Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
APR1400 Subcommittee

Docket Number: N/A

Location: April 5, 2017

Date: Rockville, Maryland

Work Order No.: NRC-2995 Pages 1-103

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

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APR1400 SUBCOMMITTEE

+ + + + +

WEDNESDAY,

APRIL 5, 2017

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:00 p.m., Ronald G. Ballinger and Matthew W. Sunseri, Co-Chairs, presiding.

COMMITTEE MEMBERS:

RONALD G. BALLINGER, Co-Chair

MATTHEW W. SUNSERI, Co-Chair

MARGARET CHU, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

DANA A. POWERS, Member

JOY REMPE, Member

PETER C. RICCARDELLA, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

CHRISTOPHER BROWN

ALSO PRESENT:

TONY AHN, KHNP

YOON JAE CHOI, KEPCO E&C

JEFF CIOCCO, NRO

SEOKHWAN HUR, KEPCO, E&C

SEO SUNG JE, KEPCO E&C

HYEOK JEONG, KEPCO E&C

SUNGJO JO, KEPCO E&C

D. KANG, KHNP

KERRI KAVANAGH, NRO

SANGWON LEE, KHNP and KEPCO E&C

SEUNG WOOK LEE, KEPCO E&C

DAEHEON LIM, KHNP

STEVE MANNON, AECOM

MICHAEL MCCOPPIN, NRO

JIYONG OH, KHNP

TARUN ROY, NRO

SUNG-JE SEO, KEPCO E&C

ROB SISK, Westinghouse

IN HO SONG, KEPCO E&C

FRANK TALBOT, NRO

WILLIAM WARD, NRO

C O N T E N T S

P R O C E E D I N G S

1:00 p.m.

CO-CHAIR BALLINGER: The meeting will now come to order, please.

This is a meeting of the APR1400 Subcommittee of the Advisory Committee on Reactor Safeguards.

I=m Ron Ballinger, chairman of the APR1400 Subcommittee.

ACRS members present are Pete Riccardella, Margaret Chu, Dick Skillman was here, Matt Sunseri, and other members are likely to appear.

Here=s Walt Kirchner. As I said, other members are likely to appear.

The purpose of today=s meeting is for the subcommittee to receive briefings from Korea Electric Power Corporation and Korea Hydro & Nuclear Power Company regarding their design certification application and the NRC staff regarding their safety evaluation report with open items specific to Chapter

14, Verification Programs.

And I might add that we=re limited to Section 14.1, really 14.2. 14.3, ITAAC, will be in a different presentation.

The ACRS was established by statute and is governed by the Federal Advisory Committee Act, FACA. That means that the committee can only speak through its published letter reports.

We hold meetings to gather information to support our deliberations. Interested parties who wish to provide comments can contact our offices requesting time after the meeting announcement is published in the Federal Register.

That said, we also set aside 10 minutes for spur of the moment comments from members of the public attending or listening to our meetings. Written comments are also welcome.

The ACRS section of the U.S. NRC public website provides our charter, bylaws, letter reports and full transcripts of all full and subcommittee meetings, including slides presented at the meetings.

The rules for participation in today=s meeting were announced in the Federal Register on Monday, March 27, 2017.

The meeting was announced as an open/closed public meeting. This meant that the chairman can close the meeting as needed to protect information proprietary to KHNP or its vendors.

No requests for making a statement to the subcommittee has been received from the public.

A transcript of the meeting is being kept and will be made available as stated in the Federal Register notice.

Therefore we request that participants in this meeting use the microphones located throughout the room when addressing the subcommittee.

Participants should first identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

We have a bridge line established for interested members of the public to listen in. The bridge number and password were published in the agenda posted on the NRC website.

To minimize disturbance the public line will be kept in a listen-only mode. The public will have an opportunity to make a statement or provide comments at a designated time towards the end of this meeting.

We request that meeting attendees and participants silence their cell phones and other electronic devices.

So, now I invite Jeff Ciocco.

MR. CIOCCO: Yes, good afternoon. My name is Jeff Ciocco. I=m the lead project manager for the APR1400 standard design certification.

Thank you, Subcommittee, for having us back today to present the staff safety evaluation on the APR1400, Chapter 14 verification programs, Section 14.2, the initial test programs.

As Dr. Ballinger said, staff are still working on Section 14.3, the ITAAC, the inspections test, analysis and acceptance criteria. And we will not be presenting that today. We will do that at a later time.

And that=s all that I have. Thank you.

CO-CHAIR BALLINGER: Before we get started I might add that Dick Skillman arrived, Joy Rempe has arrived, and Jose March-Leuba has arrived, and Member Stetkar has arrived. And Dana Powers has alighted.

Okay, you may continue.

MR. SISK: Thank you, Mr. Chairman. This is Rob Sisk, Westinghouse, consulting to KHNP on the

APR1400 DCA.

Again, it=s good to be here again to present another chapter, another step in the way to certification. And without any undo delay I=d like to introduce Sangwon Lee to lead us through the chapter 14.

MR. S. LEE: Yes, good afternoon, ladies and gentlemen. My name is Sangwon Lee, and I=m a technical manager of nuclear systems design group in KHNP central research institute.

And I=m very glad to have the opportunity to present in the ACRS meeting.

Today I will present chapter 14, verification program.

This is the outline, overview of chapter 14. Then I will talk about the initial plant test program and see where items and open items will be followed.

As was mentioned, chapter 14.3 is not presented at this time. It is to be presented in phase 5. And 14.1 is the introductory section. So mainly I will talk about 14.2, initial test program.

APR1400 initial test program is developed to meet the guidance in Reg Guide 1.68 Rev 4. And

test period is stopped at the completion of construction to the power ascension test.

The scope of the test program is chosen based on the SSC that is used for shutdown and cooldown under normal and transient conditions.

And the SSC that is functioning during the DBA written in chapter 15 and LCO in chapter 16 also -- engineered safety feature and some supporting system are included.

And then SSC, that control will limit radioactive material is included.

And finally, maintain the structural integrity during normal and transient condition system is included in the ITP program.

This slide shows the subsection of the 14.2. Section 1 is summary of test program and objective. Section 2 is organization and staffing.

Section 3 is test procedures. Section 4, conduct of test program. Five, review evaluation and approval of test results.

Six, test record. Seven, components of test program with NRC reg guide. Eight, use of reactor operating experience.

And 9 is trial use of plant operating

emergency procedures. Ten, initial fuel loading and initial criticality.

Eleven is test program schedule. Twelve is test description. Thirteen is COL items. Among them, most of the thing is included in the chapter 12.

We have 178 test plans. The rest of the section is closely related to the COL items.

And each individual test plan consists of four different pages.

Page 1 is pre-operational testing. It includes the 135 individual tests.

And the second page, fuel loading and post core hot function tests includes 11 test plans.

And page 3, initial criticality and low power critical testing has six plans.

And finally, power ascension tests have 26. So, total 178 is submitted when we DCD Lab Zero.

And then several tests were added in DCD Lab 1 to address the RAI response with the NRC.

So, I will talk briefly about the four test page. Four pages pre-operational pages. The test purities at the beginning, at the completion of construction testing to the prior to fuel loading.

The objective of this test is to

demonstrate that the individual SSC operate in accordance with the design requirements and acceptance criteria.

And some of the integral system tests, so-called pre-qual hot functional tests are performed to verify proper system operation prior to fuel loading.

Phase 2 is fuel loading and post-qual hot functional tests. This period is after the completion of phase 1 to the -- and then we fuel loading, and then we pull the initial criticality.

The objective of this test is to assure that the plant system function as expected in the fuel loading condition. And normal plant operating procedures are used.

For example, core shutdown, to hot shutdown, to hot zero power is implemented based on the normal plant operating procedures.

Page 3 is the initial criticality and low power PX test. This test is started after the initial criticality and prior to page 4.

Normally the maximum power is below 5 percent. The objective of this test is to assure that initial criticality is achieved in a safe and controlled manner.

After initial criticality achieved, a series of low power critical tests is conducted to verify quality parameters.

Finally, in page 4 of power ascension test is doing for the profile operation. This is to demonstrate that the facility operates in accordance with its design during steady state condition and some several anticipated transients.

And each test is performed at different -- with power plateau to approximately 25, 50, and 75, and 100 power.

APR1400 does not have any first of kind tests. That=s because prototype of the APR1400 design is based on the nuclear power plant.

And during the RAI process we -- a circulation test was determined not to be a fork test. And we have fully devised -- there is unique design feature, but fully devised flow rate is included in the regular SIT test plan. So, no additional first of kind test is not designated in APR1400.

MEMBER REMPE: Excuse me. I noticed in the material that we were given that you originally requested that you use Shin Kori as the prototype. And the staff came back and said no.

And I just was curious on -- I didn=t see enough in the documentation to understand why you so quickly agreed to the staff saying no, you can=t use Shin Kori.

I was just curious on some of the background on that. Could you elaborate, please?

MR. S. LEE: Based on we have much experience in our domestic plant. But in U.S. design certification case there=s some different insight or aspect or something like that.

So we did -- finally we decided the Lapros plant for the APR1400 in the U.S. plant, inside the USA is the hollow body nuclear power plant.

MEMBER REMPE: So when the staff gets up I=d be curious on their insights on that too.

