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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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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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SUBCOMMITTEE ON THE US EPR DCD

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TUESDAY,

APRIL 6, 2010

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ROCKVILLE, MARYLAND

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

COMMITTEE MEMBERS:

DANA A. POWERS, Chairman

SANJOY BANERJEE

HAROLD B. RAY

MICHAEL T. RYAN

WILLIAM J. SHACK

JOHN W. STETKAR

NRC STAFF PRESENT:

DEREK WIDMAYER, Designated Federal Official

GETACHEW TESFAYE

JASON JENNINGS

MICHELLE HART

JEAN-CLAUDE DEHMEL

JOSH WILSON

PETER HEARN

HIEN LE

JOSEPH DeMARSHALL

PETER KANG

ALSO PRESENT:

PEDRO SALAS

PEDRO PEREZ

CRAIG SCHMIESING

ROBERT SHARPE

PAUL BERGERON

C-O-N-T-E-N-T-S

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

(8:28 a.m.)

INTRODUCTION

CHAIR POWERS: The meeting will come to order. This is a meeting of the advisory committee on reactor safeguards, U.S. EPR Subcommittee. I'm Dana Powers, the Chairman of the Subcommittee. ACRS members in attendance are Bill Shack, John Stetkar, Harold Ray, Michael Ryan, Sanjoy Banerjee. Derek Widmayer is the ACRS staff who is the designated federal official for this meeting. I have no idea what their allegiances are for the various members of the Final Four, but I'm sure --

MEMBER SHACK: Go Bulldogs.

CHAIR POWERS: The purpose of this meeting is to continue our review of the SER of open items from the design certification documents submitted by AREVA NP from the US EPR design. We will hear presentations and discuss Chapter 11 Radioactive Waste Management and Chapter 16, Technical Specifications.

The Subcommittee will hear presentations by and have discussions with representatives of AREVA NP, the NRC staff, and other interested persons regarding these matters. The Subcommittee will gather relevant information today, and plans to take the results of the reviews of these chapters along with other chapters reviewed by the Subcommittee to the full committee when it meets May 6th, in 2010. Which seems like a little bit of a change in schedule, doesn't it. A little bit. We can endure.

MR. WIDMAYER: A little bit.

CHAIR POWERS: The rules for participation in today's meeting have been announced as part of the notice of this meeting previously published in the Federal Register. We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting. But, if people do have something to say today I would encourage them to get my attention and we will try to get you time at a microphone and hear what you have to say.

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 microphones located throughout the meeting room in addressing the

Subcommittee. The participants should first identify themselves and speak with sufficient quality and volume so that they may be readily heard. And we kind of introduced another little tradition in this Subcommittee, it is the first time you speak to the committee, please give us a little of your background so we know who you are, what you do, where you were educated, whether you support Duke or that other team whatever it was that played in the Final Four, things like that. The essential pieces of information.

A telephone bridge has been established with the meeting room today, and I understand we have participants from AREVA NP on the line. We request that the participants on the bridge line identify themselves when they speak, and keep their telephone on mute during the times when you are just listening.

Do any of the members of the Subcommittee have opening comments that you would care to make?

(No response.)

MR. WIDMAYER: I think Theron still needs to put the telephone line up.

CHAIR POWERS: Okay, so we are going to get to listen to that.

MR. WIDMAYER: Listen to the dialing.

CHAIR POWERS: Okay, during the dialing

period we will suffer.

We will now proceed with the meeting. And as has been our tradition and fashion, we will start with you, Ray. First of all, essential, are you a Butler or a Duke guy?

MR. TESFAYE: Neither.

CHAIR POWERS: Neither? So you're really depressed?

Go ahead.

NRC STAFF INTRODUCTION

MR. TESFAYE: Good morning, Mr. Chairman.

My name again is Getachew Tesfaye. I'm the NRC project manager for AREVA EPR design certification project.

This morning we continue our Phase 3 SERS presentation of the staff Safety Evaluation Report with Open Items.

Today we have completed the Phase 3 presentation of seven chapters. We presented Chapter 8, Electric Power, and Chapter 2, Site Characteristics, on November 3rd, and Chapter 10, Steam Power Conversion System, and Chapter 12, Radiation Protection, on November 19th, 2009.

On February 18 and 19 of this year we presented Chapter 127, Quality Assurance, and portions of Chapter - Chapter 17, Quality Assurance, and portions of Chapter 19, Probabilistic Risk Assessment and Severe Accident Evaluation.

On March 7th of this year we presented Chapter 4, Reactor; Chapter 5, Reactor Cooling System and Connected Systems.

Today we will present Chapter 112, Radioactive Waste Management, and Chapter 16, Technical Specifications. We will be briefing the ACRS full committee on Thursday, April 8, on the seven chapters that are completed so far. And we are also scheduled to complete Chapter 19 presentation on April 21, 2010.

That completes my remarks, Mr. Chairman. If there are no other questions.

CHAIR POWERS: Okay, we got a lot of open items to go through?

MR. TESFAYE: Not quite.

CHAIR POWERS: Okay. Okay, well, Mr. Salas.

U.S. EPR DC APPLICATION FSAR CHAPTER 11,

RADIOACTIVE WASTE MANAGEMENT

MR. SALAS: Thank you very much.

I'm a Florida graduate, so we were eliminated earlier this year.

CHAIR POWERS: I think there was a great line from one of the candidates for senator from Florida who said, there is a class of people in this world that think only graduates of elite universities should lead. That's not fair, because most people can't go to the University of Florida.

MR. SALAS: In terms of myself, I started my career - I've been with AREVA for four years but before that I spent my career in the operating side, actually new licensing. I started my career at Carolina Power & Light during the licensing of Shearon Harris. And I came in kind of on the tail end. And going back to licensing new plants. From there I spent with the licensing manager doing the restart of Browns Ferry 2 and 3.

CHAIR POWERS: So you've been busy.

MR. SALAS: I've been busy. I went to Sequoyah during the difficult times and helped bring that unit back to good shape. And finally ended up before coming to AREVA spent a couple of years over at Dresden with Exelon. So I've been in the older units as well as the new units it is nice to being able to actually start eliminating some of the challenges that we face in the operating side.

We are here today to present to you

Chapter 11, particularly those design pieces critical to the ERP, to the design and operation. For our presentation we have two Pedros today, two Cubans, actually. And Pedro will be our presenter, but I think before he does his Chapter 11 presentation, I think that the last time that he was here you left him with the homework assignment. And I think he is happy to report on that.

CHAIR POWERS: He has been here before, he did adequately right?

(Laughter.)

MR. PEREZ: That's why I had a homework assignment. I have been here in front of you before. My name again, Pedro Perez. And when I present Chapter 12, Radiation Protection, Dr. Ryan asked me the question: who is the occupational person who receives the highest dose? And I could not answer that at that point. I went back to the office, and report now that reviewing our calculations the individuals that perform the reactive vessel inspections, the UT inspections, are - we calculate and estimate the highest dose to be 800 millirem. So for one shift for that person.

MEMBER RYAN: And that is a one time --

MR. PEREZ: Exactly, so that one

activity, that one individual, performing that one task - supporting that task.

MEMBER RYAN: And that's done how often? It's quite a long frequency..

MR. PEREZ: It's a long frequency. There are other activities during the outage, but those are much lower.

MEMBER RYAN: Yes, sure.

CHAIR POWERS: This is kind of an expected result but it also adds fuel to our interest that we historically had in NDE methods.

MEMBER SHACK: I guess I'm a little surprised with the automation at today's NDE --

CHAIR POWERS: You still got to hook stuff up Bill. There's just no two ways about it. You still got to hook the stuff up. And when you have to hook it up - I mean if people would design the plants better we wouldn't have this problem.

MEMBER RYAN: What is the time that you have estimated for that UT exam?

MR. PEREZ: Okay, that entire operation is if I recall it is about 40 hours. And I looked at how you would divide people in shifts, so I optimized it in 8-hour shifts, one person, and I looked at the highest dose rate in a room and that's how I came with the 100 millirem per hour times 8 hours, and that's how I came up with that.

Clearly in practice you would look at, as much as you can, local hot spots, or local - you know low dose areas that you would set up.

MEMBER RYAN: I assume change of personnel somewhere halfway through.

MR. PEREZ: Exactly.

MEMBER RYAN: So this isn't really a true real dose. This is an ALARA, planning.

MR. PEREZ: Correct.

MEMBER RYAN: I just want to make it clear to everybody, that we are not expecting one individual necessarily to get 800 millirem.

CHAIR POWERS: But from a design perspective that is the number we wanted and it is exactly what we were looking for, thank you. That is very useful to us.

MR. PEREZ: If there are no further questions on this, then this morning, we will present Chapter 11 of the US EPR FSAR dealing with radioactive waste processing. We will follow the Standard Review Plan, which starts 11.1 source terms, liquid waste management systems, 11.2, gaseous waste management, 11.3, solid waste, 11.4, and the last chapter looks at process and effluent radiological monitoring and sampling systems.

Just a brief description of the buildings that we will be discussing. Here is your radioactive waste processing building, primarily for liquid waste processing and liquid waste storage, and solid waste processing and solid waste storage.

And then the gaseous waste processing is in the nuclear auxiliary building. Just to give you a brief overview of the plant layout.

The EPR radiation source terms are summarized in 11.1 for both normal and accident conditions. You may recall I was here in November where we talked about Chapter 12, and there we talked about the shielding source term. And then in the near future with Chapter 15 we will talk about the design basis accident source terms.

But everything starts with a core inventory, and from there we develop the source term, and we start there in Chapter 11, Section 1.

Just a brief background. The design basis source term starts with a bounding core inventory using ORIGEN 2. We perform a set of parametric case, enrichment from 2 weight percent, 3.5, and 5 weight percent, and we went through different burnup steps from 5 gigawatts per metric ton to 62. And came up with a bounding core inventory from which to derive the liquid source terms and gaseous source terms.

Primary and secondary system radionuclide concentrations are based on a 1 percent failed fuel fraction following SRP 11.2. Again, nonmechanistic, that's what the SRP said, that's what we apply.

However, the halogens and noble gases are said to represent a dose equivalent iodine-131 and xenon-133 that's governed by the technical specifications.

Cooling secondary concentrations are also based on the technical specifications, primary to secondary technical specifications, leakage rate of 600 gallons per day. So to derive that secondary source term, we applied that leakage rate from the technical specifications.

Activation and corrosion product are taken from ANSI 18.1 as well as tritium concentrations.

The source terms for the design basis they are used to demonstrate compliance with the concentrations in the 10 CFR 20 Appendix B, and also demonstrate that we meet the design - those design objectives, biodesign objectives of 10 CFR 50 Appendix I.

So we did it with design basis concentrations and with realistic source term. These were derived directly from ANSI/ANS 18.1. For the concentrations and the liquid gaseous effluents were taken by the GALE code, GALE-L for forms of liquid effluents, and GALE-G, for forms of gaseous effluents.

We also used these realistic concentrations to demonstrate that you are clearly going to have compliance with 10 CFR 20 Appendix B, and compared to the design basis we show that the depth we have and capability to handle up to a 1 percent design fail fuel.

So the expected concentrations are the realistic ones. The design concentrations were used simply to show you that there is sufficient capacity of the system to handle up to that level fail fuel.

Here is a slide that just simply summarizes what I described. Liquid and gaseous source terms on the right, you have the realistic following the ANSI standard for concentrations, following GALE to get the effluent, both gaseous and liquid. And from there we perform about 20 concentration comparisons, some of the ratios, the cost-benefit analysis, and dose assessments.

On the left side we have the design basis.

And .25 failed fuel was used for Chapter 12 shielding which I presented back in November. And the initial RCS concentrations for the Chapter 15 design basis accident. Again the initial concentrations. We also used the 1 percent failed fuel for that Part 20 Appendix B, and these two concentrations - these two comparisons are simply as I stated to demonstrate that we have sufficient capacity for a high failed fuel failure.

We also used the 1 percent failed fuel assumptions in performing the Regulatory 1.143 classification of the system, and it's classified RW-IIa, that assessment.

A note about the cost-benefit analysis. We performed the - all the evaluations following the SRP and following the regulatory guidance. And we deviated from there, I like to point that out, for the cost-benefit analysis we started with Regulatory Guide 1.110, with some differences. This is a 60-year plant life, so we went up to a 60-year evaluation.

We also looked at the updated NRC dollar cost per person rem from $1,000 to $2,000, and we did not adjust equipment cost for inflation. To basically biased the analysis conservatively. So these are some differences that you will see in the FSAR.

Now 11.2, we'll talk about liquid waste management system. It collects, processes and discharges waste liquids, and maintains a design to maintain doses ALARA.

It consists of two systems: a liquid waste storage system; and a liquid waste processing system. The liquid waste storage system segregates the liquid waste into five storage tanks, collects the treated waste in two monitoring tanks, and chemically adjust that liquid to acceptable chemical value like pH before discharging it to the environment.

The liquid waste processing systems consists of an evaporator, centrifuge and a demineralizer.

The liquid waste storage system as I mentioned segregates the waste into Group I liquids which are high activity levels, with low levels of organic and inorganic substances and low conductivity. These are fuel pool systems, drains, sumps, decontamination operations. And these are normally processed by the evaporator.

Group II liquid waste consists of low activity levels, high levels of organic substances, and high conductivity, for example, from hot laboratory, from showers, washrooms, Steam Generator blowdown demineralizer flushing water. These are normally processed by the centrifuge.

Group III liquid waste normally has no activity, and may have high levels of organic substances and conductivity. These come from non-radioactive floor drains; steam generator blowdown demineralizer flushing water if it's not radioactive. If activity exists in this waste stream then the waste will be processed by the centrifuge. If no activity, waste is sent directly to the monitoring tank after a short hold-up of storage in a storage tank.

MEMBER STETKAR: Pedro?

MR. PEREZ: Yes.

MEMBER STETKAR: Before you go on to the next slide.

MR. PEREZ: Yes.

MEMBER STETKAR: I think that I read somewhere that the storage tank capacity, you segregate the waste in your storage tanks, right?

MR. PEREZ: Yes.

MEMBER STETKAR: The capacity for the Group I and Group II wastes was enough to store two plus weeks worth of estimated waste, but that the Group III waste storage tank capacity was about a week's worth of waste generation, and that your waste processing capacity was such that you could process that amount of waste within about half a week. So according to my notion you have about a half-week's worth of waste generation margin, excess storage capacity.

I've reopened a plant where the designers told us that we had more than enough storage capacity, and we wound up flooding the rooms that had the storage tanks in it, we wound up bringing in all sorts of excess, extra waste processing equipment because the designers were wrong by about a factor of five.

This doesn't seem like a lot of margin. So can you tell me a little bit about that? I'm not so much concerned about the Group I and Group II. I'm a little bit more concerned about the Group III, why the presumption that you are going to actually be able to process that stuff that quickly.

MR. PEREZ: One of the things I mentioned and I didn't emphasize was that Group III is not expected to have activity. So the residence time in that storage tank will be very short, and you go directly to the monitoring tank.

MEMBER STETKAR: Okay.

MR. PEREZ: And the monitoring tank there are two tanks that you can count on to hold up until you can then have --

MEMBER STETKAR: You still process it to some extent though, don't you?

MR. PEREZ: Yes.

MEMBER STETKAR: Through an evaporator?

MR. PEREZ: Not the Group III. Where you find activity, if you sample and you realize this is either Group I or Group II, then you can route it back okay to fully evaporate all the centrifuge. But the design is that there shouldn't be any activity, and - or very low activity. I mean obviously you have tritium. And in that case you've just valved it over to the monitoring tanks, and you are ready and have the capacity in the monitoring tanks to discharge, you discharge. So that is the concept. That is why there is only one tank for the Group III. You are not expected to hold it up very long.

MEMBER STETKAR: Okay. Thanks.

MR. PEREZ: As I mentioned discharge to the environment is from the monitoring tanks, and environmental releases is made once radioactivity and chemistry such as pH or within the limits. The release line is administratively locked and monitored, and plant discharges are continuously monitored and recorded in the activity-measuring tank. These are small tanks with instrumentation that is continuously process monitoring on the effluent. Has the capability to automatically isolate the release should activity exceed a predetermined limit. And as I mentioned before the liquid waste storage system is high hazard classification for Reg Guide 1.143, RW-IIa.

MEMBER RYAN: What is the continuous discharge set up to monitor?

MR. PEREZ: What is --

MEMBER RYAN: How is monitoring performed and for what?

MR. PEREZ: Okay, it's a gross activity.

MEMBER RYAN: Just gross gamma.

MR. PEREZ: Yes.

MEMBER RYAN: Again that continuous spectral measurement with the key radionuclides.

MR. PEREZ: You do that before you put the liquid into the tank.

MEMBER RYAN: Into the discharge tank.

MR. PEREZ: Exactly, into the monitoring tank.

MEMBER RYAN: You are batching it into the discharge tank?

MR. PEREZ: Yes, and then that is again another barrier, another defense, just in case you have - you know you are monitoring for this gross activity.

MEMBER RYAN: Right, so it's really a batched discharge setup, where you take a sample, do you discharge tank, and then verify that sample and off it goes.

MR. PEREZ: Yes, as I mentioned, you fill up the monitoring tank, then that's a batch that leaves the tank.

MEMBER RYAN: Okay.

MR. PEREZ: Okay, for the liquid waste management system, I have a little pictorial here of the evaporator. The evaporator is a Group I waste. The waste room comes in through a preheater into an evaporator column, where you start to have separation and start to develop the evaporator bottoms. And this is a vapor compressor with forced recirculation that recovered some of the energy in the evaporation process. So from the vapor and the vapor column, you compress the vapor through a heat exchanger, and then you go back, recover that energy into the evaporator column, and the bottoms pick up that energy, and keep going through the evaporator column, building up the bottoms, the bottoms are collected into the concentrate storage tank, and the clean distillate is collected in the distillate tank. The energy in that distillate is actually used to preheat the incoming influent. So that is the design of the evaporator.

MEMBER BANERJEE: So what forms at the bottoms?

MR. PEREZ: Slurry that need to be solidified later.

MEMBER BANERJEE: What is the typical volume fractions? Is it pretty thick stuff?

MR. PEREZ: It's pretty thick stuff. I don't have the exact fraction, but I can tell you it's technically pretty thick stuff.

MEMBER BANERJEE: Then you evaporate and calcine it?

MR. PEREZ: Well, because it will drum dryer, which I will discuss in Section 11.4, where there you start to dry these bottoms. And I will discuss that when we get into solid waste.

MEMBER STETKAR: Pedro - if you are more concerned - I'm going to get into equipment, so if you are more concerned about what's going on.

MEMBER BANERJEE: Well, I'm just concerned, if it starts to get clogged and things like this, this line, how do you take care of that?

MR. PEREZ: Good question. There are chemicals added to this process to prevent solids to be aggregated. And it's also other chemicals to address cleaning of the internals. So there is no - it's a very highly resistant stainless steel. It does require that you have deposits that can get basically stuck to the wall; there is chemistry that is added to keep things in solution and basically keep the system clean.

MEMBER BANERJEE: But these are solids, right? So they don't go in solution.

MR. PEREZ: Correct, but the bottom is a slurry.

MEMBER BANERJEE: Yes, it's a slurry. So how do you ensure that it remains a slurry and doesn't form a cake?

MR. PEREZ: Well, you control the chemistry, and you control how often you keep recirculating.

MEMBER BANERJEE: Is this a well established process that everybody does?

MR. PEREZ: Yes. Not everybody, but it has considerable operating history.

MEMBER BANERJEE: You know you can keep

it as a slurry?

MR. PEREZ: Yes. Yes, there are not many in operation in the U.S. This design of vapor compressor with forced recirculation is more popular in Germany, for example, and it has been ported to other parts of the world.

MEMBER STETKAR: So you have exactly one of these things, right?

MR. PEREZ: Yes.

MEMBER STETKAR: In the plant.

MR. PEREZ: Yes.

MEMBER STETKAR: What has been the operating experience? Because as you mentioned this is a little bit different machine that typical operating U.S. plants. What has been the operating experience for these machines? How reliable have they been? How frequently do they fail? To back up into the tanks or bring in portable equipment?

MR. PEREZ: Okay, let me take that. I do not have a failure rate. I can give you these machines have been used for 40 years, a total of 400 reactor years of operation. I have looked at the effluent from plants that use this technology, normalized it to curies per megawatt basically, and for those plants I saw very clean effluents.

MEMBER STETKAR: That's not what I was asking. I was asking how frequently does it fail, and do you back up into requiring filling up the hold up tanks, storage tanks, or bringing in portable equipment -

MR. PEREZ: Right, I was going to go the second. Based on this, and I looked at 10 years worth of history, that's all I did, 10 years, it looked reliable in that 10 years. Okay? Every effluent I looked at. I also realized - I also realized in saying this, only one of these things, okay. So we also have this design, the demineralizer, in the event you do have the maintenance, you do have the capability, the flexibility, to kick in a demin system during that time that the system may be out.

MEMBER STETKAR: What I am trying to get to is the reliability of the design systems versus the need to use additional portable demineralizers, flow through units and such to process the volume of the waste. As I said I grew up in a plant where we had substantial problems with handling the actual volume of waste given the design of the - the amount of equipment we had piped into the design if you will, and the reliability of that equipment. We actually were able to handle the waste, but from an operational perspective, we needed an awful lot of portable demineralizers. We needed to dispose of an awful lot of portable resin beds and things like that that were not part of the original design. Like we had a lot of hoses piped around our auxiliary building to handle this stuff. Indeed our releases stayed within limits. We were eventually able to handle the waste, but it was not something that was particularly good for operations.

So I'm more concerned with how frequently could plants be challenged to establish that type of alternative waste processing mode to keep ahead of the flow stream.

MEMBER RYAN: I share John's question, and it kind of comes to me from the figures you gave for the Group I, II and II holdup times that you have.

MR. PEREZ: Yes.

MEMBER RYAN: You have a week's worth of capacity, so if there is a maintenance issue of any kind in the system, and you can't deal with it in a week, all of a sudden you have to look for alternatives in how to manage that waste.

So I think maybe there is a homework question to kind of lay out how the time reactions to any kind of a failure that challenged your holding capacity, how they would be handled.

MR. PEREZ: Okay.

MEMBER RYAN: And that's kind of the theoretical part. The second part is in an operating plant have they had those circumstances, and if they have, how are they handled? That would be a good way for us to get an understanding.

MR. PEREZ: Correct.

MEMBER STETKAR: By the way, I think they have bigger holdup capacity for the Group I and II. They've got a --

MEMBER RYAN: Two weeks plus.

MEMBER STETKAR: -- two weeks plus. Another week for the Group III. Two plus weeks of waste.

MR. PEREZ: Okay, what I'm taking is to get you the reliability of the evaporator, and what happens when that evaporator is out.

MEMBER RYAN: What is the sequence of if you do have a problem, where it is the evaporator or whatever it might be, and you have to stop dealing with your two-plus weeks of waste, some other way with an alternate system, how would you go about it.

MR. PEREZ: Okay, and I think I can answer that question because the demineralizer is not a temporary thing; it's installed. So you could tailor, you can tailor that demin should the system fail, that's how I would handle it.

MEMBER STETKAR: You're going to be saturating your resin beds a lot quicker, and depending on how long this is out. You can push it downstream but you are still going to be taxing that system, because it's designed to handle effluent from evaporator.

MR. PEREZ: Right. So we will look for that reliability of the evaporator.

MEMBER STETKAR: It's basically operating experience, since as you said it's been installed in German plants. It's not something that is easily retrievable from licensing information, unfortunately. You need to kind of go back to the users and see what they're experiencing.

MR. PEREZ: And we may have that value, and that's why I'm asking. We'll get an answer.

MEMBER BANERJEE: What type of a system do they use here?

