meeting.
> > >
> > > I tried to reach you by telephone yesterday to find out what items are
> > > expected to be discussed at the meeting, in order to decide whether or not
> > > to attend.
> > >
> > > Since we didn't manage to make contact yesterday, I expect to attend the
> > > meeting. Please let me know if there is anything else I need to do other
> > > than show up at the meeting site.
> > >
> > > Best wishes,
> > > Susan G. Sterrett

> > > Assistant Professor of Philosophy
> > > Duke University
> > > sterrett@duke.edu
> > >
> > > I will be on sabbatical for the 2003-2004 academic year and can be reached
> > > at 412-441-4867 during that time.
> > >
> > >
> >
> >
>
>

CC: <jls1@nrc.gov>, <jxc1@nrc.gov>

Department of Philosophy
201C West Duke Building
Duke University
Durham, NC
sterrett@duke.edu

July 30, 2003

To: ACRS Subcommittee on Future Plant Designs

Subject: AP1000 Fluid Systems Design & QA Procedures

1. Purpose

At the July 18th Meeting of the ACRS Subcommittee Meeting on Future Plant Designs held in Monroeville, Pennsylvania, I took advantage of the opportunity afforded members of the public to remark on a topic discussed at that meeting: the NRC's review of QA control of processes used in the AP1000 design currently under licensing review. At that meeting, the NRC staff (Ms. Joelle Starefos) responded by saying that the NRC staff would reply in a letter.

As I did not know which open items were going to be discussed, my remarks were impromptu and I did not have a prepared text. The purpose of this letter is to provide a written statement of the concerns I expressed at that meeting, which made reference to concerns I had expressed earlier, at the 501st ACRS meeting. (References 6 and 7) For completeness, I also include a chronology of the questions and responses already received from other members of the NRC staff in sections 2.1 and 2.2 below. The statement incorporating the concerns I raised at the July 18th, 2003 ACRS meeting appears in section 2.3 below.

According to the policy on Advisory Committee Meetings (10CFR7.12 (b)), " Any member of the public who wishes to do so shall be permitted to file a written statement with an NRC advisory committee regarding any matter discussed at a meeting of the committee." I am filing this letter as such a written statement, as a member of the public, unaffiliated with any organization.

I am currently a professor of philosophy at Duke University in Durham, North Carolina. Prior to my academic career, I worked in the nuclear power industry, including a few years in the mid-nineties on the AP600 fluid systems design as a consultant to Westinghouse. My involvement with the nuclear power industry ended in early 1998 when I began my academic career in philosophy full-time.

I began following the NRC licensing review of the AP1000 in mid-2002 by reading the information publicly available via the NRC's electronic reading room. My knowledge about the AP1000 design and licensing review comes from reading these publicly available documents. I decided to make use of the provisions for public participation in the AP1000 licensing process (References 8, 9) in part because, according to the 10CFR52 licensing process under which the AP1000 is being licensed, opportunities for public participation are extremely limited once design certification is granted. Thus, as a member of the public, providing this input about the AP1000 design and licensing review is a "now-or-never" situation.

2. Chronology of Questions and Statements

2.1 Two Issues Raised with NRC Staff in July 2002 -- Systems Design & AP1000 QA

In mid-2002 (July 10), after the AP1000 design certification submittal, I asked questions about the general 10CFR52 process and the AP1000 licensing review in particular in an email exchange with Jerry Wilson of the NRC. (Reference 3) One question was: what ensures that, by the close of the licensing process, the design process for some components was not still at the stage wherein only preliminary sizing of components had been performed.? In particular, I asked:

> "(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?
>
> (ii) Does the submittal of the DCD imply that the things in (i) are done?
>
> (iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur? [Reference 3]

In reply, Jerry Wilson cited 10 CFR 52.47(a)(2), and explained that the level of detail required for a DCD (design control document) submittal was sufficient information to support a safety finding in any technical area, and that this level of information corresponds to the level that, under the previous two-step 10CFR50 process, was available at the operating license stage. However, he qualified this by saying that, since design acceptance criteria were to be used in the "piping design area", that "we [NRC staff] didn't expect that signed-off, proof-of-design calculations will need to be completed to support construction." [Reference 10]

This reply made me wonder whether the NRC was in practice approving delaying performing the proof-of-design calculations for system flows, temperatures, and pressures to later stages as well, without explicitly meaning to do so. The rationale for accepting the (DAC) approach for "the piping design area", which was articulated in SECY-02-0059 [Reference 2], was based on the ability to specify piping stress and piping structural analysis acceptance criteria; that rationale does not support delaying the fluid system design to the later COL stage. It is in fact important that the finalized fluid system design be performed prior to or in conjunction with specifying pipe sizes and valve characteristics to be used in the final design. It is always possible to use preliminary calculations to size piping, valves and equipment in order to obtain values to be placed in a design certification application. Proof-of-design calculations differ from preliminary sizing calculations in that they are a set of calculations chosen to take into account all the system criteria that must be met in order for the system to perform the capabilities that are claimed for it. As explained in followup emails, in lieu of using complete piping layout information as input to "proof-of-design" calculations, L/D criteria can be specified based upon "proof-of-design" calculations; these can then be used in piping layout to ensure that the considerations underlying the "proof-of-design" calculations are met. This kind of criteria would be the fluid systems design analogue of piping DAC. My worry was that unless some attention was paid to ensuring that the "proof-of-design" kinds of analyses are done, whether in the form of calculations using "as-built" data or in the form of L/D layout criteria, that the NRC would actually be certifying a design that was based on preliminary sizing considerations rather than on proof-of-design calculations that document that the various fluid systems have actually been designed to provide the system capabilities claimed for them. Since such fundamental things as the classification of initiating events assumes that even many non-safety systems actually do provide the capabilities attributed to them by the design documents, the issue is related to the safety basis of the plant even for the design of non-safety systems.

The problem is particularly acute on the AP1000 because much of the AP1000 makes reference to AP600 documentation. This makes it especially difficult to discern whether a particular pipe size and equipment parameter is merely inherited from the AP600 design or whether final "proof-of-design" kinds of calculations specific to the AP1000 have been performed to support it. Further, there is the danger of making the false assumption that if a system configuration has not changed, the fluid system performance has not changed either. This is not always true; a system temperature or pressure in one system can affect the fluid system performance in another. Thus reasoning about the similarity to AP600 layout that applies for piping stresses and loads does not necessarily extend to fluid systems performance. A comprehensive review of the AP1000 fluid systems designs is called for, similar to the kind of review appropriate when reviewing an extended power uprating.

In further email exchanges with the NRC (Jerry Wilson and Larry Burkhart), I tried to clarify my first question about the fluid system design. These emails are references 11 and 12 and are attached to this letter.

The second question I asked in my July 10, 2002 email to Jerry Wilson concerned the QA program covering the engineering design processes. I wrote there:

> The AP1000 design processes cannot be exactly the same as for the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case. Here's why I think it is a very important issue:
>
> The AP1000 DCD claims that many of the AP600 documents are applicable to the AP1000. The crucial question is, who (in Westinghouse) makes the determination that a particular AP600 document does in fact apply for the AP1000? It seems to me crucial that the same engineering functional group (preferably the same individual engineer) that was responsible for producing and signing off the document for the AP600 pass judgement on its applicability to the AP1000. Is there a guarantee of this? If not, I suggest that there be such a requirement and that it be made explicit.
>
> Otherwise, there is a gigantic loophole that can be used to circumvent the whole intent of the quality assurance provisions covering the engineering design process -- i.e., otherwise, individuals in other functional groups such as marketing, licensing, or project management, can circumvent the engineering process by simply stating that a certain AP600 engineering report or design document applies to the AP1000. (I don't think I need to explain the conflict of interest involved were this to be permitted.) [Sterrett to Wilson July 10, 2002 Reference 3]

Jerry Wilson replied to this question as well [Reference 10]. He referred me to the NRC's letter on the AP1000 Design Certification Review Schedule [Reference 4], and explained that the NRC staff did plan to inspect Westinghouse's implementation of its design control program for the AP1000 design "in the future." Mr. Lyons's letter of July 12, 2002 stated that the NRC planned to perform these inspections "as necessary", adding that "These inspections will be coordinated with Westinghouse to support the design certification schedule." [Reference 4 , p. 4]

2.2 Clarification & Discussion of Issues with NRC Staff -- December 2002

In December 2002 Larry Burkhart, who was then the NRC's AP1000 Project Manager, held a telecon to discuss my questions. Jerry Wilson, Dave Terao, and other members of the NRC technical staff were present. In this telephone conference call, I clarified my question about fluid system design. Nothing was resolved other than the clarification of the question. However, it was agreed that we should get in contact again to revisit the issues closer to the time the DSER was about to be issued.

Subsequently, after unsucessful attempts to reach Larry Burkhart in March 2003, I learned that there had been a change in management of the NRC's AP1000 Licensing team. The entire team had been replaced with the current team (John Segala, Joelle Starefos and Joseph Colaccino).

2.3 Concerns Raised at ACRS Meetings (April & July 2003)

Soon thereafter, I requested time to speak at the 501st ACRS meeting held on April 11th, where I read a statement presenting the first question I had raised in the original July 10th email. My oral presentation followed the draft text of my comments fairly closely [Reference 7 , included as Attachment II to this letter] and was included in the summary report for the 501st ACRS meeting [Reference 6].

The second question raised in my original email (regarding quality control procedures governing the design processes used in the AP1000) was brought up at an ACRS Subcommittee on Future Plant Designs held on July 18th, 2003, shortly after the NRC issued the Draft Safety Evaluation Report (DSER), and almost a year after I sent the original email expressing concerns about the QA process on the AP1000.

The list of AP1000 DSER Open Items included Open Item17.3.2-2, which reads in part:

> Westinghouse stated that a project-specific quality control plan was used to implement the requirements of the Westinghouse QMS program. The staff plans to conduct an inspection of the implementation of the project-specific quality plan to verify that design activities conducted for the AP1000 project complied with the Westinghouse QMS and the requirements of 10CFR Part 50, Appendix B. [Reference 5]

However, the "project-specific quality control plan" Westinghouse refers to is just the AP600 plan. Although Open Item 17.3.2-2 indicates "N/A" for the original RAI corresponding to the open item, there was an RAI about the AP1000-specific quality assurance plan [RAI 260.008-1 dated May 13, 2003]. Westinghouse's response to that RAI had been to claim that the AP600 document applied to the AP1000. The rationale given in Westinghouse's response to RAI 260.008-1 was:

> As the DCD identifies: " The plan ... is applicable to work performed for the AP1000 design." Westinghouse considers that it has identified a project specific quality plan (i. e., WCAP- 12600) for the AP1000 design.

There is also a discussion of the use of the AP600 project quality plan in Chapter 17 of the DSER, which states:

> A project-specific quality plan was issued to supplement the quality management system document and the topical reports for design activities affecting the quality of structures, systems, and components for the AP6OO project . . . This plan addresses the NQA-1-1989 edition through NQA-lb-1991 addenda and is applicable to work performed for the AP1000 design. [Reference 1, page 17-1]

These statements raise concern, for the reasons mentioned in my original July 10, 2002 email and excerpted in section 2.1 above. When I attended the ACRS Subcommitte Meeting on Future Plant Designs held on July 17th and 18th, I did not anticipate that the subject open item would be mentioned, and did not request time to speak beforehand. However, when I saw that the NRC's presentation included mention of the issue of an inspection of Westinghouse's QA plan during the meeting, I asked to make some impromptu remarks along the lines of the concern raised in my email. There was not time to gather the previous correspondence, relevant Open Items, RAIs, and RAI responses at that time. Therefore, I provide a more complete statement of the situation and my concerns about it here.

My concerns regarding QA of the AP1000 design process are:

A. Integrity of design process for the singular kind of project that the AP1000 is

> The kind of process by which the AP1000 design was produced resembles an uprating in some ways, in spite of the fact that it is not regarded as an uprating. That is, one constraint was to use the AP600 design details insofar as possible. An uprating involves activities and considerations not addressed by the kind of design control procedures intended to address design of a plant where the design process starts with the specification of plant parameters and detail is filled in as the design progresses from functional specifications to detailed equipment specifications. Thus I would not expect the AP600 design control procedures to cover all the design processes on the AP1000.
>
> Of special concern is QA control of the overall plant parameters, both in terms of the design process by which they were obtained, and the design processes that use them as input. (Perhaps this question was dealt with in the pre-application phase, but in case not, I raise it here.) I believe the generation of overall plant

parameters, whether for a new plant design, an uprating, or other changes to an existing plant design, is typically very tightly controlled, with oversight by an interdisciplinary committee whose membership is established independently of any particular project.

An important question here that needs to be asked is whether there are additional oversight or formal procedures over and above those addressed in the AP600 QA plan that would be appropriate for an uprating in that they would assure that the parameters are communicated to the affected functional design areas, would see that the right agents identify the specific changes that are required, and would keep track of their implementation. My worry is that due to its special nature (the criterion of keeping the AP600 design details as much as possible), the implementation of the AP1000 project plant parameters would really call for the additional oversight or the kinds of procedures applicable to an uprating.

If design control procedures intended for new plant designs were used in implementing the AP1000 plant parameters, rather than the design control procedures written to cover upratings, this raises a concern about the way that the AP600 information was used on the AP1000 project. This is because, for an uprating, the plant parameters are an input into a design process where an already existing plant is modified under the constraints of keeping much of the design unchanged. All kinds of QA design control questions arise in this case: for instance, who determines what information originally generated for the AP600 applies to the AP1000 or whether it needs to be reviewed? And who reviews it? Whose decision is final? It seems to me that the integrity of the design process relies upon keeping the design functions separate from project management functions. When a design group reports administratively to the project management and on a matrix basis to engineering management, the integrity of the design process depends upon the matrix connection being strong enough to ensure that technical aspects of management initiatives receive their due.

This kind of situation is not explicitly addressed in 10CFR50 Appendix B, but there is a statement on the general topic of who gets to decide such things in the event of design changes: "Design changes . . . shall be approved by the organization that performed the original design unless the applicant designates another responsible organization." Now, on the AP1000, where so many AP600 features are to be inherited, there is a kind of implicit change to an unspecified number of system capabilities in that the plant parameters have changed. Meeting the spirit of the subject criteria would mean that the judgement as to whether an AP600 design or document applies to the AP1000 or not should be made by those responsible for that design or document on the

AP600 design. Since the DCD references many AP600 documents, it is not always clear that the author of the AP600 document or design has approved its applicability to the AP1000. I think an important question is: who has determined that a certain AP600 document is applicable to the AP1000?

B. Organizational Differences Between AP600 and AP1000 affecting design control

The AP600 design control procedures reflected the involvement of ARC, the Advanced Reactor Corporation, a consortium of electrical utilities. I do not have access to the relevant procedures, but I recall from my previous involvement with the AP600 project that representatives of the ARC did have a formal role in the approval of design changes. Thus, beyond the straightforward point that the design control procedure for the AP1000 can not be exactly the same as the AP600 in terms of the letter of the law, there is the more significant point that the involvement of such an agency provided checks and balances on the AP600 project that may not exist on the AP1000 project.

There may be other organizational changes since the AP600 QA inspection was performed that affect the quality and the strength of the ties between technical and engineering design personnel in the AP1000 organization and the technical department managers reported to on a matrix basis. It would seem to me that these would need to be examined in order for the NRC's review of Quality Control to conclude that the assurance provided by the procedure when applied on the AP1000 project is the same as the assurance it provided on the AP600 design.

C. It seems late in the process should problems be detected

The NRC Letter accepting the Design Certification application dated July 12 2002 (Reference 4) stated that QA inspection would be done "as needed".

The fact that a QA inspection is an open item is reassuring in that it means this item will be tracked. However, the fact that it is an open item is cause for concern as to whether the appropriate inspections were performed "as needed" in the area of review of the fluid systems design. It is a concern because of the possibility that the QA inspection might reveal that some design activities need to be performed. Should these design activities result in design changes, it is very late in the process. Further, it seems that the comprehensive fluid system design of the AP1000 plant --- deriving the basic plant parameters from the AP600 design --- as well as the design details of specific systems appropriately designed for the AP1000, should be covered by this item.

The issue here is the QA control on information that is in the DCD: was there design control guaranteeing that the generation and implementation of the basic plant parameters for the AP1000, as well as the fluid systems design details (e.g., equipment parameters, piping size, valve specifications) were the result of design work of the appropriate kind (i.e., not merely preliminary sizing calculations), performed in a context where there was proper control of design information input into the design process, and where there were the appropriate checks and balances that provide assurance of the integrity of the design process? If it turns out there were areas where it was not, it seems there is not a lot of time to allow review and comment on the required design changes if the design certification schedule is to be adhered to.

3. Additional Remarks -- Schedule for Resolution of DSER Open Items and Role of Public Review and Participation

In general, the AP1000 design certification schedule seems to permit a number of potentially significant open items at the DSER stage. This limits the time available for review and comment by the public after the open item is resolved. Considering the finality of a design certification, it seems that the time available for public review and comment should not be abbreviated in the only stage provided for it.

Respectfully submitted,

Susan G. Sterrett
Assistant Professor of
Philosophy
Duke University, Durham, NC

Attachment I Email correspondence Sterrett to NRC dated September 15, 2003.

Attachment II Draft Text of Comments Read at 501st ACRS Meeting --Dr. S. G. Sterrett

References:

1. AP1000 Draft Safety Evaluation Report (DSER)
Chapter 17 "Quality Assurance"

2. SECY-02-059 April 1, 2002
"Use of Design Acceptance Criteria for the AP1000 Standard Plant Design"
William D. Travers to The Commissioners

3. Email S. G. Sterrett to J. N. Wilson,
"AP1000 Review/ 10CFR Part 52 Process"
Wednesday, July 10, 2002

4. Letter July 12, 2002 James E. Lyons to W. E. Cummins
"AP1000 Design Certification Review Schedule (TAC NO. MB4682)"

5. Letter May 27, 2003 James E. Lyons to W. E. Cummins
"Westinghouse AP1000 Draft Safety Evaluation Report
Potential Open Items Chapter 17 Quality Assurance"

6. Letter May 7, 2003 M. Bonaca to Nils J. Diaz
"Summary Report of 501st Meeting of the Advisory Committee
on Reactor Safeguards, April 10 - 12, 2003"

7. Draft text of comments by S. G. Sterrett at 501st ACRS Meeting
(Attachment II to this letter. No transcript of April 11th meeting was made; oral statement followed written draft closely)

8. Nuclear Regulatory Commission Policy Statement
"Enhancing Public Participation in NRC Meetings; Policy Statement"
Federal Register May 28, 2002 (Volume 67, Number 102; Page 36920-36924)

9. 10 CFR7.12 Public Participation in and public notice of advisory committee meetings.

10. Email J. N. Wilson to S. G. Sterrett
"Re: Followup on Questions: AP1000 Review/ 10CFR Part 52 Process"
August 13, 2002.