MR. TALBOT: Excuse me. My name is Frank Talbot. I am in QVIB3. And I am the lead tech reviewer for 14.2.

We had communications with KHNP about the prototype plant issue, and we had determined that Palo Verde Unit 1 should be the prototype plant because it has the exact same number of fuel assemblies, 241, and almost identical power, I think it=s like 3,983 to 3,990 megawatts thermal.

Because of that similarity and the Palo Verde plant is a U.S. plant, we wanted a U.S. plant to be prototype and not a foreign plant. Our traditional -- we have never accepted a foreign plant as a prototype plant in past deliberations for DC application reviews.

MEMBER REMPE: So, I get the fact that if it were closer in design with number of fuel elements and power.

I am a little curious, especially with the way the world is going that the NRC is just not ever going to accept foreign experience because I think that=s an interesting point that I am surprised that --

MR. TALBOT: We do accept operating experience and that is under Reg Guide 168. One of the regulatory positions discusses use of operating experience to develop your initial test program.

MEMBER REMPE: But it has to be U.S. Again, I=m learning by asking these questions, but I=m a little surprised that the U.S. -- I mean, you can have a quality assurance program in another country and that the staff would not accept foreign experience.

MR. TALBOT: In the past we just haven=t accepted the foreign plants because of the different regulations associated.

MEMBER REMPE: Talk near the mic all the time. I can=t hear you.

MR. TALBOT: In the past we just haven=t accepted the foreign plants as a prototype because the plant was licensed under that country=s regulations. And so the NRC staff was very hesitant to call out accepting that plant as a prototype plant. We wanted to use a U.S. plant.

MEMBER REMPE: So, I=m going to push it further.

If the foreign country recognized they were bringing up a new plant design, and that experience might be used for other countries, they could adopt NQA 1 or whatever, the other country=s requirements and then just because it was licensed by another regulator the staff might favorably look at that foreign experience. Is that a true statement?

MR. TALBOT: We can take that back as something that our staff can look at. I just know in the past we haven=t done that.

But I=ve been on the ABWR reviews. I=ve

been on the ESBWR reviews. Those applicants did give us operating experience information and we don=t -- we let them use operating experience information to develop their initial test program. We=ve never prohibited that.

We=ve just never accepted the foreign plant as a prototype plant. That=s the only issue.

MEMBER STETKAR: So, for example, we could never build a Magnox plant here. Despite the fact that the British --

(Simultaneous speaking.)

MEMBER STETKAR: It=s a very parochial attitude.

MEMBER REMPE: That=s why when I read this I thought well hmm, we=ve gotten away with that in the past, but I=m not sure in the future if that=s a good stance.

CO-CHAIR BALLINGER: I=ve got this all highlighted in yellow as well.

I mean, the fact that you=re saying that they can bring in operational experience with the fluidic device, for example, which is a very significant difference between APR1400 and Palo Verde.

MR. TALBOT: Yes, that we are aware of.

CO-CHAIR BALLINGER: But still have to use Palo Verde as the -- what do they call it -- prototype plant. It just makes -- to me it just makes no sense.

MR. TALBOT: Well, I think it=s just the label because the foreign plant is not regulated by the NRC. And because of the differences in our regulations as opposed to the foreign plant the NRC staff has felt very uncomfortable accepting a foreign plant as a prototype.

And that would be my reasoning for why we haven=t done it in the past, and haven=t accepted it now.

CO-CHAIR BALLINGER: So it=s, in the words of that great actor, tradition.

MR. TALBOT: Yes. Now, maybe we=d have to revise our reg guide to address that issue, but currently now we just haven=t in the past accepted a foreign plant as a prototype plant.

CO-CHAIR BALLINGER: Okay. I think this is going to come up.

MR. TALBOT: Sure. We can discuss it more, as much as you want.

CO-CHAIR SUNSERI: And I=ll ask a question out of ignorance as well, or my own ignorance.

So, if there=s not a prototypical plant then what=s the impact? This plant has to do more to demonstrate their viability, or what=s the impact of not being able to reference a U.S. prototypical plant?

MR. TALBOT: Let me ask you just to repeat it one more time so I absorb your question.

CO-CHAIR SUNSERI: Okay, so let=s say that there was not a U.S. prototypical plant for the APR1400 to reference. What is the impact of that condition?

MR. TALBOT: We would be reviewing it as a prototype plant first in the USA for it to be accepted here. So the first unit would be prototype.

CO-CHAIR SUNSERI: Okay, so does that add any additional requirements?

MR. TALBOT: It may. For example, the fluidic device may need more testing to demonstrate its safety.

CO-CHAIR SUNSERI: Okay. All right. So it=s not that a plant could not get licensed here if there was not -- I mean, obviously there=s got to be somebody that=s first, right?

MR. TALBOT: Correct.

CO-CHAIR SUNSERI: Okay, I=ve got it.

Thanks.

MEMBER SKILLMAN: Let me continue this important topic.

I want to bring everybody=s attention to the DCD tier 2, table 1 at 1.3. This is a listing of the parameters that compares the APR1400, the System 80 Plus, and the SKN 3 and 4 plants.

Having chosen Palo Verde 1 as the prototype why isn=t the Palo Verde 1 data listed on this table?

And I say that because for all intents and purposes SKN 3 and 4 and what is the proposed APR1400 are identical. What you=re saying is we can=t use that. We=re going to use Palo Verde 1.

I think that the data from Palo Verde 1 should be used. The differences, the reactor coolant system volume and three or four other parameters. They may not be significant in the overall design, but to those who have done reactor coolant system design those changes are important.

That could be pressurizer volume. That could be surge line diameter, a combination of the two that may affect natural circulation flow rates, or thermal stratification. Other issues that are

important to the design of the NSSS.

And where I tumbled to this is I was trying to pull the thread that Joy was pulling, Shin Kori 3 and 4 versus the APR1400.

I said to myself what is the real difference between these machines, and that difference is revealed in Table 1.3 tier 2.

And if you go through that you find many of the parameters are identical, but there are a handful that are not.

So the question is what=s with that. And therefore what=s the case. For instance, if the data that would come from testing from Palo Verde 1 is applicable to the APR1400 when there are differences in the design.

MR. TALBOT: I think we=re going to have to take that back as something we need to look at.

CO-CHAIR SUNSERI: Amen.

MR. TALBOT: And reevaluate. Because that is good information that you=re bringing to our attention.

I personally have not looked at Table 1.3 so based on what you just told me I need to do more work.

CO-CHAIR SUNSERI: Thank you.

MR. S. LEE: Next section is COL item for --

MEMBER SKILLMAN: Let=s go back one more time.

Why wouldn=t a natural circulation test for this plant in this country be an FOAK test? Where=s the FOAK test data for the APR1400?

MR. S. LEE: FOAK test for the natural circulation is based on the Palo Verde.

MEMBER SKILLMAN: It is based on Palo Verde.

MR. S. LEE: Yes. Lapros plant is Palo Verde.

MEMBER SKILLMAN: I=m glad you answered that way.

Frank, that means that the table for the physical dimensions of Palo Verde and the physical dimensions of the APR1400 need to be checked line by line by line from top to bottom.

Because that test depends on some very subtle dimensional differences that might exist.

MR. TALBOT: This is for the natural circulation test?

MEMBER SKILLMAN: Bingo.

MR. TALBOT: Thank you. I will take a close look at that.

MEMBER SKILLMAN: Thank you.

MR. S. LEE: Next section is the COL item for section 14.2. We have 19 COL items so I will briefly introduce the COL items.

First is the development of the site-specific organization and staffing. And second is the preparation of the site-specific procedures. And third is the preparation of the start of the administer to manual. The first one is development of test procedure and high and medium pipe system break inside the containment.

And five, development of the vibration and thermal expansions and high-impact test program. And six is development of the monitoring program for stable movement.

And seven is review and evaluation of the individual test results. And eight is the establishment of the hold point and each power level such as the 25, 50, and 75.

And nine is retaining historical record in accordance with 10 CFR 50.36.

Ten is description of the available information on reactor operating and test experience.

Eleven is the preparation on schedule for the development of plant procedures.

Twelve is the identification of operator training, especially at the lower power test program.

And 13 is the development sequence and schedule for plant operation and emergency procedures.

Fourteen is the interphase testing on the gaseous process and effluent radiological monitoring system.

And 17 is preparation of the plant and offsite communications system. And 18 is the preparation on test procedure about ultimate heat sink pump house.

And finally, 19 is the verification of the ultimate heat sink pooling chains. That is the COL items.

We have 71 RAI that is directly for Section 14.2. And we complete all the RAI. And based on the SER we have 16 open items. That is written in here just for reference.

As a summary, APR1400 initial test program conforms to the relevant regulatory requirement.

We have 16 open items identified in the SER. And some response has been submitted, and some revised response will be provided in near future. Thank you for your listening.

MEMBER STETKAR: Are there -- I=ll ask the staff too, but in your opinion do you see any open items that are points of contention between you and the staff?

In other words, you said you=ve submitted responses. You=re on a path to close open items. Are there any that you have substantial disagreement about?

MR. S. LEE: Actually, I=m not well known about the U.S. EPR status. But basically we -- do you --

MEMBER STETKAR: What I=m asking is you said you=ve got --

MR. SISK: If I can, I understand your question. We don=t see any significant differences between our position and the staff=s position.