MR. PEREZ: Well, there are some plants that have used evaporators, and one as we've talked before, the question is where does the waste go to? Sometimes it's driven by your disposal options as to the technology. So the U.S. has experience with evaporators. The early experience wasn't very good.

Others have done very well with evaporators from an ALARA perspective. EPRI did some studies at a power plant in Virginia that again was having some issues with evaporator bottoms, what to do with them, and realized gee, that evaporator was doing very good, from an ALARA perspective effluent.

So now, right now most of the U.S. plants like to see demin skids. Reverse osmosis is coming into play.

MEMBER RYAN: I was going to say, RO is really coming along.

MR. PEREZ: Again EPRI has done some interesting work with that. So where we are going to be in five years or so, really we'll look at where is the disposal going.

MEMBER BANERJEE: The only thing about this that I would comment is that you've got a vapor compressor which is a complicated piece of equipment, and heat recovery in this system is quite a trick. So I'm just wondering what drives you to these systems rather than things like reverse osmosis, which are in some ways much more straightforward.

MR. PEREZ: That is the influence of the

designer. The European experience has been very positive with this technology so it was carried over. That is the driver.

CHAIR POWERS: The German guys do it and they like it.

MEMBER BANERJEE: The vapor compressor is a mess.

MR. PEREZ: Okay, the evaporator operates in batch mode as we discussed. It processes about 1,050 gallons per hour. The decontamination factor, the DF, can range from 10 to the 4th to 10 to the 7th, it has a very high DF, and volatiles elements, such as halogens, have a DF of 10 to the 4th, so for iodine, it would be 10 to the 4th.

Other nuclides, cesium, cobalt-60, strontium-90, manganese can reach 10 to the 7th. We did for analysis - I'll explain that later - we used the lowest range of these DFs for the GALE evaluations.

Now the centrifuge, remember, is supposed to have high - higher solids. It has a decanter that removes from the effluent stream the heavy particles. So the solids collect in a release container. And then the more clean liquid goes into the separator, that's actually a centrifuge, and from there you have to purify water. What's left goes into a slurry tank, and ultimately it's collected, solidified, in the solid waste system.

So this is a simpler system.

MEMBER STETKAR: Pedro, do the operating training plants also have the centrifuges installed?

MR. PEREZ: Yes, not all of them. Not all.

MEMBER STETKAR: Same question applies for them, because the centrifuge is typically a fairly high maintenance item. And here you start overloading the evaporator.

MR. PEREZ: And as I mentioned before - or as I will mention next, you really don't get too much of a DF from these. So these are just basically removing high solids in the waste stream.

MEMBER STETKAR: You will get a lot more solids in the bottoms of your evaporator.

MR. PEREZ: Like the evaporator is a process a batch mode. It can process up to 1,300 gallons per hour. And the DFs just 10 to the 1st or 10 to the 2nd. So it didn't do much from a DF perspective.

MEMBER RYAN: How dry is the solid coming out of the decanter?

MR. PEREZ: Do you know that answer, how dry is the solid? We'll get that answer.

MR. SCHMIESING: My name is Craig Schmiesing with AREVA NP. It should be the same consistency as the concentrates from the evaporator bottoms.

MEMBER RYAN: So is it fairly reasonable liquid content. Still, it is not dry?

MR. SCHMIESING: Correct. We have some place the water content.

MEMBER RYAN: It needs further treatment before it's ready for disposal, I guess?

MR. PEREZ: Yes.

MEMBER RYAN: All right, that's really my question. This waste container is really not a disposal container.

MR. PEREZ: No, it's not.

MEMBER RYAN: It's an intermediate container.

MR. PEREZ: Yes, exactly.

MEMBER RYAN: Okay.

MR. PEREZ: As I mentioned previously demineralizers are very commonly used in the United States. The resin bed configuration, you can tailor the combination of resins for what you have in the incoming influent. What we have in design certification is a system that can process 2,400 gallons per hour, which is pretty high capacity in case the evaporator centrifuges have an issue. But the DFs in the analysis only range from 10 to the 1st to 10 to the 3rd. And again, we didn't - in the analysis, we didn't tailor, we just used a common range of DF values.

From GALE you obtain the annual liquid effluents, the activities in curies per year. That is the input among other things for the LADTAP II code. We also took the GALE results and converted the activity to concentrations, effluent concentrations. First there's a realistic first term concentration comparison to things 10 CFR 20. And that concentration is then scaled up to the one percent fail fuel fraction to obtain a design basis effluent concentration. So this is what is going into the environment as calculated by LADTAP - excuse me, by GALE.

LADTAP provides the maximum exposed individual dose and demonstrates compliance withy the dose objectives of 10 CFR 50 Appendix I.

We also performed intensification a demonstrative population dose for a cost benefit analysis. Hypothetical sites were considered in the design certification, and population dose and cost benefit are COL items. We will do in DC just to demonstrate a methodology for performing. But the actual site has to be included.

LADTAP II, the inputs are in the FSAR Table 11.2-5. You had the maximally exposed individual, and as I mentioned, the allowable doses demonstrate compliance with 50 Appendix I dose objectives.

We assume a freshwater site to maximize the intake of contaminated vegetation, animal, et cetera. As I mentioned in site parameters, an effective discharge pollution flow of 100 feet per second is assumed, and just for the demonstration maximum exposed individual site parameters are listed in the FSAR 11.2, Table 5. And as I mentioned, this is a COL item.

So results for the maximally exposed individual to demonstrate compliance with Appendix I, the total body, the child group, 2.2 units per year; the dose objective is three. Recalling that we had maximized this site, this hypothetical site, to take into consideration all possible pathways. In the organ dose is the infant thyroid at almost five units per year; where the objective is 10. And of course when the plant is operating you have the offsite dose calculation manual that collects all of the effluent information and performs the actual calculations of what the effluents - the effect on the environment. That is a COL item.

The population dose was performed to look at do we even need the demineralizer. So we looked at a case, just the evaporator, another case with evaporator and demineralizer, and what we found was a benefit-cost ratio of 0.12 based on thyroid dose which is less than one. So the evaporator by itself is doing a pretty good job. The demineralizer is polishing where the evaporator effluent was. Nevertheless, because of the reliability issues, because of reliability concerns, we added to the signed certification the demineralizer system.

So you do not need it from a cost-benefit perspective, but from operational flexibility we recognized it's a good idea.

MEMBER STETKAR: But that puts the onus on that evaporator?

MR. PEREZ: Yes.

MEMBER STETKAR: Okay.

MR. PEREZ: The GALE-L effluent

concentrations as I mentioned we had the realistic source term concentrations, and we wanted to look at what was the maximum concentration we could expect at the site boundary. Here we are seeing a dilution factor of 9,000 gallons per minute. Again to maximize that concentration, and it reflects a cooling tower blowdown. The results show the sum of the ratios of the effluents released, the concentration limits for the expected release is 0.12, well below 1.0, and for the design basis it's 0.62. As a one percent failed fuel you still have a design basis release of 0.62, but again, the clean up system is doing its job. Realistically, 0.12, design basis, one percent, .62, and the goal here will show that you have that capability.

You are going to see the same later with the gaseous.

We performed an abnormal operational occurrences. We looked at 10 CFR 20.1406 from a spread of contamination perspective. We looked at pipe leaks and breaks. The liquids from leakage or pipe breaks in the system are collected by sumps in the lowest part of the building, and failures of vessels, tanks and pumps, rooms which contain storage and concentrate tanks are capable to hold the contents of a complete tank, and they are segregated by compartment. The rooms are connected to waste classification and leakage sensors monitor each waste group.

MEMBER STETKAR: Pedro, is the piping between the containment and the auxiliary building, the radwaste building, underground, or is it routed above ground through buildings?

MR. PEREZ: There are underground --

MEMBER STETKAR: I'm talking about between containment, the input to the radwaste program first. I know the effluent must be underground eventually.

MR. PEREZ: Do you mean under - between the buildings? Yes, we will give you an answer.

MEMBER STETKAR: You obviously know the reason for the question.

MR. PEREZ: And I will mention in a second the areas on which we focused in radiation protection have been the sumps, the lower sumps, and ensuring those are double-walled and pipes are double walled, and you have leakage, you can actually inspect sumps.

MEMBER STETKAR: But you can actually inspect sumps and what comes out of those sumps whether you can inspect that piping, especially since you are looking at a 60-year life on this machine, and if it's underneath buildings --

MR. PEREZ: Exactly, we have done a very conscious effort through an ALARA review to look at any piping, to the point of detecting an electrical conduit or fire by the a system warning. And between the buildings right now - we will get you that answer, but I fully understand the question and I expect the question.

MEMBER BANERJEE: So a leakage sensor, you say. What type of leakage sensor is that?

MR. PEREZ: It will be like a moisture detector between two -- an airspace, so that if you have water being collected in that space a sensor will go on. The last time I was here I mentioned to the committee that for example in my basement I have my hot water heater, I have a monitor on the floor, so if that water heater starts to leak, the moisture, that sensor will go off. So basically it's a motion sensor between an airspace, to warn - to warn the operator that, yes, there is a leak there. Because what's interesting is, if you have multiple barriers, they can be leaking, you may not know it. And we have experience with that, industry has experience with that.

MEMBER BANERJEE: So the in-service leakage sensor is not for buried pipes and things?

MR. PEREZ: Well, it can be, because a pipe will be double walled. So you can have a buried pipe, for example, leaving the building, the waste building, out to the environmental discharge point, that's a buried pipe, if it is a double walled pipe, and it will have leakage-detection capability, so you will know if there is a breach of the inner pipe. Then if that happens you will have to excavate and fix that problem. And the key here --

MEMBER BANERJEE: How large a leak will it be able to detect?

MR. PEREZ: That I do not know.

MEMBER RYAN: One of the things, just to follow up on Sanjoy's question, I appreciate the monitoring problem that you were describing, but how about the remediation part? A lot of times these have become huge projects to try and address a leak well after the leak has started. So are you taking that into account?

MR. PEREZ: That depends on the site, because depending on how the piping is routed, okay, there will be different options.

MEMBER RYAN: Yes, with the physics.

MR. PEREZ: So I have not within my scope looked at remediation, but I am very aware of that.

MR. SALAS: That would be one item that will be handled by the COL, and it will be part of -- be consistent with the industry initiative that is currently underway, that triggers what remediation needs to take place.

MEMBER RYAN: Thank you.

MEMBER STETKAR: But as far as the design is concerned, the design does specify double-walled pipe with some type of leakage monitoring system?

MR. PEREZ: Yes, and then the question of how sensitive is it, I don't have that information.

MEMBER BANERJEE: And this is all buried piping which might be containing radionuclides in the flow?

MR. PEREZ: That is correct.

MEMBER BANERJEE: All are double walled?

MR. PEREZ: Or they are in a trench, okay. The key here is to separate the reactor material with at least two barriers from the environment. And then have leak detection between the two barriers. So that can be a pipe within a pipe, or a pipe in a trench, with leakage detection.

MEMBER BANERJEE: I take it those requirements were spelled out in Chapter 12, right?

MR. PEREZ: Correct.

MEMBER BANERJEE: And the trench wall is made of what?

MR. PEREZ: It depends on where it is. It typically will be a concrete, like a concrete --

MEMBER RYAN: A chase.

MR. PEREZ: A chase, like a pipe chase.

We preformed the RW-IIa evaluation. We also looked at what were the effluents at the site boundary, so that would be the only restricted area of water concentration from unmitigated liquid releases. We followed Branch Technical Position 11-6, and recent DC/COL Interim Staff Guidance -013 and -014, dealing with source term assumptions basically. We basically looked at the total release of five tanks. We looked at concentration at an area immediately in the vicinity of the discharge point. What we noticed that these were using some site characteristic for ground transportation. We looked at just basically tritium, iron-55 and cobalt-60, as the only significant nuclides. The other ones were very low.

MEMBER RYAN: Significant in terms of, what, concentration or contribution to dose or what?

MR. PEREZ: Concentrations. This was strictly looking at concentrations. And in the FSAR 11.2-8, we demonstrate this has a compliance with 10 CFR 20 Appendix B. And again these were generic site considerations.

MEMBER RYAN: Did you think about there might be other radionuclides that might be dose significant that might not be activity significant?

MR. PEREZ: Yes, yes. And we did do site specific calculations, where we included everything. But there we needed the site characteristics.

MEMBER RYAN: So that would be a COL item too?

MR. SALAS: Yes, I think the calculations you are referring to are the COL applications.

MR. PEREZ: Yes.

MEMBER RYAN: Thanks.

MR. PEREZ: Like with liquid waste, we looked at the gaseous waste processing system. It is described in 11.3. This is a very common system. It collects, processes and discharges gaseous waste. It maintains ALARA dosage controls. It also controls explosive gases, by limiting the concentration of oxygen and hydrogen to less than - oxygen is less than 2 percent and hydrogen is less than 4.

And like the liquid waste, we have classified this as RW-IIa. It consists of obtaining any gaseous waste from taking sources through the reactor building, fuel building, safeguard building, mechanical areas, nuclear auxiliary buildings. It collects through the system, recombining hydrogen, oxygen, and then drawing the gas, and then through delay beds, three delay beds, charcoal delay beds, we have hold on xenon and krypton and ultimately all the discharges are through the plant stacks.

MEMBER BANERJEE: So what is the typical composition of the gas entering the recombiner, give me a range? How much hydrogen, how much oxygen, how much other stuff?

MR. PEREZ: Okay, the hydrogen concentration - I can tell you how much krypton goes in, but hydrogen, I need that looked up. What is the hydrogen concentration.

MEMBER BANERJEE: Hydrogen and oxygen. That's what's being recombined, right?

MR. PEREZ: Right, that's what's being recombined.

MEMBER BANERJEE: So, that is what sets the size of your recombiner.

MR. PEREZ: Yes. So what are the expected hydrogen-oxygen concentrations from like the volume control tank and all these other collection points. We will get you that answer.

MEMBER BANERJEE: And also I guess how much of the stuff is in any container. Hydrogen and oxygen in particular.

MR. PEREZ: Throughout the plant?

MEMBER BANERJEE: Well, wherever - I mean it's where you've got the highest concentrations of these noncondensibles.

MR. PEREZ: Okay.

MEMBER BANERJEE: Because my concern is that in several areas you could have things which potentially could form a small explosion or something. It's happened before.

MR. PEREZ: Yes. In PWRs, I don't know.

MEMBER BANERJEE: Well, basically not, but just for information it would be useful to know.

MR. PEREZ: Okay, we will get you that answer.

So the maximum hydrogen-oxygen concentrations that are being collected.

MEMBER BANERJEE: And volumes. The maximum volumes.

MR. PEREZ: Okay.

MEMBER STETKAR: Pedro, back to equipment, I note the recombining in the piping of ductwork, however it's piped up, is not explosion proof. You take the approach of designing against a detonable mixture.

MR. PEREZ: Yes.

MEMBER STETKAR: Without going into too many design details, are all of the - unless they are all air-operated valves in that system - do they all fail closed on massive air pressure and things like that? The FSAR talks an awful lot about controls. It talks an awful lot about how the system works. It talks about preventing isolation. I was just curious: what position do they go to when you lose air pressure? Since they are air-operated, and you lose air?

MR. PEREZ: Yes. Do you know? Do you know the answer, when you lose air, instrument air, where do the valves fail to?

MR. SCHMIESING: Not off the top of my head.

MR. PEREZ: I'm not sure we can say all valves.

MEMBER STETKAR: You know, they are hydrogen and oxygen additions, so you get the right mixtures, the recombiner, and the inlet and outlet valves on the recombiner itself. You get the flow stream isolation valves on the recombiner.

MR. PEREZ: Okay, so the focus is on the recombiner.

MEMBER STETKAR: Yes, what happens when you lose air. Here is what I'm concerned about, not getting hydrogen and oxygen together for example.

MR. PEREZ: Okay.

CHAIR POWERS: The control problem of systems is the oxygen bottle that is connected to the nitrogen inlet, and it blows up on grease. The usual problem with those systems is that the oxygen bottle gets connected to the nitrogen inlet and it blows up on grease.

You can lubricate nitrogen valves. It's usually handled just by making them different connectors.

MEMBER STETKAR: Incompatible connectors, but it happens.

MR. PEREZ: The gaseous waste system, the modes of operation, you have the normal mode most of the time, routine operation. No significant gas releases to the auxiliary building ventilation system. Now during surge mode of operation, it's only about 1 percent of the systems, normal operating time. And it's during plant start-up, due to the expansion of water from the primary circuit reducing free gas volumes in the coolant storage tanks and you vent that gas to the gaseous waste system. During outage preparation, for example, draining the reactor cooling system, we have excess gas generated from degasification of the reactor coolant that is sent to the gaseous waste system.

So routine operation, not much. It's when you go into the outage and start up and shut down. The delay beds, as I mentioned, very common, retaining xenon and krypton in activated charcoal media. They have three vertical vessels with a carrier gas of nitrogen, about 7 cubic feet per minute. Charcoal mass is 5,440 pound-mass per bed and that provides you a hold up time for xenon of 27.7 days and hold-up for krypton is 40 hours. And these are the inputs that will go into the GALE code.

MEMBER BANERJEE: 27.7 is a precise number, considering what I know about these things.

(Laughter.)

MR. PEREZ: It is a simple calculation. If you want, we could convert back to hours and I will give you just one whole number.

MEMBER BANERJEE: Oh, okay, hours is a whole number.

MR. PEREZ: Yes, because here 40 hours. Here is 27.7 days. I can multiple that time 24 and give you -- you know what I'm saying?

CHAIR POWERS: It's still going to be a very precise number. But it's just one over the decay constant for evaporation, is all that is.

MR. PEREZ: How long it takes for the charcoal mass to absorb this volume of gas.

CHAIR POWERS: So it's the desorption?

MR. PEREZ: Yes.

CHAIR POWERS: The desorption coefficient for whatever charcoal you have.

MR. PEREZ: As I mentioned, this is now in parallel to the liquid. We did exactly what we did in liquid and gaseous. We looked at realistic source terms. We looked at 1 percent failed fuel. We looked at Appendix Bravo concentrations for both. We did the maximally exposed individual doses. The key GALE-G inputs are the following: HEPA filters assumed to be 99 percent efficient, charcoal efficiency of 90 percent. I mentioned the hold-up times. The containment free volume of 2.8 million cubic feet. And within the reactor building, you have what is called a kidney filter. There are two compartments in the reactor building, in the equipment compartment and another compartment that can be accessed during power. And you have a kidney filter processing 4.1 cubic feet per minute cleaning up, okay, that internal free space and we have a containment -- we assumed a containment purge flow rate of 3210 cubic feet per minute. I write here, RAI 273 because in the FSAR right now what you have is an analysis done with 2970 cfm. And what happened to us, we looked at the design maximum supply, and that's 2970. We should have looked at design maximum exhaust. The delta is insignificant when you look at the doses. It's in the decimal places. But that was corrected from an RAI.

And we also did not include an air ejector effluent treatment, no filters. That's the GALE. The effluent releases from the stack, we looked at an elevation of about 200 feet from plant grade and about 7 feet above the reactor building with a stack flow rate of 240,000 cubic feet per minute. Again this is Chapter 11, where you can take credit for elevated releases. Later on, for the design basis accident, no, it's ground level release. But for normal effluent, we do credit the elevated release.

Atmospheric dispersion and ground

deposition, chi over q, d over q factors are based on conservative values at half a mile from the reactor building centerline which is the boundary, site boundary and we assume a mixed-mode release.

Exposure pathways: we looked at external exposure from contaminated ground, external exposure from the overhead plume, inhalation, ingestion of vegetables, milk, meat, water. And the GASPAR II results for the MEI, these are basically the calculated values and here you have your 10 CFR 50 Appendix I dose objectives. As I mentioned earlier, part of an operating plant, you have an ODCM that is collecting all this information, both liquid and gaseous, to give you your annual effluent reports. So the ODCM is a COL item.

We also perform a population dose for the sole purpose of a cost-benefit analysis. We look for stack releases, and again we looked at the same exposure pathways. And here we looked at a base case of three delay beds, and we looked at adding a fourth delay bed. The dose ratio was only .05, based on thyroid, and the expense of modifying the building and adding that delay bed did not justify adding the delay bed.

CHAIR POWERS: Because you don't any

delay in krypton and the xenon half life is too long for you.

MR. PEREZ: Exactly, it was not benefit whatsoever.

CHAIR POWERS: It would be interesting to look at what a cryoscopic system, where you would actually freeze the material out to give you long enough decay time to get some advantage. I have no idea what that would cost.

(Laughter)

There are product manufacturers and delivers them to your site a turnkey operation and things like that. But I just don't know. But an additional delay bed is going to give you nothing.

MR. PEREZ: And I will mention that, after all this, the highest contributor is krypton-85, when you look at the effluents from the plant.

And again as I mentioned, we looked at the concentrations, the Appendix Bravo Table 2 concentrations, looking at the annual average at .5 miles from the reactor centerline. And these results compare very favorable to some of the ratios for normal gaseous concentrations is only .02, and even with a 1 percent failed fuel assumption, it's .1. And again, both well below 1.0.

We looked at radioactive gas system leak or failure. As was mentioned earlier we have pressurized sections that are designed with a high degree of leak-tightness. For example liquid ring compressors are used to avoid an ignition source, and canned motor guarantees a sealed motor compressor. Some parts of the system are sub-atmospheric to prevent leakages and hydrogen interaction concentrations are controlled to prevent detonation.

We performed a bounding analysis that looked at an operator error leading to bypassing a delay bed and releasing the effluent from the coolant degasification system for one hour. It assumes that no one noticed it and you just are venting for one hour. Based on this one-hour release, the exclusion area boundary dose is less than 100 millirem in accordance with the Branch Technical Position 11-5.

Solid waste management looks at processing radioactive concentrate, solid waste processing system, solid waste storage system.

Processes concentrates from the evaporator bottom, process sludge from storage tank bottoms, and process spent resin from primary and secondary coolant purification as well as the liquid waste demineralizer systems.

Solid waste volume reduction includes shredding, solid waste brine, compaction, and a sorting box. A drum storage room for low-activity waste in drums is available. A concrete tubular shaft storage area for medium- and higher-activity waste. And we have several years' storage capacity for Type B and C waste in the plant.

MEMBER RYAN: How much volume are you planning on in that storage facility?

MR. PEREZ: Let me say first the storage capacity is 7-1/2 years and the volume is -- the total volume of Type B and C waste that use that 7.5-year -- okay, we can get that.

MEMBER RYAN: I'm curious about the volume number, because that's really the limit, not the time; sometimes they get used up faster than expected.

MR. PEREZ: Got it.

And the PCP, the Process Control Program, is a COL item. This is from one of the Chapter 12 drawings, showing that section of the waste building in the lowest elevation where you have the above-grade storage area and you have the tubular shafts, storage storage drums.

MEMBER RYAN: How high are those tubular

storage --

MR. PEREZ: Up to five drums.

MEMBER RYAN: Five drums.

MR. PEREZ: I had here five drums' high.

MEMBER RYAN: Oh, I'm sorry.

MR. PEREZ: 11.5, we look at effluent radiological monitoring and sampling. Gaseous effluents from the reactor building, fuel building, nuclear auxiliary, safeguard building mechanical area, radioactive waste processing building, controlled areas of the access building, condenser air ejector -- all of these have gaseous effluents. They are venting via the vent stack. At the vent stack you monitor noble gas activity, both gamma and beta detectors, aerosol activity, it detects iodine, activity is monitored by a dual filter for organic and inorganic iodine.

So all these effluents are collected by the different HVAC systems, routed to the vent stack, and from there you have the release, the monitored release.