11. Email S. G. Sterrett to L. J. Burkhart
"Thanks for RAIs"
September 15, 2002
(included in Attachment I to this letter)

12. Email S. G. Sterrett to J. N. Wilson
"Piping Layout L/D Criteria for Fluid System Performance"
September 15, 2002
(included in Attachment I to this letter)

cc:

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Mr. Joseph Colaccino, Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Ms. Joelle Starefos, Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ATTACHMENT I

Emails Sterrett to NRC (L. J. Burkhart; J. N. Wilson) dated September 15, 2003

This first email clarifies a question sent earlier to Jerry Wilson and discussed by telephone with Larry Burkhart . In it, I explain why the question is not addressed by the considerations provided in the rationale used in accepting DAC for the AP1000, nor covered by the RAIs sent to Westinghouse as of that date. The email below is followed by a longer one addressed to Jerry Wilson and cc'd to Larry Burkhart and Marsha Gamberoni.

Date: Sun, 15 Sep 2002 16:21:36 -0400 (EDT)
From: sterrett@duke.edu
To: Lawrence Burkhart <LJB@nrc.gov>
Subject: Thanks for RAIs

Dear Larry,

I have looked over the RAIs, and don't see any that address the question I asked Jerry Wilson about paying attention to fluid system performance in doing the piping layout. The RAIs do mention thermal-hydraulic loads, but that isn't what I meant; thermal-hydraulic loads are still related to the mechanical loads on the piping and concern the piping structural-mechanical analyis.

What I meant is the fluid system performance -- flowrates, pressures and temperatures that are achieved by the combination of driving head and fluid piping resistance. The fluid piping resistance is affected by the piping layout. In an email to Jerry Wilson, which I put you on cc for, and which I will send immediately after this one, there is more explanation. The bottom line is that even though the piping layout isn't final, the piping resistance criteria ("L/D criteria") for the AP1000 should be computed and provided at this point. In that email, following this one, there is also an explanation as to why the L/D criteria for the AP1000 will be different in many cases from the AP600.

In our conversation, you mentioned that the AP1000 is so similar to the AP600. That may be, but the question is, should the piping layout really be so similar? It is the fluid system's performance that sets the requirements of the design, and the layout has to meet those criteria. That's the point. One has to check, not just assume it will all turn out okay.

I imagine that there are people at the NRC whose reviews will address this, perhaps on a system-by-system basis. And whether or not the L/D criteria (piping resistance layout criteria) differ much for the AP1000 vis a vis the AP600 for a particular system may be a design detail. However, the overall point that L/D criteria for the AP1000 should be calculated at the DCD application stage is a plant-level issue. It's a very general point. In the email that follows, I explain why I think it is a policy issue about the new licensing process.

I am asking these questions as an individual member of the public, unaffiliated with any organization.

Sincerely,
Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
Durham NC 27708
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919-660-3054 (office)
919-660-3050 (receptionist)

.....

The "email that follows" referred to in the above email is appended below. It is: Email dated September 15, 2002 from Sterrett to NRC staff (Jerry Wilson, cc to Larry Burkhart and Marsha Gamberoni)

.....

Date: Sun, 15 Sep 2002 16:46:21 -0400 (EDT)
From: sterrett@duke.edu
To: Jerry Wilson <JNW@nrc.gov>
Cc: LJB@nrc.gov, MKG@nrc.gov, sterrett@duke.edu
Subject: Piping Layout L/D Criteria for Fluid System Performance

To: Jerry Wilson, Senior Policy Analyst, NRC
cc: Larry Burkhart, AP1000 Project Manager, NRC
Marsha Gamberoni, Deputy Director, New Reactor Licensing

Subject: Piping Layout L/D Criteria for Fluid System Performance

Dear Jerry,

In a previous email, you responded to a question I asked regarding whether proof-of-design calculations of fluid system performance were performed for the AP1000. This email is to (a.) clarify the question I was asking, and (b) explain why I think L/D criteria is an issue of policy regarding the 10CFR52 design process, not merely a minor design or schedule detail.

In spite of the length of this email, the two points are simple; I am just including the text of the things I reference to avoid any possible ambiguity.

(a) Clarification of Question Re: Calculations Supporting Fluid System Performance

To recapitulate, the question I asked (July 10) was:

``1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?" [excerpt from email of July 10, 2002 Sterrett to Wilson]

In your response (August 13) you explained why proof-of-design calculations for fluid system performance were _not_ expected to have been performed at the time of DCD submittal:

``With regard to question #1, the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design

certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design andconstruction activities [#1(iii)]. ``
[excerpt from email of August 13, 2002 Wilson to Sterrett]

I would like here to clarify my earlier question: by ``proof-of-design calculations", I was referring to proof-of-design calculations for fluid system performance, rather than to piping design calculations. By ``piping design calculations", I assume you are referring to calculations concerning things such as piping stress, fatigue and mechanical loads. But, of course, the proper flow performance of fluid systems sets another kind of criterion: that is, in addition to the criteria that aim to ensure that the structural/mechanical behavior of the piping is acceptable, piping layout activities also have to take into account criteria that ensure that the piping flow resistances will result in the flows through the system called for by the fluid system design (and for which the design of numerious interfacing systems may take credit). In addition, pressures (and, sometimes, temperatures) in the system at various key points, such as at heat exchangers and control valves, are influenced by the piping layout. And here i am including normal system operation. Your response to the question of whether there have been proof-of-design calculations for fluid flow performance was that you did not expect them to be done, because the piping layout wasn't final.

However, if the piping layout isn't far enough along to permit proof-of-design calculations to be performed, the calculations related to fluid system performance should still be done -- the only difference is that they would result in piping fluid flow resistance criteria, or ``L/D criteria."

From your response, I wasn't sure if ``L/D criteria", or piping fluid resistance criteria were included in the DAC. After looking at various meeting transcripts and the RAIs regarding DAC attached to the meeting notice for September 9, 2002 (Reference 3), it doesn't appear to me that the ``L/D criteria" are addressed in these places.

So, the question is whether L/D criteria have been provided for the AP1000 fluid systems. Even if the piping layout for the AP1000 were _exactly_ the same as the AP600 layout, new L/D criteria would need to be calculated for the AP1000. For, anytime the design flowrate for a system changes, the

L/D criteria need to be re-calculated, since piping flow resistances vary with flowrate. Even for those systems, if any, where the fluid flowrate of the system is exactly the same for the AP1000 as it was for the AP600, there is still the question whether there are differences in the inlet or outlet pressures -- i.e., in the pressure in the system or piece of equipment to which it connects and from which the fluid enters the fluid system or to where it discharges. Hence the fluid flow performance would be different for the same layout. Thus, the layout criteria would differ between the AP1000 and the AP600 for cases where a system's inlet or discharge pressures differ. (An example here of such a difference in the AP1000 is the significant change in main steam pressure: obviously L/D criteria will be different between the AP600 and the AP1000 for the inlet piping to the steam relief valves, for example.)

Thus, to rephrase the question in my July email:

``(i) Are there supposed to be signed-off, L/D criteria and supporting calculations, (using the AP1000 fluid system functional requirements and equipment parameters) for the system flows and pressures reported for all the systems in the AP1000 DCD submitted? Or, L/D criteria for the piping associated with the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves,etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?"

This is the question I have now, given your repsonse that you did not expect ``proof-of-design calculations" to be performed due to the fact that the piping layout is not final at the DCD application stage.

(b) Previous process versus new 10CFR52 process

It is simply good common sense to provide L/D criteria for the preliminary piping layout, in order to have confidence that when the final piping layout is in fact completed, the design will be such that the fluid performance functional requirements of the system are in fact met, avoiding major changes to the preliminary layout. As you may be aware, this is the process that was followed on the Westinghouse standard plants.

As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

Certainly the ITAACs and other operational tests are going to provide a checkpoint where deficiences in system performance are found, but, I trust, it certainly isn't the intent of the new 10CFR52 process to increase the surprises encountered during operational testing! I assume that everyone agrees that the intent is to have confidence that the certified design results in fluid systems that meet their functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

Thus, it seems clear that the L/D criteria should be provided at the DCD submittal stage in the 10CFR52 process. It's an issue of policy because, otherwise, the 10CFR52 process would result in the NRC certifying a design for which there was less confidence in the design than existed under the old process at a comparable stage.

It would be great to hear the answer that L/D criteria for all the AP1000 systems have in fact been calculated and provided, but, in any case, I look forward to your reply. As with my previous inquiry, I am asking these questions as an individual member of the public, unaffiliated with any organization.

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ATTACHMENT II

Draft of Remarks by Dr. S. G. Sterrett - 501st ACRS meeting, April 11th, 2003, Rockville, MD

I'm Susan G. Sterrett. I am currently a professor at Duke University in Durham, North Carolina. I should perhaps mention that, prior to my academic career, I worked as a design engineer in the commerical nuclear power plant industry, including on fluid system design of the AP600 and EPP plants in the mid-nineties. I am making these remarks as a member of the public, unaffiliated with any organization.

I'm here today because I have some questions about the NRC's review of the AP1000. Put briefly, my question is whether the NRC verifies or asks for proof that the system parameters reported in the AP1000 design certification application (and used in the analyses) are actually justified by a detailed design, as opposed to the AP1000 system designs being at the stage of conceptual system design or justified only by preliminary equipment sizing calculations. I'd like a few minutes to explain the relevance and the significance of the question.

According to the rules under which the AP1000 is being licensed by the NRC, the level of design information required in a design certification application is, with a few explicit exceptions, the level of information that was required at the operating license stage under the previous two-step licensing process. I think this requirement makes sense, too, inasmuch as what the NRC is licensing in approving the AP1000 is an actual plant design that is certified to be constructed and operated.

In following some of the AP1000 licensing activities via the NRC's website, I have noticed that much is often made of the similarities between the AP1000 systems and the AP600 systems. This can be misleading: the performance of the various fluid systems in the plant -- that is, the flows, temperatures, and pressures that obtain at various points within a system are affected by many kinds of differences in a plant design. As I am sure everyone here realizes:

--- Anytime a system flowrate changes, pressure drops in the system will change.

--- Likewise, anytime the pressure at some point in a system changes, flowrates in it or some other system can be affected.

--- Thus, even for those systems that are exactly the same physically speaking (i.e., same pipe size and layout) for the AP1000 as for the AP600, there is still the question of whether there are differences in the inlet or outlet pressures in a system or piece of equipment to which it connects. Different inlet or outlet pressures will result in differences in fluid system performance.

For example, suppose the main steam system pressure is different on the AP1000; then, on the AP1000, there would be a different driving head for lines connected to it than there was on the AP600. So, even if the system hardware and layout of a system connected to the main steam system, say, is exactly the same on the AP1000 as it was for the AP600, the resulting values of major fluid system parameters -- e.g., the mass and volume flowrates and the pressures that result -- could be quite different. Obviously the effects on things like the flow capability of relief valve piping and valve arrangements would need to be looked at. Accomodating these changes could require resizing piping or control valves in order to achieve the flowrate claimed for the system.

I've given the main steam system as an example, but the general point holds for every system in the plant. To infer from the fact that the hardware and layout on an AP1000 system is exactly the same as on the AP600, to the conclusion that the performance is the same, is incorrect. The various AP1000 analyses now under review are only as valid as the assumptions made in them about the performance of the plant systems.

What does this point mean for the review of the AP1000 design, which makes frequent appeal to the certified AP600 design? In many aspects of the safety analyses, the NRC has been very alert to the differences between the AP1000 and the AP600. The point of my examples is that this awareness ought to be extended to plant fluid system performance, specifically, that some reassurances should be sought that the fluid system design details for all the plant systems have been properly attended to, and that, given that the level of detail required at this stage is supposed to be the same as that at the operating license stage, these should not be just preliminary sizing calculations. I worry about the complacency with which the AP600 design is referenced in justifying the AP1000 system designs.

The AP1000 is sometimes referred to as an uprating of the AP600 design. Of course this would be significantly larger than any uprating that the NRC has licensed so far, and of course it differs from most upratings in that there is no AP600 operating experience to draw upon. To the extent that thinking of the AP1000 as an uprating of the AP600 is appropriate, however, it would make sense to require that all the plant system reviews that would be required for an extended power uprating be performed for the AP1000. As there is now a draft review standard for extended power uprates that could be used to guide such a review of the AP1000 (RS-001, dated December 2002), this seems a natural thing to do. I wonder whether there has in fact been a review of this sort for the AP1000. So let me ask: has there?

For those systems whose layout is finalized at this stage of the AP1000 design certification application, there should be formally signed-off engineering calculations justifying the claims that the AP1000 system flow, temperature, and pressure parameters will actually be achieved using the AP1000 equpment and layout. These are often referred to as fluid system "proof-of-design" calculations. I gather from the NRC's approval of the use of DAC (design acceptance criteria) for structural piping analysis on the AP1000 that

there may be some systems for which the layout details will not be completed until after design certification. For those systems, what is needed as far as ensuring proper fluid system performance is to provide layout criteria related to the piping flow resistance, so that the fluid flowrates claimed for the system will actually be achieved. Such criteria are commonly called "L/D criteria" and are considered part of the fluid system design. In fact, for the Westinghouse standard plant designs licensed under the previous two-step process, L/D criteria were provided for various fluid systems prior to construction so that the architect engineer could properly perform the piping layout. As I see it, at least this level of design detail is required at the time of the DCD submittal.

Why not just rely on the ITAACs (Inspections, Tests, Analysis, and Acceptance Criteria) to provide such reassurance? Certainly the ITAACs and other operational tests provide a checkpoint where some deficiences in the plant design would show up. However, I trust that it isn't the intent of ITAACs to relieve the designer of the responsibility of the engineering design work of designing the plant systems so that the system parameters crucial to safety are achieved. Certainly increasing the number of surprises encountered during plant testing is not part of the intent of the new one-step licensing process! I assume that everyone agrees that the intent of design certification is to provide confidence that the certified design will result in fluid systems that meet their stated functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

In conclusion, I am asking whether the review of the AP1000 design has included ensuring that the design details upon which the analyses that the ACRS has been reviewing depend, have in fact been attended to. In particular, I think it is clear that L/D criteria should be provided at this stage for systems whose layout is to be finalized at a later date, and "proof-of-design" calculations be provided for those whose layout is determined at this stage. Otherwise, there is no assurance that the analyses you are reviewing so carefully and thoughtfully apply to the plant design you are certifying.

Thank you for listening.

Respectfully submitted,

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July 31, 2003

To: ACRS Subcommittee on Future Plant Designs

Subject: Heat of Solar Radiation and AP1000 Ultimate Heat Sink

Although I did not make an oral statement on the subject topic at the ACRS Subcommittee on Future Plant Designs held on July 17th and 18th, 2003, I am taking the opportunity afforded members of the public to file a statement on subjects associated with the topics discussed at ACRS meetings. This statement is related to the AP1000 safety systems and the recently-issued AP1000 Draft Safety Evaluation Report (DSER).

The AP1000, unlike operating PWRs, uses the outside air as the ultimate heat sink. The Passive Containment Cooling System is responsible for transferring heat to the ultimate heat sink in the event of a design basis accident. The question I have is: whether (and if so, how) the heat of solar radiation is taken into account in the design of the AP1000 Passive Containment Cooling System.

As described in the DSER, heat removal from the containment after a design basis accident is to be accomplished by the Passive Containment Cooling System (PCS). The PCS uses the water in the PCS water storage tank located atop the containment, along with the flow of air through the spaces between the primary steel containment and the surrounding concrete building, to cool and depressurize the containment. It is the means by which heat is transferred from the reactor to the ultimate heat sink (the outside air) in the event of a design basis accident.

Thus, the temperature of the water in the PCS water storage tank and the temperature of the concrete walls affect the heat removal capabilities of the PCS. Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, it seems to me that its effect on:

(i) the temperature of the concrete building, whose walls form the air passages relied upon for the efficacy of cooling by the PCS, and

(ii) the temperature in the PCS water storage tank,

ought to be addressed by the AP1000 design. The effect will vary with geographical location (i.e., one of the coefficients involved is a function of geographical latitude) and will also depend upon the surface geometry, the properties of the concrete and/or the surface coatings used, and the humidity of the outside air.

The site parameters do not include geographical latitute, so I am wondering whether the heat of solar radiation was considered or quantified. I do not see the effect of the heat of solar radiation accounted for explicitly in the DSER. However, it is clear that, unless the heat of solar radiation is shown to make only a negligible contribution, this heat source is relevant to the design of the safety features of the plant. The question does not arise for operating PWR plant designs, since those designs do not use the method of containment cooling employed on the AP1000. It appears to me that some of the regulations and criteria related to ultimate heat sink assume that the ultimate heat sink is a body of water; thus I would not expect them to have specifically addressed the effect of heat of solar radiation on the temperature distribution in concrete walls.

Perhaps this was already addressed at earlier stages of the project. However, even if this is so, there should be some discussion in the DSER of the rationale and assumptions used in making the determination that the effect of the heat of solar radiation on the structures used by the PCS for containment cooling could be neglected.

If in fact the effect of the heat of solar radiation on PCS performance is not determined to be negligible, the assumptions regarding PCS water storage tank temperature and PCS efficacy in heat removal used in the AP1000 PRA (Probabilistic Risk Assessment) Report should also be examined to see if the heat of solar radiation might need to be taken into account in the rationales employed there.

I have raised this question with the NRC staff. I do not know what the response will be. However, due to the late point in the licensing process (the DSER is already issued), the safety significance of the ultimate heat sink, and the finality of design certification which limits opportunities to raise the issue later, I am raising it in a statement to the ACRS now.

Respectfully submitted,

Susan G. Sterrett
Assistant Professor of Philosophy
Duke University, Durham, NC

ATTACHMENT 12

Note to Joelle L. Starefos, AP1000 Project Manager, from Susan G. Sterrett, Assistant Professor, Duke University, regarding transmittal of signed copies of letters transmitted previously via electronic mail; similar notes/transmittals provided to John P. Segala and Joseph Colaccino

To: Joelle Staredos

Enclosed are hard copies of signatures of letters sent earlier by email.

Regards,
S G Stewart

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July 23, 2003

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Question on AP1000 Containment Systems/
Effect of heat from solar radiation on concrete shield building and on PCS (Passive Containment Cooling System) water storage tank contents

The purpose of this letter is to put into writing a question about the AP1000 safety system design that I discussed on the telephone with you (John Segala) a few weeks ago. I am asking this question as a member of the public, unaffiliated with any organization.

The topic is the effect of the heat of solar radiation on the Passive Containment Cooling System (PCS); the question is whether (and if so, how) the heat of solar radiation is taken into account in the AP1000 design of the Passive Containment Cooling System.

Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, it seems to me that its effect on:

(i) the temperature of the concrete shield building, whose walls form the air passages relied upon for the efficacy of cooling by the PCS, and
(ii) the temperature in the PCS water storage tank, and

ought to be addressed by the AP1000 design. The effect will vary with geographical location (e.g., the relevant coefficients tend to be larger for sites near the equator than for those far away from the equator) and will depend upon the surface geometry and the properties of the material and/or the surface coatings used.

I do not see this accounted for explicitly in the DSER. However, it is clear that, unless it is shown to make only a negligible contribution, this heat source is relevant to the design of the safety features of the plant. As described in the DSER, for long-term cooling after a design basis accident, the PCS uses the water in the PCS water storage tank and the passage of air in the spaces between the primary steel containment and the concrete shield building to cool and depressurize the containment. It is the means by which heat is transferred from the reactor to the ultimate heat sink in the event of a design basis accident. The question does not arise for operating PWR plant designs, since those designs do not use the method of containment cooling employed on the AP1000.