MEMBER STETKAR: Yes, I=m trying to establish are there any real points of contention so that we could probe those at this point.

MR. SISK: Nothing that we=re aware of,

I=ll put it that way, from our side. We had the typical discussions back and forth with the staff, but nothing that steps out as --

MEMBER STETKAR: You=re not obviously orthogonal on something.

MR. SISK: Not at this point, although I am a little nervous with the previous discussion.

MEMBER SKILLMAN: Let me ask one, Rob. Exactly what John is pointing to, the comprehensive vibration assessment program. I would think that would be one that would compel a great deal of attention. Here=s why.

Water reactor coolant pumps have seven veins. You=ve got four 1,800 rpm. You can calculate the vein passing frequency.

Unless the reactor coolant pumps for the APR1400 are identical in design and speed you have the potential for a vibration outcome that=s different than what you may be depending on if you=ve chosen Palo Verde as your basis for your CVAP.

And so what we have, the information we have is that the CVAP is not included in this program. It needs to be, or something like it needs to be because there have been NSSS vendors before, KEPCO and

KHNP, that have vibrated their internals apart because they did not go through a comprehensive vibration testing program.

So, there are fine details within the design of the RCS that need to be confirmed identical if you=re going to somehow say you don=t need a CVAP.

MR. SISK: Rob Sisk, Westinghouse. Yes, Dick, appreciate the comment.

We=ll take that back and certainly consider this in more detail.

MEMBER SKILLMAN: The real question is what=s the basis for not concluding the CVAP as part of the test program.

And if it=s not being conducted, why not, and what=s your foundation.

MR. SISK: And I=ve taken that note down based on --

MR. TALBOT: Mr. Skillman?

MEMBER SKILLMAN: Yes, sir.

MR. TALBOT: Frank Talbot speaking. We through our review have identified the KHNP plant to be built in the USA as a non-prototype category 1 plant. So they have to follow Reg Guide 1.20.

And there is guidance for testing and

monitoring under Reg Guide 1.20. It=s more limiting than it is for the prototype plant.

And I guess your concern might be how elaborate should the CVAP program be, and should it be to a Reg Guide 1.20 prototype plant, or should it be for the non-prototype category 1 plant testing. I think that=s the question you=re asking.

MEMBER SKILLMAN: I don=t want to get lost in regulatory speak.

What I=m trying to communicate is whatever the CVAP is for the APR1400, whatever is identified, for instance, as similar to Palo Verde, or similar to Shin Kori 3 and 4, and how that might be applied to the APR1400. There needs to be extreme caution.

MR. TALBOT: I agree.

MEMBER SKILLMAN: Because other NSSS vendors have stumbled here.

MR. TALBOT: Yes, I agree. And our path forward would be one of those two options that I just explained to you.

MEMBER SKILLMAN: Okay, thank you.

MR. SISK: Rob Sisk. I=d like to ask Steve Mannon to comment. We have been addressing that issue as Frank was pointing out.

MR. MANNON: Steve Mannon, I=m project manager for KHNP for chapter 14.

But Frank, you did ask some questions on that and we did add in our later items, items on including vibration and different sections including the reactor coolant pump testing.

MR. TALBOT: Yes. And I do have an open issue. Internal vibration monitoring system is referenced in a pre-op test and a power ascension test. And I wanted those two tests to be referenced in table 1.9 linked to Reg Guide 1.20. And it=s currently not in there.

MEMBER SKILLMAN: I=m not concerned about vibration in the reactor coolant pumps. I=m concerned about what the reactor coolant pumps --

(Simultaneous speaking.)

MEMBER SKILLMAN: -- do to excite the internals, particularly long members that have thin diameters. Tuning forks. Thank you.

MR. MANNON: We included that in the system test too.

MEMBER REMPE: Could you at a high level talk about what you did to the RAI, or how you responded to the RAI on boron mixing? Verifying that

it=s been mixed.

It=s RAI question 14.02-70. It=s on your slide 20 if that helps you. It=s the bottom one on the table. And it says you have a response submitted, but I think -- I wasn=t quite sure from what I read, and maybe I just didn=t find the actual response back.

But can you at a high level tell us how you=re going to verify that it=s mixed?

MR. SONG: My name is In Ho Song from KEPCO E&C.

We have received RAI number 5.2A709 about the boron mixing.

And first we submitted a response, but the NRC requests some information of boron mixing test.

And we said that APR1400 will not do the boron mix test because the Palo Verde test is the prototype and it tests.

So we submit some information, APR1400 and the Palo Verde has similar characteristic of the boron mixing.

NRC accepted our responses.

MEMBER REMPE: Okay, thank you.

CO-CHAIR BALLINGER: Not to beat a dead horse, but back to this vibration thing.

I=m trying to remember. I remember now an RAI related to vibration wherein I think it was a Shin Kori plant there was a vibration failure.

And it was determined that it was due to the position of a valve that they had to move. And once the valve was moved it changed the natural frequency or whatever it was for the system. And now you didn=t get failure.

So I keep coming back to this issue of the prototype plant. And that would never have been seen in Palo Verde. Am I missing something?

MEMBER SKILLMAN: There is a recorded OE incident at Palo Verde where there was a whistle phenomenon and the RHR piping as a consequence was moving about three quarters of an inch, swinging.

This was an acoustical vibration just due to the way the RHR line connected to the hot leg.

And so these situations are not uncommon. And the only way to discover them is through testing.

CO-CHAIR BALLINGER: Again, if you have a prototype plant which is different from the plant that you=re using you may make decisions on vibration analysis and on structures and things like that that are going to be proven to be incorrect. Is that

right?

MEMBER SKILLMAN: Well, I think the greater issue is why does this even matter. Is this a safety issue.

And I believe that it is. I believe that if the reactor coolant system isn=t known to have mechanical integrity or is vulnerable then we may be complicit in helping KHNP develop a system that has a latent failure.

And the way we smoke it out is to make sure that the startup and test program, including the comprehensive vibration test programs, really, really enable the applicant to have a good, strong system.

So, Rob, it=s a combination of the analysis, the engineering, but also the testing that will enable us to know that the system is sound.

MR. SISK: This is Rob Sisk, Westinghouse. I do want to point the committee to chapter 3, section 3.9.2.4. I know we haven=t had that discussion yet, but pre-operation of flow induced vibration testing of reactor internals is covered there.

I won=t read the whole thing. It=s quite lengthy. But in accordance with Reg Guide 1.20 which

was just mentioned earlier a comprehensive vibration assessment program is conducted for reactor internals.

Skipping down, the CVAP for APR1400 design consists of an analysis program and an inspection program. It=s described in 3.9.2.3.

But we will be talking about this further, I suspect in chapter 3. It is covered. I don=t know to what level of detail we should go into today in section 14, but I didn=t want to leave this topic without having recognition that there is a comprehensive if you will vibration assessment program in place and discussed in the DCA. Thank you.

MEMBER SKILLMAN: Thank you, Rob. I had a couple of more questions on that.

MR. TALBOT: I just wanted to make one more statement and a follow-up to what KHNP just stated.

There is a number of design chapter RAI questions that were part of this review, approximately 17 of them, and several of them came from 3.9.2 and they are discussed in our safety evaluation report.

MEMBER SKILLMAN: Maybe what I=ll do is I=ll wait until the staff is complete and if my questions haven=t been answered then I=ll raise my

questions. Thank you.

CO-CHAIR BALLINGER: That finishes your presentation?

We are well over an hour ahead. So let=s keep going so we can change out -- is the staff ready? Let=s go.

MR. ROY: My name is Tarun Roy. I=m the NRO project manager responsible for coordinating staff review of APR1400 chapter 14, section 14.2, design certification application.

During this meeting the staff plans to brief the ACRS subcommittee members on the NRC staff review of APR1400 DCD application 6 and 14.2, initial test program with open items.

Staff issued a total of 90 questions to the applicant requesting additional information. We have open item 16 till the phase 2 of the review.

We have technical staff presenter Mr. Talbot here, and we have supporting technical staff will be available.

And I will turn over to Mr. Talbot for presenting 14.2.

MR. TALBOT: Hi, I=m Francis Talbot. I introduced myself earlier.

There=s also 38 other technical reviewers that supported me in this review, and I kind of acted like the mini project manager overseeing all those technical reviewers and getting their RAI questions approved through 11 NRO branches and 1 branch in NRR, the electrical engineering branch.

MEMBER KIRCHNER: Frank?

MR. TALBOT: Yes.

MEMBER KIRCHNER: Before you launch into this in detail let me just go back to the subject we were belaboring earlier.

On page 17 of your SER there=s a statement that I=ll summarize as quickly as I can.

NRC staff determined that the first APR1400 plant built in the U.S. will not be a prototype with echo AK tests. And then goes on to say, however -- and this is what I found confusing -- the NRC staff does not accept the applicant=s position that the first APR plant built in South Korea is an FOAK plant.

And as such they cannot credit for prototype plant tests that occurred at SKN 3 and 4.

So, could you de-convolute that statement and tell us what you=re trying to say here? How would

that impact open items in the test regime?

MR. TALBOT: I think I tried to state what=s happened in the past is we haven=t accepted the foreign plant as the prototype plant because it was not licensed under NRC regulations.