The effluent radiological monitoring and sampling again concentrations show that you meet 10 CFR 20 Appendix Bravo. Effluents meet the ALARA design objectives of 10 CFR 50 Appendix I. These are also used in doses to show you meet the EPA site 40 CFR 190. So you need the site. You need to know if there are other facilities at that site.

MEMBER STETKAR: Pedro, let me -- you're speaking faster than I can think, which is not difficult.

(Laughter)

You mentioned the condenser air ejectors are exhausted back to the vent stack. Are all turbine building exhausts that could come into contact with potentially active gases routed to the vent stack? I'm thinking of things like gland seal exhausters.

MR. PEREZ: I know where you are going. The turbine building, that -- I can't answer that right now.

MEMBER STETKAR: I'm not talking about normal turbine building vents, but things you look at are condenser air ejectors, gland seal -- turbine gland seal exhausters, you know, that can get exposed to steam.

MR. PEREZ: Yes, the air ejector, of course, because of the volume --

MEMBER STETKAR: Yes.

MR. PEREZ: I tracked it. The others, I don't know right now.

MEMBER STETKAR: I haven't looked at the secondary side of the plant to see how you are piped up, but typically you'll have gland seal exhausters and -- I'm not thinking fast enough to identify another one, but gland seal is one that comes to mind.

MR. PEREZ: So the question is basically all the turbine --

MEMBER STETKAR: Anything that could be exposed to active steam.

MR. PEREZ: Yes.

MEMBER STETKAR: If you have it.

MR. PEREZ: We'll work on that answer.

MEMBER RAY: Have you ever seen those monitored, John, from the steam supply itself?

MEMBER STETKAR: No, not separately. That doesn't mean somebody hasn't tried it.

MEMBER RAY: I was just interested if you had.

MR. PEREZ: Okay, and as I mentioned, basically, these instruments provide the ODCM inputs in addition to offsite monitoring and to support the preparation of effluent reports.

Process monitoring and sampling: this is where you want to detect the migration of radioactive materials from a contaminated area to a clean area, consistent with 10 CFR 20.1406, you want to know how the material may be moving around the plant. It supports maintaining occupational and off-site doses ALARA. The process monitors main steam radiation and is the primary indication of a steam generator tube rupture. By looking at, for example, N-16 and krypton or whatever else may be leaking into that generator.

Steam generator blow-down system, is a secondary means of detecting steam generator tube rupture and provides chemical analysis of your steam generator. Condenser air removal has a radiation monitor and all the noble gas activity.

Component cooling water radiation monitoring system, here we are looking at coolers or heat exchangers to check the integrity of it, to make sure that barrier is not lost. Or if it is noticed, then you have to take into account repairs.

We look at gaseous waste disposal radiation monitoring systems, delayed bed monitoring downstream and upstream, to make sure the delay beds are working properly. Reactor coolant radiation monitoring and sampling, cooling gas, noble gas activity, to check your iodine dose-equivalent values.

Similarly chilled water supply for the gaseous waste disposal sampling systems. You monitor the integrity of the components such as heat exchangers. So we have a considerable detections around areas where you could have a barrier breach that then transports radioactive material to a clean area.

And we do have some automatic protective actions, for example, containment high range monitors feed into reactor building isolation. Fuel building air exhaust monitor feeds into a signal to close up the fuel building and go into recirculation mode. And the main control room air intake monitors look for activity in the Main Control Room air to go from normal mode of operation to a recirculation mode for control room habitability.

MEMBER RYAN: One of the things on that page you haven't touched on so much is that second part of 1406 which is the ultimate decommissioning of a plant. And 60 years out or 40 years out, that is something where there has got to be some vision on how you are going to apply -- and I completely understand, you've got in the plant, and this system is leaking and you need to control it and all of that, but that is kind of an inside-the-plant ALARA sort of approach. Then the second part is what happens to prevent long-term and perhaps very low-level radioactive material contamination in and around the plant. I can certainly understand a lot of that is the COL phase, but you mentioned an example of how your double-walled pipes will be monitored for leak protection or leak currents. That is certainly one good thing. Are there any other design features where you try to address the ultimate decommissioning aspects?

MR. PEREZ: Yes, we have a -- basically a design directive document that gives the system engineers the guidance. And I have a system engineer here who I work with -- Craig is a system engineer who I work with to apply the guidance that is basically implementing Reg Guide 4.21 for 20.1406.

For example, the small diameter piping in walls that are later on are difficult to detect are having the same pipes sloped do you don't have sedimentation. We've looked at the -- this is from a decommissioning perspective. Having all these tanks separately segregated so you don't spread the contamination is another feature, because now you can focus, this is the area that will have potentially contaminated cubicles versus the other areas of Group III waste.

So the aspects of segregation which I touched upon in Chapter 12 in November are one of those features. Let me see. What else have we put into the design from a decommissioning perspective? Segregation, the double-walled pipe, sloping pipe. Anything else you can think of?

MEMBER RYAN: You were mentioning pipe chases and so forth.

MR. PEREZ: Yes, pipe chases.

MEMBER RYAN: Maybe it's an unfair question, because from the add-on to what you've said, it really does become a very safe specific kind of implementation.

MR. PEREZ: The second part of your question is more -- it depends on your site. The sampling wells, how many -- how long is that distance from the environmental release to --

MEMBER RYAN: I guess it depends on the geohydrologic environment you are in as to what you do. So there's a big piece of it in that arena, so I appreciate that. And you did, I will say, cover quite a lot of the design detail in terms of inspection during operations that will allow for proof that things aren't leaking. So that was a pretty good discussion last time.

MR. PEREZ: Right, and we've had quite a lot of interactions with the staff which asked lots of questions about this.

MEMBER RYAN: There will be a COL step to this.

CHAIR POWERS: There are a lot of COL steps.

MEMBER RYAN: Thank you.

MR. PEREZ: You're welcome.

So that concludes my presentation. I do have some -- there is a question concerning the reliability of the evaporator and what happens when it's not available. How dry was the density of the bottoms, hydrogen and oxygen concentrations in the volume?

MR. SCHMIESING: Pedro, I do have that value. I just needed to confirm that with the system engineer.

MR. PEREZ: Okay, Craig Schmiesing.

MR. SCHMIESING: It's 4 percent by volume for hydrogen and 2 percent by volume for oxygen and it's kept at a concentration level of 2.05 to 1 hydrogen to oxygen, and it's kept below the combustible limits.

MEMBER STETKAR: Those are design specs, though, on --

MR. SCHMIESING: The recombiner.

MEMBER STETKAR: -- the recombiner. Sanjoy, were you asking that?

MEMBER BANERJEE: No, not in the recombiner. I was looking at where could be the largest accumulations.

MEMBER STETKAR: For example, the VCT, or for example when you are venting to shut down. That's -- I don't know where.

On your hit list, Pedro, put -- ask not only the reliability of the evaporator but also the centrifuge.

MR. PEREZ: Yes.

MEMBER STETKAR: It's routing the gas.

MR. PEREZ: Did I miss something? I was writing something down while you were talking.

MR. WIDMAYER: You are going to get back to us I think on the routing of the waste management systems' piping?

MR. PEREZ: Between the -- between the buildings, yes.

MR. WIDMAYER: That's liquid.

MR. PEREZ: Yes.

MEMBER STETKAR: In gas, fail positions on the valves, isolation valves, and the recombiner inlet/outlet and the hydrogen oxygen supply.

MR. PEREZ: What I like is, these are all for Craig.

(Laughter.)

MEMBER STETKAR: I notice him feverishly taking notes over there.

(Laughter.)

MR. PEREZ: He wasn't before, but now --

MR. WIDMAYER: A transcript is available.

CHAIR POWERS: Any other comments for this presentation?

MR. SALAS: I believe we will find you a way of getting the correct information.

CHAIR POWERS: Or you could come back and visit us.

Okay, any other comments?

MEMBER RYAN: None.

CHAIR POWERS: I will take a break until quarter after.

MR. PEREZ: Okay, thank you.

(Whereupon, the above-entitled matter went off the record at 9:50 a.m. and resumed at 10:13 a.m.)

U.S. EPR DC SER WITH OPEN ITEMS FOR CHAPTER 11, RADIOACTIVE WASTE MANAGEMENT

CHAIR POWERS: Let's come back into session. We will now have the staff's view on this

Chapter 11. I'm not sure who's handling this. Jason, are you going to present it?

MR. JENNINGS: Getachew is now arriving, but I'll go ahead and get us started nonetheless.

I'm Jason Jennings. I'm the project manager for Chapter 11. We met previously for Chapter 12. Mr. Chairman, I have no college basketball allegiances one way or the other. If I had to choose, it would probably be Villanova, and as a fan of all Philadelphia sports, except for my baseball team recently, I'm used to disappointment. So.

(Laughter.)

CHAIR POWERS: On that down note --

MR. JENNINGS: Yes, so as I mentioned, I'm the project manager for Chapter 11. To my right is Jean-Claude Dehmel, who is the lead reviewer for Section 11.2 through 11.5. Michelle Hart was our lead reviewer for Section 11.1. Also supporting us is Josh Wilson off to the side here from Balance of Plant Branch for 11.2 through 11.4.

This is our overview of the list of RAIs, the number of RAIs that were issued on this chapter and the number of open items in total. You will notice that there are no open items remaining on Section 11.1, and 24 in total on Sections 11.2 through

11.5, with a total of 71 RAIs sent out at this point.

Before I forget, I will mention that the last slide in the package is a list of acronyms that are used throughout the presentation, in the event we try to slip one pass you somewhere along the line here.

The next several slides includes a list of all the open items by section. I won't take the time to read these to you, and Jean-Claude will cover these in the course of his presentation. They are part of the package.

So at this point, I will turn it over to Michelle Hart, who will address Section 11.1, and then Jean-Claude will take us through the rest of the slides.

Michelle?

MS. HART: Hello, I'm Michelle Hart. I'm from the Siting and Accident Consequences Branch. I have a master's in nuclear engineering from The Ohio State University, so I have nothing to say about basketball.

CHAIR POWERS: If it were football, we'd be in better shape.

MS. HART: Perhaps. As Jason had said there are no open items in Section 11.1. The coolant source terms followed the guidance that we have and followed also the ANSI/ANS-18.1 1999 standard. They used the PWR GALE code. It's all what we expected to see.

The key SRP interfaces, of course, with the rest of Chapter 11 for the radwaste systems, with the shielding sections of the SRP and also with the design basis accident analysis.

For 11.1 there are no COL information items, so there is nothing for a COL Applicant to necessarily to do, and there are no open items.

CHAIR POWERS: A question comes up, somewhat philosophical in nature, and probably more pertinent to this particular application, and that is, the widely used ORIGEN code and the overall confidence we have in ORIGEN; our European colleagues don't always seem to have that confidence. And yet it is used by everybody and his dog in this country. Where do we stand on that?

MS. HART: We're fairly confident that the ORIGEN code is up to date for the higher burnup fuels, and for the types of fuels that we are talking about in these types of plants. They are 17x17 fuel. The fuel in these plants are a little bit longer -- two feet longer than the plants that are currently operating in the United States, except South Texas also has 14 foot fuel. So we feel we have good experience with this. There is not a lot of difference in the way the fuel is exercised in the plant. Plus, this particular applicant did a parametric study to try to bound the source term.

MEMBER SHACK: And that covers using the older version of the code that they used?

MS. HART: That was one of my RAIs. I had several RAIs on the use of the ORIGEN code, whether they -- because ORIGEN 2.1 is not currently supported anymore by Oak Ridge, and they've moved on to the package that is with the SCALE code, as well, I asked about the use of high burnup cross section libraries and the applicant did use the higher burnup cross section libraries and they did a parametric study to determine whether, if they had used the more recent version of SCALE, and at that time it was the version that was with SCALE 5 -- SCALE 6 has since come out -- if the source terms would have been different or remarkably different, and they would not have been. The source terms that they have were actually bounding for what they would have gotten in the current version of ORIGEN.

CHAIR POWERS: Okay, so we're in good

shape on the source term.

MS. HART: I think we're in good shape on the source term.

CHAIR POWERS: Okay.

MS. HART: We'll discuss it some more, I'm sure.

CHAIR POWERS: One of the things that a little bit surprised me on some of their discharges, they said, gee, the only isotopes that we have that are significant, tritium which you kind of expect, cobalt 60 you kind of expect, iron 65, you kind of expect. No manganese isotopes and that kind of surprised me a little bit. I made a note to myself to go check their steels because manganese chemistry is unknown to everyone and it seems to go where it damn well pleases to go.

MS. HART: Right.

CHAIR POWERS: So I'm a little bit surprised as you that they didn't show any manganese isotopes in their discharge.

Okay.

MR. DEHMEL: Okay, my name is Jean-Claude Dehmel. I'm a health physicist with the Construction Health Physics Group, and I have a B.S. from Manhattan College in health physics, and a Master's from NYU in health physics and I've been certified since 1986.

CHAIR POWERS: And your basketball allegiances?

MR. DEHMEL: It's kind of strange. You see I was born and raised in France, so I was exposed to the Harlem Globetrotters.

(Laughter.)

So this part of the presentation will focus on the balance of the radioactive waste management system covered in Section 11.2 to 11.5 of the SER. So for the liquid waste management system, the topics of interest that were looked at were, for example, the completeness of the information supporting the description, and performance characteristics of evaporated centrifuge systems in treating liquid waste.

Specific concern about the use of chelating and anti-foaming agent and how such agent might impact the performance and integrity of the demineralizer ion exchange columns.

Information supporting the development of radioactive liquid effluent source terms, assumption and parameters used in calculating the liquid effluent releases and off-site doses to members of the public and population and a description of the elements of a quality assurance plan addressing the design, fabrication, procurement and installation of the liquid waste management system.

CHAIR POWERS: Did you also look at the issues of fire?

MR. DEHMEL: Fire?

CHAIR POWERS: Fire.

MR. DEHMEL: No, that's addressed -- in the -- when we talk about Section 11.3 there is an issue having to do with General Design Criteria for that. But with respect to routine fires, no.

CHAIR POWERS: I was just thinking of fire particularly in the charcoal retention beds.

MR. DEHMEL: This is addressed in Chapter 11.3, when we talk about the gaseous waste management system. That would not be an issue in the liquid waste management.

With respect to the next slide, we looked at supporting assumptions and parameters used to assess the impacts of a postulated failure of a radwaste tank. Interfaces with other plant systems and operational programs and look at COL information item, in this case the commitment for the COL Applicant to conduct a site-specific cost-benefit analysis.

So in essence, the topics I went through are kind of recurring themes for the other sections, 11.3, .4 and .5. I'm not addressing the Off-site Dose Calculation Manual here because it is addressed in Chapter 11.5.

MEMBER STETKAR: Jean-Claude, before you get to the gaseous stuff, there was a statement in the SER that left me a little bit confused. The topic -- let me just quote the statement to give you a frame of reference here. This is for processing capacity, basically. It says, however, for events occurring at low frequency or producing effluents not compatible with currently used processing equipment, temporary processing equipment may be brought into the radwaste building. Therefore, the liquid waste management system can be unavailable for about three days and the temporary equipment can process that expected influent while meeting NRC regulations. This satisfies the Standard Review Plan caution in which processing equipment should be assumed to be unavailable for two consecutive days per week. In view of the above, the staff determined that the equipment sizing and processing rates are adequate for a liquid waste management system.

Does that approval implicitly account for the fact that they are going to use portable equipment, because I thought the design capacity is just based on the capacities of the hard-piped systems?

MR. DEHMEL: That's right. There is no -- the design certification does not endorse at this point any temporary skid-mounted processing equipment. Because to start with, it describes an option in the FSAR and there is no information describing what kind of system would be connected to supplement the existing permanently installed system.

MEMBER STETKAR: I was confused because this statement, the -- your determination that they have adequate processing capacity, seems to rely on the fact that they are going to need to use portable equipment or perhaps I am misreading the statement.

MR. DEHMEL: Yes, I think it may require some editing on our part. But basically, no, it does not imply that. It simply says, it recognizes that the margin that specified in the SRP, two to three days, is rather narrow.

MEMBER STETKAR: It is and this was excerpted from that discussion. There is a larger discussion in the SER.

MR. DEHMEL: Right, right. It recognizes

that it's a rather narrow margin and that, since we cannot essentially at this point endorse in the DCD and the SER, in essence, the nondescript skid-mounted processing system, it only recognizes the fact that there are provisions to augment the permanently installed system with some skid-mounted system that would be brought on-board specifically to address an operational event that would perhaps generate certain types of waste that may or may not be compatible with the existing system as installed.

MEMBER STETKAR: But your determination is just based on their stated hold-up tank volume -- waste generation rate, processing rate, with a margin of two or three days' downtime.

MR. DEHMEL: That's right.

MEMBER STETKAR: I just wanted to make sure I understood that.

MR. DEHMEL: I will revisit that language.

MEMBER STETKAR: When I read it, I got a bit -- it was a good discussion but when I finally came down to the conclusion, I got a little bit concluded.

MEMBER SHACK: Yes, you just need to move that sentence to the end of the paragraph.

MEMBER STETKAR: I am not going to wordsmith it. I thought I understood what you were doing until I got to that one little paragraph there.

MR. DEHMEL: For the gaseous waste management system, so for the gaseous waste management, the major topics of interest targeted in the review were, again, the completeness of information describing the operational features and performance characteristics of the gaseous waste management, for example, the hold-up time for noble gases in the charcoal delay beds. Completeness of information supporting the development of the radioactive effluent source terms, description of the elements of a QA plan addressing the design, fabrication, procurement and installation of a gaseous waste management system.

CHAIR POWERS: And I take it we did not look at fire here?

MR. DEHMEL: No.

CHAIR POWERS: Why don't we look at fire in the charcoal beds or around the charcoal beds or near them?

MR. DEHMEL: Well, there is a description in the system that it naturally provides the means to detect if there is a problem with charcoal beds. For example motion detection or fire, there is a means to actually suppress, to flush the charcoal bed but it's a contained volume of charcoal with the recognition that O2 and H2 are introduced ahead of that to control and recombine the hydrogen and oxygen. We don't look at actually combustion of the charcoal.

Josh? Balance of plant? Any comments on that?

MR. WILSON: Yes, that is exactly what I was going to say, suppression/detection. I don't know why the SRP doesn't talk about that.

CHAIR POWERS: Well, I can imagine many things. The most likely time for fire is exactly when you are using this for hold-up; it's during shutdown and start-up processes. If you had a fire near or adjacent and got much heat transfer, they hold that function is strongly determined by temperature. It seems to me it is something -- it comes to mind before earthquake comes to mind. Let's say that.

MR. DEHMEL: Yes, I hate to tell you this, but there is, I believe, in Section 9.5, it is supposed to address fire protection; is that right?

MR. TESFAYE: Yes.

CHAIR POWERS: It might be separated into a separate --

MR. DEHMEL: And it is also to meet the GDC Criteria 3. So that's all I can say at this point beyond what I just described.

MR. TESFAYE: We will consider this in Section 9.5, if it is not already considered.

CHAIR POWERS: Okay, follow up on that and just tell me what your status is and what your thinking is because it may be that the wall is seven feet thick and it would take a fire of heroic proportions to raise the temperature a tenth of a degree, in which case it's not really a problem. I'm not so concerned about fire in the graphite itself; I presume that is possible, but it is a fire adjacent to it that would cause me -- I mean, at least I would look. There may not be any combustibles in that area. On the other hand, there probably is a hydrogen tank and a hydrogen line and things like that.

MR. DEHMEL: All right, and this slide has to do with the -- so with respect to this slide, we looked at the information parameter using calculating effluent releases and off-site doses, again, to members of the public and populations. Supporting assumptions of parameter used to assess the impact of postulated failure of the gaseous waste management component. Again, this interfaces with other plant systems in operational program. Again, the COLA on Applicant responsibility to look at the merits of the cost-benefit analysis presented in the FSAR, and again, as before the ODCM, which is used to control gaseous effluent releases in this case is addressed in Chapter 11.5.

For the solid waste management system, again, we looked to make sure that there was sufficient information that fully described the major components of the solid waste management system, the listing of systems into text, tables and figures, the internal and technical consistency. We looked at the information supporting the estimated storage capacity for Class B and C low-level waste in the radwaste processing building. Those were the slide that Pedro presented earlier: the drum store room and tubular shaft storage room.

We also looked at, and requested expanded descriptions of inventories of expected low-level waste specifically to include to those described, the amounts of spent charcoal media and spent HEPA filters that may be generated yearly. And we also looked at system design feature used to commit and support compliance with the waste disposal acceptance criteria of the disposal site as well as the waste form characteristics of 61.56.

Again the same thing about theme about the QA plan addressing the design fabrication, procurement, installation of the solid waste management components interface with other plant. Just as an aside, the solid waste management system does not release directly any byproduct waste, namely, liquid or gaseous waste, to the environment. All of those wastes are routed either to the liquid waste management system or the gaseous waste management system. So in essence, there is no direct release mechanism from that system to the plant stack or through the discharge pipe.

So as far as the COL information requirement, this one is a process control program, we should address the methods and program procedures to process waste such that it can be shipped, it can be packaged and prepared to meet the low-level waste disposal facility requirement as well as those of 10 CFR 61.55 on the waste classification, Class A, B or C and 61.56 on the waste form, and essentially having to do in this case with stability of the waste and excessive presence of moisture or water in waste.

So the FSAR adopts the NEI PCP Template which is a generic process control program where the

Applicant would fill in site-specific information. So there was a Safety Evaluation Report written specifically for the NEI PCP Template. So the adoption of the NEI PCP Template is acceptable to the staff.

For the process and effluent radiation monitoring and sampling system, the issues that we looked at were completeness again or completeness of such system descriptions and operational characteristics of radiation monitoring equipment. Basically all this information is supposed to be in Chapter 11.5-1 of the FSAR that describes the systems, the dynamic operational ranges, whether or not they have sampling systems and whether or not they have automatic control features. So that is where the focus was on that part of the review.

We also look at description of equipment and provision used to collect samples in processing effluent streams. Also looked at the interface of other plant systems. And again, just like the solid waste management systems the process effluent radiation monitoring system does not generate any waste. Basically what it does is, a sample stream is either returned to the discharge point or returned to the appropriate liquid waste management system or gaseous waste management system.

Again on the COL information item, the FSAR endorses the NEI Template for 07-09A and it's the same, essentially, situation as was described for the PCP. It's a generic template where the COLA is responsible for, in this particular case, for providing site-specific information and plant-specific information: the site-specific information having to do with the information that is drawn from the periodic line-use sensors, whether those receptors are line-use information, any credit for specific dilution for liquid effluents that are released in surface water bodies.

So in conclusion, we have a number of open items, and those are associated with a technical clarification and information supporting design basis and description of the treatment system and the radiation monitoring system. Another major focus has been with the effort in confirming the estimates of liquid and gaseous effluent releases and associated doses, on both the meeting of requirements on Part 20 and Part 50 Appendix I. And then we expect the resolution of the open items to be based on forthcoming RAI responses and the resolution of confirmatory items will be completed pending receipt and review of the next portion of the FSAR. And we talked about the PCP and the ODCM cost-benefit analysis as COL information items that are going to be obviously addressed on an application by application basis.

MEMBER STETKAR: I have one.

CHAIR POWERS: Is it your intention to keep it to yourself?

MEMBER STETKAR: If you tell me to, I will.

CHAIR POWERS: I would never tell you such a thing.