If in fact the effect of the heat of solar radiation is not determined to be negligible, the assumptions regarding PCS water storage tank temperature and PCS efficacy in heat removal used in the AP1000 PRA (Probabilistic Risk Assessment) Report should also be examined to see if the heat of solar radiation was taken into account.

I look forward to your reply. Should you wish to contact me, the best way is by email at sterrett@duke.edu.

Sincerely,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor
Department of Philosophy
Duke University, Durham, NC

References: 1. AP1000 Draft Safety Evaluation Report (DSER)
Section 6.2 "Containment Systems"
(in Chapter 6 "Engineered Safety Features"
ADAMS accession number ML031671499)
June 16, 2003 (available on ADAMS 07/01/03)

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July 30, 2003

To: ACRS Subcommittee on Future Plant Designs

Subject: AP1000 Fluid Systems Design & QA Procedures

1. Purpose

At the July 18th Meeting of the ACRS Subcommittee Meeting on Future Plant Designs held in Monroeville, Pennsylvania, I took advantage of the opportunity afforded members of the public to remark on a topic discussed at that meeting: the NRC's review of QA control of processes used in the AP1000 design currently under licensing review. At that meeting, the NRC staff (Ms. Joelle Starefos) responded by saying that the NRC staff would reply in a letter.

As I did not know which open items were going to be discussed, my remarks were impromptu and I did not have a prepared text. The purpose of this letter is to provide a written statement of the concerns I expressed at that meeting, which made reference to concerns I had expressed earlier, at the 501st ACRS meeting. (References 6 and 7) For completeness, I also include a chronology of the questions and responses already received from other members of the NRC staff in sections 2.1 and 2.2 below. The statement incorporating the concerns I raised at the July 18th, 2003 ACRS meeting appears in section 2.3 below.

According to the policy on Advisory Committee Meetings (10CFR7.12 (b)), " Any member of the public who wishes to do so shall be permitted to file a written statement with an NRC advisory committee regarding any matter discussed at a meeting of the committee." I am filing this letter as such a written statement, as a member of the public, unaffiliated with any organization.

I am currently a professor of philosophy at Duke University in Durham, North Carolina. Prior to my academic career, I worked in the nuclear power industry, including a few years in the mid-nineties on the AP600 fluid systems design as a consultant to Westinghouse. My involvement with the nuclear power industry ended in early 1998 when I began my academic career in philosophy full-time.

I began following the NRC licensing review of the AP1000 in mid-2002 by reading the information publicly available via the NRC's electronic reading room. My knowledge about the AP1000 design and licensing review comes from reading these publicly available documents. I decided to make use of the provisions for public participation in the AP1000 licensing process (References 8, 9) in part because, according to the 10CFR52 licensing process under which the AP1000 is being licensed, opportunities for public participation are extremely limited once design certification is granted. Thus, as a member of the public, providing this input about the AP1000 design and licensing review is a "now-or-never" situation.

2. Chronology of Questions and Statements

2.1 Two Issues Raised with NRC Staff in July 2002 -- Systems Design & AP1000 QA

In mid-2002 (July 10), after the AP1000 design certification submittal, I asked questions about the general 10CFR52 process and the AP1000 licensing review in particular in an email exchange with Jerry Wilson of the NRC. (Reference 3) One question was: what ensures that, by the close of the licensing process, the design process for some components was not still at the stage wherein only preliminary sizing of components had been performed.? In particular, I asked:

> "(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?
>
> (ii) Does the submittal of the DCD imply that the things in (i) are done?
>
> (iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur? [Reference 3]

In reply, Jerry Wilson cited 10 CFR 52.47(a)(2), and explained that the level of detail required for a DCD (design control document) submittal was sufficient information to support a safety finding in any technical area, and that this level of information corresponds to the level that, under the previous two-step 10CFR50 process, was available at the operating license stage. However, he qualified this by saying that, since design acceptance criteria were to be used in the "piping design area", that "we [NRC staff] didn't expect that signed-off, proof-of-design calculations will need to be completed to support construction." [Reference 10]

This reply made me wonder whether the NRC was in practice approving delaying performing the proof-of-design calculations for system flows, temperatures, and pressures to later stages as well, without explicitly meaning to do so. The rationale for accepting the (DAC) approach for "the piping design area", which was articulated in SECY-02-0059 [Reference 2], was based on the ability to specify piping stress and piping structural analysis acceptance criteria; that rationale does not support delaying the fluid system design to the later COL stage. It is in fact important that the finalized fluid system design be performed prior to or in conjunction with specifying pipe sizes and valve characteristics to be used in the final design. It is always possible to use preliminary calculations to size piping, valves and equipment in order to obtain values to be placed in a design certification application. Proof-of-design calculations differ from preliminary sizing calculations in that they are a set of calculations chosen to take into account all the system criteria that must be met in order for the system to perform the capabilities that are claimed for it. As explained in followup emails, in lieu of using complete piping layout information as input to "proof-of-design" calculations, L/D criteria can be specified based upon "proof-of-design" calculations; these can then be used in piping layout to ensure that the considerations underlying the "proof-of-design" calculations are met. This kind of criteria would be the fluid systems design analogue of piping DAC. My worry was that unless some attention was paid to ensuring that the "proof-of-design" kinds of analyses are done, whether in the form of calculations using "as-built" data or in the form of L/D layout criteria, that the NRC would actually be certifying a design that was based on preliminary sizing considerations rather than on proof-of-design calculations that document that the various fluid systems have actually been designed to provide the system capabilities claimed for them. Since such fundamental things as the classification of initiating events assumes that even many non-safety systems actually do provide the capabilities attributed to them by the design documents, the issue is related to the safety basis of the plant even for the design of non-safety systems.

The problem is particularly acute on the AP1000 because much of the AP1000 makes reference to AP600 documentation. This makes it especially difficult to discern whether a particular pipe size and equipment parameter is merely inherited from the AP600 design or whether final "proof-of-design" kinds of calculations specific to the AP1000 have been performed to support it. Further, there is the danger of making the false assumption that if a system configuration has not changed, the fluid system performance has not changed either. This is not always true; a system temperature or pressure in one system can affect the fluid system performance in another. Thus reasoning about the similarity to AP600 layout that applies for piping stresses and loads does not necessarily extend to fluid systems performance. A comprehensive review of the AP1000 fluid systems designs is called for, similar to the kind of review appropriate when reviewing an extended power uprating.

In further email exchanges with the NRC (Jerry Wilson and Larry Burkhart), I tried to clarify my first question about the fluid system design. These emails are references 11 and 12 and are attached to this letter.

The second question I asked in my July 10, 2002 email to Jerry Wilson concerned the QA program covering the engineering design processes. I wrote there:

> The AP1000 design processes cannot be exactly the same as for the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case. Here's why I think it is a very important issue:
>
> The AP1000 DCD claims that many of the AP600 documents are applicable to the AP1000. The crucial question is, who (in Westinghouse) makes the determination that a particular AP600 document does in fact apply for the AP1000? It seems to me crucial that the same engineering functional group (preferably the same individual engineer) that was responsible for producing and signing off the document for the AP600 pass judgement on its applicability to the AP1000. Is there a guarantee of this? If not, I suggest that there be such a requirement and that it be made explicit.
>
> Otherwise, there is a gigantic loophole that can be used to circumvent the whole intent of the quality assurance provisions covering the engineering design process -- i.e., otherwise, individuals in other functional groups such as marketing, licensing, or project management, can circumvent the engineering process by simply stating that a certain AP600 engineering report or design document applies to the AP1000. (I don't think I need to explain the conflict of interest involved were this to be permitted.) [Sterrett to Wilson July 10, 2002 Reference 3]

Jerry Wilson replied to this question as well [Reference 10]. He referred me to the NRC's letter on the AP1000 Design Certification Review Schedule [Reference 4], and explained that the NRC staff did plan to inspect Westinghouse's implementation of its design control program for the AP1000 design "in the future." Mr. Lyons's letter of July 12, 2002 stated that the NRC planned to perform these inspections "as necessary", adding that "These inspections will be coordinated with Westinghouse to support the design certification schedule." [Reference 4 , p. 4]

2.2 Clarification & Discussion of Issues with NRC Staff -- December 2002

In December 2002 Larry Burkhart, who was then the NRC's AP1000 Project Manager, held a telecon to discuss my questions. Jerry Wilson, Dave Terao, and other members of the NRC technical staff were present. In this telephone conference call, I clarified my question about fluid system design. Nothing was resolved other than the clarification of the question. However, it was agreed that we should get in contact again to revisit the issues closer to the time the DSER was about to be issued.

Subsequently, after unsucessful attempts to reach Larry Burkhart in March 2003, I learned that there had been a change in management of the NRC's AP1000 Licensing team. The entire team had been replaced with the current team (John Segala, Joelle Starefos and Joseph Colaccino).

2.3 Concerns Raised at ACRS Meetings (April & July 2003)

Soon thereafter, I requested time to speak at the 501st ACRS meeting held on April 11th, where I read a statement presenting the first question I had raised in the original July 10th email. My oral presentation followed the draft text of my comments fairly closely [Reference 7 , included as Attachment II to this letter] and was included in the summary report for the 501st ACRS meeting [Reference 6].

The second question raised in my original email (regarding quality control procedures governing the design processes used in the AP1000) was brought up at an ACRS Subcommittee on Future Plant Designs held on July 18th, 2003, shortly after the NRC issued the Draft Safety Evaluation Report (DSER), and almost a year after I sent the original email expressing concerns about the QA process on the AP1000.

The list of AP1000 DSER Open Items included Open Item17.3.2-2, which reads in part:

> Westinghouse stated that a project-specific quality control plan was used to implement the requirements of the Westinghouse QMS program. The staff plans to conduct an inspection of the implementation of the project-specific quality plan to verify that design activities conducted for the AP1000 project complied with the Westinghouse QMS and the requirements of 10CFR Part 50, Appendix B. [Reference 5]

However, the "project-specific quality control plan" Westinghouse refers to is just the AP600 plan. Although Open Item 17.3.2-2 indicates "N/A" for the original RAI corresponding to the open item, there was an RAI about the AP1000-specific quality assurance plan [RAI 260.008-1 dated May 13, 2003]. Westinghouse's response to that RAI had been to claim that the AP600 document applied to the AP1000. The rationale given in Westinghouse's response to RAI 260.008-1 was:

> As the DCD identifies: " The plan ... is applicable to work performed for the AP1000 design." Westinghouse considers that it has identified a project specific quality plan (i. e., WCAP- 12600) for the AP1000 design.

There is also a discussion of the use of the AP600 project quality plan in Chapter 17 of the DSER, which states:

> A project-specific quality plan was issued to supplement the quality management system document and the topical reports for design activities affecting the quality of structures, systems, and components for the AP6OO project . . . This plan addresses the NQA-1-1989 edition through NQA-lb-1991 addenda and is applicable to work performed for the AP1000 design. [Reference 1, page 17-1]

These statements raise concern, for the reasons mentioned in my original July 10, 2002 email and excerpted in section 2.1 above. When I attended the ACRS Subcommitte Meeting on Future Plant Designs held on July 17th and 18th, I did not anticipate that the subject open item would be mentioned, and did not request time to speak beforehand. However, when I saw that the NRC's presentation included mention of the issue of an inspection of Westinghouse's QA plan during the meeting, I asked to make some impromptu remarks along the lines of the concern raised in my email. There was not time to gather the previous correspondence, relevant Open Items, RAIs, and RAI responses at that time. Therefore, I provide a more complete statement of the situation and my concerns about it here.

My concerns regarding QA of the AP1000 design process are:

A. Integrity of design process for the singular kind of project that the AP1000 is

> The kind of process by which the AP1000 design was produced resembles an uprating in some ways, in spite of the fact that it is not regarded as an uprating. That is, one constraint was to use the AP600 design details insofar as possible. An uprating involves activities and considerations not addressed by the kind of design control procedures intended to address design of a plant where the design process starts with the specification of plant parameters and detail is filled in as the design progresses from functional specifications to detailed equipment specifications. Thus I would not expect the AP600 design control procedures to cover all the design processes on the AP1000.
>
> Of special concern is QA control of the overall plant parameters, both in terms of the design process by which they were obtained, and the design processes that use them as input. (Perhaps this question was dealt with in the pre-application phase, but in case not, I raise it here.) I believe the generation of overall plant

parameters, whether for a new plant design, an uprating, or other changes to an existing plant design, is typically very tightly controlled, with oversight by an interdisciplinary committee whose membership is established independently of any particular project.

An important question here that needs to be asked is whether there are additional oversight or formal procedures over and above those addressed in the AP600 QA plan that would be appropriate for an uprating in that they would assure that the parameters are communicated to the affected functional design areas, would see that the right agents identify the specific changes that are required, and would keep track of their implementation. My worry is that due to its special nature (the criterion of keeping the AP600 design details as much as possible), the implementation of the AP1000 project plant parameters would really call for the additional oversight or the kinds of procedures applicable to an uprating.

If design control procedures intended for new plant designs were used in implementing the AP1000 plant parameters, rather than the design control procedures written to cover upratings, this raises a concern about the way that the AP600 information was used on the AP1000 project. This is because, for an uprating, the plant parameters are an input into a design process where an already existing plant is modified under the constraints of keeping much of the design unchanged. All kinds of QA design control questions arise in this case: for instance, who determines what information originally generated for the AP600 applies to the AP1000 or whether it needs to be reviewed? And who reviews it? Whose decision is final? It seems to me that the integrity of the design process relies upon keeping the design functions separate from project management functions. When a design group reports administratively to the project management and on a matrix basis to engineering management, the integrity of the design process depends upon the matrix connection being strong enough to ensure that technical aspects of management initiatives receive their due.

This kind of situation is not explicitly addressed in 10CFR50 Appendix B, but there is a statement on the general topic of who gets to decide such things in the event of design changes: "Design changes . . . shall be approved by the organization that performed the original design unless the applicant designates another responsible organization." Now, on the AP1000, where so many AP600 features are to be inherited, there is a kind of implicit change to an unspecified number of system capabilities in that the plant parameters have changed. Meeting the spirit of the subject criteria would mean that the judgement as to whether an AP600 design or document applies to the AP1000 or not should be made by those responsible for that design or document on the

AP600 design. Since the DCD references many AP600 documents, it is not always clear that the author of the AP600 document or design has approved its applicability to the AP1000. I think an important question is: who has determined that a certain AP600 document is applicable to the AP1000?

B. Organizational Differences Between AP600 and AP1000 affecting design control

The AP600 design control procedures reflected the involvement of ARC, the Advanced Reactor Corporation, a consortium of electrical utilities. I do not have access to the relevant procedures, but I recall from my previous involvement with the AP600 project that representatives of the ARC did have a formal role in the approval of design changes. Thus, beyond the straightforward point that the design control procedure for the AP1000 can not be exactly the same as the AP600 in terms of the letter of the law, there is the more significant point that the involvement of such an agency provided checks and balances on the AP600 project that may not exist on the AP1000 project.

There may be other organizational changes since the AP600 QA inspection was performed that affect the quality and the strength of the ties between technical and engineering design personnel in the AP1000 organization and the technical department managers reported to on a matrix basis. It would seem to me that these would need to be examined in order for the NRC's review of Quality Control to conclude that the assurance provided by the procedure when applied on the AP1000 project is the same as the assurance it provided on the AP600 design.

C. It seems late in the process should problems be detected

The NRC Letter accepting the Design Certification application dated July 12 2002 (Reference 4) stated that QA inspection would be done "as needed".

The fact that a QA inspection is an open item is reassuring in that it means this item will be tracked. However, the fact that it is an open item is cause for concern as to whether the appropriate inspections were performed "as needed" in the area of review of the fluid systems design. It is a concern because of the possibility that the QA inspection might reveal that some design activities need to be performed. Should these design activities result in design changes, it is very late in the process. Further, it seems that the comprehensive fluid system design of the AP1000 plant --- deriving the basic plant parameters from the AP600 design --- as well as the design details of specific systems appropriately designed for the AP1000, should be covered by this item.

The issue here is the QA control on information that is in the DCD: was there design control guaranteeing that the generation and implementation of the basic plant parameters for the AP1000, as well as the fluid systems design details (e.g., equipment parameters, piping size, valve specifications) were the result of design work of the appropriate kind (i.e., not merely preliminary sizing calculations), performed in a context where there was proper control of design information input into the design process, and where there were the appropriate checks and balances that provide assurance of the integrity of the design process? If it turns out there were areas where it was not, it seems there is not a lot of time to allow review and comment on the required design changes if the design certification schedule is to be adhered to.

3. Additional Remarks -- Schedule for Resolution of DSER Open Items and Role of Public Review and Participation

In general, the AP1000 design certification schedule seems to permit a number of potentially significant open items at the DSER stage. This limits the time available for review and comment by the public after the open item is resolved. Considering the finality of a design certification, it seems that the time available for public review and comment should not be abbreviated in the only stage provided for it.

Respectfully submitted,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor of
Philosophy
Duke University, Durham, NC

Attachment I Email correspondence Sterrett to NRC dated September 15, 2003.

Attachment II Draft Text of Comments Read at 501st ACRS Meeting --Dr. S. G. Sterrett

References:

1. AP1000 Draft Safety Evaluation Report (DSER)
Chapter 17 "Quality Assurance"

2. SECY-02-059 April 1, 2002
"Use of Design Acceptance Criteria for the AP1000 Standard Plant Design"
William D. Travers to The Commissioners

3. Email S. G. Sterrett to J. N. Wilson,
"AP1000 Review/ 10CFR Part 52 Process"
Wednesday, July 10, 2002

4. Letter July 12, 2002 James E. Lyons to W. E. Cummins
"AP1000 Design Certification Review Schedule (TAC NO. MB4682)"

5. Letter May 27, 2003 James E. Lyons to W. E. Cummins
"Westinghouse AP1000 Draft Safety Evaluation Report
Potential Open Items Chapter 17 Quality Assurance"

6. Letter May 7, 2003 M. Bonaca to Nils J. Diaz
"Summary Report of 501st Meeting of the Advisory Committee
on Reactor Safeguards, April 10 - 12, 2003"

7. Draft text of comments by S. G. Sterrett at 501st ACRS Meeting
(Attachment II to this letter. No transcript of April 11th meeting was made; oral statement followed written draft closely)

8. Nuclear Regulatory Commission Policy Statement
"Enhancing Public Participation in NRC Meetings; Policy Statement"
Federal Register May 28, 2002 (Volume 67, Number 102; Page 36920-36924)

9. 10 CFR7.12 Public Participation in and public notice of advisory committee meetings.

10. Email J. N. Wilson to S. G. Sterrett
"Re: Followup on Questions: AP1000 Review/ 10CFR Part 52 Process"
August 13, 2002.