So the staff has been very hesitant to do that. So that was the major reason why we told KHNP we thought it would be more beneficial to use Palo Verde Unit 1 which is a System 80 plant, very similar to the CE System 80 Plus plant.

And KHNP=s same number of reactor coolant pumps -- excuse me, same number of fuel assemblies, same power, except as noted what Mr. Skillman said, there are some NSSS design differences. We may need to go back and address those issues.

But that=s the major reason why we would not accept KHNP 3 and 4, the units 3 and 4 -- SKN 3 and 4 as the prototype plant.

We had to use an existing plant that was as close to the design as APR1400 in the U.S. and that=s Palo Verde Units 1, 2, and 3.

MEMBER KIRCHNER: But certainly the experience gained with number 3 and 4 in Korea would be invaluable.

So how would you allow that to be introduced in the docket so to speak?

MR. TALBOT: I would request that the DC applicant submit topical reports or technical reports associated with the differences that you are mentioning.

And that they could be put on the docket in the USA to address any outstanding issues with differences between the -- the differences between the APR1400 and the Palo Verde plant.

If they address those differences then we can get to resolution if there=s any open outstanding issues.

MEMBER KIRCHNER: So there is a vehicle to credit --

MR. TALBOT: There is.

MEMBER KIRCHNER: -- the experience from SKN 3 and 4.

MR. TALBOT: Absolutely.

MEMBER KIRCHNER: You just don=t ignore that because that=s valuable --

(Simultaneous speaking.)

MR. TALBOT: We have a regulatory position under Reg Guide 1.68 to collect operating experience.

That=s the avenue to get that information.

MEMBER KIRCHNER: Okay.

CO-CHAIR BALLINGER: You used the word had to. Is that correct? You had to use a U.S. plant?

MR. TALBOT: Based on precedence, because of what we=ve done in the past with design certification applications like the ABWR, they never built it in the U.S. They were proposing to build it at South Texas Project Units 3 and 4. We don=t even know if it will ever be built. We couldn=t accept the Japanese ABWR.

CO-CHAIR BALLINGER: What is the prototype plant for AP1000?

MR. TALBOT: The prototype for AP1000 is still going to be Vogtle Unit 3 or V.C. Summer Unit 2, whichever unit starts up first.

MEMBER MARCH-LEUBA: Just to emphasize what Walt was saying, I think we think alike.

I mean, your regulatory basis I think as you said, Reg Guide 1.20.

MR. TALBOT: Yes, 1.20 is the only reg guide too that really jumps into so much detail on prototype plant versus non prototype plant.

None of the other reg guides do it except

Reg Guide 1.68 addresses it. I was the author of Reg Guide 1.68. We had four issued in June of 2013. We beefed up that reg guide to cover prototype plant issues.

MEMBER MARCH-LEUBA: What I=m trying to get to is the regulatory decision will be based on the prototype plant which is Palo Verde.

MR. TALBOT: Correct.

MEMBER MARCH-LEUBA: But they will be informed by all the operating plants which are closer. So wherever there are differences --

MR. TALBOT: You can address it through topical --

MEMBER MARCH-LEUBA: You can address it through operating experience in foreign reactors.

MR. TALBOT: There=s another issue that=s come up with respect to the fluidic device based on the fluid dynamic analysis.

KHNP has already submitted that to us under a technical report, not a topical report. I=ve reviewed that document and there are some issues related to that that are related to vibration monitoring, cavitation, and potential for water hammer.

We want KHNP to address those issues associated with the fluidic device. It=s not going to get lost.

MEMBER MARCH-LEUBA: Experimentally when they=re in the plant.

MR. TALBOT: One way is to do the prototype scale model testing.

MEMBER MARCH-LEUBA: Well, they=ve done full model testing.

MR. TALBOT: I know there=s two reports that have been issued, a topical report and a technical report.

MEMBER MARCH-LEUBA: We=ve seen them?

MR. TALBOT: And I=ve reviewed both of them. There are still some outstanding issues with that fluidic device.

MEMBER MARCH-LEUBA: Are we seeing them tomorrow? We=re issuing a letter very soon.

MR. TALBOT: They=re the mechanical engineering branch.

MEMBER STETKAR: We wrote a letter on the topical report. We did not review the technical report.

MR. TALBOT: I have a copy of the

technical report if you want to look at it. We can give it to you.

MEMBER STETKAR: The technical report would support chapter 6 analyses, or 15.

MR. TALBOT: The main lead technical reviewer is an individual named Alexander Sinotis. We have been communicating a lot on this issue with the fluidic device.

So, he is in the process of still evaluating that technical report. And there are still some outstanding issues that we would like KHNP to address.

MEMBER MARCH-LEUBA: Just for the record what this body, the ACRS reviewed was a topical report and the main concern was measuring the performance of the fluidic device.

So they were trying to measure a K factor for pressure loss with an uncertainty, not vibrations or operation.

MR. TALBOT: I think the technical reviewer was Matt Thomas who worked on that topical report. I=m sure you asked him questions during -- or are going to ask him questions if he has -- has he presented to the ACRS yet?

MEMBER STETKAR: The ACRS has written a letter regarding the safety evaluation of the topical report. That=s a done deal.

The application of the fluidic device, the use of a fluidic device in a particular nuclear power plant application which might have the name APR1400 has not been reviewed by the ACRS because that will be reviewed by the ACRS as part of -- whether it=s chapter 15 I guess, or 6, one of those things. Neither of which we=ve looked at yet.

MEMBER REMPE: During this last response you said even though we are saying a U.S. plant will be the prototype there is another requirement that they have to collect operational experience from not only the U.S. but other countries and document it as a technical report.

So, whether that occurs after the thing is certified, when the applicant comes in for building it, or before it=s certified, either way NRC will be cognizant of foreign experience.

So, in the AP1000 if they startup a plant in China and something happens, before they would startup Vogtle that would hold too.

I=m just kind of exploring how the rules

work here.

MR. TALBOT: Absolutely. I=m going through that myself right now because I=m writing the inspection procedures for digital instrumentation and control for AP1000. We just updated an inspection procedure, 7.0.7.0.7 with a new Appendix A to address how are we going to test a 12 digital I&C systems at AP1000 Vogtle and V.C. Summer.

And we=re also sharing operating experience with Saman Unit 1 starting up.

So, with the Ovation logic platform, and the Common Q logic platform. So we=re looking at issues that may come up because of unknown failure modes that may occur associated with digital instrumentation and control systems. So they still have to address them.

And this label about prototype or non-prototype doesn=t matter. We=re going to capture it.

MEMBER REMPE: Okay, thank you.

MEMBER KIRCHNER: Thank you.

MR. TALBOT: Okay, so I=m going to start off with slide 4. As you know there=s four phases to the initial test program. The pre-op test, the fuel loading, post core hot functional tests are phase 2,

the initial criticality and low power tests are phase 3, and power ascension tests are phase 4.

There=s also the pre-operational test program overlaps with the pre-operational test inspections, test analyses and acceptance criteria, also known as ITAAC, which must be completed before the NRC would allow the loading of fuel.

Of course, that=s the 52.103G finding that all of the ITAAC must be completed before fuel load.

Now, you=ll note from KHNP=s slides that they had a Rev Zero, not a Rev 1. Rev 1 has not been issued yet. The Rev Zero AP1000 DCD Section 14.212 had 135 pre-op tests, 11 post core load hot functional tests, 6 low power tests, and 26 power ascension tests.

And in October 2015 we had informed the DC applicant that there was a lot of information lacking in the description of the 178 tests that did not follow the generic guidance Reg Guide 1.68 Revision 4.

It=s also noted that Reg Guide 1.68 Revision 4 which was updated in June 2013 had 15 pages of new guidance in it, plus the references to Reg Guide 1.68 which is the motherhood reg guide, went from about mid to high twenties up to 42 cross

references to other reg guides and guidance documents that we use to implement the initial test program for licensees and DC applicants.

So there=s a lot of new guidance out there. I would say the growth in guidance probably increased by 50 percent.

Okay, so based on those communications with KHNP and Steve Mannon who=s also here of AECOM we had formed that we needed more information in the reg guides.

So, in February 2016 they submitted an updated reg guide -- or they submitted an updated DCD section 14.2, Rev Zero still with a revised list of test descriptions and more tests. So the next revision that came in in February 2016 had 139 pre-op tests. You see four more pre-op tests. Eleven post core load hot functional tests, six low power tests and 26 power ascension tests.

And the DC applicant also upgraded all the test objectives, the test prerequisites, test methods, data required, and test acceptance criteria.

This next slide lists all the new tests that KHNP has added based on our communications with them about their non-compliance with Reg Guide 1.68

Rev 4.

So they added the RCP vibration monitoring system tests, the NSSS integrity monitoring system tests, core protection calculator tests, diverse indication system test, pre-core pressurizer surge line stratification test, and that=s to meet an NRC bulletin 88.11.

And they did not have a test for initial fuel load. We asked them to add that. And they did not have a specific test description for initial criticality so we asked them to add that.

And then the fatigue monitoring system test is for the NSSS system and also includes post core -- during power ascension pressurizer surge line stratification testing which is very important, more important at power than during pre-op.

And so the NRC staff reviewed these eight new tests and we found them to be acceptable.