MEMBER STETKAR: And I don't know, Jean-Claude, if this is for you or for Getachew. There were a couple of statements, both in the gaseous waste area and the solid waste area, where, let me just quote this so I can get the context right, and it's discussing a response to RAI -- a specific RAI. The quote says, the Applicant stated the gaseous waste management system does not have the safety-significant features that warrant inclusion in FSAR Tier 1. The staff disagrees with the Applicant's response to this SAR and formulation of FSAR Tier 1 screening criteria in determining which systems are included as an FSAR Tier 1 entry. And then it goes on to say that, while this issue has not yet been resolved to the staff's satisfaction, it goes on to say that, well, you are basically postponing that discussion until Chapter 14 regarding ITAAC. And I guess my question is, what areas of disagreement do you have with the Applicant regarding the screening criteria for what's in the Tier 1 information in the FSAR? What is the issue here, because I didn't have a chance to go back and look at the whole stream of RAIs and responses? Both within the context of -- is it only limited to the waste management systems or is it a more generic issue?

MR. TESFAYE: It is a more generic issue.

MEMBER STETKAR: Okay. Because this is the first I've heard of that.

MR. TESFAYE: There is an outstanding RAI and I can get you the details this afternoon.

MEMBER STETKAR: Outstanding RAI from NRO Chapter 1?

MR. TESFAYE: No, Chapter 14.

MEMBER STETKAR: Oh, Chapter 14. Okay. Okay.

MR. DEHMEL: Specifically, in the context of this one, it has to do with the screening criteria that were identified in Chapter 14.3 of the FSAR. We looked at it and I did not see a screening criteria that said, well, for plant systems that are used to control releases, either effluent releases or doses to members of the public, those systems were not included in Tier 1. Traditionally, if you look at a hierarchy, well, you know, is it safety-related? So the thought was, if your systems are essential to comply with Part 20, even though it's a lower tier, right, of safety, there should be something in Tier 1. And the concern specifically for the liquid and gaseous waste management system -- and starting with the gaseous waste management system -- is the thought that, as far as Tier 1, there should be some information to describe and commits that the proper types and amounts of charcoal that have been introduced into the charcoal delay bed because otherwise the system will complete -- essentially truly complete, with the valves and the piping and everything and all the radiation monitoring, but if the charcoal was missing, that means the performance goal or commitment that they have made in Chapter 11.3 with respect to source term and outside doses. So a similar RAI was generated for the liquid waste management system to make sure that the initial loading of ion exchange presents in the demin system where they are. And again, the focus is on the initial loading because it's understood that after that it's the Applicant's responsibility, the COL holder's responsibility.

MEMBER STETKAR: But, Getachew, you said it's a more generic issue in terms of the screening criteria that they apply across all systems?

MR. TESFAYE: Yes.

MEMBER STETKAR: Okay. I guess we will see that in Chapter 14.

MR. TESFAYE: Chapter 14.

MEMBER STETKAR: I just wanted to make sure that I understood whether it was a more generic issue or whether it was only specific to these particular topics. Obviously, it will filter down to this but if it's generic, it will filter to several other areas as well. Thank you.

CHAIR POWERS: Any other comments to make on this?

Okay, I have checked with my designated federal official and he tells me that I can go ahead with the next chapter. But I can take a break and allow people to get ready to make their presentations.

MR. TESFAYE: That may be a problem. I don't think AREVA is here.

MR. WIDMAYER: He said he's all right.

MR. TESFAYE: All right.

CHAIR POWERS: Okay, we will have to do half and then the other half will be after lunch.

MR. TESFAYE: Okay.

CHAIR POWERS: But that will move -- your presentation will obviously move up this afternoon. That's no problem for you?

MR. TESFAYE: No.

CHAIR POWERS: And we are sending you off with a homework assignment.

MR. TESFAYE: Yes.

CHAIR POWERS: OK. Pedro is starting a trend here that is getting infectious.

Okay, so we are going to take a break until eleven o'clock and then we are going to come back and start on technical specifications.

(Whereupon, the above-entitled matter went off the record at 10:42 a.m. and resumed at 10:58 a.m.)

US EPR DC APPLICATION FSAR CHAPTER 16

TECHNICAL SPECIFICATIONS

CHAIR POWERS: I think we are in good shape to get started. Thank you, Pedro, for allowing us to move forward. And like I say, our schedule calls for two hours. I'd like a break at noon or wherever it's logical to break. I mean, you know, mas o menos and advance forward. So, your show.

MR. SALAS: Robert Sharpe will be our presenter. And Robert, do you want to -- this is your first presentation.

MR. SHARPE: First presentation in about 25 years.

CHAIR POWERS: Well, we have a bit of a tradition. The first time you speak in front of us, you have to tell us why you are qualified to speak in front of this August body. And today you have to tell us your basketball allegiances.

MR. SHARPE: I prepared for that. My name is Robert Sharpe. I'm with AREVA. I went to school at NC State University, so that should give you some idea. And my school was one of the few losses that Duke had this year. I think there is a case to be made that NC State should be the national champion for that reason.

(Laughter.)

After graduating from NC State, I spent 31 years working for Duke Power, starting out at Oconee and start-up testing and operator training and getting my SRO license at Oconee. Moved from there to be the licensing lead for both the Catawba units, and then onto McGuire to be the regulatory compliance manager for a number of years for moving and steam generator replacements for Duke and then for Framatome and then for AREVA, steam generator replacement support to the new plant project and supporting EPR licensing.

CHAIR POWERS: So he's trying to put you out of business, Shack.

MR. SALAS: I remember interviewing with him when I got out of college.

CHAIR POWERS: You must have done pretty well.

MR. SHARPE: I will discuss with you today the development of the technical specifications, the generic technical specifications for the U.S. EPR.

In developing the tech specs, we took the U.S. EPR systems and compared them to the 10 CFR 50.36 criteria. The next slide will show that graphically but I'll go through the words first. We found in most cases that the Westinghouse Standard Tech Specs, NUREG-1431 Revision 3.1, was the best fit. That was not really a surprise because the U.S. EPR is a four-loop active PWR, so many of the specifications fit very nicely.

We did find that other standard technical specifications were useful. We used the B&W standard tech spec for the accumulator out of service time. We used the Combustion Engineering Standard Technical Specifications: the digital version for reactivity control and power distribution limits along with Westinghouse Tech Specs there.

We found in one case that the BWR-6 tech specs, that surprised everybody --

CHAIR POWERS: That probably sticks in your throat someplace. You probably had to look up the acronym.

MR. SHARPE: Given my background, I know very little about BWRs other than the control rods go in the wrong way. But they did have a standby liquid control system spec that was a good fit for the EPR's extra borating system and so we used that as a starting model.

And we also used AP1000 tech specs as a precedent in a number of cases where there were up-to-date features that plants now incorporate such as an in-containment refueling water storage tank.

We did not develop risk-based tech specs for the U.S. EPR and we accepted the completion times and frequencies that are common in the Standard Tech Specs.

This shows graphically what I just talked about. The column on the left is just representative of all the U.S. EPR systems and it continues on down the alphabet and that's not in the list of acronyms, trying to define all those.

That's all safety, non-safety. It is everything -- applied the 50.36 criteria and that is where we ended up using, of course, a number of NUREG-1431 specs as a starting point. And I might add that in some cases it really doesn't matter which spec you are using. They are all the same, like the spent fuel pool water level spec is the same in every PWR, even though we saw we're using NUREG-1431, it would have been the same if we were using CE or B&W.

Though the U.S. EPR Tech Specs continue to be a complete document for use by COL Applicants, there are some things that a COL Applicant would have to provide. In Section 3.3.1 a COL Applicant would need to confirm the setpoints that have been provided for user setpoint control program for the protection system setpoints.

In Section 4.1 there is a paragraph in everybody's tech specs that describes the plant location and in Section 5.6.2 there is an option of single- or multiple-unit radiological reports.

In the ultimate heat sink makeup, a COL Applicant would need to describe their unique makeup for ultimate heat sink.

These are the chapter topics for the U.S. EPR generic tech specs. This table of contents, if you compared it with an operating PWR, would look identical to it, but we really haven't changed a lot from operating PWR tech specs.

A brief word on the treatment of trains. The U.S. EPR uses four trains for the main safety systems with an N+2 safety concept which allows for one train to be out of service for maintenance or surveillance; one train is assumed lost to a single failure; one train may be lost to an initiating event such as ECCS being lost to a pipe break in the wrong location, and then that always leaves at least 100 percent capacity available for accident mitigation.

TSTF Travelers, the standard tech specs are living documents. The NRC and the industry work together to improve the tech specs. The Tech Spec Task Force, which is an industry group, generates proposed changes to the NUREG Standard Tech Specs, and the NRC staff reviews and approves or disapproves those changes. And then they are incorporated into the standard and that's what we started with, the

Revision 3.1, and eventually a number of the tech spec travelers, as they are called, will be being rolled up into Revision 4.0.

So we took the TSTF Travelers that had been improved since Revision 3.1 and reviewed each one of those for applicability to the U.S. EPR. A number of them we discarded because they were BWR-specific or they were risk-based and the ones that were applicable to the U.S. EPR we included those in our tech specs.

The differences between our tech specs and the standard tech specs section by section now. In general, we have revised the standard tech specs or used tech specs as a model and incorporated the EPR-specific design in our supporting safety analysis into the specs.

In Section 1.1, with the definitions, we revised definitions to reflect AREVA terminology and core parameters. I think that is typically done in everybody's tech specs.

In Section 2.0, a similar thing that we revised to reflect that our fuel usage and our methodologies that we use for fuel performance.

Section 3.1 and 3.2, as I previously mentioned, we did use a combination of Westinghouse and CE standard tech specs as best-fits for the approach that AREVA takes to core management. For the part-length control rods, because EPRs do not use part-length control rods, and we revised it to our nomenclature and fuel design in general.

Section 3.3, instrumentation, the digital protection system that U.S. EPR uses incorporates multiple functions that in standard tech specs would be a number of the subsections in the tech specs. So our protection system eliminates the need for some of those separate sections such as engineered safety features and diesel generator starting. We chose to use a component- rather than a function-based approach as most appropriate to the architecture for our protection system.

In Section 3.3, Remote Shutdown Station, we used the AP1000 precedent to reflect computerized work station versus hard-wired Remote Shutdown Station that most people are familiar with in operating plants.

In Section 3.4, the Reactor Coolant System, we revised the standard specs to allow for limited 3-loop operation consistent with our safety analysis. We did not incorporate a PORV specification because U.S. EPR uses a pressurizer safety relief valve, which I believe you have seen in previous presentations. We also did not include loop isolation valves or start-up of isolated loops because we don't use those features.

And we did not incorporate a restriction on high-head pumps for low-temperature overpressure protection operation, because this is not a limiting event for an EPR.

Section 3.5, emergency core cooling systems, we needed to make a number of changes to reflect the U.S. EPR design, first of which was to incorporate an in-containment refueling water storage tank. We also added the extra borating system. As I mentioned the use of the BWR-6 tech specs that the BWR tech specs just didn't have a two-train high concentration boric acid system that fit.

We also added the IRWST and ECCS specifications in Modes 5 and 6 to provide a core-cooling capability during the reduced inventory operation.

And we revised a number of tech specs to reflect the use of enriched boric acid. We use greater than 37 percent enriched boric acid in the borated systems.

And we did not incorporate a seal injection flow specification. Since CVCS is not a safety system, it's not credited.

MEMBER STETKAR: Bob, on emergency boration, I notice -- could you explain the rationale that the tech specs are listed says that if the concentration in the emergency boration storage tanks is out of spec, you have 72 hours to restore it to normal. But if an emergency boration train is in operable, you have a seven-day allowed average time. That doesn't seem consistent with the overall general philosophy from all of the other systems in the plant, where now you are down to a single operable train and if that train fails, you fail that function.

So I was curious why the seven-day allowed average time applies to a single train of emergency boration rather than for example 72 hours, which would seem more consistent with the overall philosophy?

MR. SHARPE: In general, we took the allowed outage times from similar specs. In the case of the extra borating system, it is a manually started system. It is not automatically actuated.

MEMBER STETKAR: That still doesn't really answer my question about the philosophy in terms of n minus x whether it is one, two, three or four.

MR. BERGERON: On the seven days versus

the 72 days --

MEMBER STETKAR: Seventy-two hours. I was trying to read through and figure out the basic philosophy when you get down to x, and if you have four Xs, too, because it is n minus two, once you get down to two remaining, you fall into a 72-hour time. So I'm trying to think now in a two-train system what would be the analogous time window, and seven days just --

MR. BERGERON: I understand your question. I'm not sure where the seven days came from.

MEMBER STETKAR: I can understand it came from another plant design that might not necessarily comply with this.

MR. SHARPE: I think we will have to get back to you on that.

MEMBER STETKAR: Okay, thanks, I'd appreciate that. Because it was the one area in the whole safety system that sort of jumped out at me as different. I look back at the bases, and the bases don't describe why 7 versus 73 --

MR. SHARPE: Okay, thanks.

Section 3.6, the containment systems, U.S. EPR does not incorporate containment spray in the cooling systems that may be used to. We use other means for removing heat from the containment and those of course are reflected in the tech specs.

We also eliminated the bypass leakage which in many operating plants is containment leakage that does not terminate in an appropriate area. In EPR all penetrations terminate in one filtered area or another, so we have eliminated that bypass leakage term.

Section 3.7, the Plant Systems, we revised a number of these specifications to reflect the U.S. EPR design. I believe you had a presentation already on the main steam system, so you know that in Chapter 10 --

MEMBER STETKAR: I don't know if we've had Chapter 10 yet.

MR. TESFAYE: Yes.

MEMBER STETKAR: I'm sorry. We are intimately familiar with that --

(Laughter)

MR. SHARPE: From that you would have learned that the valving arrangement on the steam lines is a little bit different. We don't have the large number of main steam safety line and main steam relief trains is a part of that. So therefore the specs needed to change for that reason.

Also the emergency feed roller system has a motor driven pump in each train, and a turbine driven pump, and has a separate water storage pool for each of the four pump trains.

We also added safety to our water system as a tech spec that is not in the standard.

We also added a specification in the main steam line leakage since we take credit for leak before break inside containment.

MEMBER STETKAR: Here too, in the controlling air conditioning system, acronym CRACS, with a C, the tech spec says with two control room air conditioning systems, trains inoperable, to restore one inoperable train to operable status in 30 days. Here again I am down to N minus two and I have a 30-day time limit for this system rather than what I would have expected to see is 72 hours. And 30 days is a long time.

MR. SHARPE: If you look at the standard specs that follows the same thinking there -

MEMBER STETKAR: For a four train system?

MR. SHARPE: I just wrote down from the first system out of service was 120 days, and got down to some point that we looked at a current plant and then applied the 72 hours.

MEMBER STETKAR: That's right, and that is consistent with all of your systems like the injection systems, electrical systems, except for this one. It says 30 days once I - if I'm down to two out of service rather than 72 hours.

MR. SHARPE: Again, I'll have to go back and review that.

MEMBER STETKAR: I'd appreciate that, because the - again, back in bases, I'd want to see if the bases had any more elaboration. And they really don't. This again seems to be a bit of an anomaly.

MR. SHARPE: Okay, we'll take a look.

Section 3.8, electrical power systems, the electrical specs for U.S. EPR look very much like the current operating fleet. They are pretty consistent across BWRs and PWRS. The big difference being that U.S. EPR does have four electrical trains with four emergency diesel generators, and we've revised the specs to reflect that.

Section 3.9, refueling operations, we did not incorporated the unborated water source isolation valve as allowed by the standard tech specs, since we did boron dilution analysis in those sets.

MEMBER STETKAR: Okay, you have a boron

dilution analysis, and I went to go look at that analysis in Chapter 15. And the analysis takes credit for the protection system signals that isolates the CVCS system. So why don't you have a tech spec that requires operability of that isolation function including the isolation valves?

MR. SHARPE: The valves are in a separate spec.

MEMBER STETKAR: Where are they? I couldn't find them.

MR. SHARPE: I can find them.

MEMBER STETKAR: Okay, if you could I'd really appreciate it.

MR. SHARPE: Maybe after lunch. Those are CVCS valves, and because CVCS is non-safety we didn't have that CVCS spec. So we had to find another place to put them.

MEMBER STETKAR: If you could point me to where they are. I went looking for them and couldn't find them. I don't really want to read every word in the tech specs.

MR. SHARPE: We do have that one.

MEMBER STETKAR: Okay, thanks.

MR. SHARPE: We replaced the containment penetration specification that is in Section 3.9 with a specification for fuel decay time that is consistent with Pedro's dose analysis.

In Section 5, administrative controls, we really needed to make a number of changes to reflect the U.S. EPR design, first of which was the use of grouted tendons, which is not typical, so we had to change that aspect to reflect the grouted tendons. We revised the steam generator program per TSTF. That spec is now pretty common among plants that have replaced their steam generators and have Alloy 690 tubing.

We added a tech spec, another TSTF on controlling habitability. And we replaced the liquid outdoor storage tank discussion with a reviewer's note since the U.S. EPR doesn't come standard with an outdoor storage tank.

MR. WIDMAYER: Robert, excuse me, you have to be careful with the microphone when you are turning your pages.

(Off the record comments.)

MR. SHARPE: In summary we found applicable instances of 50.36 regulation, including the tech specs. We found the format, content and usage rules for the Improved Standard Tech Specs. And it reflected the design of the U.S. EPR in these tech specs.

The last page is the acronyms.

(Off the record comments.)

CHAIR POWERS: Any other questions from the committee on the technical specifications chapter?

Seeing none, I will recess until one o'clock.

(Whereupon, the above-entitled matter went off the record at 11:25 a.m. and resumed at 12:58 p.m.)

CHAIR POWERS: We will come back into session. You wanted to say something?

MEMBER STETKAR: Yes, I have been given the section of the tech specs that indeed does address the isolation valves for the CVCS. So now I'm aware of it and this seems reasonable. I was just looking for it. Thank you.

CHAIR POWERS: Your record is now complete?

MEMBER STETKAR: That's a stretch.

(Laughter.)

MEMBER STETKAR: I'm pretty happy about these valves, though.

CHAIR POWERS: Well, you are easier to please than most of us.

MEMBER STETKAR: I'm an engineer.

CHAIR POWERS: We will now continue with our discussion of the technical specifications, Chapter 16, with the staff presentation.

U.S. EPR DC APPLICATIONS FSAR CHAPTER 16, TECHNICAL SPECIFICATIONS

MR. TESFAYE: Good afternoon. Again, my name is Getachew Tesfaye, I'm the project manager for EPR design certification.

We are here to present Chapter 16, the SE with Open Items. Pete Hearn will be leading that discussion. Before we get started I took an assignment this morning from you, so this is not on Chapter 16; this is Chapter 11.

I talked to the Chapter 9 guy. He informed me that Section 9a includes the area where these charcoal beds are.

CHAIR POWERS: Okay.

MR. TESFAYE: Which is the auxiliary building and the fire analysis is done in Section 9a.

CHAIR POWERS: 9a.

MR. TESFAYE: And I also talked to Jean-Claude Dehmel. He's going to put a pointer in his SE to indicate where that fire analysis is done.

CHAIR POWERS: Very nice. Thank you very

much.

MR. TESFAYE: You are welcome.

CHAIR POWERS: Okay, Peter.

MR. HEARN: My name is Peter Hearn. Do you want my background?

CHAIR POWERS: You bet.

MR. HEARN: After graduating Brooklyn Polytechnic Institute, which is now the Polytechnic Institute of NYU, I went to work for the Navy for about five years where I worked in the ship propulsion systems on diesel-powered, steam-powered, gas turbine-powered, and the secondary side of the nuclear-powered systems.

Then I came to the NRC in '73 -- or the AEC. And at the AEC, I spent over 10 years in the auxiliary systems branch, which included the balance of plant, chemical engineering, and the diesel generators.

Spent over 10 years in the containment systems branch. Spent about 15 years in the technical specifications. Now I'm in projects. And that brings us up to the presentation. We'll start with the technical reviews. They are all from the Technical Specifications Branch. There's Hien Le, Joe DeMarshall, and Derek Scully.

Hien and Joseph will be doing the presentations on the tech specs.

The next slide is the overview of the areas where the review took place. The first column is the Chapter 16 section. The second column is the title of the section. And then the third column is the number of RAIs, questions asked, and the last column is the number of open items. And you can see the distribution by the subject matter. A lot of questions in the electrical and instrumentation areas.

All told, we had 293 questions, with 30 open items. The next slide is a listing of all 30 open items with a brief description of what they entail. We use this as a check-off list when we close out open items.

MR. TESFAYE: I would like to say something about this discussion here. In all the chapters that we have presented, we are listing all the open items so that when we come back in Phase 5, we know exactly where we left off. So this is just for the record.

CHAIR POWERS: That's right. I think we understand that and if there were any of them that you thought were particularly significant, you would have highlighted them.

MR. TESFAYE: Yes.

MR. HEARN: After the listing of the open items, that will bring us to the overview of the technical presentation which will be presented by Hien Le.

MR. LE: My name is Hien Le. I am with the Technical Specification Branch. I'm a technical reviewer for mechanical system area.

In our presentation today, we will go through applicable regulations and review guidance, our tech spec review criteria that we use --

MR. TESFAYE: Hien Le, could you please give a little bit of background information about you.

MR. LE: My background is; I finished my bachelor from Long Beach State University in California and finished my MS from UCLA in mechanical engineering. And then after that, I start working with Bechtel Corporation doing start-up for San Onofre nuclear plant Units 2 and 3 at the time they tried to complete their start-up program there.

When Bechtel conclude their program there, I left Bechtel and working for various start-up programs around the country at the time. I'm doing some technical review for a start-up program in Clinton for two years there, and then I move to South

Texas to review the record at the time and also start-up program for South Texas. After staying in South Texas for three years, I came to Calvert Cliffs nuclear plant. At the time Calvert Cliffs nuclear plant was in the watch list, so I come in, working there for two years as a contract helping to include vendor from technical manuals, upgrade that program there. And then became permanent worker, permanent for Calvert Cliff from 91 to 2005, after 14 years.

I left Calvert Cliff. I joined NRC and now I work in the NRC for four years, slightly more than four years.

Starting now with QA group vendor inspection group in the NRR, and two years ago, joining the NRO tech spec branch, and been with this branch since.

MEMBER RAY: Thank you for your service at San Onofre. I was the project manager there.

MR. LE: Bechtel or --

MEMBER RAY: Edison.

MR. LE: Edison.

CHAIR POWERS: San Onofre 2 was the first commercial nuclear plant I ever toured, just prior to it going critical.

MR. LE: If you recall John Hirsch, he

was my boss at the start-up organization for Edison.

MEMBER RAY: That was a lot of fun we had there.

MR. LE: I am starting now with the applicable regulation. Okay, we going through applicable regulations and review criteria, then our review criteria in the tech spec area. I think -- going fast through the summary, RAI summary. After that we will go into significant issues, open issues that we identified. For the regulation and review criteria, we have 10 CFR 50.36 and 10 CFR 50.36(a). 50.36 provides requirements for content in tech spec that -- in an operating license. The 50.36(a) require tech specification for control of effluent, radioactive effluent, from the operating plant to the environment.

I want to make a note here that that Generic Letter 89-01 allowed the relocation of all of those requirements from tech specs, and implement the programmatic control in the tech spec, administrative control in tech spec Section 5, so with the current tech spec, we would not see any tech spec for the control effluent from open plant.

Then CFR 52.47(a)(11) require that a DC, design certification application include tech spec in accordance with the requirement at 50.36.

The guidance was provided in SRP Chapter 16. Basically, SRP Chapter 16 recommend use of standard tech spec for guidance relating to the format and reliable content for the information provided in the base.

NRC issue five sets of SDS for three BWR design and two BWR design. The three BWR designs from Westinghouse, Combustion Engineering and Babcock and Wilcox. For the two designs for BWR is from GE.

So based on those regulations and guidance, the staff review of the proposed GTS and the base, we ensure that the specification meets the requirement of 10 CFR 50.36 regarding safety limits, limiting safety system setting, limiting the condition of operation, surveillance requirement, design feature and administrative control. That is the content of tech spec.