11. Email S. G. Sterrett to L. J. Burkhart
"Thanks for RAIs"
September 15, 2002
(included in Attachment I to this letter)

12. Email S. G. Sterrett to J. N. Wilson
"Piping Layout L/D Criteria for Fluid System Performance"
September 15, 2002
(included in Attachment I to this letter)

cc:

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Mr. Joseph Colaccino, Project Manager, AP1000 Licensing
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Ms. Joelle Starefos, Project Manager, AP1000 Licensing
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ATTACHMENT I

Emails Sterrett to NRC (L. J. Burkhart; J. N. Wilson) dated September 15, 2003

This first email clarifies a question sent earlier to Jerry Wilson and discussed by telephone with Larry Burkhart . In it, I explain why the question is not addressed by the considerations provided in the rationale used in accepting DAC for the AP1000, nor covered by the RAIs sent to Westinghouse as of that date. The email below is followed by a longer one addressed to Jerry Wilson and cc'd to Larry Burkhart and Marsha Gamberoni.

Date: Sun, 15 Sep 2002 16:21:36 -0400 (EDT)
From: sterrett@duke.edu
To: Lawrence Burkhart <LJB@nrc.gov>
Subject: Thanks for RAIs

Dear Larry,

I have looked over the RAIs, and don't see any that address the question I asked Jerry Wilson about paying attention to fluid system performance in doing the piping layout. The RAIs do mention thermal-hydraulic loads, but that isn't what I meant; thermal-hydraulic loads are still related to the mechanical loads on the piping and concern the piping structural-mechanical analyis.

What I meant is the fluid system performance -- flowrates, pressures and temperatures that are achieved by the combination of driving head and. fluid piping resistance. The fluid piping resistance is affected by the piping layout. In an email to Jerry Wilson, which I put you on cc for, and which I will send immediately after this one, there is more explanation. The bottom line is that even though the piping layout isn't final, the piping resistance criteria ("L/D criteria") for the AP1000 should be computed and provided at this point. In that email, following this one, there is also an explanation as to why the L/D criteria for the AP1000 will be different in many cases from the AP600.

In our conversation, you mentioned that the AP1000 is so similar to the AP600. That may be, but the question is, should the piping layout really be so similar? It is the fluid system's performance that sets the requirements of the design, and the layout has to meet those criteria. That's the point. One has to check, not just assume it will all turn out okay.

I imagine that there are people at the NRC whose reviews will address this, perhaps on a system-by-system basis. And whether or not the L/D criteria (piping resistance layout criteria) differ much for the AP1000 vis a vis the AP600 for a particular system may be a design detail. However, the overall point that L/D criteria for the AP1000 should be calculated at the DCD application stage is a plant-level issue. It's a very general point. In the email that follows, I explain why I think it is a policy issue about the new licensing process.

I am asking these questions as an individual member of the public, unaffiliated with any organization.

Sincerely,
Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
Durham NC 27708
sterrett@duke.edu
919-660-3054 (office)
919-660-3050 (receptionist)

.....

The "email that follows" referred to in the above email is appended below. It is: Email dated September 15, 2002 from Sterrett to NRC staff (Jerry Wilson, cc to Larry Burkhart and Marsha Gamberoni)

.....

Date: Sun, 15 Sep 2002 16:46:21 -0400 (EDT)
From: sterrett@duke.edu
To: Jerry Wilson <JNW@nrc.gov>
Cc: LJB@nrc.gov, MKG@nrc.gov, sterrett@duke.edu
Subject: Piping Layout L/D Criteria for Fluid System Performance

To: Jerry Wilson, Senior Policy Analyst, NRC
cc: Larry Burkhart, AP1000 Project Manager, NRC
Marsha Gamberoni, Deputy Director, New Reactor Licensing

Subject: Piping Layout L/D Criteria for Fluid System Performance

Dear Jerry,

In a previous email, you responded to a question I asked regarding whether proof-of-design calculations of fluid system performance were performed for the AP1000. This email is to (a.) clarify the question I was asking, and (b) explain why I think L/D criteria is an issue of policy regarding the 10CFR52 design process, not merely a minor design or schedule detail.

In spite of the length of this email, the two points are simple; I am just including the text of the things I reference to avoid any possible ambiguity.

(a) Clarification of Question Re: Calculations Supporting Fluid System Performance

To recapitulate, the question I asked (July 10) was:

``1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?" [excerpt from email of July 10, 2002 Sterrett to Wilson]

In your response (August 13) you explained why proof-of-design calculations for fluid system performance were _not_ expected to have been performed at the time of DCD submittal:

``With regard to question #1, the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design

certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design andconstruction activities [#1(iii)]. ``
[excerpt from email of August 13, 2002 Wilson to Sterrett]

I would like here to clarify my earlier question: by ``proof-of-design calculations", I was referring to proof-of-design calculations for fluid system performance, rather than to piping design calculations. By ``piping design calculations", I assume you are referring to calculations concerning things such as piping stress, fatigue and mechanical loads. But, of course, the proper flow performance of fluid systems sets another kind of criterion: that is, in addition to the criteria that aim to ensure that the structural/mechanical behavior of the piping is acceptable, piping layout activities also have to take into account criteria that ensure that the piping flow resistances will result in the flows through the system called for by the fluid system design (and for which the design of numerious interfacing systems may take credit). In addition, pressures (and, sometimes, temperatures) in the system at various key points, such as at heat exchangers and control valves, are influenced by the piping layout. And here i am including normal system operation. Your response to the question of whether there have been proof-of-design calculations for fluid flow performance was that you did not expect them to be done, because the piping layout wasn't final.

However, if the piping layout isn't far enough along to permit proof-of-design calculations to be performed, the calculations related to fluid system performance should still be done -- the only difference is that they would result in piping fluid flow resistance criteria, or ``L/D criteria."

From your response, I wasn't sure if ``L/D criteria", or piping fluid resistance criteria were included in the DAC. After looking at various meeting transcripts and the RAIs regarding DAC attached to the meeting notice for September 9, 2002 (Reference 3), it doesn't appear to me that the ``L/D criteria" are addressed in these places.

So, the question is whether L/D criteria have been provided for the AP1000 fluid systems. Even if the piping layout for the AP1000 were _exactly_ the same as the AP600 layout, new L/D criteria would need to be calculated for the AP1000. For, anytime the design flowrate for a system changes, the

L/D criteria need to be re-calculated, since piping flow resistances vary with flowrate. Even for those systems, if any, where the fluid flowrate of the system is exactly the same for the AP1000 as it was for the AP600, there is still the question whether there are differences in the inlet or outlet pressures -- i.e., in the pressure in the system or piece of equipment to which it connects and from which the fluid enters the fluid system or to where it discharges. Hence the fluid flow performance would be different for the same layout. Thus, the layout criteria would differ between the AP1000 and the AP600 for cases where a system's inlet or discharge pressures differ. (An example here of such a difference in the AP1000 is the significant change in main steam pressure: obviously L/D criteria will be different between the AP600 and the AP1000 for the inlet piping to the steam relief valves, for example.)

Thus, to rephrase the question in my July email:

``(i) Are there supposed to be signed-off, L/D criteria and supporting calculations, (using the AP1000 fluid system functional requirements and equipment parameters) for the system flows and pressures reported for all the systems in the AP1000 DCD submitted? Or, L/D criteria for the piping associated with the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves,etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?"

This is the question I have now, given your repsonse that you did not expect ``proof-of-design calculations" to be performed due to the fact that the piping layout is not final at the DCD application stage.

(b) Previous process versus new 10CFR52 process

It is simply good common sense to provide L/D criteria for the preliminary piping layout, in order to have confidence that when the final piping layout is in fact completed, the design will be such that the fluid performance functional requirements of the system are in fact met, avoiding major changes to the preliminary layout. As you may be aware, this is the process that was followed on the Westinghouse standard plants.

As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

Certainly the ITAACs and other operational tests are going to provide a checkpoint where deficiences in system performance are found, but, I trust, it certainly isn't the intent of the new 10CFR52 process to increase the surprises encountered during operational testing! I assume that everyone agrees that the intent is to have confidence that the certified design results in fluid systems that meet their functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

Thus, it seems clear that the L/D criteria should be provided at the DCD submittal stage in the 10CFR52 process. It's an issue of policy because, otherwise, the 10CFR52 process would result in the NRC certifying a design for which there was less confidence in the design than existed under the old process at a comparable stage.

It would be great to hear the answer that L/D criteria for all the AP1000 systems have in fact been calculated and provided, but, in any case, I look forward to your reply. As with my previous inquiry, I am asking these questions as an individual member of the public, unaffiliated with any organization.

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ATTACHMENT II

Draft of Remarks by Dr. S. G. Sterrett - 501st ACRS meeting, April 11th, 2003, Rockville, MD

I'm Susan G. Sterrett. I am currently a professor at Duke University in Durham, North Carolina. I should perhaps mention that, prior to my academic career, I worked as a design engineer in the commerical nuclear power plant industry, including on fluid system design of the AP600 and EPP plants in the mid-nineties. I am making these remarks as a member of the public, unaffiliated with any organization.

I'm here today because I have some questions about the NRC's review of the AP1000. Put briefly, my question is whether the NRC verifies or asks for proof that the system parameters reported in the AP1000 design certification application (and used in the analyses) are actually justified by a detailed design, as opposed to the AP1000 system designs being at the stage of conceptual system design or justified only by preliminary equipment sizing calculations. I'd like a few minutes to explain the relevance and the significance of the question.

According to the rules under which the AP1000 is being licensed by the NRC, the level of design information required in a design certification application is, with a few explicit exceptions, the level of information that was required at the operating license stage under the previous two-step licensing process. I think this requirement makes sense, too, inasmuch as what the NRC is licensing in approving the AP1000 is an actual plant design that is certified to be constructed and operated.

In following some of the AP1000 licensing activities via the NRC's website, I have noticed that much is often made of the similarities between the AP1000 systems and the AP600 systems. This can be misleading: the performance of the various fluid systems in the plant -- that is, the flows, temperatures, and pressures that obtain at various points within a system are affected by many kinds of differences in a plant design. As I am sure everyone here realizes:

--- Anytime a system flowrate changes, pressure drops in the system will change.

--- Likewise, anytime the pressure at some point in a system changes, flowrates in it or some other system can be affected.

--- Thus, even for those systems that are exactly the same physically speaking (i.e., same pipe size and layout) for the AP1000 as for the AP600, there is still the question of whether there are differences in the inlet or outlet pressures in a system or piece of equipment to which it connects. Different inlet or outlet pressures will result in differences in fluid system performance.

For example, suppose the main steam system pressure is different on the AP1000; then, on the AP1000, there would be a different driving head for lines connected to it than there was on the AP600. So, even if the system hardware and layout of a system connected to the main steam system, say, is exactly the same on the AP1000 as it was for the AP600, the resulting values of major fluid system parameters -- e.g., the mass and volume flowrates and the pressures that result -- could be quite different. Obviously the effects on things like the flow capability of relief valve piping and valve arrangements would need to be looked at. Accomodating these changes could require resizing piping or control valves in order to achieve the flowrate claimed for the system.

I've given the main steam system as an example, but the general point holds for every system in the plant. To infer from the fact that the hardware and layout on an AP1000 system is exactly the same as on the AP600, to the conclusion that the performance is the same, is incorrect. The various AP1000 analyses now under review are only as valid as the assumptions made in them about the performance of the plant systems.

What does this point mean for the review of the AP1000 design, which makes frequent appeal to the certified AP600 design? In many aspects of the safety analyses, the NRC has been very alert to the differences between the AP1000 and the AP600. The point of my examples is that this awareness ought to be extended to plant fluid system performance, specifically, that some reassurances should be sought that the fluid system design details for all the plant systems have been properly attended to, and that, given that the level of detail required at this stage is supposed to be the same as that at the operating license stage, these should not be just preliminary sizing calculations. I worry about the complacency with which the AP600 design is referenced in justifying the AP1000 system designs.

The AP1000 is sometimes referred to as an uprating of the AP600 design. Of course this would be significantly larger than any uprating that the NRC has licensed so far, and of course it differs from most upratings in that there is no AP600 operating experience to draw upon. To the extent that thinking of the AP1000 as an uprating of the AP600 is appropriate, however, it would make sense to require that all the plant system reviews that would be required for an extended power uprating be performed for the AP1000. As there is now a draft review standard for extended power uprates that could be used to guide such a review of the AP1000 (RS-001, dated December 2002), this seems a natural thing to do. I wonder whether there has in fact been a review of this sort for the AP1000. So let me ask: has there?

For those systems whose layout is finalized at this stage of the AP1000 design certification application, there should be formally signed-off engineering calculations justifying the claims that the AP1000 system flow, temperature, and pressure parameters will actually be achieved using the AP1000 equpment and layout. These are often referred to as fluid system "proof-of-design" calculations. I gather from the NRC's approval of the use of DAC (design acceptance criteria) for structural piping analysis on the AP1000 that

there may be some systems for which the layout details will not be completed until after design certification. For those systems, what is needed as far as ensuring proper fluid system performance is to provide layout criteria related to the piping flow resistance, so that the fluid flowrates claimed for the system will actually be achieved. Such criteria are commonly called "L/D criteria" and are considered part of the fluid system design. In fact, for the Westinghouse standard plant designs licensed under the previous two-step process, L/D criteria were provided for various fluid systems prior to construction so that the architect engineer could properly perform the piping layout. As I see it, at least this level of design detail is required at the time of the DCD submittal.

Why not just rely on the ITAACs (Inspections, Tests, Analysis, and Acceptance Criteria) to provide such reassurance? Certainly the ITAACs and other operational tests provide a checkpoint where some deficiences in the plant design would show up. However, I trust that it isn't the intent of ITAACs to relieve the designer of the responsibility of the engineering design work of designing the plant systems so that the system parameters crucial to safety are achieved. Certainly increasing the number of surprises encountered during plant testing is not part of the intent of the new one-step licensing process! I assume that everyone agrees that the intent of design certification is to provide confidence that the certified design will result in fluid systems that meet their stated functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

In conclusion, I am asking whether the review of the AP1000 design has included ensuring that the design details upon which the analyses that the ACRS has been reviewing depend, have in fact been attended to. In particular, I think it is clear that L/D criteria should be provided at this stage for systems whose layout is to be finalized at a later date, and "proof-of-design" calculations be provided for those whose layout is determined at this stage. Otherwise, there is no assurance that the analyses you are reviewing so carefully and thoughtfully apply to the plant design you are certifying.

Thank you for listening.

Respectfully submitted,

Dr. Susan G. Sterrett
Duke University
Durham, NC 27708
sterrett@duke.edu
919-660-3054 (office & voicemail)
919-660-3050 (receptionist)

FROM
Barnett / PHILOSOPHY
Duke Univ.
Durham NC ZIP 27708

TO
Joelle Starefos
U.S. NRC
Washington DC
ZIP 20555-0001

BY AIR MAIL
par avion
Royal Mail

4D9A

TO: John Segala

Enclosed are hard copies of signature

of pdf files sent previously by email.

Regards

S Stewart.

Department of Philosophy
201C West Duke Building
Duke University
Durham, NC
sterrett@duke.edu

July 23, 2003

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Question on AP1000 Containment Systems/
Effect of heat from solar radiation on concrete shield building and on PCS (Passive Containment Cooling System) water storage tank contents

The purpose of this letter is to put into writing a question about the AP1000 safety system design that I discussed on the telephone with you (John Segala) a few weeks ago. I am asking this question as a member of the public, unaffiliated with any organization.

The topic is the effect of the heat of solar radiation on the Passive Containment Cooling System (PCS): the question is whether (and if so, how) the heat of solar radiation is taken into account in the AP1000 design of the Passive Containment Cooling System.

Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, it seems to me that its effect on:

(i) the temperature of the concrete shield building, whose walls form the air passages relied upon for the efficacy of cooling by the PCS, and
(ii) the temperature in the PCS water storage tank, and

ought to be addressed by the AP1000 design. The effect will vary with geographical location (e.g., the relevant coefficients tend to be larger for sites near the equator than for those far away from the equator) and will depend upon the surface geometry and the properties of the material and/or the surface coatings used.

I do not see this accounted for explicitly in the DSER. However, it is clear that, unless it is shown to make only a negligible contribution, this heat source is relevant to the design of the safety features of the plant. As described in the DSER, for long-term cooling after a design basis accident, the PCS uses the water in the PCS water storage tank and the passage of air in the spaces between the primary steel containment and the concrete shield building to cool and depressurize the containment. It is the means by which heat is transferred from the reactor to the ultimate heat sink in the event of a design basis accident. The question does not arise for operating PWR plant designs, since those designs do not use the method of containment cooling employed on the AP1000.

If in fact the effect of the heat of solar radiation is not determined to be negligible, the assumptions regarding PCS water storage tank temperature and PCS efficacy in heat removal used in the AP1000 PRA (Probabilistic Risk Assessment) Report should also be examined to see if the heat of solar radiation was taken into account.

I look forward to your reply. Should you wish to contact me, the best way is by email at sterrett@duke.edu.

Sincerely,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor
Department of Philosophy
Duke University, Durham, NC

References: 1. AP1000 Draft Safety Evaluation Report (DSER)
Section 6.2 "Containment Systems"
(in Chapter 6 "Engineered Safety Features"
ADAMS accession number ML031671499)
June 16, 2003 (available on ADAMS 07/01/03)

Department of Philosophy
201C West Duke Building
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July 30, 2003

To: ACRS Subcommittee on Future Plant Designs

Subject: AP1000 Fluid Systems Design & QA Procedures

1. Purpose

At the July 18th Meeting of the ACRS Subcommittee Meeting on Future Plant Designs held in Monroeville, Pennsylvania, I took advantage of the opportunity afforded members of the public to remark on a topic discussed at that meeting: the NRC's review of QA control of processes used in the AP1000 design currently under licensing review. At that meeting, the NRC staff (Ms. Joelle Starefos) responded by saying that the NRC staff would reply in a letter.

As I did not know which open items were going to be discussed, my remarks were impromptu and I did not have a prepared text. The purpose of this letter is to provide a written statement of the concerns I expressed at that meeting, which made reference to concerns I had expressed earlier, at the 501st ACRS meeting. (References 6 and 7) For completeness, I also include a chronology of the questions and responses already received from other members of the NRC staff in sections 2.1 and 2.2 below. The statement incorporating the concerns I raised at the July 18th, 2003 ACRS meeting appears in section 2.3 below.

According to the policy on Advisory Committee Meetings (10CFR7.12 (b)), " Any member of the public who wishes to do so shall be permitted to file a written statement with an NRC advisory committee regarding any matter discussed at a meeting of the committee." I am filing this letter as such a written statement, as a member of the public, unaffiliated with any organization.

I am currently a professor of philosophy at Duke University in Durham, North Carolina. Prior to my academic career, I worked in the nuclear power industry, including a few years in the mid-nineties on the AP600 fluid systems design as a consultant to Westinghouse. My involvement with the nuclear power industry ended in early 1998 when I began my academic career in philosophy full-time.

I began following the NRC licensing review of the AP1000 in mid-2002 by reading the information publicly available via the NRC's electronic reading room. My knowledge about the AP1000 design and licensing review comes from reading these publicly available documents. I decided to make use of the provisions for public participation in the AP1000 licensing process (References 8, 9) in part because, according to the 10CFR52 licensing process under which the AP1000 is being licensed, opportunities for public participation are extremely limited once design certification is granted. Thus, as a member of the public, providing this input about the AP1000 design and licensing review is a "now-or-never" situation.