So, the NRC staff has issued a total of 90 RAI questions. You noted in KHNP slides they had only listed 71. Well, they had more. There were 17 from the design chapters, and then 2 were later on too. So there were a total of 90 in SER 14.2.

As of the end of phase 2 which was

completed in the beginning of December 2016 there were 16 open items in the SER.

As of today the 16 open items have gone down to 12 open items. And there is -- KHNP has sent five responses. And of those five responses to five open items we have closed four of them and made them confirmatory items for adding information to DCD Section 14.2.

I still have an issue with the startup administration manual. There are three -- we asked them to add a lot of administrative controls into the startup administration manual that are done by the DC applicant in accordance with NUREG-0800 SRP 14.2.

But they didn=t capture the entire list of tests. They got 183 tests and there were supposed to be 186 per what they=ve given me as commitments that they are going to put in DCD Section 14.2 Revision 1.

And I note in the fourth bullet that there is going to be 186 tests in the initial test program. One hundred seventy-eight we=ve now determined to be acceptable.

This is a summary of remaining issues associated with the APR1400 ITP program. The remote shutdown console. We want them to add tests to

control cooldown from the remote shutdown console.

Steam generator blowdown tests. They need to add two tests for thermal protection of the resin beds and radiation monitor isolation features.

This bullet involves three open items, one for each test. The hydrogen mitigation system, the liquid waste management system test, and the gaseous waste management system test.

We want them to add a radiation check source to each of these pre-operational tests.

The applicant had proposed these simulated signals. We said no, you need to use a radiation check source to verify that the radiation monitors can perform their intended function. A simulated signal is not good enough.

MEMBER STETKAR: Frank, and KHNP will have to stop me if I go too far here.

There is another control console that exists in the plant that I know about that is not the remote shutdown console and is not the main control room console.

That console is available to mitigate the effects from aircraft crashes. That=s all I=m going to say about that because it=s -- you get into

security-related things.

You=re supposed to be able to do some things from that console. I am just sort of vaguely aware of what you might be able to do from that console.

I have to admit that I didn=t look at their test procedures in gory detail. I know that aircraft crashes are beyond the design basis of the plant.

But I think control room abandonment is also beyond the design basis of the plant.

So my question is is there in the staff=s mind a need to have a test program for that other console area.

MR. TALBOT: As far as I know there is nothing in DCD Section 14.2 related to that console. They don=t address it and I haven=t looked at it from that angle.

MEMBER STETKAR: And I don=t know.

MR. TALBOT: I=ll have to take that back.

MEMBER STETKAR: We=re treading here in kind of a gray area in regulatory space because it=s beyond design basis events for a particular purpose. And KHNP probably wants to say something.

MR. MANNON: This is Steve Mannon. Frank, we did add that into a couple of the tests in a later --

MEMBER STETKAR: Did you? Okay. As I said, I didn=t read through all the applicable ones.

MR. MANNON: We put it in.

MEMBER STETKAR: Okay. Thank you.

MR. TALBOT: So it is there. Where? I haven=t seen it.

MEMBER STETKAR: You guys can work out where it is.

MR. TALBOT: I have to take a closer look at it because I do initial test programs. The NSIR people look at aircraft impact assessment. They own it. So they=re the experts. So I=m not going to speak for that.

MEMBER STETKAR: They tend to just look at -- I=ll just say they tend to look at what they look at which is not necessarily related to --

MR. TALBOT: Testing.

MEMBER STETKAR: -- this aspect of it. And again, we=re in that gray area between security-related stuff and stuff that we can talk about in a public meeting.

MR. TALBOT: I=d just ask Steve Mannon, do you know the name of the NSIR person that=s doing the review for APR1400? Off the top of your head. No.

MEMBER STETKAR: You guys can work it out. Thanks. I appreciate --

MR. TALBOT: We=ll figure it out. That=s a good question.

MEMBER STETKAR: -- KHNP=s response.

MEMBER SKILLMAN: Frank, before you go on, you raised the question or you raised the issue of insisting that there be a radiation source --

(Simultaneous speaking.)

MEMBER SKILLMAN: -- to validate those instrumentation strengths. Let me pull a thread on another of the items that I had.

This was RAI 281-8232. And this had to do with the difference between an area monitor and an airborne monitor if you might recall that.

MR. TALBOT: I do remember reading that. My feeling is if you think of a radiation monitor inside containment that=s an area radiation monitor you have up in the higher portions of containment an airborne radiation monitor. I almost thought they were one and the same. Are you saying they=re

different?

MEMBER SKILLMAN: I think they=re different. I think they=re very different.

I think one is basically a gamma monitor of the area, and I think that the airborne -- an airborne monitor is actually looking more for alpha. At least that=s the experience that I=ve had.

MR. TALBOT: Would that be outside containment?

MEMBER SKILLMAN: Anywhere you want them.

MR. TALBOT: Anywhere you want them outside containment?

MEMBER SKILLMAN: It=s a nomenclature issue is why I=m raising it. And there is that RAI.

MR. TALBOT: I=ll have to go back and talk to -- we have three health physicists that are looking at the APR1400. I=m going to have to take that question back to them and ask them about it.

MEMBER SKILLMAN: This is not a bead, but I was going through all those RAIs and this --

(Simultaneous speaking.)

MR. TALBOT: -- those RAI questions were written by --

(Simultaneous speaking.)

MR. TALBOT: -- Steve Williams, and another guy name Zachary Grant. I=m going to have to go talk to them about that issue.

MEMBER SKILLMAN: What I=m trying to communicate is I think that there really is a difference between an airborne and an area monitor.

And it seems that the staff was trying to probe into that, and the RAI at least in my view didn=t come to closure.

And again, it=s RAI 281-8232.

MR. TALBOT: 281-8232?

MEMBER SKILLMAN: 281-8232.

MR. TALBOT: Did you get the question number?

MEMBER SKILLMAN: Yes, the question is 14.02-46.

MR. TALBOT: Is that question now as you read the SER with open items a confirmatory item or an open item?

MEMBER SKILLMAN: It=s not yet a confirmatory item.

MR. TALBOT: Okay. I have to go back and ask them.

MEMBER SKILLMAN: Thank you.

MEMBER POWERS: As long as you=re on that one you did ask for a radiation check source on their hydrogen mitigation system. What were you looking for there?

MR. TALBOT: Yes, sir?

MEMBER POWERS: What were you looking for?

MR. TALBOT: Just that the radiation check source verifies that the radiation monitor works.

MEMBER POWERS: It says hydrogen mitigation system test.

MR. TALBOT: Yes, there was a similar issue for all three tests, for the hydrogen mitigation system, the liquid waste management system test and the gaseous waste management system test.

They were asking for a radiation check source to verify that the rad monitors in that system were functional.

MEMBER POWERS: So it=s not the hydrogen mitigation system.

MR. TALBOT: It=s not related to hydrogen mitigation. It=s just a radiation check source to verify that the rad monitor is functional.

MEMBER POWERS: Thank you.

MR. TALBOT: I think the rest of the test

was found to be acceptable.

Now, let me see, which slide -- I think I was on this one. I think this was the next slide I was supposed to be on, 10.

Gaseous waste management system test. We wanted them to add manual and automatic response tests for normal control alarms and indications for process of fluent radiological monitor system tests.

We=ve asked them to add radiation monitor test methods, data requirements and the acceptance criteria. Again, that came from the health physics guys.

One of the electrical engineers for digital I&C for the core protection calculator system tests, they wanted tests added to tests for redundancy and independence.

And then the post core ex-core neutron monitoring system test. The technical reviewer again wanted the digital I&C NRC folk. Diana Zheng wanted digital I&C in-core and ex-core neutron detectors. And the core protection calculator test used for initial fuel load.

And then the last three open items we have are related to the startup admin manual which I

mentioned.

The DC applicant=s response for the most part is acceptable. They did add administrative controls that utilized the guidance in NUREG-0800 SRP 14.2, and they did add the list of ITP tests except three tests were still missing so that issue still remains open until KHNP adds the three tests.

And then for the internal vibration monitoring system test there=s a table in 1.9-1 related to APR1400 performance to reg guides that references Reg Guide 1.20. There was no reference in that reg guide to 14.2 tests.

And there were two of them. One pre-op test for the internal vibration monitoring system and one power ascension test for internal vibration monitoring system that we want referenced, associated with compliance with Reg Guide 1.20.

And of course, I think we=ll still have debates on whether KHNP APR1400 is a prototype or not a prototype category 1 plant. We=re going to have to go back and talk to some more people about that issue based on Mr. Skillman=s questions related to Reg Guide 1.20 and differences in the NSSS system.

And then the last open item relates to a

COL information item where we want them to add containment area radiation monitors which supply signals to the emergency response data system.

MEMBER SKILLMAN: Frank, before you change I have a question about the startup administrative manual control, the SAM that you were talking about.

MR. TALBOT: Yes, sir.

MEMBER SKILLMAN: In the response to question 14.02-8 KHNP has provided the basic tables and forms that they use for this procedure.

MR. TALBOT: Correct.

MEMBER SKILLMAN: And included them is their workflow diagram.

MR. TALBOT: Yes, I believe I saw that.

MEMBER SKILLMAN: To what extent has this workflow diagram been challenged against operating experience?

MR. TALBOT: It has not been challenged to date because we don=t have a COL applicant yet. That startup admin manual will have to be revised again by a COL applicant that will have to put in more administrative controls that are the responsibility of the COL applicant to complete the SAM. It=s not a complete SAM now.