We will ensure that they will conform to the STS format, the STS convention regarding format and usage rule and level of detail for information provided in the base, and ensure that tech spec requirement and the information in the base reflect EPR design and accident analysis provide in the FSAR.

This is just a capture of what Getachew

mentioned earlier, a total of 293 RAI issues, with the 30 open items. The 15 confirmatory items is for a proposed change. That was reviewed and found acceptable by the NRC but we need to verify that the proposed change will be incorporated correctly in the future revision of the DCD.

Of the 30 issues, open items, we found five issues that we feel are significant enough that would be of interest to the Subcommittee members. The first one was on 120 days' completion time to restore a train to an operable status for condition with one out of four required trains inoperable due to maintenance.

The second issue is on surveillance testing of instrumentation systems. The third issue is on specification requirement on the post-accident monitoring instrumentation system before was on specification on remote shutdown system. And the last one is the omission of the manual reactor trip function from the EPR GTS.

For this 120-day completion time, EPR proposed this particular completion time in LCO for six safety-related systems that have four independent trains. Those six systems are safety injection system, emergency feedwater, component cooling water, essential service water, the ultimate heat sink and the emergency diesel generator system.

I want to point out here that the EDG system is a support system to the other five systems. This is an item that we will cover later.

For those - for the six systems, except for the emergency diesel generator, the remaining three inoperable trains in order, five system by design still satisfy the single-failure criteria without further system equipment realignment.

For the EDG system, in contrast, additional alignment is required to maintain that capability. We will cover the EDG system requirements in later slides.

Under the SDS guidance, unlimited operation is allowed when an alternate configuration can withstand a single failure in a design basis accident. What I mean by unlimited operation in the language of SDS, it was a continual operation for an unlimited period of time after you implement the alternate configuration.

Therefore, from a deterministic point of view, any proposed condition time for those five systems is acceptable to the staff. However, because the EDG system is a support system to the other five, the staff final disposition of this 120-day completion time is dependent upon resolution of the staff concern in the EDG system.

MEMBER STETKAR: Could you explain that rationale just a little bit? Why, by definition, are the EDGs more important than the other systems?

MR. LE: The EDG system was a support system.

MEMBER STETKAR: As is component cooling water or essential service water.

MR. LE: Yes, every other system was a supported system. So this one was when you had -- you don't want to have the completion time on the supported system is less or more restrictive than the support system.

MEMBER STETKAR: Why doesn't that same rationale apply, though, to the emergency service water system which is a support system for all heat removal for design basis accidents, and in fact, if an emergency service water pump fails, I do not have that system, whereas if an EDG fails, I still have offsite electric power? I don't understand the rationale for focusing only on EDGs as the most important support system. That's basically what I'm trying to ask you.

MR. LE: In this particular case because

we don't have a precedent, we still meet the redundancy requirement in this particular case, 120-days completion time. So my argument is on application of this 120 days, why --

MEMBER STETKAR: I see that rationale but me flip it on you. If you fully accept the rationale of 120 days for emergency service water; is that correct?

MR. LE: We accept the 120 days in this case if the EDG accept the 120 days before -- 120 days after realignment.

MEMBER STETKAR: Let's not talk about EDGs. Let's talk only about emergency service water. Do you accept the 120 days for emergency service water because as I understood it you said there were six safety related systems? You elaborated what those six were, and you are now focusing on EDGs as being a special case. So that tells me that the emergency service water is not a special case.

MR. LE: I can directly answer your question, yes, we can accept a 120 day for the essential service water with one train out, of the four train, because with the three remaining trains we still fully support the safety --

MEMBER STETKAR: Doesn't that same

rationale apply, then, to the EDGs? Doesn't that same rationale then apply to the emergency diesel generators?

MR. LE: The emergency diesel generator, okay, remember, we don't have -- we don't need any realignment for the service water.

MEMBER STETKAR: Okay.

MR. LE: We don't need anything. If we have one out, that one out is not -- we still maintain fully redundancy. I mean we still fulfill the single criterion, and our requirement of the accident resistance has been met. So with one service water train out, that's true, we don't need anything.

MEMBER STETKAR: So your primary concern, if I understand it, and maybe you will get to it in a later slide, with the EDGs is not the EDG itself in a sense; it's the necessity to realign that system to pick up the -- the other two systems.

(Simultaneous speaking.)

MEMBER STETKAR: Okay, that helps a little bit to kind of straighten out what the real concern is. And the -- just to make sure I've got it, the basis for your acceptance of the other ones is that -- I think the last bullet on this slide covers that -- is that basically the standard tech specs would allow essentially an infinite allowed average time for those so therefore 120 days is fine.

MR. LE: Yes.

MEMBER STETKAR: Okay, thank you.

MR. LE: At this point, I would like to turn over our presentation to Joe DeMarshall for his discussion on EDG and instrumentation systems.

MR. DeMARSHALL: Good afternoon. My name is Joe DeMarshall. I'm the technical reviewer for the instrumentation and electrical tech spec sections of the design cert.

Prior to joining the NRC, I spent six years in the naval nuclear power program, submarines. I qualified as a Reactor Operator and Engineering Watch Supervisor.

Prior to joining the NRC in March of 08, I spent 18 years with PSE&G, all 18 years at the Hope Creek Nuclear Generating Station, six of which were spent as an I&C systems engineer, and the last eight were spent as a licensed ownership Senior Reactor Operator.

Bachelor of science degree in industrial engineering technology from the University of Southern Maine.

Okay, I'm ready to move into the slides.

The 120-day completion time for one diesel inoperable. The alternate feed design feature serves as the basis for the 120-day completion time in LCO 3, with AC sources operating. Let me take a few minutes just to talk about the alternate design feature. Basically, the EPR emergency power supply system consists of four divisions. There are four Class 1E buses. And within in the EPR emergency power supply system, the system utilizes a divisional paired concept in which divisions one and two constitute one divisional pair, divisions three and four make up a second divisional pair.

It's important to note that between those divisional pairs they are completely independent.

Alternate power feed capabilities within each divisional pair provide a standby source of power to require safety-related equipment within a division when the associated diesel is inoperable. So for example, if division one diesel is out of service for maintenance, a standby source of AC power can be supplied from division two with an alternate feed alignment and the same thing, division one can supply division two if the division two diesel was out of service. Same capabilities exist within the second divisional pair, for divisions three and four.

At no time is the alternate feed alignment configured between divisional pairs. It is strictly within the defined divisional pairs.

The alternate feed alignment is not a temporary modification. It is an actual design feature. However, it is not the normal configuration and it is implemented only when in a tech spec accident state that is intended to be temporary in nature.

The U.S. EPR safety analysis assumptions in Chapter 15 of FSAR satisfy the three operable diesels in the alternate feed established. With one diesel inoperable and alternate feed-aligned, there is sufficient AC power source availability to ensure the completion of all safety functions for a postulated accident coincident with a single failure and the loss of offsite power.

In order to conclude that the 120 day completion time is acceptable the staff needs assurance that use of the alternate feed design feature to support maintenance activities rendering a diesel inoperable will be infrequent. And what I mean by that is, the staff's main concern is that remaining in a nonstandard alignment and alternate feed configuration for an extended length of time, up to

120 days should not be viewed as routine because of the potential for an additional failure or failures that could result in additional challenges to plant operators, such as the complication of actions necessary for operators to stabilize or recover the plant.

With that concern in mind, the staff requests that AREVA provide the following information in a followup RAI: a detailed list of maintenance activities that would result in a diesel being out of service for a period of up to 120 days; the approximate maintenance time associated with each activity; the frequency of these maintenance activities; and the type of compensatory measures that would be in effect during the 120 days and what configuration control management would be in place for an additional diesel failure.

The RAI response is pending.

MEMBER STETKAR: Joe?

MR. DeMARSHALL: Yes.

MEMBER STETKAR: I really like those questions by the way.

On the other hand, if I take a very cynical view of life, if they are allowed to have a diesel inoperable for 120 days for any reason, regardless of what they may say in an RAI response are the most likely causes for entering this 120 day condition. If I'm operating in the plant and something happens to my diesel and I can't get spare parts for 119.5 days, I'm still okay. So in terms of the frequency of entering this LCO it's interesting information but it's not clear what type of regulatory basis it has, is it?

MR. DeMARSHALL: Correct. Because with three diesels operable, and with the cross-feed established, single failure criteria is met.

MEMBER STETKAR: So in truth the frequency at which they enter that condition, as long as the protection is in place to ensure that they have the cross feed aligned is not a completely moot point, but in a sense it's an excellent point.

MR. DeMARSHALL: Right, the staff's major concern is that -- when I use the word infrequent, I mean not routine. And what I'd like at this time, I'd like Peter Kang from the electrical branch, if you could elaborate on that, because that if your staff's major concern.

MR. KANG: Hi, my name is Peter Kang.

The way the EPR is designed, they are not totally independent four divisions, right. It's functionally independent.

MEMBER STETKAR: I understand the design. My only point is that I think it's interesting that you are asking the applicant for information about how frequently they think they will enter this 120-day LCO, but indeed, whatever information is available right now at the design stage is not binding on the final licensee, the people who actually operate this plant and indeed, if they are allowed 120 days -- he can take up to 120 days for any reason. If they want to paint the room, they can go out and paint the room for 120 days because they are still following the regulation.

MR. KANG: Before they go into a 120-day LCO, they have to perform the usual analysis as compensatory maintenance, and also -- but in this case, this feature is a design feature as a part of design, and could be very useful during online maintenance. But on the other hand, the negative side is, they could start operating at all times with only three diesels. We are concerned that we can't prevent it. So this is the negative side of it.

MEMBER STETKAR: But my point is, is, indeed, from a design basis safety perspective, indeed, if they can operate continuously with only three diesels in the plant, provided that they have assurance that those three diesels are operable and that the alternate feed connection is established and available, there is nothing to argue against that.

MR. KANG: Yes, other than the fact that it's an off-normal configuration.

MEMBER STETKAR: It's an off-normal configuration, but it does not actually impair the design basis safety response of that plant.

MR. KANG: Yes.

MEMBER STETKAR: Okay. So that's my only point in terms of asking about how frequently -- at this stage in the design process, how frequently do they anticipate entering that LCO, that's an interesting piece of information, but indeed, if being continuously in that LCO, which they can at a plant level, they could have one diesel out continuously. As long as that still satisfies the fundamental design safety of the plant, then the frequency that they enter that condition is not necessarily be prudent operation but it's not something from a licensing perspective. I just wanted to make sure I understand that. I still like the question.

MR. DeMARSHALL: Okay, that includes my topic of the 120-day completion time for one diesel inoperable. Next slide, please.

I'd like to talk about instrumentation surveillance requirements for the EPR protection system. The U.S. EPR protection system, it's important to understand that it is an integrated, digital reactor protection system and engineered safety features actuation system. For this reason, EPR instrumentation tech specs combine the standard tech spec LCOs for reactor trip system instrumentation, and SFAS instrumentation in one LCO for the protection system.

There are two significant open item issues associated with surveillance requirements. The first has to do with the fact that the protection system LCO utilizes a component-based approach to surveillance testing rather than the function-based approach that has been the standard for nuclear power plants currently operating in the United States.

Protection system surveillance requirements are specified for individual components instead of for the significant safety functions that these components support, components such as sensors, manual actuation switches, signal processors and actuation devices.

Operating a plant in a standard tech spec instrumentation LCOs for a rapid trip system and SFAS instrumentation include a single table that specifies significant safety functions required by technical specifications along with the associated surveillance requirements. So in that table, the surveillance requirements are specified for the significant safety functions.

EPR LCO 3.3.1, protection system LCO, has two instrumentation tables. One is a dedicated table that lists all of the components associated with the significant safety functions. And a second table that specifies only the significant safety functions and the permissive signals.

Surveillance requirements are specified only for -- only in the component table for the individual components. Surveillance requirements are not specified for the significant safety functions and that is a deviation from standard technical specifications.

The staff was unable to determine how surveillance testing specified solely at the component level ensures that each safety function required by technical specifications is adequately tested, including verification of the limited safety system setting.

This determination proved to be particularly challenging for the staff with respect to the following two items: detection system logic for certain functions requires upon the acquisition of input signals from more than one sensor. Secondly, in many cases the design relies upon a single sensing device to provide the input signals for multiple functions. It was not evident to the staff that the performance of surveillance testing specified for each of the components utilized in these ways provides assurance that the functions supported by these components are operable. That's the conclusion of my first point.

The second significant open item issue associated with surveillance requirements is that the U.S. EPR digital protection system includes continuous sub-monitoring online diagnostics to verify the proper functioning of digital systems and to ensure the integrity of the installed application system software. The FSAR requires these features as a means of ensuring partial compliance with established surveillance requirements for reactor protection systems, and also justifying the release of the channel check and actuation logic test surveillances.

I'd like to note that continuous self-testing with on-line diagnostic monitoring capabilities are being evaluated in Chapter 7 of the SER to determine the extent to which these features may be credited for surveillance testing.

CHAIR POWERS: So your review does not deal with the Chapter 7 function? You simply note that that they are asking for credit for that.

MR. DeMARSHALL: That is correct. There is a topical report that has been reviewed by Chapter 7 with respect to those issues.

MEMBER RAY: Dana, what is -- what is your point there?

CHAIR POWERS: The point is that his assessment does not constitute an acceptance that that contention that the staff is making -- your previous slide. You simply note that that is what they are trying to do. Whether the staff has accepted it or not, we'll find that out when we review Chapter 7.

MR. TESFAYE: That is correct.

MEMBER STETKAR: Let me ask you one thing in that line, there is one thing in the SER that I tripped over and it had to do with the diesel load sequencing. There were questions about diesel load sequencing back through the protection system. And the conclusion, if I read it correctly says -- it's a long paragraph, and I don't want to read the whole thing if I don't have to. But it says, the staff finds this explanation acceptable because load sequencing is a software-controlled function with appropriate self-testing and checking provisions. So there is at least one area where you see to accept this notion in this SER of testing of that load shedding and load sequencing function.

MR. DeMARSHALL: Yes, my thought process there was that, typically, load sequences are actual physical components in the plant. Whereas in this application, it's strictly a software-controlled function. And I didn't -- based on I believe there is like five criteria that we were provided and based on the combination of all five, I was okay with that. I understand the point you are making.

MEMBER STETKAR: Let me ask you and see if there is an out and perhaps we don't know is the answer. But there are requirements on a 24-month interval, surveillance requirements to verify that a diesel starts and accepts loads but I don't know how those surveillance requirements are implemented. In other words, if indeed those surveillance requirements test the function of that software to actually strip loads and load it onto the diesel, then indeed there is a commitment for a surveillance to test that function. On the other hand, if it does not strip loads and load them onto the diesel, then it's not clear to me how this particular part of that integrated software system is any different from any of the other functions for safety injection or containment isolation or whatever function.

MR. DeMARSHALL: There are -- and I'm going off memory -- but the electrical system tech specs there are 24-month surveillances. There are provisions to check load sequencing.

MEMBER STETKAR: It's really a question of how they are implemented, if they actually drop voltage to the bus and verify that indeed the load sequence on actual, not intercepted signals some place higher up in the signal hierarchy, then indeed that would be a true end-to-end functional check if you will, and I was just curious whether you --

MR. DeMARSHALL: I did look at that, but I did not base my acceptance on that criteria.

MEMBER STETKAR: You based the acceptance on their arguments that --

MR. DeMARSHALL: Yes, they -- once again I don't remember what those are off the top of my head.

MEMBER STETKAR: I can read them to you if you want. Do you want them? The U.S. EPR design does not have a separate physical load sequencer component which includes relays and time delay circuits. That was number one. Number two, load sequencing is a software-controlled function performed by the protection system where loads are only allowed to be placed on the EDGs after specified conditions are met. Number three, the software utilized by the protection system is highly reliable. Number four, the protection system is designed with self-diagnostic test features to detect both hardware and software faults and a system diagnostic repair activities. Number five, the integrity of the software is checked cyclically as part of the processor's self-monitoring programs, and actually there are six.

And number six, an extended self-test which includes a verification of the operating system, is performed every cycle. I don't know what that extended self-test was.

MR. DeMARSHALL: I felt that in lieu of -- there is an extraordinary amount of testing that was conducted on this TELEPERM-accessed system. It is true that -- once again we are talking of a software function here. There are no relays or components.

Extenuous software testing, not only every 24 months but also continuously. And I felt that, based on that information that I was okay with that decision.

Now --

MEMBER STETKAR: For the load sequencer, but not for other functions.

MR. DeMARSHALL: Well, that --

MEMBER STETKAR: Let me not call it the load sequencer, sequencing loads on safety buses.

MR. DeMARSHALL: We are talking -- that's electrical tech specs, that particular --

MEMBER STETKAR: But in my mind they are analogous, because we are talking -- whether it's a low pressurizer pressure signal that comes through some sort of software logic that eventually tells a safety injection pump to start or whether it's a loss of voltage on a bus that comes through some logic that tells circuit breakers to open and a diesel to start and circuit breakers to close, they all sort of sound the same to me.

MR. DeMARSHALL: The protection system is performing that function and that is an IC system through 3.3.1.

MEMBER STETKAR: Dana gets concerned if we delve into excruciating details, so I'll pull back from excruciating detail.

You have an open issue on resolution of this -- what's called functional-based versus component-based surveillance. Do you see that reaching closure?

MR. DeMARSHALL: Actually, we had an audit several weeks ago with AREVA and we plan to have a dedicated meeting to address that issue and several others probably some time third week of this month, prior to the end of this month. And at that time -- I mean that is in my mind one of the biggest issues associated with the instrumentation system design. And we plan to have Chapter 7 people there as well, and I see, if not full resolution at that time, significant progress because that is my goal for that meeting.

But I can certainly -- I understand what you are asking with that specific question.

MEMBER STETKAR: That was the only place, by the way, in the SER where I saw an acceptance based on their assertions about self-testing features, and highly reliable reliable, never fails kind of stuff.

MR. DeMARSHALL: That's a good point. I kind of, in my mind, separated instrumentation tech specs from electrical tech specs when I made that decision. But it is still a protection system.

MEMBER STETKAR: I would just hope that in the grand scheme of things, however this whole issue of function, if I can classify it simply as function- versus component-based, that it is at least resolved consistently across the whole protection system, regardless of whether it's being -- start pumps that pump water versus start things that move electrons around.

MR. DeMARSHALL: One of the things that I will make sure that we do is during that meeting I'll bring this issue up and I'll make sure we get resolution on it as well.

MEMBER RAY: I guess it goes without saying that resolution when we say.

MEMBER STETKAR: I would hope so. It's pretty important because it's kind of a fundamental issue of how you verify comparability of -- important things to safety.

MEMBER RAY: I understand this isn't the place we're going to talk about the resolution of this.

CHAIR POWERS: But understand that the strategy we have here is, we'll come back and we'll look at, reexamine every one of those chapters. The depth and detail of reexamination is something that the Subcommittee will negotiate with all the participants based on level of interest.

I believe that we've only seen one chapter with more open items, and even that one we can come back to if we see fit. But right now we are flagging things, and the staff is still doing its work and we are just trying to get a jump on things and all these issues will come back in front of us. Clearly, this is one that we will spend some attention to, probably more in connection with Chapter 7 than Chapter 16, but that obviously has tendrils that move out.

MEMBER STETKAR: I think the only danger is in 7, you very quickly go into the details of other things.

(Simultaneous speaking.)

MEMBER STETKAR: The surveillance requirements are the only place that tell the operators absolutely how to verify what we intend to have verified operable and how to do that.

CHAIR POWERS: And for that reason you are right, we may well have to make sure that this whole area gets isolated out. Because this is more of a -- what would you call it -- a performance-based criterion.

MR. DeMARSHALL: Peter Kang.

MR. KANG: This is Peter Kang again. And traditionally in a sequencer, in emergency diesel generator sequencer was in Chapter 8, with the electrical system. And they were tested every 24 months periodically for basically what they are testing is the sequencer, the timing of it. And of course the relay is there and it's also the testing timing, and not like the parameters, the safety parameter comes in and kicking in or anything like that. In an emergency, a loss of offsite power, or a design basis accident, they stripped all the load, okay. Then they did sequencing on one at a time. So in U.S. EPR design, they don't have a sequencer like a mechanical sequencer like a traditional sequence in a sense. But they would have a protection system base which does the same thing, probably more accurate, and also self-testing and Dr. Stetkar was mentioning all the features included in that. So even the power operation to begin, in the old days, you had to have all the offsite power emergency diesel generators available. Also sequencer was available, as one parameter, so you were supposed to be in part of a tech spec. Now in U.S. EPR because they moved it from tech specs, so they don't even have a sequencer to be operable.

CHAIR POWERS: Okay.

MR. DeMARSHALL: Okay, that concludes my instrumentation surveillance requirements topic. I'd like to move on to post-accident monitoring instrumentation. COL Applicants that reference the U.S. EPR design certification must address Revision 4 of Reg Guide 1.97, entitled, Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants.

Rev 3 does not provide a criteria for advanced instrumentation designs based on modern digital technology and that is why Rev 4 must be addressed.

PAM variable selection criteria in Reg Guide 1.97, Revision 4, depend on the prior development of specific Emergency Operating Procedures, EOPs, and Abnormal Operating Procedures, AOPs, which are post-COL activities. Next slide.

COL Applicants must complete site-specific tech spec information in the plant-specific tech specs in accordance with Interim Staff Guidance DC/COL-ISG-8, entitled, Necessary Content of Plant-Specific Technical Specifications when a Combined License is Issued, and this must be done prior to COL issuance using one of the following three options. Option 1 provide site-specific tech spec information. Option 1 is not practical in this instance because development of EOPs and AOPs are a post-COL license activity.

Option 2 provides usable bounding information, i.e. development of a bounding list of PAM functions.

And Option 3 relocates site-specific information to a licensee-controlled document and establishes an administrative control tech spec that requires determining information using an approved -- an NRC-approved methodology, Reg Guide 1.97 and that controls changes to the information. Next slide.

AREVA has proposed a usable bounding list of PAM functions which is Option 2. COL Applicants could incorporate the bounding list by reference, and that is the intent.

The staff is evaluating the proposed PAM function list to determine if the list is truly bounding.

And that, once again, that evaluation is in progress. Next slide.

The remote shutdown system. AREVA proposes to no longer specify the required Remote Shutdown System functions in the generic tech spec and associated basis, which is a deviation from the standard tech spec basis, NUREG-1431, Rev 3. Instead, AREVA proposes that the GTS bases state that the displays and controls at the Remote Shutdown Station are functionally the same as the displays and controls normally used by the operator to achieve and maintain safe shutdown from the Main Control Room.

The system that provides these displays and controls at both the Main Control Room and the Remote Shutdown Station is essentially a digital human-machine interface, a digital HMI if you will, with operator work stations located at both the Main Control Room and at the Remote Shutdown Station with control and monitoring capabilities to shut down the plant and maintain it in a safe shutdown condition.

The data available at the Remote Shutdown Station is populated from the same information buses that supply data to the Main Control Room. The proposed Remote Shutdown Station tech spec and basis do not identify or provide an FSAR reference that lists the required Remote Shutdown Station functions relied upon to achieve and maintain safe shutdown from outside the Main Control Room. Next slide.

It is unclear how to determine the operability requirements of GTS LCO 3.3.3 are met because the limiting condition of operability states

Remote Shutdown Station functions shall be operable.

Because the Remote Shutdown Station provides operations personnel with the same control and monitoring capabilities as in the Main Control Room, it is unclear based on the LCO whether or not the required Remote Shutdown Station functions relied upon to achieve and maintain safe shutdown from outside the Main Control Room are assured through a select set of safe shutdown functions, a minimum inventory, if you will, and if so, what those functions are.