2. Chronology of Questions and Statements

2.1 Two Issues Raised with NRC Staff in July 2002 -- Systems Design & AP1000 QA

In mid-2002 (July 10), after the AP1000 design certification submittal, I asked questions about the general 10CFR52 process and the AP1000 licensing review in particular in an email exchange with Jerry Wilson of the NRC. (Reference 3) One question was: what ensures that, by the close of the licensing process, the design process for some components was not still at the stage wherein only preliminary sizing of components had been performed.? In particular, I asked:

> "(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?
>
> (ii) Does the submittal of the DCD imply that the things in (i) are done?
>
> (iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur? [Reference 3]

In reply, Jerry Wilson cited 10 CFR 52.47(a)(2), and explained that the level of detail required for a DCD (design control document) submittal was sufficient information to support a safety finding in any technical area, and that this level of information corresponds to the level that, under the previous two-step 10CFR50 process, was available at the operating license stage. However, he qualified this by saying that, since design acceptance criteria were to be used in the "piping design area", that "we [NRC staff] didn't expect that signed-off, proof-of-design calculations will need to be completed to support construction." [Reference 10]

This reply made me wonder whether the NRC was in practice approving delaying performing the proof-of-design calculations for system flows, temperatures, and pressures to later stages as well, without explicitly meaning to do so. The rationale for accepting the (DAC) approach for "the piping design area", which was articulated in SECY-02-0059 [Reference 2], was based on the ability to specify piping stress and piping structural analysis acceptance criteria; that rationale does not support delaying the fluid system design to the later COL stage. It is in fact important that the finalized fluid system design be performed prior to or in conjunction with specifying pipe sizes and valve characteristics to be used in the final design. It is always possible to use preliminary calculations to size piping, valves and equipment in order to obtain values to be placed in a design certification application. Proof-of-design calculations differ from preliminary sizing calculations in that they are a set of calculations chosen to take into account all the system criteria that must be met in order for the system to perform the capabilities that are claimed for it. As explained in followup emails, in lieu of using complete piping layout information as input to "proof-of-design" calculations, L/D criteria can be specified based upon "proof-of-design" calculations; these can then be used in piping layout to ensure that the considerations underlying the "proof-of-design" calculations are met. This kind of criteria would be the fluid systems design analogue of piping DAC. My worry was that unless some attention was paid to ensuring that the "proof-of-design" kinds of analyses are done, whether in the form of calculations using "as-built" data or in the form of L/D layout criteria, that the NRC would actually be certifying a design that was based on preliminary sizing considerations rather than on proof-of-design calculations that document that the various fluid systems have actually been designed to provide the system capabilities claimed for them. Since such fundamental things as the classification of initiating events assumes that even many non-safety systems actually do provide the capabilities attributed to them by the design documents, the issue is related to the safety basis of the plant even for the design of non-safety systems.

The problem is particularly acute on the AP1000 because much of the AP1000 makes reference to AP600 documentation. This makes it especially difficult to discern whether a particular pipe size and equipment parameter is merely inherited from the AP600 design or whether final "proof-of-design" kinds of calculations specific to the AP1000 have been performed to support it. Further, there is the danger of making the false assumption that if a system configuration has not changed, the fluid system performance has not changed either. This is not always true; a system temperature or pressure in one system can affect the fluid system performance in another. Thus reasoning about the similarity to AP600 layout that applies for piping stresses and loads does not necessarily extend to fluid systems performance. A comprehensive review of the AP1000 fluid systems designs is called for, similar to the kind of review appropriate when reviewing an extended power uprating.

In further email exchanges with the NRC (Jerry Wilson and Larry Burkhart), I tried to clarify my first question about the fluid system design. These emails are references 11 and 12 and are attached to this letter.

The second question I asked in my July 10, 2002 email to Jerry Wilson concerned the QA program covering the engineering design processes. I wrote there:

> The AP1000 design processes cannot be exactly the same as for the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case. Here's why I think it is a very important issue:
>
> The AP1000 DCD claims that many of the AP600 documents are applicable to the AP1000. The crucial question is, who (in Westinghouse) makes the determination that a particular AP600 document does in fact apply for the AP1000? It seems to me crucial that the same engineering functional group (preferably the same individual engineer) that was responsible for producing and signing off the document for the AP600 pass judgement on its applicability to the AP1000. Is there a guarantee of this? If not, I suggest that there be such a requirement and that it be made explicit.
>
> Otherwise, there is a gigantic loophole that can be used to circumvent the whole intent of the quality assurance provisions covering the engineering design process -- i.e., otherwise, individuals in other functional groups such as marketing, licensing, or project management, can circumvent the engineering process by simply stating that a certain AP600 engineering report or design document applies to the AP1000. (I don't think I need to explain the conflict of interest involved were this to be permitted.) [Sterrett to Wilson July 10, 2002 Reference 3]

Jerry Wilson replied to this question as well [Reference 10]. He referred me to the NRC's letter on the AP1000 Design Certification Review Schedule [Reference 4], and explained that the NRC staff did plan to inspect Westinghouse's implementation of its design control program for the AP1000 design "in the future." Mr. Lyons's letter of July 12, 2002 stated that the NRC planned to perform these inspections "as necessary", adding that "These inspections will be coordinated with Westinghouse to support the design certification schedule." [Reference 4 , p. 4]

2.2 Clarification & Discussion of Issues with NRC Staff -- December 2002

In December 2002 Larry Burkhart, who was then the NRC's AP1000 Project Manager, held a telecon to discuss my questions. Jerry Wilson, Dave Terao, and other members of the NRC technical staff were present. In this telephone conference call, I clarified my question about fluid system design. Nothing was resolved other than the clarification of the question. However, it was agreed that we should get in contact again to revisit the issues closer to the time the DSER was about to be issued.

Subsequently, after unsucessful attempts to reach Larry Burkhart in March 2003, I learned that there had been a change in management of the NRC's AP1000 Licensing team. The entire team had been replaced with the current team (John Segala, Joelle Starefos and Joseph Colaccino).

2.3 Concerns Raised at ACRS Meetings (April & July 2003)

Soon thereafter, I requested time to speak at the 501st ACRS meeting held on April 11th, where I read a statement presenting the first question I had raised in the original July 10th email. My oral presentation followed the draft text of my comments fairly closely [Reference 7 , included as Attachment II to this letter] and was included in the summary report for the 501st ACRS meeting [Reference 6].

The second question raised in my original email (regarding quality control procedures governing the design processes used in the AP1000) was brought up at an ACRS Subcommittee on Future Plant Designs held on July 18th, 2003, shortly after the NRC issued the Draft Safety Evaluation Report (DSER), and almost a year after I sent the original email expressing concerns about the QA process on the AP1000.

The list of AP1000 DSER Open Items included Open Item17.3.2-2, which reads in part:

> Westinghouse stated that a project-specific quality control plan was used to implement the requirements of the Westinghouse QMS program. The staff plans to conduct an inspection of the implementation of the project-specific quality plan to verify that design activities conducted for the AP1000 project complied with the Westinghouse QMS and the requirements of 10CFR Part 50, Appendix B. [Reference 5]

However, the "project-specific quality control plan" Westinghouse refers to is just the AP600 plan. Although Open Item 17.3.2-2 indicates "N/A" for the original RAI corresponding to the open item, there was an RAI about the AP1000-specific quality assurance plan [RAI 260.008-1 dated May 13, 2003]. Westinghouse's response to that RAI had been to claim that the AP600 document applied to the AP1000. The rationale given in Westinghouse's response to RAI 260.008-1 was:

> As the DCD identifies: " The plan ... is applicable to work performed for the AP1000 design." Westinghouse considers that it has identified a project specific quality plan (i. e., WCAP- 12600) for the AP1000 design.

There is also a discussion of the use of the AP600 project quality plan in Chapter 17 of the DSER, which states:

> A project-specific quality plan was issued to supplement the quality management system document and the topical reports for design activities affecting the quality of structures, systems, and components for the AP6OO project . . . This plan addresses the NQA-1-1989 edition through NQA-lb-1991 addenda and is applicable to work performed for the AP1000 design. [Reference 1, page 17-1]

These statements raise concern, for the reasons mentioned in my original July 10, 2002 email and excerpted in section 2.1 above. When I attended the ACRS Subcommitte Meeting on Future Plant Designs held on July 17th and 18th, I did not anticipate that the subject open item would be mentioned, and did not request time to speak beforehand. However, when I saw that the NRC's presentation included mention of the issue of an inspection of Westinghouse's QA plan during the meeting, I asked to make some impromptu remarks along the lines of the concern raised in my email. There was not time to gather the previous correspondence, relevant Open Items, RAIs, and RAI responses at that time. Therefore, I provide a more complete statement of the situation and my concerns about it here.

My concerns regarding QA of the AP1000 design process are:

A. Integrity of design process for the singular kind of project that the AP1000 is

> The kind of process by which the AP1000 design was produced resembles an uprating in some ways, in spite of the fact that it is not regarded as an uprating. That is, one constraint was to use the AP600 design details insofar as possible. An uprating involves activities and considerations not addressed by the kind of design control procedures intended to address design of a plant where the design process starts with the specification of plant parameters and detail is filled in as the design progresses from functional specifications to detailed equipment specifications. Thus I would not expect the AP600 design control procedures to cover all the design processes on the AP1000.
>
> Of special concern is QA control of the overall plant parameters, both in terms of the design process by which they were obtained, and the design processes that use them as input. (Perhaps this question was dealt with in the pre-application phase, but in case not, I raise it here.) I believe the generation of overall plant

parameters, whether for a new plant design, an uprating, or other changes to an existing plant design, is typically very tightly controlled, with oversight by an interdisciplinary committee whose membership is established independently of any particular project.

An important question here that needs to be asked is whether there are additional oversight or formal procedures over and above those addressed in the AP600 QA plan that would be appropriate for an uprating in that they would assure that the parameters are communicated to the affected functional design areas, would see that the right agents identify the specific changes that are required, and would keep track of their implementation. My worry is that due to its special nature (the criterion of keeping the AP600 design details as much as possible), the implementation of the AP1000 project plant parameters would really call for the additional oversight or the kinds of procedures applicable to an uprating.

If design control procedures intended for new plant designs were used in implementing the AP1000 plant parameters, rather than the design control procedures written to cover upratings, this raises a concern about the way that the AP600 information was used on the AP1000 project. This is because, for an uprating, the plant parameters are an input into a design process where an already existing plant is modified under the constraints of keeping much of the design unchanged. All kinds of QA design control questions arise in this case: for instance, who determines what information originally generated for the AP600 applies to the AP1000 or whether it needs to be reviewed? And who reviews it? Whose decision is final? It seems to me that the integrity of the design process relies upon keeping the design functions separate from project management functions. When a design group reports administratively to the project management and on a matrix basis to engineering management, the integrity of the design process depends upon the matrix connection being strong enough to ensure that technical aspects of management initiatives receive their due.

This kind of situation is not explicitly addressed in 10CFR50 Appendix B, but there is a statement on the general topic of who gets to decide such things in the event of design changes: "Design changes . . . shall be approved by the organization that performed the original design unless the applicant designates another responsible organization." Now, on the AP1000, where so many AP600 features are to be inherited, there is a kind of implicit change to an unspecified number of system capabilities in that the plant parameters have changed. Meeting the spirit of the subject criteria would mean that the judgement as to whether an AP600 design or document applies to the AP1000 or not should be made by those responsible for that design or document on the

AP600 design. Since the DCD references many AP600 documents, it is not always clear that the author of the AP600 document or design has approved its applicability to the AP1000. I think an important question is: who has determined that a certain AP600 document is applicable to the AP1000?

B. Organizational Differences Between AP600 and AP1000 affecting design control

The AP600 design control procedures reflected the involvement of ARC, the Advanced Reactor Corporation, a consortium of electrical utilities. I do not have access to the relevant procedures, but I recall from my previous involvement with the AP600 project that representatives of the ARC did have a formal role in the approval of design changes. Thus, beyond the straightforward point that the design control procedure for the AP1000 can not be exactly the same as the AP600 in terms of the letter of the law, there is the more significant point that the involvement of such an agency provided checks and balances on the AP600 project that may not exist on the AP1000 project.

There may be other organizational changes since the AP600 QA inspection was performed that affect the quality and the strength of the ties between technical and engineering design personnel in the AP1000 organization and the technical department managers reported to on a matrix basis. It would seem to me that these would need to be examined in order for the NRC's review of Quality Control to conclude that the assurance provided by the procedure when applied on the AP1000 project is the same as the assurance it provided on the AP600 design.

C. It seems late in the process should problems be detected

The NRC Letter accepting the Design Certification application dated July 12 2002 (Reference 4) stated that QA inspection would be done "as needed".

The fact that a QA inspection is an open item is reassuring in that it means this item will be tracked. However, the fact that it is an open item is cause for concern as to whether the appropriate inspections were performed "as needed" in the area of review of the fluid systems design. It is a concern because of the possibility that the QA inspection might reveal that some design activities need to be performed. Should these design activities result in design changes, it is very late in the process. Further, it seems that the comprehensive fluid system design of the AP1000 plant --- deriving the basic plant parameters from the AP600 design --- as well as the design details of specific systems appropriately designed for the AP1000, should be covered by this item.

The issue here is the QA control on information that is in the DCD: was there design control guaranteeing that the generation and implementation of the basic plant parameters for the AP1000, as well as the fluid systems design details (e.g., equipment parameters, piping size, valve specifications) were the result of design work of the appropriate kind (i.e., not merely preliminary sizing calculations), performed in a context where there was proper control of design information input into the design process, and where there were the appropriate checks and balances that provide assurance of the integrity of the design process? If it turns out there were areas where it was not, it seems there is not a lot of time to allow review and comment on the required design changes if the design certification schedule is to be adhered to.

3. Additional Remarks -- Schedule for Resolution of DSER Open Items and Role of Public Review and Participation

In general, the AP1000 design certification schedule seems to permit a number of potentially significant open items at the DSER stage. This limits the time available for review and comment by the public after the open item is resolved. Considering the finality of a design certification, it seems that the time available for public review and comment should not be abbreviated in the only stage provided for it.

Respectfully submitted,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor of
Philosophy
Duke University, Durham, NC

Attachment I Email correspondence Sterrett to NRC dated September 15, 2003.

Attachment II Draft Text of Comments Read at 501st ACRS Meeting --Dr. S. G. Sterrett

References:

1. AP1000 Draft Safety Evaluation Report (DSER)
Chapter 17 "Quality Assurance"

2. SECY-02-059 April 1, 2002
"Use of Design Acceptance Criteria for the AP1000 Standard Plant Design"
William D. Travers to The Commissioners

3. Email S. G. Sterrett to J. N. Wilson,
"AP1000 Review/ 10CFR Part 52 Process"
Wednesday, July 10, 2002

4. Letter July 12, 2002 James E. Lyons to W. E. Cummins
"AP1000 Design Certification Review Schedule (TAC NO. MB4682)"

5. Letter May 27, 2003 James E. Lyons to W. E. Cummins
"Westinghouse AP1000 Draft Safety Evaluation Report
Potential Open Items Chapter 17 Quality Assurance"

6. Letter May 7, 2003 M. Bonaca to Nils J. Diaz
"Summary Report of 501st Meeting of the Advisory Committee
on Reactor Safeguards, April 10 - 12, 2003"

7. Draft text of comments by S. G. Sterrett at 501st ACRS Meeting
(Attachment II to this letter. No transcript of April 11th meeting was made; oral statement followed written draft closely)

8. Nuclear Regulatory Commission Policy Statement
"Enhancing Public Participation in NRC Meetings; Policy Statement"
Federal Register May 28, 2002 (Volume 67, Number 102; Page 36920-36924)

9. 10 CFR7.12 Public Participation in and public notice of advisory committee meetings.

10. Email J. N. Wilson to S. G. Sterrett
"Re: Followup on Questions: AP1000 Review/ 10CFR Part 52 Process"
August 13, 2002.

11. Email S. G. Sterrett to L. J. Burkhart
"Thanks for RAIs"
September 15, 2002
(included in Attachment I to this letter)

12. Email S. G. Sterrett to J. N. Wilson
"Piping Layout L/D Criteria for Fluid System Performance"
September 15, 2002
(included in Attachment I to this letter)

cc:

Mr. John Segala, Lead Project Manager, AP1000 Licensing
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Mr. Joseph Colaccino, Project Manager, AP1000 Licensing
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Ms. Joelle Starefos, Project Manager, AP1000 Licensing
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ATTACHMENT I

Emails Sterrett to NRC (L. J. Burkhart; J. N. Wilson) dated September 15, 2003

This first email clarifies a question sent earlier to Jerry Wilson and discussed by telephone with Larry Burkhart . In it, I explain why the question is not addressed by the considerations provided in the rationale used in accepting DAC for the AP1000, nor covered by the RAIs sent to Westinghouse as of that date. The email below is followed by a longer one addressed to Jerry Wilson and cc'd to Larry Burkhart and Marsha Gamberoni.

Date: Sun, 15 Sep 2002 16:21:36 -0400 (EDT)
From: sterrett@duke.edu
To: Lawrence Burkhart <LJB@nrc.gov>
Subject: Thanks for RAIs

Dear Larry,

I have looked over the RAIs, and don't see any that address the question I asked Jerry Wilson about paying attention to fluid system performance in doing the piping layout. The RAIs do mention thermal-hydraulic loads, but that isn't what I meant; thermal-hydraulic loads are still related to the mechanical loads on the piping and concern the piping structural-mechanical analyis.

What I meant is the fluid system performance -- flowrates, pressures and temperatures that are achieved by the combination of driving head and fluid piping resistance. The fluid piping resistance is affected by the piping layout. In an email to Jerry Wilson, which I put you on cc for, and which I will send immediately after this one, there is more explanation. The bottom line is that even though the piping layout isn't final, the piping resistance criteria ("L/D criteria") for the AP1000 should be computed and provided at this point. In that email, following this one, there is also an explanation as to why the L/D criteria for the AP1000 will be different in many cases from the AP600.

In our conversation, you mentioned that the AP1000 is so similar to the AP600. That may be, but the question is, should the piping layout really be so similar? It is the fluid system's performance that sets the requirements of the design, and the layout has to meet those criteria. That's the point. One has to check, not just assume it will all turn out okay.

I imagine that there are people at the NRC whose reviews will address this, perhaps on a system-by-system basis. And whether or not the L/D criteria (piping resistance layout criteria) differ much for the AP1000 vis a vis the AP600 for a particular system may be a design detail. However, the overall point that L/D criteria for the AP1000 should be calculated at the DCD application stage is a plant-level issue. It's a very general point. In the email that follows, I explain why I think it is a policy issue about the new licensing process.

I am asking these questions as an individual member of the public, unaffiliated with any organization.