I=m only picking up portions of which the DC applicant can meet based on their organizational structure for inputting into a startup admin manual for what they are responsible for.

But they=re only responsible for the NSSS and several other systems. They=re not picking up the COL applicant=s site-specific design test that they would have to complete with an architect engineer that may design those systems.

MEMBER SKILLMAN: The reason that I ask the question is because it has been many years since there has been a startup test program like we are talking about today.

And many individuals who were part of those activities are either on the cusp of retirement or gone.

But there is information from people who were involved that can inform this workflow diagram and potentially prevent some if you will integration failures that need to be recognized.

There are still people around who really know how to do this. And I think an appropriate question would be for the staff to ask KHNP what confidence do you have that this workflow diagram is

going to get you to where you need to get to.

MR. TALBOT: We=ll take that as an RAI question that we need to submit to the DC applicant.

MEMBER SKILLMAN: Thank you.

MR. TALBOT: Okay. COL information items.

The DC applicant identified 11 COL information items in the upgrade to DCD Section 14.2 submitted in February 2016.

We had reviewed those COL items and we had a problem with the level of detail in those 11 COL information items. And we told them to rewrite them with a lot of administrative controls that we had identified from previous applications that we had submitted and what=s in our Reg Guide 1.68 and our SRP 14.2.

So we had them update those administrative controls. And then we identified two additional COL information items that needed to be added.

And then when KHNP started responding to a number of RAI questions they had informed us that they had actually re-looked at their COL information item list and they added six more on top of what we requested them to add.

And those mostly were related to -- I

think all of them, the other six were related to site-specific tests that are the responsibility of a COL applicant.

And then we have reviewed these 19 COL information items and we found them to be acceptable.

And that is the end of my presentation. Here=s the acronym list for all the acronyms in my slides. So I open it up to any more questions you have.

CO-CHAIR BALLINGER: Matt was kind enough to remind me to remind you that this is a subcommittee meeting. So the feedback that we get is from individual members, not -- we only communicate through our letters.

So, individual members have asked questions. And so any feedback is to them.

MR. TALBOT: Okay. So when I report -- because I=ve got to take the transcript from this meeting, read through it, circle and identify all questions asked by the ACRS and address them.

MEMBER STETKAR: These are not ACRS questions. You are not speaking to the ACRS. You=re speaking to 10 individuals.

MR. TALBOT: Okay.

MEMBER STETKAR: Not even a subcommittee. You=re speaking to 10 discrepancy.

MEMBER MARCH-LEUBA: You will still send the responses to Chris.

MR. CIOCCO: This is Jeff Ciocco. I=ll talk to Frank.

MEMBER STETKAR: We just have to be really clear about that because there=s been misinterpretation in the past.

(Simultaneous speaking.)

MEMBER STETKAR: The only reason that we do this is there=s been misinterpretation in the past by the staff, by applicants, and by the public regarding statements that are made in these subcommittee meetings, or questions that are raised as being ACRS questions, or ACRS concerns, and they=re not. They=re individuals.

And only until the ACRS meets as a full committee to deliberate and put something in writing in the letter does anyone get feedback from the ACRS.

MR. TALBOT: -- difference between subcommittee and full committee.

CO-CHAIR BALLINGER: Okay, I think we need to get the bridge open.

(Simultaneous speaking.)

CO-CHAIR BALLINGER: So, are there any comments from people in the room?

MR. MANNON: I would like to just make one comment.

Frank, when you look at answering Members Rempe and Skillman=s responses to the natural circulation boron mixing, the parameters that are associated, if you look at our RAI response to 14.02-70, it=s 8709, we went through a pretty detailed explanation of the velocities, and the parameters, and the volumes, and the differences comparing Palo Verde and also the APR1400 in coming to the conclusion that it was acceptable.

MEMBER SKILLMAN: Please state that number again.

MR. MANNON: Sure will. It=s 528-8709. And the question number is 14.02-70.

MR. TALBOT: And Steve is right on that. In that particular example they elaborated on operating experience from Palo Verde Unit 1. So they -- everything about how the natural circulation test was performed at Palo Verde Unit 1.

Because our big concern was we don=t want

you developing a steam bubble in the reactor pressure vessel.

And we had asked questions that you may need to consider adding SSCs to mitigate the steam bubble in the upper head during natural circulation cooling.

So there=s a lot of SSCs in a Brookhaven NUREG that could have been added. But they proved to us through Palo Verde Unit 1 that they didn=t need those SSCs. And that includes the reactor pressure vessel vent valves. That includes the CETM cooling fans, and pours on the pressurizer and other components.

But there was other -- and some of those components are not even safety-related. I don=t think the vent valves -- I can=t remember if the vent valves are safety-related or not.

MEMBER SKILLMAN: Thank you for the reference.

MR. TALBOT: But they came back and said here=s what happened at Palo Verde. A steam bubble. It is not generated in the reactor pressure vessel head.

That gave us more confidence that the test

that they had developed was acceptable.

But that was the big concern of the staff. No steam bubble in the upper head. Do not want to see that during a power ascension test.

CO-CHAIR BALLINGER: Other questions from the room? Now, are there any people out there on the bridge line that would like to ask a question? Identify yourself just so that we know you=re there. Five second rule. There aren=t any questions out there. Can we close it.

So, I guess we just go around the room and get final questions from members starting with Joy.

MEMBER REMPE: I have no more questions. Thanks for everyone=s presentations.

MEMBER KIRCHNER: Thank you, no further questions.

MEMBER MARCH-LEUBA: Nothing to add.

MEMBER STETKAR: Nothing more.

CO-CHAIR SUNSERI: No other questions and thanks for the presentations.

MEMBER SKILLMAN: Thank you.

MEMBER POWERS: Nothing.

MEMBER CHU: Thank you.

MEMBER RICCARDELLA: No further comments.

CO-CHAIR BALLINGER: I have a comment. We finished several hours early, thank you very much.

MR. TALBOT: I=m glad we were able to give you enough information to get through this so quickly.

CO-CHAIR BALLINGER: Say again?

MR. TALBOT: I=m glad we were able to give you enough information to get through this so quickly.

CO-CHAIR BALLINGER: I=m sure we=re not through.

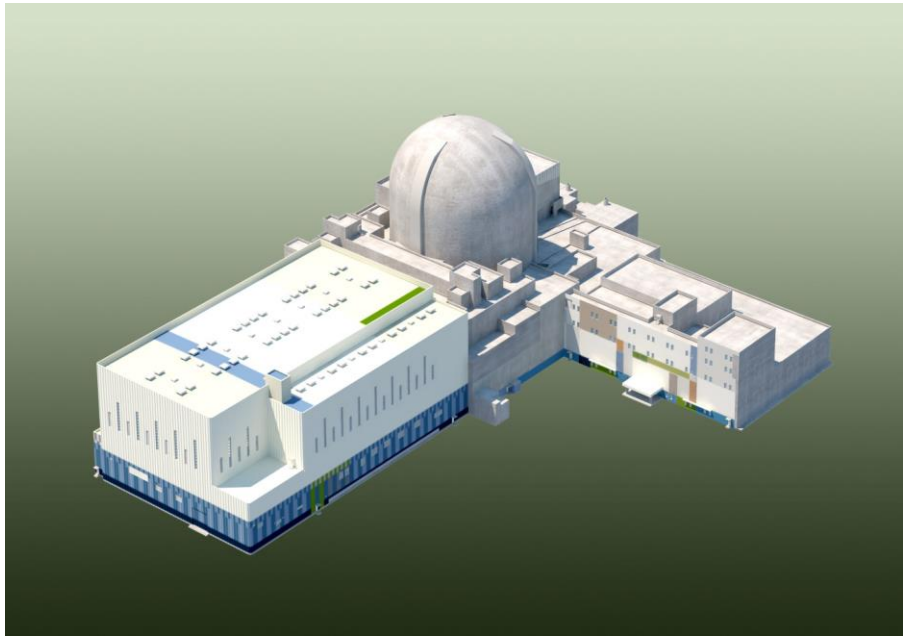
MR. TALBOT: Oh, I know.

(Laughter.)

CO-CHAIR BALLINGER: In that case, we are adjourned.

(Whereupon, the above-entitled matter went off the record at 2:21 p.m.)