Okay, the last significant open item issue, omission of the manual reactor trip function from the GTS. AREVA has omitted the manual reactor trip function from the GTS on the basis that the trip is not credited in the Chapter 15 accident analysis, and two, that the trip does not satisfy 10 CFR 50.36 Criterion 3, which states an SSC -- structure, system or component -- that is part of the primary success path which functions or actuates to mitigate a design basis accident or transient that either assumes failure of or presents a challenge to the integrity of a fission product barrier.

The staff questions omission of the manual reactor trip function from the GTS on the basis that the steam generator tube rupture accident analysis in Chapter 15 states, in three cases rapid trip by operator action and concurrent loss of offsite power were postulated to take place at 30 minutes into the accident. A follow-up RAI was issued and the response is pending. Next slide.

Staff has conducted a review and evaluation of the U.S. EPR FSAR, which generated 293 questions with 30 open items. Through a series of meetings, audits and conference calls the open items have been defined and the staff and AREVA have arrived at a common understanding of the requirements that must be satisfied.

Presently, the staff concludes that resolution of the 30 open items is manageable within the planned schedule. Upon resolving the open items, Chapter j16 U.S. EPR FSAR will provide sufficient information to assist the COL Applicant in constructing U.S. EPR that satisfies the requirements of 10 CFR Part 52.

That concludes my presentation.

MEMBER STETKAR: A question -- this is purely a question; don't read anything into it.

CHAIR POWERS: We never read anything into your questions.

MEMBER STETKAR: Thank you. I'll stop spending inordinate amounts of time reading this stuff, then.

What, historically, in the technical specifications, is there any precedent for treating things like the severe accident depressurization valves in this plant, that we haven't -- I don't think we've seen -- correct me I'm wrong, since I've been wrong at least once today -- we haven't seen Chapter 15 yet; have we?

MR. WIDMAYER: That is correct.

MEMBER STETKAR: Thanks. I don't know, then, whether the severe accident depressurization valves are credited in any of the Chapter 15 analyses. Let's presume that they are not. Is there any precedent for including requirements for the operability of equipment like that in the technical specifications?

MR. LE: Severe accident was beyond design basis accident, so the tech spec only cover item that functioned to mitigate the design basis accident.

MEMBER STETKAR: Because when I was reading through things, I had questions about those and I had questions about the primary safety release valves which, although they are not, quote-unquote, power-operated relief valves, they are indeed pilot-operated relief valves that can be operated from the control room. And certainly the PRA that we have seen does indeed take credit for operation of both the PSRVs and the severe accident depressurization valves to do things like feed-and-bleed cooling, which again is not necessarily design basis accident mitigation function and they certainly take credit for depressurization for high pressure core-melt scenarios out into Level 2 space.

CHAIR POWERS: Now be careful about using the phrase, take credit for.

MEMBER STETKAR: They acknowledge it and evaluate it.

CHAIR POWERS: That's true, but it is different than taking credit for it in a Chapter 15 analysis.

MEMBER STETKAR: That is correct.

CHAIR POWERS: It's either there or it ain't.

MEMBER STETKAR: Right.

CHAIR POWERS: Any other comments on this technical specification chapter? As I say, the intention is we will come back and examine each of these chapters again to the depth and detail that the Subcommittee chooses to do and staff and licensees are willing to put up with, I suppose. But so we are not -- this is not the last time we will look at this by intention. The whole strategy is so we can get things moving and if we flag things, as obviously we have on a couple of occasions here, then staff knows to give us more information on that particular item.

Any closing comments you would like to make?

MR. TESFAYE: Yes, you are absolutely correct; this is not the end of this chapter. We will come back and discuss all the open items and how we closed them. The next activity is on April 21 for the Subcommittee to finish up Chapter 19.

CHAIR POWERS: We will come back to that one and I doubt we will finish it again.

MR. TESFAYE: But by then we will have finished all the Group 2 chapters.

CHAIR POWERS: Right.

MR. TESFAYE: And then the next Group 3 will be sometime this Summer and early Fall.

CHAIR POWERS: Well, I will have to truthfully apologize for dragging this out in such a protracted way but I think we have largely covered these two chapters. I thank everyone for well put together and succinctly presented presentations, both the Applicant and the staff.

And with that, I close this Subcommittee meeting.

(Whereupon, the above-entitled matter went off the record at 1:58 p.m.)

AREVA NP Inc.

Presentation to ACRS U.S. EPR Subcommittee

Design Certification Application FSAR Tier 2 Chapter 11

Pedro B. Perez, Supervisor
Radiological Engineering

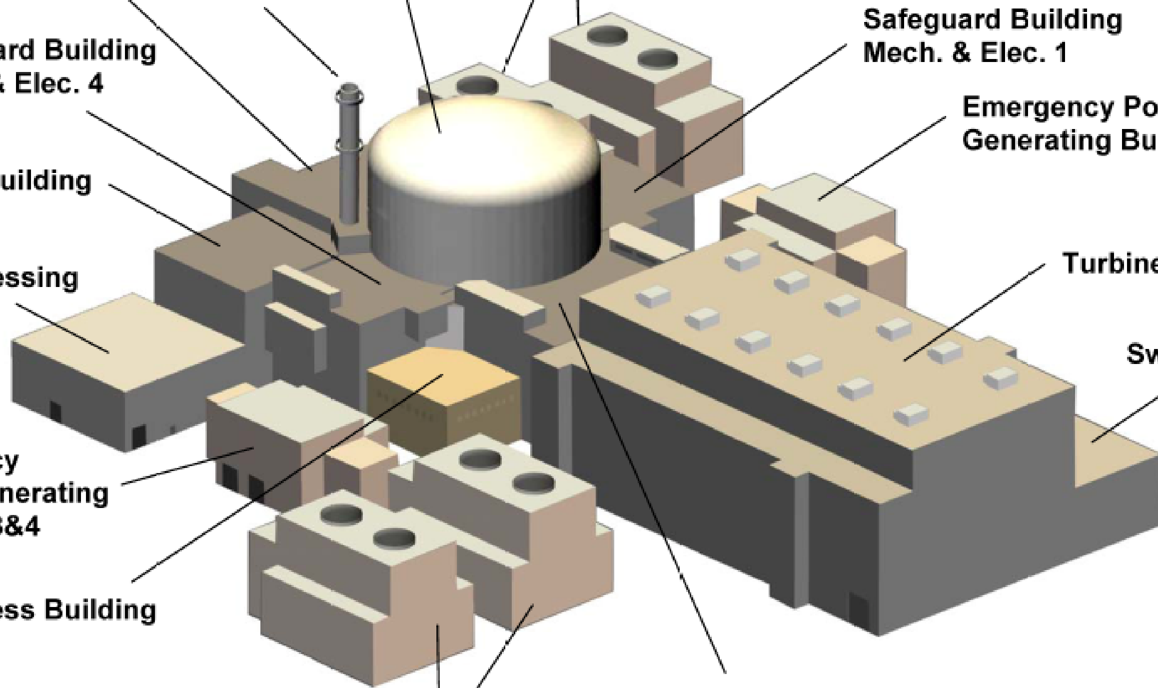
EPR™ by AREVA

AREVA

Chapter 11, Radioactive Waste Management: Chapter Topics

- Source Terms – 11.1
- Liquid Waste Management System – 11.2
- Gaseous Waste Management Systems – 11.3
- Solid Waste Management Systems – 11.4
- Process and Effluent Radiological Monitoring and Sampling Systems – 11.5

Chapter 11, Radioactive Waste Management



Chapter 11, Radioactive Waste Management: Section 11.1 - Source Terms

- The U.S. EPR radiation source terms are summarized in Section 11.1 for normal operations and accident conditions
  - Shielding source term for Chapter 12 was presented to the ACRS in November 2009
  - Design Basis Accident source terms will be presented to the ACRS in the FSAR Chapter 15 presentation (Section 15.0.3)
- Chapter 11 provides normal operations design basis and realistic source terms for the radioactive waste management system

Chapter 11, Radioactive Waste Management: Section 11.1 - Source Terms

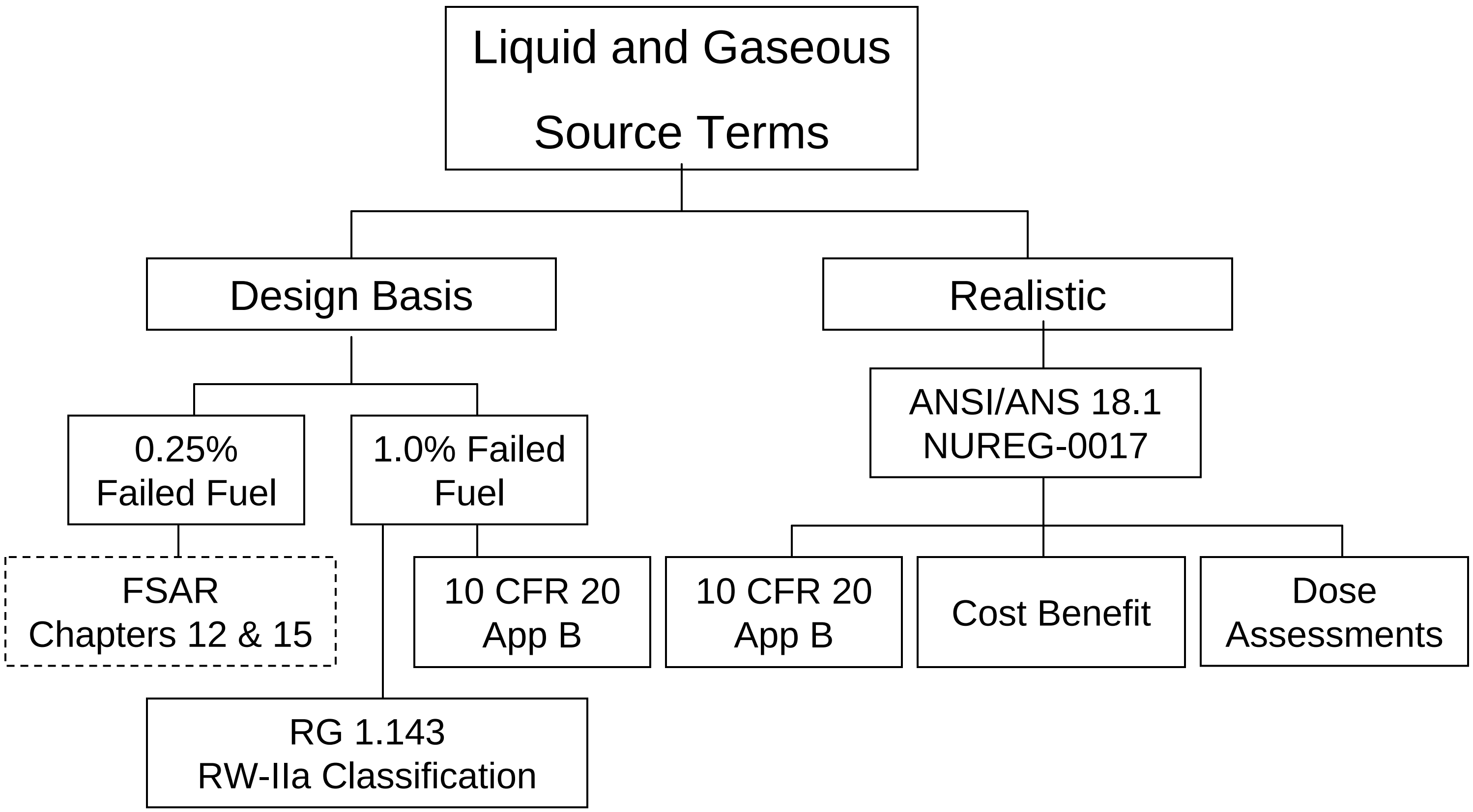
- **Radioactive Waste Management System Design Basis Source Term Derivation**
  - **Design basis source terms are derived from a bounding core radionuclide inventory**
  - **ORIGEN 2 parametric cases were run to cover a broad range of operating characteristics**
  - **Primary and secondary system radionuclide concentrations based on a 1% failed fuel fraction (SRP 11.2)**
    - The halogens and noble gases that are set to represent DE I-131 and DE-Xe-133 Technical Specification limit
    - Secondary coolant concentration based on TS primary to secondary leakage rate limit of 600 gallons per day
    - Activation/corrosion products and tritium based on ANSI/ANS 18.1-1999
  - **Demonstrate compliance with 10CFR20, Appendix B, Table 2**
  - **Demonstrate the U.S. EPR meets the design objectives of 10CFR50 Appendix I**

Chapter 11, Radioactive Waste Management: Section 11.1 - Source Terms

- **Radioactive Waste Management System <u>Realistic</u> Source Term Derivation**
  - **Primary and secondary realistic source terms were derived using the model described in ANSI/ANS 18.1-1999**
  - **Liquid and gaseous effluents from the U.S. EPR were calculated by the GALE code**
    - GALE-L – Liquid effluent model description and results follow in Section 11.2
    - GALE-G – Gaseous effluent model description and results follow in Section 11.3
  - **Demonstrate compliance with 10CFR20, Appendix B, Table 2**

Chapter 11, Radioactive Waste Management: Section 11.1 - Source Terms

- **Source Term Summary**



Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Cost Benefit Analysis (CBA)**
  - **CBA performed for LWS and GWS**
  - **CBA follows RG 1.110 with some differences**
    - 60 year equipment life used instead of 30 year
    - $2000 per person-rem instead of $1000 per person-rem
    - Equipment cost was not adjusted for inflation

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Liquid Waste Management System**
  - Collects, processes, and discharges waste liquids
  - Maintains doses ALARA
- **Consists of two sub-systems**
  - Liquid waste storage system
  - Liquid waste processing system
- **Liquid waste storage system**
  - Segregates the liquid waste in five storage tanks
  - Collects treated waste water in two monitoring tanks and chemically adjusts water to acceptable pH
- **Liquid waste processing system**
  - Evaporator
  - Centrifuge
  - Demineralizer

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

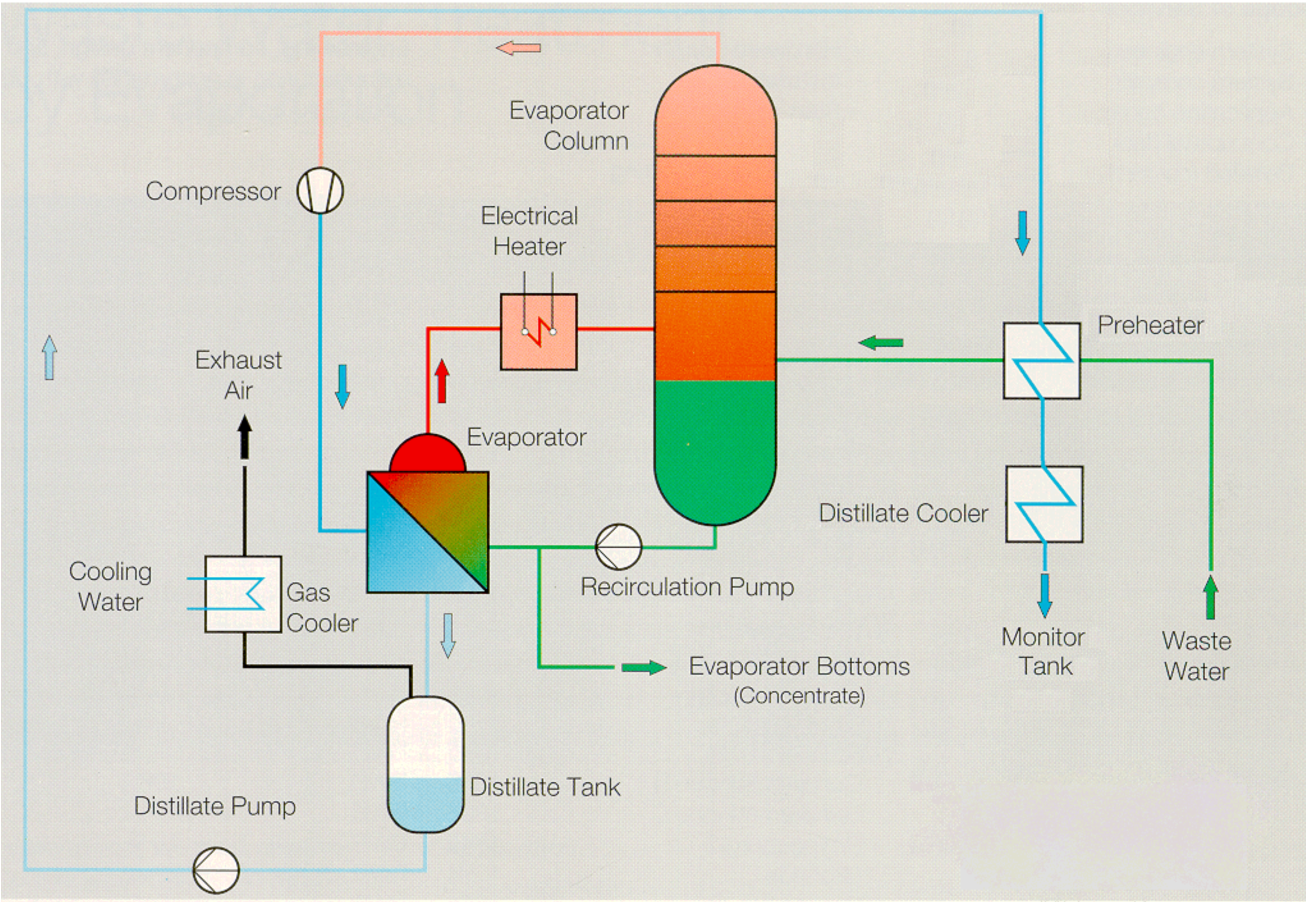
- **Liquid waste storage system**
  - **Group I liquid waste consists of high activity levels, low levels of organic and inorganic substances and low conductivity**
    - Fuel pool systems, drains, sumps, decontamination operations
    - Normally processed by the evaporator
  - **Group II liquid waste consists of low activity levels, high levels of organic substance and high conductivity**
    - Hot laboratory, showers, washrooms, SG blowdown demineralizer flushing water
    - Normally processed by the centrifuge
  - **Group III liquid waste normally has no activity, but may have high levels of organic substance and conductivity**
    - Non-radioactive floor drains
    - SG blowdown demineralizer flushing water (if not radioactive)
    - If activity exists, waste is processed by the centrifuge
    - If no activity, waste is sent directly to monitoring tank after a short hold-up in storage tank

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Liquid waste storage system**
  - **Discharge to the environment is from the monitoring tanks**
  - **Environmental release is made once radioactivity and pH are within limits**
  - **Release line is administratively locked and monitored**
  - **Plant discharges are continuously monitored and recorded in the activity-measurement tank**
  - **Automatic isolation is provided should activity exceed predetermined limits**
  - **Liquid waste storage system is RG 1.143 classified as RW-IIa**

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Evaporator - vapor-compressor with forced recirculation**

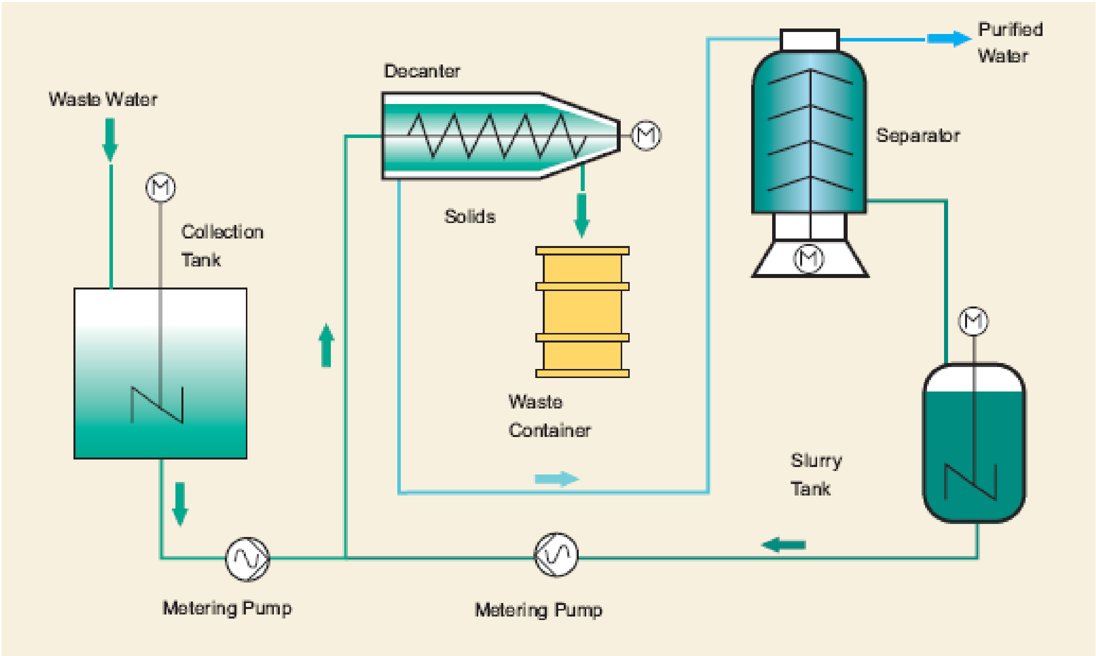


Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Evaporator**
  - **Operated in batch mode**
  - **Process 1050 gallons per hour**
  - **Decontamination factor range from 10^4 to 10^7**
    - Volatile elements such as halogens DF is 10^4
    - Other nuclides such as Cs-137, Co-60, Mn-54, Sr-90 DF is 10^7

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Centrifuge**



Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Centrifuge**
  - Operated in batch mode
  - Process 1300 gallons per hour
  - Decontamination factor range from 10^1 to 10^2

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Demineralizer**
  - **Unit commonly used in the U.S.**
  - **Resin bed configuration include tailoring combinations of resin (anion, cation, mixed)**
  - **Process 2400 gallons per hour**
  - **Decontamination factor range from $10^1 – 10^3$**

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Dose assessments for liquid waste**
- **GALE-L provides the annual liquid effluent activity**
  - **Activity expressed in curies released per year and used in LADTAP II**
  - **Annual activity converted to annual average concentration to demonstrate compliance with 10CFR20 Appendix B Table 2**
    - Realistic source term concentrations
    - Design basis (1% failed fuel fraction) source term concentration
- **LADTAP II provides doses**
  - **Maximally Exposed Individual (MEI) dose calculated to comply with the dose objectives of 10CFR50 Appendix I**
  - **Population dose calculated for the cost benefit analysis**
  - **Hypothetical sites considered**
  - **Population dose and cost benefit are COL items**

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **LADTAP II (NUREG/CR-4013)**
  - LADTAP II inputs (FSAR Table 11.2-5)
  - Maximally Exposed Individual (MEI) and population doses
  - ALARA Design Objective of 10CFR50 Appendix I
- **LADTAP II Liquid Pathways for MEI**
  - Fresh water site type
- **Dilution and Site Parameters**
  - Effective discharge point dilution flow rate 100 cfs
  - MEI site parameters are listed in FSAR Table 11.2-5
  - COL Item

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **LADTAP II results**
- **Maximally Exposed Individual (MEI)**

Type of Dose	Calculated (mrem/y)	10CFR50, Appendix I ALARA Design Objective (mrem/y)
Total Body	2.18 (child)	3
Organ Dose	4.83 (infant thyroid)	10

- **Offsite Dose Calculation Manual (ODCM) – COL Item**

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **LADTAP II – population dose**
  - **Applicable only to cost benefit analysis**
- **LADTAP II liquid pathways**
  - **Salt water site type**
- **Results**
  - **Benefit cost ratio is 0.12 based on thyroid dose which is less than 1.0**

Augment	Population Total Body Dose (person-rem)	Population Total Thyroid (person-rem)
Demineralizer not used	0.177	0.682
Demineralizer used	0.121	0.222
Obtainable dose benefit	0.06	0.46