Sincerely,
Susan G. Sterrett
Assistant Professor of Philosophy
Duke University
Durham NC 27708
sterrett@duke.edu
919-660-3054 (office)
919-660-3050 (receptionist)

The "email that follows" referred to in the above email is appended below. It is: Email dated September 15, 2002 from Sterrett to NRC staff (Jerry Wilson, cc to Larry Burkhart and Marsha Gamberoni)

Date: Sun, 15 Sep 2002 16:46:21 -0400 (EDT)
From: sterrett@duke.edu
To: Jerry Wilson <JNW@nrc.gov>
Cc: LJB@nrc.gov, MKG@nrc.gov, sterrett@duke.edu
Subject: Piping Layout L/D Criteria for Fluid System Performance

To: Jerry Wilson, Senior Policy Analyst, NRC
cc: Larry Burkhart, AP1000 Project Manager, NRC
Marsha Gamberoni, Deputy Director, New Reactor Licensing

Subject: Piping Layout L/D Criteria for Fluid System Performance

Dear Jerry,

In a previous email, you responded to a question I asked regarding whether proof-of-design calculations of fluid system performance were performed for the AP1000. This email is to (a.) clarify the question I was asking, and (b) explain why I think L/D criteria is an issue of policy regarding the 10CFR52 design process, not merely a minor design or schedule detail.

In spite of the length of this email, the two points are simple; I am just including the text of the things I reference to avoid any possible ambiguity.

(a) *Clarification of Question Re: Calculations Supporting Fluid System Performance*

To recapitulate, the question I asked (July 10) was:

``1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?" [excerpt from email of July 10, 2002 Sterrett to Wilson]

In your response (August 13) you explained why proof-of-design calculations for fluid system performance were _not_ expected to have been performed at the time of DCD submittal:

``With regard to question #1,
the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design

certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design andconstruction activities [#1(iii)]. ``
[excerpt from email of August 13, 2002 Wilson to Sterrett]

I would like here to clarify my earlier question: by ``proof-of-design calculations", I was referring to proof-of-design calculations for fluid system performance, rather than to piping design calculations. By ``piping design calculations", I assume you are referring to calculations concerning things such as piping stress, fatigue and mechanical loads. But, of course, the proper flow performance of fluid systems sets another kind of criterion: that is, in addition to the criteria that aim to ensure that the structural/mechanical behavior of the piping is acceptable, piping layout activities also have to take into account criteria that ensure that the piping flow resistances will result in the flows through the system called for by the fluid system design (and for which the design of numerious interfacing systems may take credit). In addition, pressures (and, sometimes, temperatures) in the system at various key points, such as at heat exchangers and control valves, are influenced by the piping layout. And here i am including normal system operation. Your response to the question of whether there have been proof-of-design calculations for fluid flow performance was that you did not expect them to be done, because the piping layout wasn't final.

However, if the piping layout isn't far enough along to permit proof-of-design calculations to be performed, the calculations related to fluid system performance should still be done -- the only difference is that they would result in piping fluid flow resistance criteria, or ``L/D criteria."

From your response, I wasn't sure if ``L/D criteria", or piping fluid resistance criteria were included in the DAC. After looking at various meeting transcripts and the RAIs regarding DAC attached to the meeting notice for September 9, 2002 (Reference 3), it doesn't appear to me that the ``L/D criteria" are addressed in these places.

So, the question is whether L/D criteria have been provided for the AP1000 fluid systems. Even if the piping layout for the AP1000 were _exactly_ the same as the AP600 layout, new L/D criteria would need to be calculated for the AP1000. For, anytime the design flowrate for a system changes, the

L/D criteria need to be re-calculated, since piping flow resistances vary with flowrate. Even for those systems, if any, where the fluid flowrate of the system is exactly the same for the AP1000 as it was for the AP600, there is still the question whether there are differences in the inlet or outlet pressures -- i.e., in the pressure in the system or piece of equipment to which it connects and from which the fluid enters the fluid system or to where it discharges. Hence the fluid flow performance would be different for the same layout. Thus, the layout criteria would differ between the AP1000 and the AP600 for cases where a system's inlet or discharge pressures differ. (An example here of such a difference in the AP1000 is the significant change in main steam pressure: obviously L/D criteria will be different between the AP600 and the AP1000 for the inlet piping to the steam relief valves, for example.)

Thus, to rephrase the question in my July email:

``(i) Are there supposed to be signed-off, L/D criteria and supporting calculations, (using the AP1000 fluid system functional requirements and equipment parameters) for the system flows and pressures reported for all the systems in the AP1000 DCD submitted? Or, L/D criteria for the piping associated with the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves,etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?"

This is the question I have now, given your repsonse that you did not expect ``proof-of-design calculations" to be performed due to the fact that the piping layout is not final at the DCD application stage.

(b) Previous process versus new 10CFR52 process

It is simply good common sense to provide L/D criteria for the preliminary piping layout, in order to have confidence that when the final piping layout is in fact completed, the design will be such that the fluid performance functional requirements of the system are in fact met, avoiding major changes to the preliminary layout. As you may be aware, this is the process that was followed on the Westinghouse standard plants.

As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

Certainly the ITAACs and other operational tests are going to provide a checkpoint where deficiences in system performance are found, but, I trust, it certainly isn't the intent of the new 10CFR52 process to increase the surprises encountered during operational testing! I assume that everyone agrees that the intent is to have confidence that the certified design results in fluid systems that meet their functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

Thus, it seems clear that the L/D criteria should be provided at the DCD submittal stage in the 10CFR52 process. It's an issue of policy because, otherwise, the 10CFR52 process would result in the NRC certifying a design for which there was less confidence in the design than existed under the old process at a comparable stage.

It would be great to hear the answer that L/D criteria for all the AP1000 systems have in fact been calculated and provided, but, in any case, I look forward to your reply. As with my previous inquiry, I am asking these questions as an individual member of the public, unaffiliated with any organization.

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ATTACHMENT II

Draft of Remarks by Dr. S. G. Sterrett - 501st ACRS meeting, April 11th, 2003, Rockville, MD

I'm Susan G. Sterrett. I am currently a professor at Duke University in Durham, North Carolina. I should perhaps mention that, prior to my academic career, I worked as a design engineer in the commerical nuclear power plant industry, including on fluid system design of the AP600 and EPP plants in the mid-nineties. I am making these remarks as a member of the public, unaffiliated with any organization.

I'm here today because I have some questions about the NRC's review of the AP1000. Put briefly, my question is whether the NRC verifies or asks for proof that the system parameters reported in the AP1000 design certification application (and used in the analyses) are actually justified by a detailed design, as opposed to the AP1000 system designs being at the stage of conceptual system design or justified only by preliminary equipment sizing calculations. I'd like a few minutes to explain the relevance and the significance of the question.

According to the rules under which the AP1000 is being licensed by the NRC, the level of design information required in a design certification application is, with a few explicit exceptions, the level of information that was required at the operating license stage under the previous two-step licensing process. I think this requirement makes sense, too, inasmuch as what the NRC is licensing in approving the AP1000 is an actual plant design that is certified to be constructed and operated.

In following some of the AP1000 licensing activities via the NRC's website, I have noticed that much is often made of the similarities between the AP1000 systems and the AP600 systems. This can be misleading: the performance of the various fluid systems in the plant -- that is, the flows, temperatures, and pressures that obtain at various points within a system are affected by many kinds of differences in a plant design. As I am sure everyone here realizes:

--- Anytime a system flowrate changes, pressure drops in the system will change.

--- Likewise, anytime the pressure at some point in a system changes, flowrates in it or some other system can be affected.

--- Thus, even for those systems that are exactly the same physically speaking (i.e., same pipe size and layout) for the AP1000 as for the AP600, there is still the question of whether there are differences in the inlet or outlet pressures in a system or piece of equipment to which it connects. Different inlet or outlet pressures will result in differences in fluid system performance.

For example, suppose the main steam system pressure is different on the AP1000; then, on the AP1000, there would be a different driving head for lines connected to it than there was on the AP600. So, even if the system hardware and layout of a system connected to the main steam system, say, is exactly the same on the AP1000 as it was for the AP600, the resulting values of major fluid system parameters -- e.g., the mass and volume flowrates and the pressures that result -- could be quite different. Obviously the effects on things like the flow capability of relief valve piping and valve arrangements would need to be looked at. Accomodating these changes could require resizing piping or control valves in order to achieve the flowrate claimed for the system.

I've given the main steam system as an example, but the general point holds for every system in the plant. To infer from the fact that the hardware and layout on an AP1000 system is exactly the same as on the AP600, to the conclusion that the performance is the same, is incorrect. The various AP1000 analyses now under review are only as valid as the assumptions made in them about the performance of the plant systems.

What does this point mean for the review of the AP1000 design, which makes frequent appeal to the certified AP600 design? In many aspects of the safety analyses, the NRC has been very alert to the differences between the AP1000 and the AP600. The point of my examples is that this awareness ought to be extended to plant fluid system performance, specifically, that some reassurances should be sought that the fluid system design details for all the plant systems have been properly attended to, and that, given that the level of detail required at this stage is supposed to be the same as that at the operating license stage, these should not be just preliminary sizing calculations. I worry about the complacency with which the AP600 design is referenced in justifying the AP1000 system designs.

The AP1000 is sometimes referred to as an uprating of the AP600 design. Of course this would be significantly larger than any uprating that the NRC has licensed so far, and of course it differs from most upratings in that there is no AP600 operating experience to draw upon. To the extent that thinking of the AP1000 as an uprating of the AP600 is appropriate, however, it would make sense to require that all the plant system reviews that would be required for an extended power uprating be performed for the AP1000. As there is now a draft review standard for extended power uprates that could be used to guide such a review of the AP1000 (RS-001, dated December 2002), this seems a natural thing to do. I wonder whether there has in fact been a review of this sort for the AP1000. So let me ask: has there?

For those systems whose layout is finalized at this stage of the AP1000 design certification application, there should be formally signed-off engineering calculations justifying the claims that the AP1000 system flow, temperature, and pressure parameters will actually be achieved using the AP1000 equpment and layout. These are often referred to as fluid system "proof-of-design" calculations. I gather from the NRC's approval of the use of DAC (design acceptance criteria) for structural piping analysis on the AP1000 that

there may be some systems for which the layout details will not be completed until after design certification. For those systems, what is needed as far as ensuring proper fluid system performance is to provide layout criteria related to the piping flow resistance, so that the fluid flowrates claimed for the system will actually be achieved. Such criteria are commonly called "L/D criteria" and are considered part of the fluid system design. In fact, for the Westinghouse standard plant designs licensed under the previous two-step process, L/D criteria were provided for various fluid systems prior to construction so that the architect engineer could properly perform the piping layout. As I see it, at least this level of design detail is required at the time of the DCD submittal.

Why not just rely on the ITAACs (Inspections, Tests, Analysis, and Acceptance Criteria) to provide such reassurance? Certainly the ITAACs and other operational tests provide a checkpoint where some deficiences in the plant design would show up. However, I trust that it isn't the intent of ITAACs to relieve the designer of the responsibility of the engineering design work of designing the plant systems so that the system parameters crucial to safety are achieved. Certainly increasing the number of surprises encountered during plant testing is not part of the intent of the new one-step licensing process! I assume that everyone agrees that the intent of design certification is to provide confidence that the certified design will result in fluid systems that meet their stated functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

In conclusion, I am asking whether the review of the AP1000 design has included ensuring that the design details upon which the analyses that the ACRS has been reviewing depend, have in fact been attended to. In particular, I think it is clear that L/D criteria should be provided at this stage for systems whose layout is to be finalized at a later date, and "proof-of-design" calculations be provided for those whose layout is determined at this stage. Otherwise, there is no assurance that the analyses you are reviewing so carefully and thoughtfully apply to the plant design you are certifying.

Thank you for listening.

Respectfully submitted,

Dr. Susan G. Sterrett
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FROM
Stewart (Philosophy
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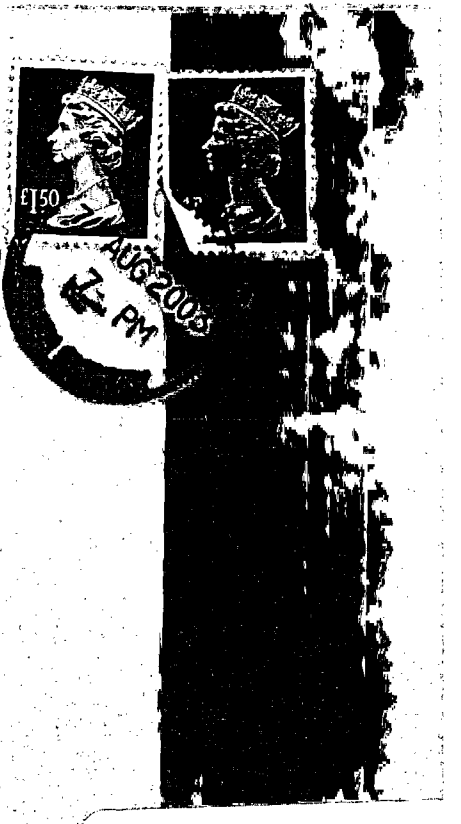

BY AIR MAIL
par avion
Royal Mail

TO
John Segala
New Reactor Licensing/NRR
U.S. NRC
Washington DC ZIP 20555-0001

TO: Joseph Colaccino

Enclosed are hard copies of signature pdf files sent earlier by email.

Regards,

Department of Philosophy
201C West Duke Building
Duke University
Durham, NC
sterrett@duke.edu

July 23, 2003

Mr. John Segala, Lead Project Manager, AP1000 Licensing
New Reactor Licensing Project Office
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Question on AP1000 Containment Systems/
Effect of heat from solar radiation on concrete shield building and on PCS (Passive Containment Cooling System) water storage tank contents

The purpose of this letter is to put into writing a question about the AP1000 safety system design that I discussed on the telephone with you (John Segala) a few weeks ago. I am asking this question as a member of the public, unaffiliated with any organization.

The topic is the effect of the heat of solar radiation on the Passive Containment Cooling System (PCS): the question is whether (and if so, how) the heat of solar radiation is taken into account in the AP1000 design of the Passive Containment Cooling System.

Since the heat of solar radiation can cause the temperature of objects to exceed that of the surrounding air, it seems to me that its effect on:

(i) the temperature of the concrete shield building, whose walls form the air passages relied upon for the efficacy of cooling by the PCS, and
(ii) the temperature in the PCS water storage tank, and

ought to be addressed by the AP1000 design. The effect will vary with geographical location (e.g., the relevant coefficients tend to be larger for sites near the equator than for those far away from the equator) and will depend upon the surface geometry and the properties of the material and/or the surface coatings used.

I do not see this accounted for explicitly in the DSER. However, it is clear that, unless it is shown to make only a negligible contribution, this heat source is relevant to the design of the safety features of the plant. As described in the DSER, for long-term cooling after a design basis accident, the PCS uses the water in the PCS water storage tank and the passage of air in the spaces between the primary steel containment and the concrete shield building to cool and depressurize the containment. It is the means by which heat is transferred from the reactor to the ultimate heat sink in the event of a design basis accident. The question does not arise for operating PWR plant designs, since those designs do not use the method of containment cooling employed on the AP1000.

If in fact the effect of the heat of solar radiation is not determined to be negligible, the assumptions regarding PCS water storage tank temperature and PCS efficacy in heat removal used in the AP1000 PRA (Probabilistic Risk Assessment) Report should also be examined to see if the heat of solar radiation was taken into account.

I look forward to your reply. Should you wish to contact me, the best way is by email at sterrett@duke.edu.

Sincerely,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor
Department of Philosophy
Duke University, Durham, NC

References: 1. AP1000 Draft Safety Evaluation Report (DSER)
Section 6.2 "Containment Systems"
(in Chapter 6 "Engineered Safety Features"
ADAMS accession number ML031671499)
June 16, 2003 (available on ADAMS 07/01/03)

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July 30, 2003

To: ACRS Subcommittee on Future Plant Designs

Subject: AP1000 Fluid Systems Design & QA Procedures

1. Purpose

At the July 18th Meeting of the ACRS Subcommittee Meeting on Future Plant Designs held in Monroeville, Pennsylvania, I took advantage of the opportunity afforded members of the public to remark on a topic discussed at that meeting: the NRC's review of QA control of processes used in the AP1000 design currently under licensing review. At that meeting, the NRC staff (Ms. Joelle Starefos) responded by saying that the NRC staff would reply in a letter.

As I did not know which open items were going to be discussed, my remarks were impromptu and I did not have a prepared text. The purpose of this letter is to provide a written statement of the concerns I expressed at that meeting, which made reference to concerns I had expressed earlier, at the 501st ACRS meeting. (References 6 and 7) For completeness, I also include a chronology of the questions and responses already received from other members of the NRC staff in sections 2.1 and 2.2 below. The statement incorporating the concerns I raised at the July 18th, 2003 ACRS meeting appears in section 2.3 below.

According to the policy on Advisory Committee Meetings (10CFR7.12 (b)), " Any member of the public who wishes to do so shall be permitted to file a written statement with an NRC advisory committee regarding any matter discussed at a meeting of the committee." I am filing this letter as such a written statement, as a member of the public, unaffiliated with any organization.

I am currently a professor of philosophy at Duke University in Durham, North Carolina. Prior to my academic career, I worked in the nuclear power industry, including a few years in the mid-nineties on the AP600 fluid systems design as a consultant to Westinghouse. My involvement with the nuclear power industry ended in early 1998 when I began my academic career in philosophy full-time.

I began following the NRC licensing review of the AP1000 in mid-2002 by reading the information publicly available via the NRC's electronic reading room. My knowledge about the AP1000 design and licensing review comes from reading these publicly available documents. I decided to make use of the provisions for public participation in the AP1000 licensing process (References 8, 9) in part because, according to the 10CFR52 licensing process under which the AP1000 is being licensed, opportunities for public participation are extremely limited once design certification is granted. Thus, as a member of the public, providing this input about the AP1000 design and licensing review is a "now-or-never" situation.

2. Chronology of Questions and Statements

2.1 Two Issues Raised with NRC Staff in July 2002 -- Systems Design & AP1000 QA

In mid-2002 (July 10), after the AP1000 design certification submittal, I asked questions about the general 10CFR52 process and the AP1000 licensing review in particular in an email exchange with Jerry Wilson of the NRC. (Reference 3) One question was: what ensures that, by the close of the licensing process, the design process for some components was not still at the stage wherein only preliminary sizing of components had been performed.? In particular, I asked:

> "(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?
>
> (ii) Does the submittal of the DCD imply that the things in (i) are done?
>
> (iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur? [Reference 3]

In reply, Jerry Wilson cited 10 CFR 52.47(a)(2), and explained that the level of detail required for a DCD (design control document) submittal was sufficient information to support a safety finding in any technical area, and that this level of information corresponds to the level that, under the previous two-step 10CFR50 process, was available at the operating license stage. However, he qualified this by saying that, since design acceptance criteria were to be used in the "piping design area", that "we [NRC staff] didn't expect that signed-off, proof-of-design calculations will need to be completed to support construction." [Reference 10]

This reply made me wonder whether the NRC was in practice approving delaying performing the proof-of-design calculations for system flows, temperatures, and pressures to later stages as well, without explicitly meaning to do so. The rationale for accepting the (DAC) approach for "the piping design area", which was articulated in SECY-02-0059 [Reference 2], was based on the ability to specify piping stress and piping structural analysis acceptance criteria; that rationale does not support delaying the fluid system design to the later COL stage. It is in fact important that the finalized fluid system design be performed prior to or in conjunction with specifying pipe sizes and valve characteristics to be used in the final design. It is always possible to use preliminary calculations to size piping, valves and equipment in order to obtain values to be placed in a design certification application. Proof-of-design calculations differ from preliminary sizing calculations in that they are a set of calculations chosen to take into account all the system criteria that must be met in order for the system to perform the capabilities that are claimed for it. As explained in followup emails, in lieu of using complete piping layout information as input to "proof-of-design" calculations, L/D criteria can be specified based upon "proof-of-design" calculations; these can then be used in piping layout to ensure that the considerations underlying the "proof-of-design" calculations are met. This kind of criteria would be the fluid systems design analogue of piping DAC. My worry was that unless some attention was paid to ensuring that the "proof-of-design" kinds of analyses are done, whether in the form of calculations using "as-built" data or in the form of L/D layout criteria, that the NRC would actually be certifying a design that was based on preliminary sizing considerations rather than on proof-of-design calculations that document that the various fluid systems have actually been designed to provide the system capabilities claimed for them. Since such fundamental things as the classification of initiating events assumes that even many non-safety systems actually do provide the capabilities attributed to them by the design documents, the issue is related to the safety basis of the plant even for the design of non-safety systems.