APR1400 DCA
Chapter 14: Verification Programs



KEPCO/KHNP

April 5, 2017

Contents

1. Overview of Chapter 14

❑ Contents of Chapter 14

Section No.	Description	Remark
14.1	Specific Information to be Addressed for the Initial Plant Test Program	
14.2	Initial Plant Test Program	
14.3	Inspection, Tests, Analyses, and Acceptance Criteria	To be presented in Phase 5

2. Initial Plant Test Program

❑ APR1400 Initial Test Program

- Developed to meet the guidance in RG 1.68 Rev.04
- Test period : Completion of construction ~ Power ascension test

❑ Scope of testing program

- SSCs used for shutdown and cooldown under normal condition
- SSCs used for shutdown and cooldown under transient condition
- SSCs that function during DBAs in Chapter 15
- SSCs used to establish conformance with LCO in Chapter 16
- SSCs classified as Engineered Safety Features or support system
- SSCs that are used to control or limit radioactive materials
- SSCs that maintain structural integrity during normal and transient

2. Initial Plant Test Program

❑ Contents of 14.2 Initial Test Program

Section No. (14.2.X)	Description
1	Summary of Test Program and Objectives
2	Organization and Staffing
3	Test Procedures
4	Conduct of Test Program
5	Review, Evaluation, and Approval of Test Results
6	Test Records
7	Conformance of Test Program with NRC Regulatory Guides
8	Use of Reactor Operating Experience in the Development of the ITP
9	Trial Use of Plant Operating and Emergency Procedures
10	Initial Fuel Loading and Initial Criticality
11	Test Program Schedules
12	**Test Description**
13	Combined License Information
14	Reference

2. Initial Plant Test Program

❑ 14.2.12 Test Description consists of four phases

Phase	Test Description	No of tests (DCD Rev.0)
I	Pre-operational testing	135
II	Fuel loading and post-core hot functional test	11
III	Initial Criticality and low-power physics testing	6
IV	Power ascension testing	26
Total		**178**

- ❑ Several tests were added in DCD Rev.01 to address the RAI responses.

2. Initial Plant Test Program

❑ Phase 1 : Preoperational Testing

- Testing period
  - Begins after completion of construction testing ~ prior to fuel load.

- Test Summary
  - To demonstrate that individual SSCs operate in accordance with design requirement and acceptance criteria
  - The integrated system tests (pre-core hot functional test) are performed to verify proper systems operation prior to fuel loading.

2. Initial Plant Test Program

❑ Phase 2 : Fuel Loading and Post Core HFT

- Testing period
  - After completion of Phase 1
  - Fuel Loading ~ Prior to Initial Criticality

- Test Summary
  - To assure that plant systems function as expected in fuel loading condition
  - Normal plant operating procedures, to the extent practicable, are used
    - cold shutdown → hot shutdown → hot zero-power (HZP) conditions

2. Initial Plant Test Program

❑ Phase 3 : Initial Criticality and Low Power Physics Tests

- Testing period
  - Initial Criticality ~ Prior to Phase 4 (Rx power < 5%)

- Test Summary
  - To assure that initial criticality is achieved in a safe and controlled manner.
  - After initial criticality achieved, a series of low-power physics tests is conducted to verify core design parameters

2. Initial Plant Test Program

❑ Phase 4 : Power Ascension Test

- Testing period
  - After LPPT ~ Full Power Operation (100%)

- Test Summary
  - To demonstrate that the facility operates in accordance with its design during steady-state conditions and anticipated transients
  - Each test is performed at different reactor power plateaus of approximately 25, 50, 75 and 100

2. Initial Plant Test Program

❑ First-of-a-Kind Test

- The APR1400 does not have any First-of-a-Kind Tests.
  - Palo Verde Nuclear Generating Station (PVNGS) Unit 1 is considered the prototype FOAK plant for the APR1400 design.
  - Natural Circulation Test was determined not to be a FOAK Test
  - Fluidic Device flowrate is included in existing SIT test plan.

3. COL Items for Section 14.2 (1/4)

COL No.	Description
COL 14.2(1)	The COL applicant is to develop the site-specific organization and staffing level appropriate for its facility to implement the initial test program. The COL's plant operating and plant technical staff should participate, to the extent practical, in developing and conducting the Initial Test Program and evaluating the test results.
COL 14.2(2)	The COL applicant is to prepare the site-specific preoperational and startup test specifications and test procedures and/or guidelines that is to be used for the conduct of the plant Initial Test Program. The preoperational and startup test procedures should have controls in place to ensure that test procedures include appropriate prerequisites, objectives, safety precautions, initial test conditions, methods to direct and control test performance and test acceptance criteria by which the test is evaluated. Testing performed at other than design operating conditions for systems is to be reconciled either through the test acceptance criteria or post-test data analysis. These procedures are to be submitted at least 60 days prior to their intended use to the NRC staff for review as described in Subsection 14.2.11.
COL 14.2(3)	The COL applicant is to prepare a startup administrative manual (SAM) which contains administrative controls that govern the conduct of each major phase of the ITP. This description should include the administrative controls used to ensure that necessary prerequisites are satisfied for each major phase and for individual tests. The COL applicant should also describe the methods to be followed in initiating plant modifications or maintenance tasks that are deemed to be necessary to conduct the ITP. This description should include methods used to ensure retesting following such modifications or maintenance. In addition, the description should discuss the involvement of design organizations with the COL applicant in reviewing and approving proposed plant modifications. The COL applicant should also describe in the SAM adherence to approved test procedures during the conduct of the ITP as well as the methods for effecting changes to approved test procedures.
COL 14.2(4)	The COL applicant is to develop the test procedure including a listing of the high- and moderate-energy piping systems inside containment that are covered by the vibration, thermal expansion, and dynamic effects testing program.

3. COL Items for Section 14.2 (2/4)

COL No.	Description
COL 14.2(5)	The COL applicant is to develop the test procedure including a listing of the different flow modes to which the systems will be subjected during the vibration, thermal expansion, and dynamic effects testing program to confirm that the piping systems, restraints, components, and supports have been adequately designed to withstand flow-induced dynamic loadings under the steady-state and operational transient conditions anticipated during service.
COL 14.2(6)	The COL applicant is to develop the test procedure including a description of the thermal motion monitoring program for verification of snubber movement, adequate clearances and gaps, the acceptance criteria, and the method regarding how motion will be measured.
COL 14.2(7)	The COL applicant is to perform review and evaluation of individual test results in a test report made available to NRC personnel after preoperational and startup tests are completed. The specific test acceptance criteria for determining success or failure of a test shall be included in the test report approval of the test results. The test report should also include test results associated with any license conditions in the plant specific Initial Test Program.
COL 14.2(8)	The COL applicant is responsible for establishing hold points at selected milestones throughout the power ascension test phase to ensure that designated personnel or groups evaluate and approve relevant test results before proceeding to the next power ascension test phase. At a minimum, the COL applicant should establish hold points at approximately 25- percent, 50- percent, and 75-percent power-level test conditions for pressurized-water reactors.
COL 14.2(9)	The COL applicant is responsible for retaining preoperational and startup test procedures and test results as part of the plant's historical records in accordance with 10 CFR 50.36, "Technical Specification," 10 CFR 50.71, "Maintenance of Records, Making of Reports," 10 CFR 50, Appendix B, Criterion XVII, "Test Records," and RG 1.28, "Quality Assurance Program Criteria (Design and Construction)." The preoperational and startup testing procedures and test results are to be retained for the life of the plant be the COL applicant.

3. COL Items for Section 14.2 (3/4)

COL No.	Description
COL 14.2(10)	The COL applicant is to describe its program for reviewing available information on reactor operating and testing experiences and discusses how it used this information in developing the initial test program. The description is to include the sources and types of information reviewed, the conclusions or findings, and the effect of the review on the initial test program.
COL 14.2(11)	The COL applicant is to provide a schedule for the development of plant procedures, as well as a description of how, and to what extent, the plant operating, emergency, and surveillance procedures are use-tested during the initial test program.
COL 14.2(12)	The COL applicant that references the APR1400 design certification is to identify the specific operator training to be conducted as part of the low-power testing program related to the resolution of TMI Action Plan Item I.G.1, as described in (1) NUREG-0660 – NRC Action Plans Developed as a Result of the TMI-2 Accident, Revision 1, August 1980 and (2) NUREG-0737 – Clarification of TMI Action Plan Requirements.
COL 14.2(13)	The COL applicant is to develop a sequence and schedule for the development of the plant operating and emergency procedures should allow sufficient time for trial use of these procedures during the Initial Test Program. The sequence and schedule for plant startup is to be developed by the COL applicant to allow sufficient time to systematically perform the required testing in each phase.
COL 14.2(14)	The COL applicant is to perform the appropriate interface testing of the gaseous PERMSS monitors with ERDS.
COL 14.2(15)	The COL applicant is to prepare the preoperational test of cooling tower and associated auxiliaries, and raw water and service water cooling systems.
COL 14.2(16)	The COL applicant is to develop the test program of personnel monitors, radiation survey instruments, and laboratory equipment used to analyze or measure radiation levels and radioactivity concentrations.

3. COL Items for Section 14.2 (4/4)

COL No.	Description
COL 14.2(17)	The COL applicant is to prepare the site-specific preoperational and startup test specification and test procedure and/or guideline for plant and offsite communication system.
COL 14.2(18)	The COL applicant is to prepare the pre-operational test of ultimate heat sink pump house.
COL 14.2(19)	The COL applicant is to prepare the testing and verification of ultimate heat sink cooling chains.