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **GALE–L effluent concentrations**
  - **Annual activity converted to annual average concentration to demonstrate compliance with 10CFR20 Appendix B Table 2**
    - Realistic source term concentrations
    - Design basis (1% failed fuel fraction) source term concentration
- **Dilution**
  - **A dilution factor of 9000 gallons per minute (cooling tower blowdown) was applied to maximize the average release concentration**
- **Results**
  - **Sum-of-the-ratios of the effluent released to concentration limit for the expected release is 0.12, which is well below the allowable value of 1.0**
  - **Sum-of-the-ratios of the effluent released to concentration limit for the design basis release is 0.62, which is below the allowable value of 1.0**

Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Abnormal Operation Occurrences – 10CFR20.1406**
- **Pipe leaks and breaks**
  - **The liquids from leakages or pipe breaks in the system are collected by sumps in the lowest part of the Radioactive Waste Processing Building**
- **Failures of vessels, tanks and pumps**
  - **Rooms which contain storage and concentrate tanks are able to hold the content of a complete tank in the segregated compartments**
  - **The rooms are connected according to the waste water groups. A leakage sensor monitors each waste water group**

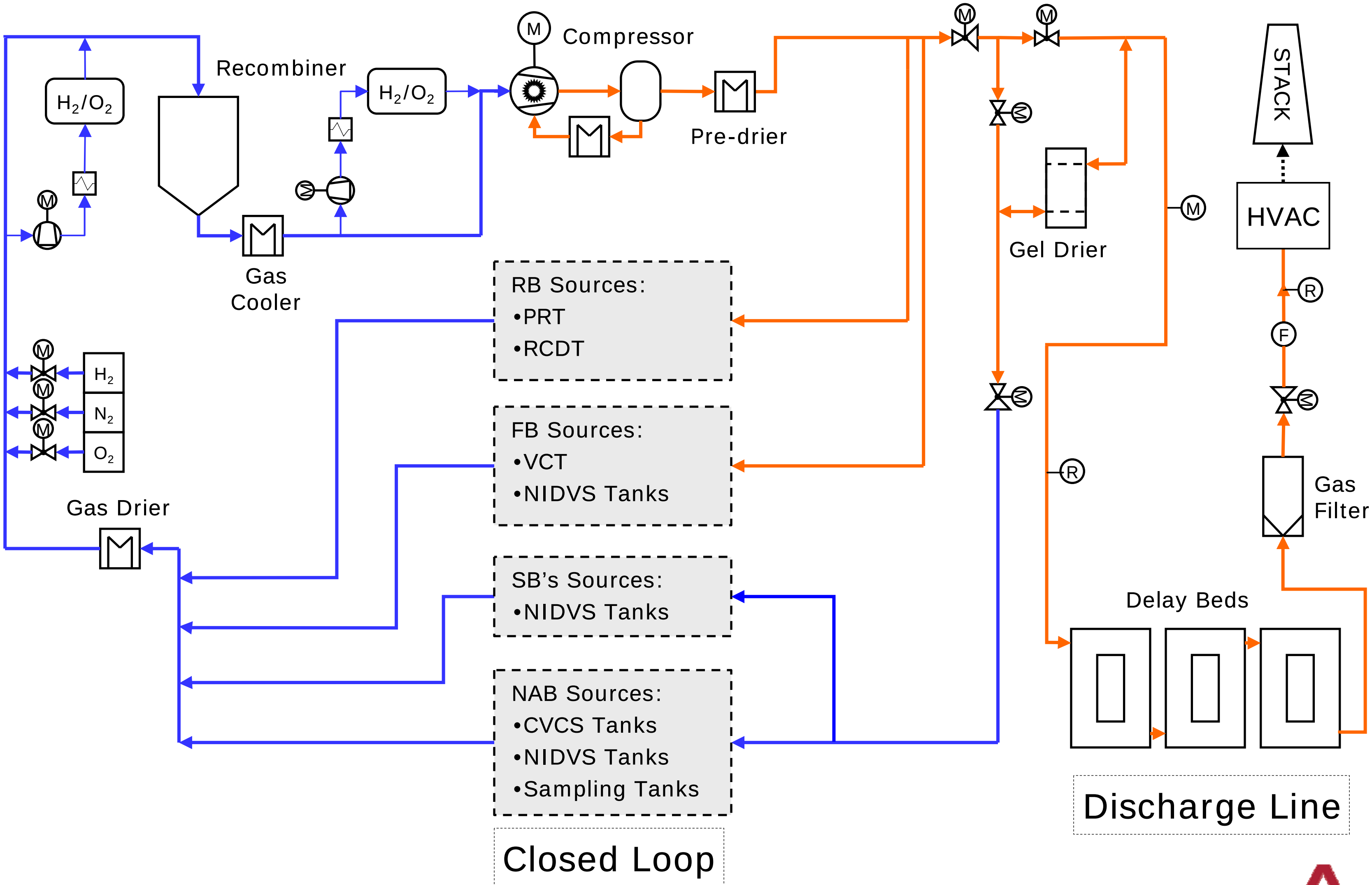
Chapter 11, Radioactive Waste Management: Section 11.2 - Liquid Waste Management System

- **Radioactive Liquid Waste System Leak or Failure**
  - Unrestricted area water concentration from unmitigated liquid release
  - SRP BTP 11-6 and DC/COL ISG-013 and 14
  - Unrestricted area assumed at 1200 feet from Auxiliary Building
  - Total release rate based on entire volume of 5 tanks
  - Discharge concentration are at the immediate vicinity of the discharge point
  - H-3, Fe-55 and Co-60 the only significant nuclides at the discharge point
  - FSAR Table 11.2-8 demonstrates compliance with 10CFR20 Appendix B

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management Systems

- **Gaseous Waste Processing System**
  - **Collects, processes, and discharges waste gases**
  - **Maintains doses ALARA**
  - **Controls explosive gases - Limiting concentrations: O_2 < 2% / H_2 < 4%**
  - **RG 1.143 classified as RW II-a**

Chapter 11, Radioactive Waste Management:
Section 11.3 - Gaseous Waste Management Systems



Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management Systems

- **GWS – Modes of operation**
- **Normal**
  - **Routine operation**
  - **No significant gas releases to the auxiliary building ventilation system**
- **GWS - Surge operation mode**
  - **Operating mode for about 1% of the system’s annual operating time**
  - **During plant start-up the expansion water from the primary circuit reduces the free gas volume available in the coolant storage tanks. Thus, the gas is vented to the GWS**
  - **During outage preparation (i.e. draining) the excess gas generated from degasification of the reactor coolant is sent to the GWS**

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management Systems

- **Delay Beds**
  - **Retain Xenon and Krypton in activated charcoal media**
  - **Three vertical pressure vessels**
  - **N_2 flow rate of about 7.3 cfm**
  - **Charcoal mass 5440 lbm per bed**
  - **Hold-up time for Xenon is 27.7 days**
  - **Hold-up time for Krypton is 40 hours**

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **Dose assessments for gaseous waste**
- **GALE-G provides the annual gaseous effluent activity**
  - **Activity expressed in curies released per year and used in GASPAR II**
  - **Annual activity converted to annual average concentration to demonstrate compliance with 10CFR20 Appendix B Table 2**
    - Realistic source term concentrations
    - Design basis (1% failed fuel fraction) source term concentration (except halogens and noble gases which are at Technical Specification limits)
- **GASPAR II provides doses**
  - **Maximally Exposed Individual (MEI) dose calculated to comply with the dose objectives of 10CFR50 Appendix I**
  - **Population dose calculated for the cost benefit analysis**
  - **Hypothetical sites considered**
  - **Population dose and cost benefit are COL items**

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **Key GALE-G input**
  - HEPA filter efficiency is 99%
  - Charcoal filter efficiency is 90%
  - Hold-up time for Xenon 27.7 days
  - Hold-up time for Krypton is 40 hours
  - Containment free volume is 2.8E+06 cubic feet
  - Containment internal clean-up rate is 4.1E+03 cfm
  - Containment purge flow rate is 3210 cfm (RAI 273)
  - Condenser air ejector released without treatment

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **GALE-G Results - Effluent release from the plant stack**
  - **Elevation of about 200 feet from plant grade and about 7 feet above the top of the reactor building**
  - **Total stack flow is about 240,000 cfm**
  - **Atmospheric dispersion and ground deposition factors are based on conservative values for a 0.5 mile distance from the reactor centerline to the site boundary and a mixed-mode release**
  - **Exposure Pathways**
    - External exposure to contaminated ground
    - External exposure to noble gases in airborne plume
    - Inhalation
    - Ingestion of vegetables, milk and meat

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **GASPAR II dose results**
  - **Maximally Exposed Individual (MEI) dose calculated to comply with the dose objectives of 10CFR50 Appendix I**

Type of Dose	Calculated	10CFR50, Appendix I ALARA Design Objective
Beta Air (mrad/y)	13.3	20
Gamma Air (mrad/y)	1.62	10
Total Body	1.03	5
Skin (mrem/y)	9.76	15
Organ Dose (mrem/y)	9.9 (infant thyroid)	15

- **Offsite Dose Calculation Manual (ODCM) – COL Item**

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **GASPAR II – population dose**
  - **Applicable only to cost benefit analysis**
- **GASPAR II pathways**
  - **Stack releases**
  - **Exposure Pathways: external, inhalation, ingestion of vegetation, milk and meat**
- **Results**
  - **Benefit cost ratio is 0.05 based on thyroid dose which is less that 1.0**

Augment	Population Total Body Dose (person-rem)	Population Total Thyroid (person-rem)
Base Line	5.52	5.80
Additional Delay Bed	5.49	5.77
Obtainable dose benefit	0.03	0.03

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **GALE–G Effluent concentrations**
  - **Annual activity converted to annual average concentration to demonstrate compliance with 10CFR20 Appendix B Table 2**
- **Atmospheric dispersion**
  - **Annual average at 0.5 miles from reactor centerline assuming a mixed-mode release**
- **Results**
  - **Sum-of-the-ratios of the effluent released to concentration limit for the expected release is 0.02, which is well below the allowable value of 1.0**
  - **Sum-of-the-ratios of the effluent released to concentration limit for the design basis release is 0.10, which is well below the allowable value of 1.0**

Chapter 11, Radioactive Waste Management: Section 11.3 - Gaseous Waste Management System

- **Radioactive Gaseous Waste System leak or failure**
  - **Pressurized sections are designed with a high degree of leak tightness**
    - Example: Liquid ring compressors are used to avoid an ignition source and canned motor guarantees a sealed motor compressor
  - **Sub-atmospheric system prevents leakage**
  - **Hydrogen and oxygen concentrations are controlled to prevent detonation**
- **Bounding analysis**
  - **Operator error leads to bypassing delay bed and releasing effluent from coolant degasification for one hour**
  - **Based on a 1 hour release, the exclusion area boundary dose is less than 100 mrem in accordance with BTP 11-5**

Chapter 11, Radioactive Waste Management: Section 11.4 - Solid Waste Management Systems

- Solid Waste Management System
  - Radioactive Concentrate Processing System
  - Solid Waste Processing System
  - Solid Waste Storage System
- Process concentrates from evaporator bottom
- Process sludge from storage tank bottoms
- Process spent resin from primary and secondary coolant purification and liquid waste demineralizer systems

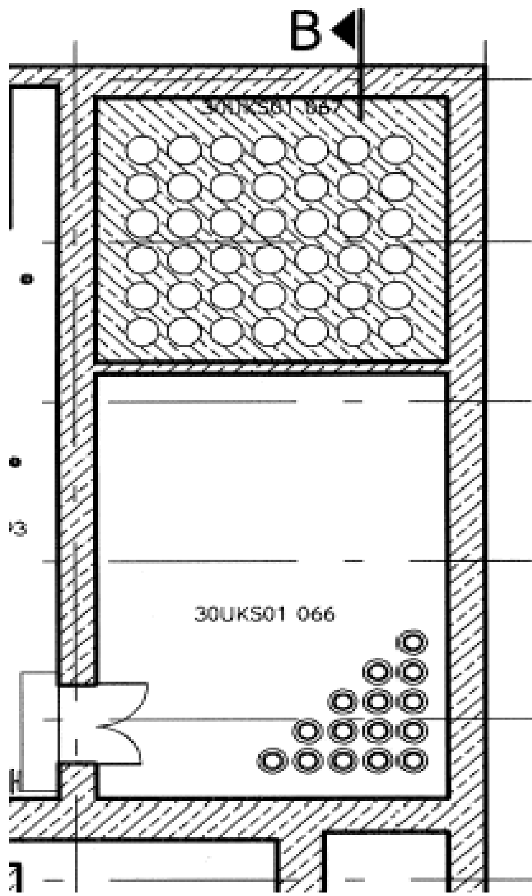
Chapter 11, Radioactive Waste Management: Section 11.4 - Solid Waste Management Systems

- **Solid waste volume reduction**
  - **Shredding device**
  - **Solid Waste drying**
  - **Compaction**
  - **Sorting box**
- **A drum store room for low activity waste in drums**
- **A concrete tubular shaft storage area for medium and high activity waste**
- **Several years storage capacity for Type B&C**
- **Process Control Program (PCP) – COL Item**

Chapter 11, Radioactive Waste Management: Section 11.4 - Solid Waste Management Systems

Storage in Rad Waste Building

Below Grade



Medium Activity Tubular Storage

5 Drums High

Low Activity Storage in Room.

5 Drums High

Chapter 11, Radioactive Waste Management: Section 11.5 - Process and Effluent Radiological Monitoring and Sampling Systems

- Effluent radiological monitoring and sampling
- Gaseous effluents
  - Reactor building
  - Fuel building
  - Nuclear auxiliary building
  - Safeguard building mechanical area
  - Radioactive waste processing building
  - Controlled areas of the access building
  - Condenser air ejector
- Vent stack gaseous sampling system
  - Noble gas activity is monitored with gamma and beta
  - Aerosol activity is monitored with gamma-sensitive detector
  - Iodine activity is monitored by a dual filter for organic and inorganic iodine

Chapter 11, Radioactive Waste Management: Section 11.5 - Process and Effluent Radiological Monitoring and Sampling Systems

- **Effluent radiological monitoring and sampling**
  - **Concentrations meet 10CFR20 Appendix B**
  - **Effluents meet ALARA design objectives of 10CFR50 Appendix I**
  - **Effluents comply with 40CFR190**
  - **Provide inputs to the Offsite Dose Calculation Manual (ODCM)**
  - **Support preparation of effluent reports**

Chapter 11, Radioactive Waste Management: Section 11.5 - Process and Effluent Radiological Monitoring and Sampling Systems

- **Process monitoring and sampling**
  - **Early detection of a radioactive material migration**
  - **Minimization of contamination (10CFR20.1406)**
  - **Maintain occupational and off-site doses ALARA**
- **Process monitors**
  - **Main Steam Radiation Monitoring System**
    - **Primary indication of a steam generator tube rupture**
  - **Steam Generator Blow-down System**
    - **Second means for detecting a steam generator tube rupture**
    - **Chemical sample analysis**
  - **Condenser Air Removal Radiation Monitoring System**
    - **Noble gas activity**
  - **Component Cooling Water Radiation Monitoring System**
    - **Monitors components such as coolers (heat exchanger) integrity**

Chapter 11, Radioactive Waste Management: Section 11.5 - Process and Effluent Radiological Monitoring and Sampling Systems

- **Process monitors**
  - **Gaseous waste disposal radiation monitoring system**
    - **Delay bed monitoring - down-stream (β for kr-85) and up-stream (γ)**
  - **Reactor coolant radiation monitoring and sampling system**
    - **Coolant noble gas activity**
  - **Chilled water Supply for the gaseous waste disposal Sampling System**
    - **Monitor integrity of component such as heat exchangers**
- **Automatic protective actions**
    - **Containment high range monitors**
    - **Fuel building air exhaust monitoring**
    - **Main control room air intake monitoring**

Chapter 11, Radioactive Waste Management Acronyms

- ALARA – As Low As Reasonably Achievable
- COL – Combined Operating License
- ECCS – Emergency Core Cooling System
- ESF – Engineered Safety Features
- GWS – Gaseous Waste System
- LWS – Liquid Waste System
- MEI – Maximally Exposed Individual
- ODCM – Offsite Dose Calculation Manual
- PCP – Process Control Program
- RCS – Reactor Coolant System
- SG – Steam Generator

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Presentation to the ACRS Subcommittee

AREVA U.S. EPR Design Certification Application Review

Safety Evaluation with Open Items: Chapter 11

RADIOACTIVE WASTE MANAGEMENT

April 6, 2010

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United States Nuclear Regulatory Commission
Protecting People and the Environment

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Overview of DCA

SRP Section/Application Section		Number of Questions	Number of Open Items
11.1	Source Terms	4	0
11.2	Liquid Waste Management System	18	8
11.3	Gaseous Waste Management System	15	4
11.4	Solid Waste Management Systems	14	6
11.5	Process and Effluent Radiological Monitoring and Sampling Systems	20	6
Totals		71	24

Description of SE Open Items – FSAR Sect. 11.2 Liquid Waste Management System

- **RAI 273 Question # 11.02-5**: Describe how the use of chelating and anti-foaming agents will not degrade the performance and integrity of the LWMS demineralizer system.
- **RAI 273 Question # 11.02-14 and RAI 301 Question # 11.02-17:** Provide information used in calculating offsite doses using the LADTAP II code.
- **RAI 299 Question # 11.02-16:** Provide supporting information used in developing the liquid effluent radioactive source term.
- **RAI 273 Question # 11.02-15:** Update listing of LWMS components for consistency among FSAR descriptions, tables, and figures.
- **RAI 301 Question # 11.02-17(4):** Provide supporting information used in LWMS cost-benefit analyses.
- **RAI 301 Question # 11.02-17(5):** Provide information used in assessing the offsite radiological impacts of the postulated failure of a LWMS radioactive waste tank.
- **RAI 359 Question # 11.02-18**: Provide information describing the elements of a QA program for the design, fabrication, procurement, and installation of the LWMS using the guidance of RG 1.143.

Description of SE Open Items – FSAR Sect. 11.3 Gaseous Waste Management System

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- **RAI 273 Question # 11.03-12**: Provide supporting information used for the GWMS cost-benefit analyses.
- **RAI 273 Question # 11.03-13:** Provide supporting information used for the analysis of the postulated failure of a GWMS component.
- **RAI 299 Question # 11.03-14:**. Provide information supporting the development of the gaseous effluent radioactive source term.
- **RAI 301 Question # 11.03-15:** Provide supporting information used in calculating offsite doses using the GASPAR II code.

Description of SE Open Items –
FSAR Sect. 11.4 Solid Waste Management System

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- **RAI 273 Question # 11.04-8**: Provide information supporting the conclusion that the radioactive waste processing building can store Class B and C radioactive wastes for several years.
- **RAI 273 Question # 11.04-10**: Update listing of SWMS components for consistency among FSAR descriptions, tables, and figures.
- **RAI 273 Question # 11.04-11:** Update listing of expected radioactive waste streams to include spent-charcoal, dessicant, and HEPA filters.
- **RAI 273 Question # 11.04-12:** Update the acceptance criteria for the presence of free standing liquid in waste for consistency with the requirements of Part 61.56.
- **RAI 273 Question # 11.04-13:** Describe how the design of the SWMS will comply with the requirements of 10 CFR 20.1406 and guidance of RG 4.21 and issues identified in IE Bulletin 80-10.
- **RAI 273 Question # 11.04-15:** Revise inconsistent estimates of yearly low level waste activity shipped.

Description of SE Open Items –
FSAR Sect. 11.5 Process and Effluent Radiological Monitoring and Sampling Systems

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- **RAI 273 Question # 11.05-1**: Update descriptions of the design basis given the guidance in SRP Section 11.5 and RG 1.206.
- **RAI 273 Question # 11.05-2:** Update the description of the operational characteristics of process and effluent radiation monitoring instrumentation.
- **RAI 276 Question # 11.05-13:** Describe the radiation monitoring equipment response characteristics in complying with TS 16.3.4.12.b on the allowable RCS leakage rate of 1 gal/min.
- **RAI 276 Question # 11.05-14:** Update description of radiation monitoring instrumentation and sampling systems for consistency among FSAR Sections 1.9, 7.1, 7.5, 9.3.2, and 11.5, given TMI-related requirements of 10 CFR 50.34(f)(2), and guidance of SRP Sections 9.3.2 and 11.5 and RGs 1.21 and 1.206.
- **RAI 290 Question # 11.05-15:** Update the description of the liquid effluent release path from the Radioactive Waste Processing Building to the point of discharge, and provide information supporting system blowdown and dilution flow rates at the point of discharge.
- **RAI 346 Question # 11.05-20:** Describe the radiation monitoring equipment response characteristics in complying with TS 16.3.4.12.d on the allowable SG leakage rate of 150 gal/d.

Technical Topics of Interest

Section 11.1 – Source Terms

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Section 11.1 SER – No Open Items:

- Input for radwaste systems analyses and design basis accident radiological consequences analyses
- Coolant source terms based on ANSI/ANS-18.1-1999
  - PWR-GALE code
- Core isotopic inventory developed using ORIGEN-2.1
- Applicant followed SRP 11.1 and RG 1.112
- Key SRP Interfaces: 11.2, 11.3, 12.2 to 12.4, and 15.0.3
- No COL Information Items
- No Open Items

<u>Section 11.2 SER with Open Items:</u>

- Processing methods: evaporation, centrifugal separation, ultra-filtration, and demineralization.
- Equipment design basis and features, system descriptions, processing methods, and capacities; seismic and quality group classifications; performance characteristics; instrumentation systems; automatic termination of effluent release; estimated waste throughput; ALARA design features; and definition of discharge path.
- Basis and development of liquid process waste streams, estimates of liquid waste volumes, treatment performance (DF), and liquid effluent source term.
- Assumptions and parameters used in complying with effluent concentration limits at the point of discharge.
- Assumptions and parameters used in complying with Part 20 dose limits for members of the public, Part 50, Appendix I design objectives, and cost-benefit ratio.

Section 11.2 SER with Open Items:

- Assumptions and parameters used in assessing radiological impacts of a postulated failure of a LWMS tank.
- Minimization of contamination, Tier 1 and ITAAC information, technical specifications, and pre-operational testing.
- Key SRP interfaces: 9.2, 9.3, 9.4, 10.3, 10.4, 11.5, 14.2, and 16.
- COL Information Item
  - COL applicant will develop a site-specific CBA if FSAR LWMS CBA is not applicable for the proposed COLA site.

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Section 11.3 SER with Open Items:

- Waste gas processing methods: recombiner, charcoal delay and dessicant beds, and gas filters.
- Building ventilation exhaust systems: HEPA and charcoal filters.
- Equipment design basis and features, system descriptions, processing methods, and capacities; seismic and quality group classifications; performance characteristics; instrumentation systems; recombiner and explosive gas mixture controls; automatic isolation of process flow and effluent releases; estimated waste throughput; ALARA design features; and definition of release point.
- Basis and development of gaseous process waste streams, recombiner processing rate, purge modes; treatment process performance (removal efficiencies and holding times), and gaseous effluent source terms for gas stripping, air ejectors, and building ventilation systems.
- Assumptions and model parameters used in complying with effluent concentration limits at the EAB.

Section 11.3 SER with Open Items:

- Assumptions and parameters used in complying with Part 20 dose limits for members of the public, and Part 50, Appendix I design objectives, and cost-benefit ratio.
- Assumptions and model parameters used in assessing the radiological impacts of a postulated failure of a waste gas process component.
- Minimization of contamination, Tier 1 and ITAAC information, technical specifications, and pre-operational testing.
- Key SRP interfaces: 6.2, 9.3, 9.4, 10.3, 10.4, 11.2, 11.5, 14.2, and 16.
- COL Information Item
  - COL applicant will develop a site-specific CBA if FSAR GWMS CBA is not applicable for the proposed COLA site.