The problem is particularly acute on the AP1000 because much of the AP1000 makes reference to AP600 documentation. This makes it especially difficult to discern whether a particular pipe size and equipment parameter is merely inherited from the AP600 design or whether final "proof-of-design" kinds of calculations specific to the AP1000 have been performed to support it. Further, there is the danger of making the false assumption that if a system configuration has not changed, the fluid system performance has not changed either. This is not always true; a system temperature or pressure in one system can affect the fluid system performance in another. Thus reasoning about the similarity to AP600 layout that applies for piping stresses and loads does not necessarily extend to fluid systems performance. A comprehensive review of the AP1000 fluid systems designs is called for, similar to the kind of review appropriate when reviewing an extended power uprating.

In further email exchanges with the NRC (Jerry Wilson and Larry Burkhart), I tried to clarify my first question about the fluid system design. These emails are references 11 and 12 and are attached to this letter.

The second question I asked in my July 10, 2002 email to Jerry Wilson concerned the QA program covering the engineering design processes. I wrote there:

> The AP1000 design processes cannot be exactly the same as for the AP600, simply in virtue of the fact that the AP1000 refers to so many design documents for the previously certified, yet different, AP600 design. If the quality assurance program covers the engineering design processes, it seems it needs to be looked at (and maybe revised or supplemented) to ensure that it appropriately covers the case of producing a new design that references another, different, certified design, and to explicitly state what is required in such a case. Here's why I think it is a very important issue:
>
> The AP1000 DCD claims that many of the AP600 documents are applicable to the AP1000. The crucial question is, who (in Westinghouse) makes the determination that a particular AP600 document does in fact apply for the AP1000? It seems to me crucial that the same engineering functional group (preferably the same individual engineer) that was responsible for producing and signing off the document for the AP600 pass judgement on its applicability to the AP1000. Is there a guarantee of this? If not, I suggest that there be such a requirement and that it be made explicit.
>
> Otherwise, there is a gigantic loophole that can be used to circumvent the whole intent of the quality assurance provisions covering the engineering design process -- i.e., otherwise, individuals in other functional groups such as marketing, licensing, or project management, can circumvent the engineering process by simply stating that a certain AP600 engineering report or design document applies to the AP1000. (I don't think I need to explain the conflict of interest involved were this to be permitted.) [Sterrett to Wilson July 10, 2002 Reference 3]

Jerry Wilson replied to this question as well [Reference 10]. He referred me to the NRC's letter on the AP1000 Design Certification Review Schedule [Reference 4], and explained that the NRC staff did plan to inspect Westinghouse's implementation of its design control program for the AP1000 design "in the future." Mr. Lyons's letter of July 12, 2002 stated that the NRC planned to perform these inspections "as necessary", adding that "These inspections will be coordinated with Westinghouse to support the design certification schedule." [Reference 4 , p. 4]

2.2 Clarification & Discussion of Issues with NRC Staff -- December 2002

In December 2002 Larry Burkhart, who was then the NRC's AP1000 Project Manager, held a telecon to discuss my questions. Jerry Wilson, Dave Terao, and other members of the NRC technical staff were present. In this telephone conference call, I clarified my question about fluid system design. Nothing was resolved other than the clarification of the question. However, it was agreed that we should get in contact again to revisit the issues closer to the time the DSER was about to be issued.

Subsequently, after unsucessful attempts to reach Larry Burkhart in March 2003, I learned that there had been a change in management of the NRC's AP1000 Licensing team. The entire team had been replaced with the current team (John Segala, Joelle Starefos and Joseph Colaccino).

2.3 Concerns Raised at ACRS Meetings (April & July 2003)

Soon thereafter, I requested time to speak at the 501st ACRS meeting held on April 11th, where I read a statement presenting the first question I had raised in the original July 10th email. My oral presentation followed the draft text of my comments fairly closely [Reference 7 , included as Attachment II to this letter] and was included in the summary report for the 501st ACRS meeting [Reference 6].

The second question raised in my original email (regarding quality control procedures governing the design processes used in the AP1000) was brought up at an ACRS Subcommittee on Future Plant Designs held on July 18th, 2003, shortly after the NRC issued the Draft Safety Evaluation Report (DSER), and almost a year after I sent the original email expressing concerns about the QA process on the AP1000.

The list of AP1000 DSER Open Items included Open Item17.3.2-2, which reads in part:

> Westinghouse stated that a project-specific quality control plan was used to implement the requirements of the Westinghouse QMS program. The staff plans to conduct an inspection of the implementation of the project-specific quality plan to verify that design activities conducted for the AP1000 project complied with the Westinghouse QMS and the requirements of 10CFR Part 50, Appendix B. [Reference 5]

However, the "project-specific quality control plan" Westinghouse refers to is just the AP600 plan. Although Open Item 17.3.2-2 indicates "N/A" for the original RAI corresponding to the open item, there was an RAI about the AP1000-specific quality assurance plan [RAI 260.008-1 dated May 13, 2003]. Westinghouse's response to that RAI had been to claim that the AP600 document applied to the AP1000. The rationale given in Westinghouse's response to RAI 260.008-1 was:

> As the DCD identifies: " The plan ... is applicable to work performed for the AP1000 design." Westinghouse considers that it has identified a project specific quality plan (i. e., WCAP- 12600) for the AP1000 design.

There is also a discussion of the use of the AP600 project quality plan in Chapter 17 of the DSER, which states:

> A project-specific quality plan was issued to supplement the quality management system document and the topical reports for design activities affecting the quality of structures, systems, and components for the AP6OO project . . . This plan addresses the NQA-1-1989 edition through NQA-lb-1991 addenda and is applicable to work performed for the AP1000 design. [Reference 1, page 17-1]

These statements raise concern, for the reasons mentioned in my original July 10, 2002 email and excerpted in section 2.1 above. When I attended the ACRS Subcommitte Meeting on Future Plant Designs held on July 17th and 18th, I did not anticipate that the subject open item would be mentioned, and did not request time to speak beforehand. However, when I saw that the NRC's presentation included mention of the issue of an inspection of Westinghouse's QA plan during the meeting, I asked to make some impromptu remarks along the lines of the concern raised in my email. There was not time to gather the previous correspondence, relevant Open Items, RAIs, and RAI responses at that time. Therefore, I provide a more complete statement of the situation and my concerns about it here.

My concerns regarding QA of the AP1000 design process are:

A. Integrity of design process for the singular kind of project that the AP1000 is

> The kind of process by which the AP1000 design was produced resembles an uprating in some ways, in spite of the fact that it is not regarded as an uprating. That is, one constraint was to use the AP600 design details insofar as possible. An uprating involves activities and considerations not addressed by the kind of design control procedures intended to address design of a plant where the design process starts with the specification of plant parameters and detail is filled in as the design progresses from functional specifications to detailed equipment specifications. Thus I would not expect the AP600 design control procedures to cover all the design processes on the AP1000.
>
> Of special concern is QA control of the overall plant parameters, both in terms of the design process by which they were obtained, and the design processes that use them as input. (Perhaps this question was dealt with in the pre-application phase, but in case not, I raise it here.) I believe the generation of overall plant

parameters, whether for a new plant design, an uprating, or other changes to an existing plant design, is typically very tightly controlled, with oversight by an interdisciplinary committee whose membership is established independently of any particular project.

An important question here that needs to be asked is whether there are additional oversight or formal procedures over and above those addressed in the AP600 QA plan that would be appropriate for an uprating in that they would assure that the parameters are communicated to the affected functional design areas, would see that the right agents identify the specific changes that are required, and would keep track of their implementation. My worry is that due to its special nature (the criterion of keeping the AP600 design details as much as possible), the implementation of the AP1000 project plant parameters would really call for the additional oversight or the kinds of procedures applicable to an uprating.

If design control procedures intended for new plant designs were used in implementing the AP1000 plant parameters, rather than the design control procedures written to cover upratings, this raises a concern about the way that the AP600 information was used on the AP1000 project. This is because, for an uprating, the plant parameters are an input into a design process where an already existing plant is modified under the constraints of keeping much of the design unchanged. All kinds of QA design control questions arise in this case: for instance, who determines what information originally generated for the AP600 applies to the AP1000 or whether it needs to be reviewed? And who reviews it? Whose decision is final? It seems to me that the integrity of the design process relies upon keeping the design functions separate from project management functions. When a design group reports administratively to the project management and on a matrix basis to engineering management, the integrity of the design process depends upon the matrix connection being strong enough to ensure that technical aspects of management initiatives receive their due.

This kind of situation is not explicitly addressed in 10CFR50 Appendix B, but there is a statement on the general topic of who gets to decide such things in the event of design changes: "Design changes . . . shall be approved by the organization that performed the original design unless the applicant designates another responsible organization." Now, on the AP1000, where so many AP600 features are to be inherited, there is a kind of implicit change to an unspecified number of system capabilities in that the plant parameters have changed. Meeting the spirit of the subject criteria would mean that the judgement as to whether an AP600 design or document applies to the AP1000 or not should be made by those responsible for that design or document on the

AP600 design. Since the DCD references many AP600 documents, it is not always clear that the author of the AP600 document or design has approved its applicability to the AP1000. I think an important question is: who has determined that a certain AP600 document is applicable to the AP1000?

B. Organizational Differences Between AP600 and AP1000 affecting design control

The AP600 design control procedures reflected the involvement of ARC, the Advanced Reactor Corporation, a consortium of electrical utilities. I do not have access to the relevant procedures, but I recall from my previous involvement with the AP600 project that representatives of the ARC did have a formal role in the approval of design changes. Thus, beyond the straightforward point that the design control procedure for the AP1000 can not be exactly the same as the AP600 in terms of the letter of the law, there is the more significant point that the involvement of such an agency provided checks and balances on the AP600 project that may not exist on the AP1000 project.

There may be other organizational changes since the AP600 QA inspection was performed that affect the quality and the strength of the ties between technical and engineering design personnel in the AP1000 organization and the technical department managers reported to on a matrix basis. It would seem to me that these would need to be examined in order for the NRC's review of Quality Control to conclude that the assurance provided by the procedure when applied on the AP1000 project is the same as the assurance it provided on the AP600 design.

C. It seems late in the process should problems be detected

The NRC Letter accepting the Design Certification application dated July 12 2002 (Reference 4) stated that QA inspection would be done "as needed".

The fact that a QA inspection is an open item is reassuring in that it means this item will be tracked. However, the fact that it is an open item is cause for concern as to whether the appropriate inspections were performed "as needed" in the area of review of the fluid systems design. It is a concern because of the possibility that the QA inspection might reveal that some design activities need to be performed. Should these design activities result in design changes, it is very late in the process. Further, it seems that the comprehensive fluid system design of the AP1000 plant --- deriving the basic plant parameters from the AP600 design --- as well as the design details of specific systems appropriately designed for the AP1000, should be covered by this item.

The issue here is the QA control on information that is in the DCD: was there design control guaranteeing that the generation and implementation of the basic plant parameters for the AP1000, as well as the fluid systems design details (e.g., equipment parameters, piping size, valve specifications) were the result of design work of the appropriate kind (i.e., not merely preliminary sizing calculations), performed in a context where there was proper control of design information input into the design process, and where there were the appropriate checks and balances that provide assurance of the integrity of the design process? If it turns out there were areas where it was not, it seems there is not a lot of time to allow review and comment on the required design changes if the design certification schedule is to be adhered to.

3. Additional Remarks -- Schedule for Resolution of DSER Open Items and Role of Public Review and Participation

In general, the AP1000 design certification schedule seems to permit a number of potentially significant open items at the DSER stage. This limits the time available for review and comment by the public after the open item is resolved. Considering the finality of a design certification, it seems that the time available for public review and comment should not be abbreviated in the only stage provided for it.

Respectfully submitted,

Susan G. Sterrett

Susan G. Sterrett
Assistant Professor of
Philosophy
Duke University, Durham, NC

Attachment I Email correspondence Sterrett to NRC dated September 15, 2003.

Attachment II Draft Text of Comments Read at 501st ACRS Meeting --Dr. S. G. Sterrett

References:

1. AP1000 Draft Safety Evaluation Report (DSER)
Chapter 17 "Quality Assurance"

2. SECY-02-059 April 1, 2002
"Use of Design Acceptance Criteria for the AP1000 Standard Plant Design"
William D. Travers to The Commissioners

3. Email S. G. Sterrett to J. N. Wilson,
"AP1000 Review/ 10CFR Part 52 Process"
Wednesday, July 10, 2002

4. Letter July 12, 2002 James E. Lyons to W. E. Cummins
"AP1000 Design Certification Review Schedule (TAC NO. MB4682)"

5. Letter May 27, 2003 James E. Lyons to W. E. Cummins
"Westinghouse AP1000 Draft Safety Evaluation Report
Potential Open Items Chapter 17 Quality Assurance"

6. Letter May 7, 2003 M. Bonaca to Nils J. Diaz
"Summary Report of 501st Meeting of the Advisory Committee
on Reactor Safeguards, April 10 - 12, 2003"

7. Draft text of comments by S. G. Sterrett at 501st ACRS Meeting
(Attachment II to this letter. No transcript of April 11th meeting was made; oral statement followed written draft closely)

8. Nuclear Regulatory Commission Policy Statement
"Enhancing Public Participation in NRC Meetings; Policy Statement"
Federal Register May 28, 2002 (Volume 67, Number 102; Page 36920-36924)

9. 10 CFR7.12 Public Participation in and public notice of advisory committee meetings.

10. Email J. N. Wilson to S. G. Sterrett
"Re: Followup on Questions: AP1000 Review/ 10CFR Part 52 Process"
August 13, 2002.

11. Email S. G. Sterrett to L. J. Burkhart
"Thanks for RAIs"
September 15, 2002
(included in Attachment I to this letter)

12. Email S. G. Sterrett to J. N. Wilson
"Piping Layout L/D Criteria for Fluid System Performance"
September 15, 2002
(included in Attachment I to this letter)

cc:

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ATTACHMENT I

Emails Sterrett to NRC (L. J. Burkhart; J. N. Wilson) dated September 15, 2003

This first email clarifies a question sent earlier to Jerry Wilson and discussed by telephone with Larry Burkhart . In it, I explain why the question is not addressed by the considerations provided in the rationale used in accepting DAC for the AP1000, nor covered by the RAIs sent to Westinghouse as of that date. The email below is followed by a longer one addressed to Jerry Wilson and cc'd to Larry Burkhart and Marsha Gamberoni.

Date: Sun, 15 Sep 2002 16:21:36 -0400 (EDT)
From: sterrett@duke.edu
To: Lawrence Burkhart <LJB@nrc.gov>
Subject: Thanks for RAIs

Dear Larry,

I have looked over the RAIs, and don't see any that address the question I asked Jerry Wilson about paying attention to fluid system performance in doing the piping layout. The RAIs do mention thermal-hydraulic loads, but that isn't what I meant; thermal-hydraulic loads are still related to the mechanical loads on the piping and concern the piping structural-mechanical analyis.

What I meant is the fluid system performance -- flowrates, pressures and temperatures that are achieved by the combination of driving head and fluid piping resistance. The fluid piping resistance is affected by the piping layout. In an email to Jerry Wilson, which I put you on cc for, and which I will send immediately after this one, there is more explanation. The bottom line is that even though the piping layout isn't final, the piping resistance criteria ("L/D criteria") for the AP1000 should be computed and provided at this point. In that email, following this one, there is also an explanation as to why the L/D criteria for the AP1000 will be different in many cases from the AP600.

In our conversation, you mentioned that the AP1000 is so similar to the AP600. That may be, but the question is, should the piping layout really be so similar? It is the fluid system's performance that sets the requirements of the design, and the layout has to meet those criteria. That's the point. One has to check, not just assume it will all turn out okay.

I imagine that there are people at the NRC whose reviews will address this, perhaps on a system-by-system basis. And whether or not the L/D criteria (piping resistance layout criteria) differ much for the AP1000 vis a vis the AP600 for a particular system may be a design detail. However, the overall point that L/D criteria for the AP1000 should be calculated at the DCD application stage is a plant-level issue. It's a very general point. In the email that follows, I explain why I think it is a policy issue about the new licensing process.

I am asking these questions as an individual member of the public, unaffiliated with any organization.

Sincerely,
Susan G. Sterrett
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The "email that follows" referred to in the above email is appended below. It is: Email dated September 15, 2002 from Sterrett to NRC staff (Jerry Wilson, cc to Larry Burkhart and Marsha Gamberoni)

Date: Sun, 15 Sep 2002 16:46:21 -0400 (EDT)
From: sterrett@duke.edu
To: Jerry Wilson <JNW@nrc.gov>
Cc: LJB@nrc.gov, MKG@nrc.gov, sterrett@duke.edu
Subject: Piping Layout L/D Criteria for Fluid System Performance

To: Jerry Wilson, Senior Policy Analyst, NRC
cc: Larry Burkhart, AP1000 Project Manager, NRC
Marsha Gamberoni, Deputy Director, New Reactor Licensing

Subject: Piping Layout L/D Criteria for Fluid System Performance

Dear Jerry,

In a previous email, you responded to a question I asked regarding whether proof-of-design calculations of fluid system performance were performed for the AP1000. This email is to (a.) clarify the question I was asking, and (b) explain why I think L/D criteria is an issue of policy regarding the 10CFR52 design process, not merely a minor design or schedule detail.

In spite of the length of this email, the two points are simple; I am just including the text of the things I reference to avoid any possible ambiguity.

(a) Clarification of Question Re: Calculations Supporting Fluid System Performance

To recapitulate, the question I asked (July 10) was:

``1. What point of maturity is the design supposed to have at the stage the AP1000 application is presently at? I take it that by the time a design is certified, it is not supposed to be one for which only preliminary sizing calculations have been performed to size the equipment. What ensures this doesn't happen?