4. Open Items & Summary

❑ RAI Summary (RAIs directly for Section 14.2)

No. of Questions	No. of Responses	Not Responded	SER Open Items
71	71	0	16

4. Open Items & Summary

RAI No.	Question No.	Description	Response Submitted	Status
513-8663 (91-7867)	14.02-67 (14.02-08)	More information in the SAM to cover Items A through D including administrative controls for the list of test abstracts in DCD Section 14.2	02/03/2017	Response submitted
91-7867 & 187-8101	14.02-09	Conformance of subsystems of NIMS test to RG 1.20	08/28/2015	Response submitted (Working with NRC on resolution)
	14.02-10		05/19/2016	
284-8234 & 281-8232	14.02-65	Revision to DCD Section 14.2.12.1.66 to address testing of (1) the isolation features for the SGBS, based on the presence of radioactivity and (2) thermal protection of the demineralizer beds	06/17/ 2016	Response submitted (Working with NRC on resolution)
	14.02-54	Part 3. Testing of components to control the temperature of the SGBS to protect the resin beds (Same Open Item as discussed in RAI 284-8234 Q14.02-65)	06/30/2016	

4. Open Items & Summary

RAI No.	Question No.	Description	Response Submitted	Status
281-8232	14.02-49	Containment upper operating area monitor should transmit signals to the ERDS.	12/09/2016	Revised response submitted
524-8697	14.02-69	Not include any initial fuel load/initial criticality tests to conform to the guidance in RG 1.68, which specifies Initial Fuel Loading, Inverse Count Ratio or 1/M Plot Test for Fuel Loading, and Initial Criticality.	12/19/2016	Response submitted (Currently a Confirmatory Action)
198-8208	14.02-23	Test for CET operation and in-core detectors' proper location.	03/23/2017	Revised response submitted
198-8208	14.02-37	• Which test verifies the operation of the diverse manual ESF actuation • There is no integrated test of the MCR manual controls to verify the plant can be cool down	06/22/2016	Under discussion with staff
529-8711	14.02-71	Add the information on monitoring the performance of the AAC GTG source	01/06/2017	Revised response submitted (Under review by staff)

4. Open Items & Summary

RAI No.	Question No.	Description	Response Submitted	Status
283-8229	14.02-63	ITP preoperational test will use a radiation check source to test radiation monitors	10/05/2016	Agreed with staff. Revised response will be submitted.
283-8229	14.02-64			
192-8180	14.02-15	Include verification of manual and automatic response to normal control, alarms, and indications for the Gaseous Radwaste System	04/07/2016	Agreed with staff. Revised response will be submitted.
195-8182	14.02-18	Include verification of manual and automatic response to normal control, alarms, and indications for the PERMS	03/29/2016	Revised response submitted (Working with NRC on resolution)
281-8232	14.02-50	Use a radiation check source to verify that radiation monitors are functional	06/15/2016	Agreed with staff. Revised response will be submitted.
198-8208	14.02-21	Test method for redundancy and independence in Section 14.2.12.1.138. (CPCS Test)	12/19/2016	Revised response submitted (Currently a Confirmatory Action)

4. Open Items & Summary

RAI No.	Question No.	Description	Response Submitted	Status
198-8208	14.02-35	ENFMS neutron monitor testing performance in Section 14.2.12 (Post-core HFT)	06/20/2016	Revised response to be submitted.
528-8709	14.02-70	Verification of boron mixing during natural circulation test in Section 14.2.14.4.22	02/03/2017	Response submitted (Currently a Confirmatory Action)

4. Open Items & Summary

❑ Summary

- The APR1400 14.2 Initial Test Program conforms to the relevant regulatory requirements.

- Open Items
  - 16 items are identified in staff's SER as Open Items
  - Some responses have been submitted and some accepted
  - Revised responses to remaining items will be provided soon

5. Acronyms

AAC	alternate alternating current
CET	core exit thermocouple
COL	combined license
CPCS	core protection calculator system
ENFMS	ex-core neutron flux monitoring system
ERDS	emergency response data system
GTG	gas turbine generator
HFT	hot functional test
NIMS	nuclear steam supply system integrity monitoring system
NSSS	nuclear steam supply system
SGBS	steam generator blowdown system
SSC	structures, systems, and components
~~S~~AM	startup administrative manual
PERMSS	process and effluent radiation monitoring and sampling system

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Presentation to the ACRS Subcommittee

APR1400 Design Certification Application

Safety Evaluation Report (SER) with Open Items

Chapter 14, Section 14.2: Initial Test Program

April 5, 2017

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

Purpose

- To brief the ACRS Subcommittee on the NRC staff's review of the APR1400 DCD application, Section 14.2, Initial Test Program (ITP)

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

- Technical Staff Presenters
  - Francis X. Talbot, Reactor Operations Engineer
- Supporting Technical Staff - 38 Technical Reviewers
  - 11 NRO Branches and 1 NRR Branch (Electrical)
- Project Managers
  - Jeff Ciocco – Lead PM
  - Tarun Roy – Chapter PM

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

The APR1400 ITP consists of operational tests and initial startup tests in the following 4 phases:

- Phase I: Preoperational Tests
- Phase II: Fuel loading and post-core hot functional tests
- Phase III: Initial criticality and low-power physics tests
- Phase IV: Power ascension tests

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APR1400 DCD Section 14.2.12, “Individual Test Descriptions”

- 135 preoperational tests,
- 11 post core load hot functional tests,
- 6 low power physics tests and
- 26 power ascension tests.

In October 2015, the NRC staff informed the DC applicant that the description of 178 tests did not follow the generic guidance.

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- In February 2016, the DC applicant provided an upgraded DCD Section 14.2 with a revised list of test descriptions:

- 139 preoperational tests,
- 11 post core load hot functional tests,
- 6 low power tests and
- 26 power ascension tests

- The DC applicant also upgraded all the test objectives, prerequisites, test methods, data required and test acceptance criteria

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In the KHNP response to a number of NRC RAI questions, the DC applicant proposed to update DCD Section 14.2 to include 140 Preoperational Tests, 12 Hot Functional Tests, 7 Low Power Tests, and 27 Power Ascension Tests; Total: 186 tests. The new tests being added include:

- RCP Vibration Monitoring System Test
- NSSS Integrity Monitoring System (Pre-Core)
- Core Protection Calculator System Test
- Diverse Indication System Test
- Pre-Core Pressurizer Surge Line Stratification Test
- Initial Fuel Loading Test
- Initial Criticality Test
- Fatigue Monitoring System Test

The NRC staff found the proposed new tests were acceptable.

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Open Item Status

- The NRC staff issued 90 NRC RAI questions related to APR1400 DCD Section 14.2. This includes 17 NRC RAI questions from the design chapters but related to DCD Section 14.2.

- The NRC Phase II SER 14.2 has 16 open items.

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- KHNP continues to resolve 16 open items after the Phase II SER was completed. Since that time, the NRC staff have resolved 4 open items that are now tracked as Confirmatory Items (12 still open).

- The NRC staff determined that the DC applicant provided 178/186 ITP tests that are acceptable in the APR 1400 design with no open issues.

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

Summary of Remaining Issues with ITP Tests

- Remote Shutdown Console Test (Add test controls to cooldown the plant from the Remote Shutdown Console)
- Steam Generator Blowdown Test (Add two tests for thermal protection of resin beds and radiation monitor isolation features)
- Hydrogen Mitigation System Test, Liquid Waste Management System Test and Gaseous Waste Management System Test (Add a Radiation Check Source Test to each of these preoperational tests)

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

Summary of Remaining Issues with ITP Tests

- Gaseous Waste Management System (GWMS) Test (Add GWMS Manual and Automatic Response Tests for normal control, alarms and indications)
- Process and Effluent Radiological Monitoring System Test (Add radiation monitor test methods, data requirements and acceptance criteria)
- Core Protection Calculator System Test (Add Tests for Redundancy and Independence)
- Post-Core Ex-Core Neutron Monitoring System Test (Add tests for digital I&C In-Core and Ex-Core neutron detectors, and Core Protection Calculator (CPC) Tests used for initial fuel load)

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2, Initial Test Program

Summary of Remaining Issues Related to ITP Tests

- Revise Startup Administration Manual to add DC applicant administrative control guidance from NUREG-0800, SRP 14.2 and add the list of ITP Tests
- Add two references related to DCD Sections 14.2.12.1.41 and 14.2.12.4.18, for Internal Vibration Monitoring System (IVMS) Tests to Table 1.9-1, “APR1400 Conformance to Regulatory Guides,” for RG 1.20 Tests in APR1400 DCD Section 14.2.
- For a COL Information Item, add testing of Containment Area Radiation monitors for test signals to the Emergency Response Date System (ERDS)

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ACRS Subcommittee Presentation NRC Staff Review of APR1400 DCD Section 14.2 COL Action Items

COL Information Items

The DC applicant identified 11 COL Information Items in the upgrade to DCD Section 14.2

In the DC applicant's response to NRC RAI questions: (1) the DC applicant added a commitment to upgrade administrative controls for 11 COL Information items referenced in DCD Section 14.2.13, and (2) the DC applicant added COL information items 14.2(12) and 14.2(13).

The DC applicant also added 6 more COL information items for a total of 19 COL information Items in DCD Section 14.2.13 related to site specific tests that are the responsibility of the COL applicant.

The NRC staff determined that the DC applicant's commitments to add 19 COL Information Items are acceptable.

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Questions?

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Acronyms

- Advisory Committee on Reactor Safeguards (ACRS)
- Core Protection Calculator (CPC)
- Design Certification (DC)
- Design Certification Document (DCD)
- Emergency Response Data System (ERDS)
- Initial Test Program (ITP)
- Office of Nuclear Reactor Regulation (NRR)
- Office of New Reactors (NRO)
- Nuclear Steam Supply System (NSSS)
- Request for Information (RAI)
- Reactor Coolant Pump (RCP)
- Vibration Monitoring System (VMS)