(i) Are there supposed to be signed-off, proof-of-design calculations, (using the actual piping sizes, equipment parameters, and layout) for the flows reported for all the systems in the AP1000 DCD submitted? Or, performance analyses for the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves, etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?" [excerpt from email of July 10, 2002 Sterrett to Wilson]

In your response (August 13) you explained why proof-of-design calculations for fluid system performance were _not_ expected to have been performed at the time of DCD submittal:

``With regard to question #1,
the Commission expects that when submitted, the design maturity is equivalent to the level of design information available at the operating license stage under the old 2-step process in Part 50 (Final Safety Analysis Report). The NRC's requirement for the level of detail of design information supporting an application for design certification is set forth in 10 CFR 52.47(a)(2). Specifically, it is sufficient information to support a safety finding in any technical review area. However, with regard to piping design, Westinghouse is proposing to use design acceptance criteria in lieu of detailed design information for design

certification. The Commission found that approach acceptable for the ABWR and System 80+ designs. Therefore, for questions #1(i) and (ii), we did't expect that signed-off, proof-of-design calculations were complete when the DCD was submitted. However, piping design calculations will need to be completed to support construction and the NRC will do verification inspections of the design andconstruction activities [#1(iii)]. ``
[excerpt from email of August 13, 2002 Wilson to Sterrett]

I would like here to clarify my earlier question: by ``proof-of-design calculations", I was referring to proof-of-design calculations for fluid system performance, rather than to piping design calculations. By ``piping design calculations", I assume you are referring to calculations concerning things such as piping stress, fatigue and mechanical loads. But, of course, the proper flow performance of fluid systems sets another kind of criterion: that is, in addition to the criteria that aim to ensure that the structural/mechanical behavior of the piping is acceptable, piping layout activities also have to take into account criteria that ensure that the piping flow resistances will result in the flows through the system called for by the fluid system design (and for which the design of numerious interfacing systems may take credit). In addition, pressures (and, sometimes, temperatures) in the system at various key points, such as at heat exchangers and control valves, are influenced by the piping layout. And here i am including normal system operation. Your response to the question of whether there have been proof-of-design calculations for fluid flow performance was that you did not expect them to be done, because the piping layout wasn't final.

However, if the piping layout isn't far enough along to permit proof-of-design calculations to be performed, the calculations related to fluid system performance should still be done -- the only difference is that they would result in piping fluid flow resistance criteria, or ``L/D criteria."

From your response, I wasn't sure if ``L/D criteria", or piping fluid resistance criteria were included in the DAC. After looking at various meeting transcripts and the RAIs regarding DAC attached to the meeting notice for September 9, 2002 (Reference 3), it doesn't appear to me that the ``L/D criteria" are addressed in these places.

So, the question is whether L/D criteria have been provided for the AP1000 fluid systems. Even if the piping layout for the AP1000 were _exactly_ the same as the AP600 layout, new L/D criteria would need to be calculated for the AP1000. For, anytime the design flowrate for a system changes, the

L/D criteria need to be re-calculated, since piping flow resistances vary with flowrate. Even for those systems, if any, where the fluid flowrate of the system is exactly the same for the AP1000 as it was for the AP600, there is still the question whether there are differences in the inlet or outlet pressures -- i.e., in the pressure in the system or piece of equipment to which it connects and from which the fluid enters the fluid system or to where it discharges. Hence the fluid flow performance would be different for the same layout. Thus, the layout criteria would differ between the AP1000 and the AP600 for cases where a system's inlet or discharge pressures differ. (An example here of such a difference in the AP1000 is the significant change in main steam pressure: obviously L/D criteria will be different between the AP600 and the AP1000 for the inlet piping to the steam relief valves, for example.)

Thus, to rephrase the question in my July email:

``(i) Are there supposed to be signed-off, L/D criteria and supporting calculations, (using the AP1000 fluid system functional requirements and equipment parameters) for the system flows and pressures reported for all the systems in the AP1000 DCD submitted? Or, L/D criteria for the piping associated with the more complex pieces of equipment such as the pressurizer, the steam generator, large control and relief valves,etc.?

(ii) Does the submittal of the DCD imply that the things in (i) are done?

(iii) Does the NRC verify or ask for proof that the things above are in fact completed and signed off by the appropriate functional groups, and that they justify the design details in the DCD? If so, when does this occur?"

This is the question I have now, given your repsonse that you did not expect ``proof-of-design calculations" to be performed due to the fact that the piping layout is not final at the DCD application stage.

(b) Previous process versus new 10CFR52 process

It is simply good common sense to provide L/D criteria for the preliminary piping layout, in order to have confidence that when the final piping layout is in fact completed, the design will be such that the fluid performance functional requirements of the system are in fact met, avoiding major changes to the preliminary layout. As you may be aware, this is the process that was followed on the Westinghouse standard plants.

As I see it, requiring that L/D criteria for performance of fluid system functional requirements be provided at the DCD submittal stage in the AP1000 design process is also a _policy_ issue. Here is why: under the older process, L/D criteria were provided to the architect-engineer for use in laying out piping, that is, in the preliminary layout. Thus they were performed PRIOR to the application for an operating license under the old process. L/D criteria can be provided now, as they do not depend upon the piping layout, much less on the piping layout being final. (They are criteria calculated for use in laying out piping such that the fluid system functional requirements (which should be final at the DCD submittal stage) are met.) The L/D criteria are criteria that apply for _preliminary_ layout as well as final layout.

Certainly the ITAACs and other operational tests are going to provide a checkpoint where deficiences in system performance are found, but, I trust, it certainly isn't the intent of the new 10CFR52 process to increase the surprises encountered during operational testing! I assume that everyone agrees that the intent is to have confidence that the certified design results in fluid systems that meet their functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

Thus, it seems clear that the L/D criteria should be provided at the DCD submittal stage in the 10CFR52 process. It's an issue of policy because, otherwise, the 10CFR52 process would result in the NRC certifying a design for which there was less confidence in the design than existed under the old process at a comparable stage.

It would be great to hear the answer that L/D criteria for all the AP1000 systems have in fact been calculated and provided, but, in any case, I look forward to your reply. As with my previous inquiry, I am asking these questions as an individual member of the public, unaffiliated with any organization.

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ATTACHMENT II

Draft of Remarks by Dr. S. G. Sterrett - 501st ACRS meeting, April 11th, 2003, Rockville, MD

I'm Susan G. Sterrett. I am currently a professor at Duke University in Durham, North Carolina. I should perhaps mention that, prior to my academic career, I worked as a design engineer in the commerical nuclear power plant industry, including on fluid system design of the AP600 and EPP plants in the mid-nineties. I am making these remarks as a member of the public, unaffiliated with any organization.

I'm here today because I have some questions about the NRC's review of the AP1000. Put briefly, my question is whether the NRC verifies or asks for proof that the system parameters reported in the AP1000 design certification application (and used in the analyses) are actually justified by a detailed design, as opposed to the AP1000 system designs being at the stage of conceptual system design or justified only by preliminary equipment sizing calculations. I'd like a few minutes to explain the relevance and the significance of the question.

According to the rules under which the AP1000 is being licensed by the NRC, the level of design information required in a design certification application is, with a few explicit exceptions, the level of information that was required at the operating license stage under the previous two-step licensing process. I think this requirement makes sense, too, inasmuch as what the NRC is licensing in approving the AP1000 is an actual plant design that is certified to be constructed and operated.

In following some of the AP1000 licensing activities via the NRC's website, I have noticed that much is often made of the similarities between the AP1000 systems and the AP600 systems. This can be misleading: the performance of the various fluid systems in the plant -- that is, the flows, temperatures, and pressures that obtain at various points within a system are affected by many kinds of differences in a plant design. As I am sure everyone here realizes:

--- Anytime a system flowrate changes, pressure drops in the system will change.

--- Likewise, anytime the pressure at some point in a system changes, flowrates in it or some other system can be affected.

--- Thus, even for those systems that are exactly the same physically speaking (i.e., same pipe size and layout) for the AP1000 as for the AP600, there is still the question of whether there are differences in the inlet or outlet pressures in a system or piece of equipment to which it connects. Different inlet or outlet pressures will result in differences in fluid system performance.

For example, suppose the main steam system pressure is different on the AP1000; then, on the AP1000, there would be a different driving head for lines connected to it than there was on the AP600. So, even if the system hardware and layout of a system connected to the main steam system, say, is exactly the same on the AP1000 as it was for the AP600, the resulting values of major fluid system parameters -- e.g., the mass and volume flowrates and the pressures that result -- could be quite different. Obviously the effects on things like the flow capability of relief valve piping and valve arrangements would need to be looked at. Accomodating these changes could require resizing piping or control valves in order to achieve the flowrate claimed for the system.

I've given the main steam system as an example, but the general point holds for every system in the plant. To infer from the fact that the hardware and layout on an AP1000 system is exactly the same as on the AP600, to the conclusion that the performance is the same, is incorrect. The various AP1000 analyses now under review are only as valid as the assumptions made in them about the performance of the plant systems.

What does this point mean for the review of the AP1000 design, which makes frequent appeal to the certified AP600 design? In many aspects of the safety analyses, the NRC has been very alert to the differences between the AP1000 and the AP600. The point of my examples is that this awareness ought to be extended to plant fluid system performance, specifically, that some reassurances should be sought that the fluid system design details for all the plant systems have been properly attended to, and that, given that the level of detail required at this stage is supposed to be the same as that at the operating license stage, these should not be just preliminary sizing calculations. I worry about the complacency with which the AP600 design is referenced in justifying the AP1000 system designs.

The AP1000 is sometimes referred to as an uprating of the AP600 design. Of course this would be significantly larger than any uprating that the NRC has licensed so far, and of course it differs from most upratings in that there is no AP600 operating experience to draw upon. To the extent that thinking of the AP1000 as an uprating of the AP600 is appropriate, however, it would make sense to require that all the plant system reviews that would be required for an extended power uprating be performed for the AP1000. As there is now a draft review standard for extended power uprates that could be used to guide such a review of the AP1000 (RS-001, dated December 2002), this seems a natural thing to do. I wonder whether there has in fact been a review of this sort for the AP1000. So let me ask: has there?

For those systems whose layout is finalized at this stage of the AP1000 design certification application, there should be formally signed-off engineering calculations justifying the claims that the AP1000 system flow, temperature, and pressure parameters will actually be achieved using the AP1000 equpment and layout. These are often referred to as fluid system "proof-of-design" calculations. I gather from the NRC's approval of the use of DAC (design acceptance criteria) for structural piping analysis on the AP1000 that

there may be some systems for which the layout details will not be completed until after design certification. For those systems, what is needed as far as ensuring proper fluid system performance is to provide layout criteria related to the piping flow resistance, so that the fluid flowrates claimed for the system will actually be achieved. Such criteria are commonly called "L/D criteria" and are considered part of the fluid system design. In fact, for the Westinghouse standard plant designs licensed under the previous two-step process, L/D criteria were provided for various fluid systems prior to construction so that the architect engineer could properly perform the piping layout. As I see it, at least this level of design detail is required at the time of the DCD submittal.

Why not just rely on the ITAACs (Inspections, Tests, Analysis, and Acceptance Criteria) to provide such reassurance? Certainly the ITAACs and other operational tests provide a checkpoint where some deficiences in the plant design would show up. However, I trust that it isn't the intent of ITAACs to relieve the designer of the responsibility of the engineering design work of designing the plant systems so that the system parameters crucial to safety are achieved. Certainly increasing the number of surprises encountered during plant testing is not part of the intent of the new one-step licensing process! I assume that everyone agrees that the intent of design certification is to provide confidence that the certified design will result in fluid systems that meet their stated functional requirements in terms of flowrates, pressures, and temperatures, even if the piping layout for the certified design may not be final in every detail.

In conclusion, I am asking whether the review of the AP1000 design has included ensuring that the design details upon which the analyses that the ACRS has been reviewing depend, have in fact been attended to. In particular, I think it is clear that L/D criteria should be provided at this stage for systems whose layout is to be finalized at a later date, and "proof-of-design" calculations be provided for those whose layout is determined at this stage. Otherwise, there is no assurance that the analyses you are reviewing so carefully and thoughtfully apply to the plant design you are certifying.

Thank you for listening.

Respectfully submitted,

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201C W. DUKE BLDG.
DUKE UNIVERSITY
DURHAM ZIP 27708

BY AIR MAIL
par avion
Royal Mail

TO Joseph Colaccino
U.S. NRC
Washington DC
ZIP 20555-0001

ATTACHMENT 13

Electronic mail from Joelle L. Starefos, AP1000 Project Manager, to Dr. Susan Sterrett, dated November 16, 2003, providing information related to the public release of documentation regarding the inspection of the Westinghouse quality assurance program as it relates to AP1000

Mail Envelope Properties (3FB7E591.C48 : 18 : 20163)

Subject: AP1000 QA Inspection Report
Creation Date: 11/16/2003 4:01PM
From: Joelle Starefos

Created By: JLS1@nrc.gov

Recipients	**Action**	**Date & Time**
duke.edu	Transferred	11/16/03 04:01PM
Sterrett (Sterrett@duke.edu)		
nrc.gov		
owf2_po.OWFN_DO	Delivered	11/16/03 04:01PM
JPS1 BC (John Segala)		
nrc.gov		
owf4_po.OWFN_DO	Delivered	11/16/03 04:01PM
JXC1 BC (Joseph Colaccino)		
LAD BC (Laura Dudes)		

Post Office	**Delivered**	**Route**
		duke.edu
owf2_po.OWFN_DO	11/16/03 04:01PM	nrc.gov
owf4_po.OWFN_DO	11/16/03 04:01PM	nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	1993	11/16/03 04:01PM

Options

Auto Delete:	No
Expiration Date:	None
Notify Recipients:	Yes
Priority:	Standard
Reply Requested:	No
Return Notification:	None
Concealed Subject:	No
Security:	Standard
To Be Delivered:	Immediate
Status Tracking:	All Information

From: Joelle Starefos
To: Sterrett@duke.edu
Date: 11/16/2003 4:01PM
Subject: AP1000 QA Inspection Report

Dr. Sterrett,

As we discussed on October 6, 2003, I am providing the information related to the public release of documentation regarding the inspection of the Westinghouse quality assurance program as it relates to AP1000. The inspection report was made publicly available on Thursday, November 13, 2003, and can be found on the NRC public website http://www.nrc.gov/reading-rm/adams.html with ADAMS Accession No. ML033090510.

In addition, an email transmitting the issues pertinent to resolution of the associated DSER Open Item 17.3.2-2 was made publicly available on Friday, November 14, 2003, and can be found at ADAMS Accession No. ML033080213.

Please contact me if you have any questions.
Joelle Starefos

Joelle L. Starefos
Project Manager, AP1000
NRC/NRR/DRIP/RNRP
Mail Stop: OWFN 4D9A
(301) 415-8488
jls1@nrc.gov

ATTACHMENT 14

Electronic mail from Susan G. Sterrett, to Joelle Starefos, dated January 13, 2004, acknowledging receipt of information provided on November 16, 2003. Following review of documents identified in the e-mail, Dr. Sterrett identified unanswered concerns about AP1000 design control

From: <sterrett@duke.edu>
To: Joelle Starefos <JLS1@nrc.gov>
Date: 01/13/2004 10:48AM
Subject: Re: AP1000 QA Inspection Report

Dear Joelle,

Thanks for this information. It was very helpful in locating the documents. Using ADAMS, I was also able to locate and download WCAP-12600, which is identified as the AP1000 QA plan.

I have read these documents, but there is still a lot unanswered. WCAP-12600 really doesn't give any specifics about design control. It doesn't really answer questions about the makeup of the body that reviews and approves changes, and it doesn't address at all the question of something as major as a 70+ % uprating.

I have two questions related to design control at the moment:

1. Can you tell me of any other procedures that might cover design control and/or the uprating of the AP600 to the AP1000, whether they are public documents, and how to locate and download/obtain them?

2. In the ACRS subcommitee on Future Plant Designs meeting held at Monroeville in summer of 2003, you said you planned to write a letter responding to the concerns I voiced at that meeting. I later wrote these concerns down more clearly, and these were sent to you as well as to the ACRS members. Do you expect to have this letter done soon? The reason I ask is that there is an upcoming ACRS meeting on the AP1000 design scheduled for February 10th.

Also, in addition to the letter more clearly delineating my concerns about the level of detail and design processes used in the AP1000 design, I also wrote a letter asking a question about the heat of solar radiation and its effect on the AP1000 design. I think I also briefly raised the question with John Segala in a telephone conversation. I was wondering if you have anything to tell me about that question at this point.

Thanks very much,

Susan G. Sterrett
sterrett@duke.edu

On Sun, 16 Nov 2003 sterrett@duke.edu wrote:

>
> Dear Ms. Starefos,
>
> Thanks very much for this information.
>
> Sincerely,
> Susan G. Sterrett
>

>
>
> On Sun, 16 Nov 2003, Joelle Starefos wrote:
>
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> >
> > As we discussed on October 6, 2003, I am providing the information related to the public release of documentation regarding the inspection of the Westinghouse quality assurance program as it relates to AP1000. The inspection report was made publicly available on Thursday, November 13, 2003, and can be found on the NRC public website http://www.nrc.gov/reading-rm/adams.html with ADAMS Accession No. ML033090510.
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> >
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> > Joelle Starefos
> >
> > Joelle L. Starefos
> > Project Manager, AP1000
> > NRC/NRR/DRIP/RNRP
> > Mail Stop: OWFN 4D9A
> > (301) 415-8488
> > jls1@nrc.gov
> >
> >
>

Received: from igate.nrc.gov
by nrcgwia.nrc.gov; Tue, 13 Jan 2004 10:48:23 -0500
Received: from zahn.acpub.duke.edu (zahn.acpub.duke.edu [152.3.233.71])
by smtp-gateway ESMTPœ id i0DFhKU3006720
for <JLS1@nrc.gov>; Tue, 13 Jan 2004 10:43:21 -0500 (EST)
Received: from godzilla4.acpub.duke.edu (godzilla4.acpub.duke.edu [152.3.233.45])
by zahn.acpub.duke.edu (8.12.10/8.12.10/Duke-5.0.0) with ESMTP id i0DFmJ5J001921
for <JLS1@nrc.gov>; Tue, 13 Jan 2004 10:48:19 -0500
From: sterrett@duke.edu
Received: (from sterrett@localhost)
by godzilla4.acpub.duke.edu (8.9.3/8.9.3) id KAA05942;
Tue, 13 Jan 2004 10:48:18 -0500 (EST)
Date: Tue, 13 Jan 2004 10:48:17 -0500 (EST)
Sender: sterrett@duke.edu
To: Joelle Starefos <JLS1@nrc.gov>
Subject: Re: AP1000 QA Inspection Report
In-Reply-To: <Pine.GSO.4.58.0311161919160.6763@godzilla2.acpub.duke.edu>
Message-ID: <Pine.GSO.4.58.0401131019320.5247@godzilla4.acpub.duke.edu>
References: <sfb79f51.094@nrcgwia.nrc.gov>
<Pine.GSO.4.58.0311161919160.6763@godzilla2.acpub.duke.edu>
MIME-Version: 1.0
Content-Type: TEXT/PLAIN; charset=US-ASCII
X-PMX-Version: 4.1.1.86173

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sterrett@duke.edu

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> > Joelle L. Starefos
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