<u>Section 11.4 SER with Open Items:</u>

- Solid waste processing/storage methods: sorting box, shredder, compactor, and drum store and tubular storage facilities.
- Waste concentrates and wet wastes processing methods: tanks, resin traps, condenser drying units, vacuum units, drying stations, a transfer station, a sampling station, and a drum measuring system.
- Equipment design basis and features, system descriptions, processing methods, and capacities; seismic and quality group classifications; performance characteristics; instrumentation systems; automatic isolation of process; yearly estimate of waste generation rates; ALARA design features; capability to move drums and HICs; and use of supplemental skid-mounted processing systems.
- Storage facilities and basis for expected storage capacity for Class A, B, and C wastes.

Section 11.4 SER with Open Items:

- No direct liquid and gaseous effluent releases from SWMS. Associated releases and compliance with ECLs and dose limits are addressed in FSAR Section 11.2 (LWMS) and Section 11.3 (GWMS).
- Minimization of contamination, Tier 1 and ITAAC information, technical specifications, and pre-operational testing.
- Key SRP interfaces: 9.3, 9.4, 11.2, 11.3, 11.5, 13.4, 14.2 and 16.

Technical Topics of Interest

Sect. 11.4 – Solid Waste Management System

- COL Information Item
- Process Control Program (PCP)
  - Description of the operational program for the processing of Class A, B, and C low-level wastes in accordance with 10 CFR 61.55 and 61.56.
  - FSAR adopts NEI PCP Template 07-10A until a plant-specific PCP is developed to support plant operation.
  - Approach acceptable given staff endorsement of NEI PCP template.

Section 11.5 SER with Open Items:

- Plant process systems and effluent flow paths monitored by radiation monitoring and sampling equipment.
- Equipment design basis and features, system descriptions, types, number, and locations of instrumentation; types and location of process and effluent sampling systems; seismic and quality group classifications; operational ranges and sensitivities or detection limits; system calibrations and provisions for built-in check sources; provisions for automatic isolation and termination features; and ALARA design features.
- PERMSS does not generate process waste; system returns sampled process and effluent streams to their points of origin.

Section 11.5 SER with Open Items:

- Minimization of contamination, Tier 1 and ITAAC information, technical specifications, and pre-operational testing.
- Key SRP interfaces: 6.2.3, 5.2.5, 7.1, 7.5, 9.3.2, 9.4, 10.4, 11.2, 11.3, 11.4, 11.5, 13.4, 14.2, and 16.

Technical Topics of Interest

Sect. 11.5 – Process and Effluent Radiological Monitoring and Sampling Systems

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- COL Information Item
- Offsite Dose Calculation Manual (ODCM)
  - Description of the operational program for controlling and monitoring all effluent releases and assessing offsite doses in accordance with 10 CFR 20.1301 and 20.1302; 40 CFR Part 190 as referenced in 10 CFR 20.1301(e); 10 CFR Part 20, Appendix B, Table 2 ECLs; and design objectives of Appendix I to 10 CFR Part 50.
  - FSAR adopts NEI ODCM Template 07-09A until a plant and site-specific ODCM is developed to support plant operation.
  - Approach acceptable given staff endorsement of NEI ODCM template.

CONCLUSIONS - Chapter 11

- **Remaining open items associated with**:
  - technical clarifications and information supporting the design basis and descriptions of treatment systems and radiation monitoring and sampling equipment.
  - confirmation of the estimates of liquid and gaseous effluent source terms, associated offsite doses, and compliance with 10 CFR Part 20 and 50 requirements.
  - Resolution of open items expected based on RAI responses.
  - Resolution of confirmatory items will be completed pending receipt and review of FSAR revision.
- **Significant COL items:**
  - PCP, ODCM, and cost-benefit analyses.

ACRONYMS

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- ALARA – As Low As is Reasonably Achievable
- CBA – Cost-Benefit Analysis
- COL – Combined License
- ECL – Effluent Concentration Limit
- GDC – Generic Design Criteria
- GWMS – Gaseous Waste Management System
- HEPA – High Efficiency Particulate Air
- LOCA – Loss Of Coolant Accident
- LWMS – Liquid Waste Management System
- MEI – Maximally Exposed Individual
- RAI – Request for Additional Information
- RCS – Reactor Coolant System
- RG – Regulatory Guide
- SE – Safety Evaluation
- SRP – Standard Review Plan
- SWMS – Solid Waste Management System
- TS – Technical Specifications

Presentation to ACRS
U.S. EPR Subcommittee
Design Certification Application
FSAR Tier 2 Chapter 16 – Technical Specifications

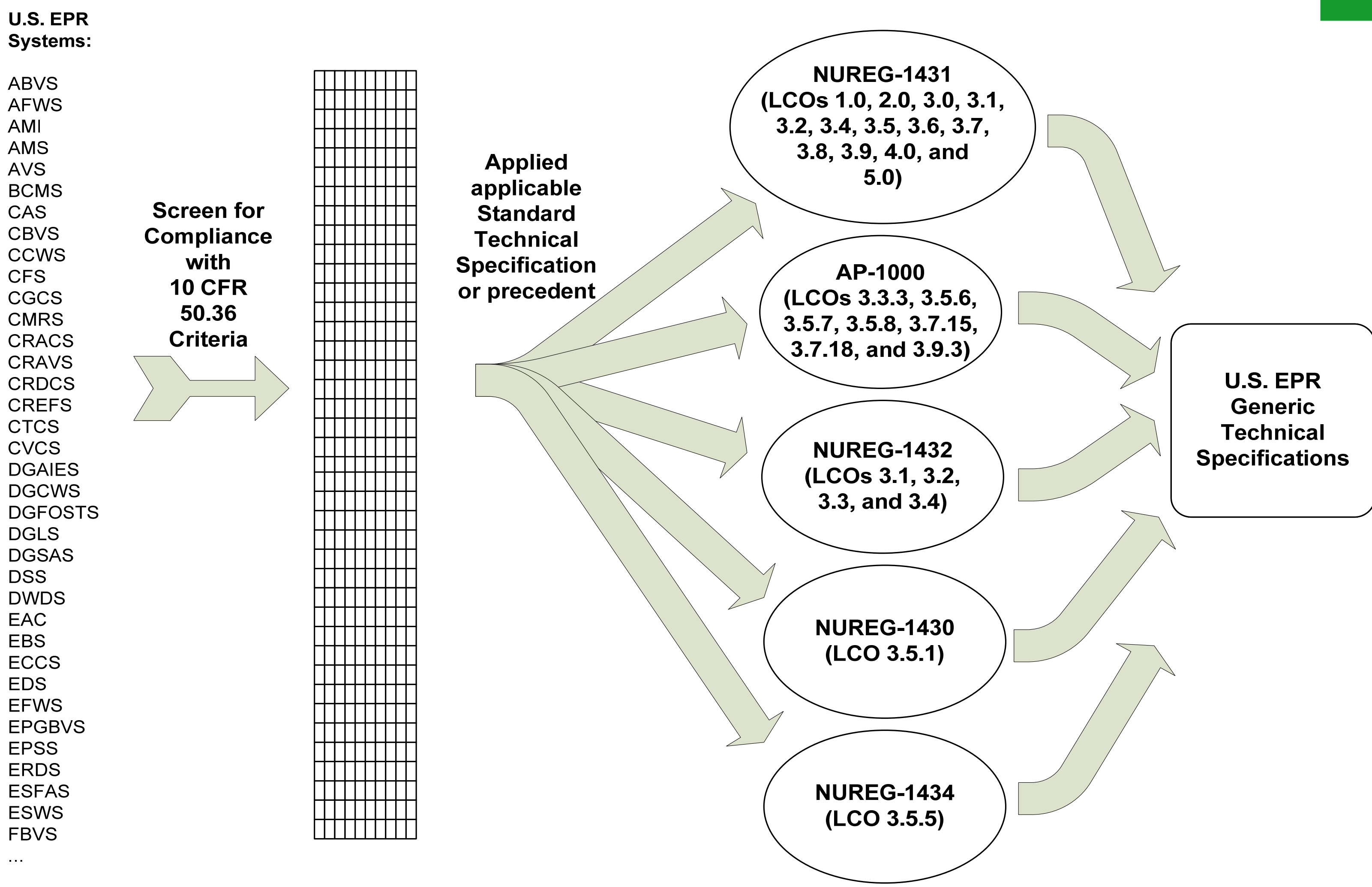
Robert Sharpe,
Advisory Engineer
AREVA NP

April 6, 2010

Development of U.S. EPR GTS

- **U.S. EPR Systems were reviewed for inclusion in the GTS**
  - **Applied 10 CFR 50.36 (c) criteria**
- **The U.S. EPR is an active, 4-loop PWR; therefore, Standard Technical Specifications (STS), NUREG 1431 Revision 3.1 was chosen as the primary model for the U.S. EPR GTS**
- **Also used other Improved STS NUREGs and precedents**
  - **NUREG 1430 - Accumulator out of service time (NUREG 1431 time was risk based)**
  - **NUREG 1432 - Digital version of these specifications were a closer fit for some Sec 3.1, Reactivity Control and Sec 3.2, Power Distribution specifications**
  - **NUREG 1434 - BWR/6 Standby Liquid Control System was most appropriate model for Extra Borating System**
  - **AP1000 – Precedent for IRWST, Remote Shutdown, ECCS in shutdown Modes, and core decay time**
- **Did not develop risk based specifications for the U.S. EPR GTS**
- **Accepted Completion Times and Frequencies from the STS were used**

Development of U.S. EPR GTS



COL Supplied Information

- **Protection System Setpoints or Setpoint Control Program (Section 3.3.1)**
  - **Confirmation of provided setpoints dependent on plant-specific instrument selection and detailed installation information**
- **Site description (Section 4.1)**
  - **Describe plant specific location**
- **Single unit/Multiple unit Radiological Reports Option (Section 5.6.2)**
  - **Allows option for multiple unit site to file single report**
- **UHS makeup (Bases Section B3.7.19)**
  - **Describe site specific interface details for UHS make-up source**

Chapter 16, Technical Specifications
Chapter Topics

- **The U.S. GTS follow the format and content of the Improved Standard Technical Specification**
  - **1.0 Use and Application**
  - **2.0 Safety Limits**
  - **3.0 Limiting Condition for Operation and Surveillance Requirement Applicability**
  - **3.1 Reactivity Control**
  - **3.2 Power Distribution Limits**
  - **3.3 Instrumentation**
  - **3.4 Reactor Coolant System**
  - **3.5 Emergency Core Cooling System**
  - **3.6 Containment Systems**
  - **3.7 Plant Systems**
  - **3.8 Electrical Power Systems**
  - **3.9 Refueling Operations**
  - **4.0 Design Features**
  - **5.0 Administrative Controls**
  - **Bases**

Treatment of Trains

- **The four trains of safety systems is consistent with an “N+2” safety concept:**
  - **One train may be out for maintenance/surveillance**
  - **One train is assumed lost to single failure**
  - **One train may be lost to initiating event**
  - **One 100% capacity system is available for accident mitigation**

Use of TSTF Travelers

- The NRC controls changes to the STS by coordination with the industry's Technical Specification Task Force (TSTF). The TSTF proposes generic changes to the approved NUREG STS for NRC review.
- A number of TSTF Travelers have been approved by the NRC since Revision 3.1 to the STS were approved.
- The TSTFs were evaluated for applicability to the U.S. EPR design and a number of these were incorporated into the U.S. EPR GTS
- Risk based TSTF Travelers were not incorporated in the U.S. EPR GTS

Differences from STS NUREGs

- **Differences reflect U.S. EPR specific design and supporting safety analysis**

- **Section 1.1, Definitions**
  - **Definitions related to instrumentation and controls and core parameters were replaced or revised from NUREG 1431 to reflect U.S. EPR design and terminology**

- **Section 2.0, Safety Limits**
  - **Revised Section 2.1 to reflect AREVA fuel and ECCS performance analysis methodologies**

Differences from STS NUREGs (cont.)

- **Section 3.1, Reactivity Control Systems and Section 3.2, Power Distribution Limits**
  - **NUREGs 1431 and 1432 STS used as models**
  - **Did not incorporate a part length control rod specification (U.S. EPR does not use part length control rods)**
  - **Revised to be applicable to AREVA nomenclature and fuel design**

Differences from STS NUREGs (cont.)

- **Section 3.3, Instrumentation**
  - **3.3.1, Protection System, U.S. EPR's digital protection system incorporates reactor trip and ESF functions credited in the safety analysis thereby reducing the number of subsections**
    - Does not reflect any STS or precedent
    - LCOs and Actions are component rather than function based
    - Necessary for operator implementation since single components may support several functions
    - Unique surveillance testing reflects system architecture, complies with regulatory guidance, and was previously reviewed when the generic platform was approved by the NRC.
  - **3.3.3, Remote Shutdown Station, used AP1000 precedent to reflect computerized work station versus hard wired instruments and controls**

Differences from STS NUREGs (cont.)

- **Section 3.4, Reactor Coolant System**
  - **Revised to allow limited 3-loop operation (consistent with U.S. EPR safety analysis)**
  - **Did not incorporate a PORV specification (function combined with PSRV)**
  - **Did not incorporate a loop isolation valve and isolated loop specification (U.S. EPR does not have loop isolation valves)**
  - **Did not incorporate a restriction on high head pumps as related to LTOP operation (Mis-operation of CVCS is not a limiting event)**

Differences from STS NUREGs (cont.)

- Section 3.5, Emergency Core Cooling Systems (ECCS)
  - Revised to reflect four ECCS trains and the In-containment Refueling Water Storage Tank (IRWST)
  - Added Extra Borating System (Two train boric acid injection modeled after BWR/6 specification)
  - Added IRWST and ECCS specifications in Modes 5 and 6 to provide core cooling capability during reduced inventory operation
  - Added requirements for use of enriched boric acid (U.S. EPR uses ≥ 37% enriched boric acid)
  - Did not incorporate a Seal Injection Flow specification (Seal injection is provided by CVCS which is non-safety and not credited)

Differences from STS NUREGs (cont.)

- **Section 3.6, Containment Systems**
  - **Did not incorporate a containment spray and cooling specifications (not credited in U.S. EPR analysis)**
    - Passive heat sinks (concrete walls and steel structures) inside containment are credited post-LOCA
    - Containment heat removal is performed by recirculation of reactor coolant from the IRWST, through the low-head safety injection heat exchangers, to the RCS, and through the postulated break back to the IRWST
    - Doses mitigated by Annulus Ventilation System
  - **Eliminated bypass leakage – all penetrations terminate in filtered area**

Differences from STS NUREGs (cont.)

- **Section 3.7, Plant Systems**
  - **Revised specifications to reflect U.S. EPR design differences**
    - Revised LCOs and Actions to reflect four trains as appropriate
    - Fewer but larger main steam safety valves
    - U.S. EPR uses main steam relief trains
      - Replaces atmospheric dump valves
      - Used for depressurization
    - Each Emergency Feedwater train has a motor driven pump and a separate water storage pool with a normally isolated common header
    - Added specification for Safety Chilled Water System
  - **Added specification for main steam line leakage (AP1000 specification used as a model) (U.S. EPR credits main steam line LBB)**

Differences from STS NUREGs (cont.)

- **Section 3.8, Electrical Power Systems**
  - **U.S. EPR utilizes four EDGs**
  - **Alternate feeds can be established between Division 1 and 2 (one divisional pair) or Division 3 and 4 (another divisional pair)**
  - **The alternate feed provides versatility in electrical alignments**
  - **A single EDG can be inoperable for up to 120 days provided:**
    - offsite circuits are operable,
    - no EDG common cause failure mode exists,
    - required redundant features are addressed, and
    - the associated alternate feed is established within 72 hours

Differences from STS NUREGs (cont.)

- **Section 3.9, Refueling Operations**
  - **Did not incorporate an Unborated Water Source Isolation Valve specification since boron dilution is analyzed in Mode 6**
  - **Replaced Containment Penetrations specification with specification for fuel decay time (Dose analysis demonstrates acceptable results)**

Differences from STS NUREGs (cont.)

- **Section 5.0, Administrative Controls**
  - **Revised tendon surveillance program to reflect U.S. EPR design (use of grouted tendons)**
  - **Revised Steam Generator Program per TSTF 449-A (specification consistent with current plants with Alloy 690 steam generator tubes)**
  - **Added the Control Room Envelope Habitability Program per TSTF 448-A**
  - **Replaced outdoor liquid storage tank discussion with a Reviewer's Note (outdoor liquid storage tank not part of standard U.S. EPR design)**

Conclusions

- **U.S. EPR GTS were created to reflect:**
  - **Applicable regulatory requirements of 10CFR 50.36**
  - **The format, content, and usage rules of the Improved Standard Technical Specifications**
  - **The design of the U.S. EPR**

Chapter 16, Technical Specifications: Acronyms/Nomenclature

- **COL – Combined License**
- **CVCS – Chemical & Volume Control System**
- **ECCS – Emergency Core Cooling System**
- **EDG – Emergency Diesel Generator**
- **ESF – Engineered Safety Features**
- **GTS – Generic Technical Specifications**
- **IRWST – In-containment Refueling Water Storage Tank**
- **LBB – Leak Before Break**
- **LCO – Limiting Condition for Operation**
- **LTOP – Low Temperature Overpressure Protection**
- **PORV – Power Operated Relief Valve**
- **PSRV – Pressurizer Safety Relief Valve**
- **RCS – Reactor Coolant System**
- **STS – Standard Technical Specifications**
- **TSTF – Technical Specification Task Force**
- **UHS – Ultimate Heat Sink**

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Presentation to the ACRS Subcommittee

AREVA EPR Design Certification Application Review

Safety Evaluation Report with Open Items

Chapter 16: Technical Specifications

April 06, 2010

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    Branch Name: Technical Specifications
- **Project Managers**
  - **Lead PM Name: Getachew Tesfaye**
  - **Chapter PM Name: Peter Hearn**

Overview of DCA

SRP Section/Application Section		Number of RAI Questions	Number of SER Open Items
16.4.1	General	0	0
16.4.2	Use and Application	6	0
16.4.3	Safety Limits	3	0
16.4.4	Limiting Condition for Operation and Surveillance Requirement Applicability	2	0
16.4.5	Reactivity Control System	16	0
16.4.6	Power Distribution Limits	17	0
16.4.7	Instrumentation	108	11
16.4.8	Reactor Coolant System	22	9
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Overview of DCA (Cont.)

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SRP Section/Application Section		Number of RAI Questions	Number of SER Open Items
16.4.9	Emergency Core Cooling System (ECCS)	13	2
16.4.10	Containment Systems	15	1
16.4.11	Plant Systems	19	4
16.4.12	Electric Power Systems	57	2
16.4.13	Refueling Operations	7	0
16.4.14	Design Features	2	1
16.4.15	Administrative Controls	6	0
Totals		293	30

Description of Open Items

- RAI 300, Question 16-311 was issued as a follow-up RAI for the applicant to provide the additional information and update the RAI responses associated with Instrumentation TS open items in RAI set 103, based on the results of audits conducted with the staff on 7/30/09, 7/31/09, 8/13/09, and 8/14/09.
- RAI 103, Question 16-197 is being tracked as an open item to address the staff's concerns regarding omission of the PAM instrumentation Channel Check surveillance requirement from LCO 3.3.2.
- RAI 315, Question 16-320 was issued as a follow-up RAI for the applicant to provide the additional information necessary for the staff to conclude that GTS LCO 3.3.3, "Remote Shutdown Station," is implementable. The applicant proposes to no longer specify the required Remote Shutdown System functions in the GTS and Bases.
- RAI 110, Question 16-232 is being tracked as an open item to address technical and topical report references in Bases B 3.3.1, Protection System, whose versions or revisions have not been accepted or separately approved by the staff. These reports are being evaluated in Chapter 7 of the SER.

Description of Open Items

- RAI 293, Question 16-294 is being tracked as an open item. In the GTS 3.4.1 and its associated bases, the applicant needs to demonstrate that the specified RCS flow limit is bounding (e.g., the value in the COLR is at least equal to or more restrictive than the SG tube plugging limit assumed in the accident analyses) before the staff can determine the adequacy of LCO 3.4.1 requirements.
- RAI 293, Question 16-295 is being tracked as an open item. This open item involves a precautionary “Note” regarding low temperature overpressure protection before starting an idle reactor coolant pump in GTS 3.4.7.
- RAI 293, Question 16-296 is being tracked as an open item. This open item involves inconsistencies between the proposed changes to Condition A and the related discussions in the bases.
- RAI 293, Question 16-297 is being tracked as an open item. Editorial errors.
- RAI 293, Question 16-299 is being tracked as an open item**.** This open item involves the removal by the applicant of a discussion of the single-failure criterion applicable to the required number of PSRVs.

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Description of Open Items

- RAI 293, Question 16-300 is being tracked as an open item. This open item involves the staff request to revise Condition F instead of Condition C to resolve the issue raised in the original RAI 101, Question 16-69.
- RAI 293, Question 16-301 is being tracked as an open item. This open item involves not incorporating the TSTF-449 model requirements into LCO 3.4.12d and TS 5.5.8.
- RAI 293, Question 16-302 is being tracked as an open item. This open item involves the limits for Dose Equivalent I-131 in the U.S. EPR design.
- RAI 293, Question 16-303 is being tracked as an open item. This open item involves the main steam safety valves set point tolerance for operability.
- RAI 293, Question 16-304 is being tracked as an open item. This open item involves the rated lift capacity assumed in the accident analyses for the MSSV inconsistent with ASME Code, Section III (NC-7512.1) requirements.
- RAI 293, Question 16-305 is being tracked as an open item. Editorial Errors.

Description of Open Items

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- RAI 293, Question 16-306 is being tracked as an open item. This open item involves the explanation for not entering applicable LCOs for the supported systems when the safety chilled water system is inoperable.
- RAI 293, Question 16-307 is being tracked as an open item. This open item involves incomplete discussions in the Bases B 3.5.2 for Actions B.1, B.2 and C.1 for the ECCS.
- RAI 293, Question 16-308 is being tracked as an open item. Editorial errors.
- RAI 293, Question 16-309 is being tracked as an open item. This open item involves the applicant's addressing the conforming change to Condition D for the resilient seals for the Containment Purge valves.
- RAI 300, Question 16-310 is being tracked as an open item. This open item involves the assembly pitch provided in the GTS Paragraph 4.3.1.1.c not matching the values provided in the spent fuel pool criticality Topical Report.
- RAI 300, Question 16-312 was issued as a follow-up RAI for the applicant to provide the additional information and update the RAI responses associated with Instrumentation TS open items in RAI set 110, based on the results of audits conducted with the staff on 7/30/09, 7/31/09, 8/13/09, and 8/14/09.

Description of Open Items

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- RAI 300, Question 16-313 was issued as a follow-up RAI for the applicant to provide the additional information and update the RAI responses associated with Electrical Power System TS open items in RAI set 74, based on the results of an audit conducted with the staff on 6/24/09.
- RAI 300, Question 16-314 was issued as a follow-up RAI for the applicant to resolve discrepancies in Bases B 3.8.1, AC Sources – Operating, regarding the total combined variation in EDG steady state output voltage and frequency permitted by National Electrical Manufacturers Association standard, NEMA MG 1-2006.
- RAI 300, Question16-315 was issued as a follow-up RAI for the applicant to provide the additional information necessary to address interim staff guidance DC/COL-ISG-8, "Necessary Content of Plant-Specific Technical Specifications When a Combined License Is Issued," with respect to Post Accident Monitoring variable selection criteria in Regulatory Guide 1.97, Revision 4.

Description of Open Items

- RAI 311, Question 16-316 is being tracked as an open item for the applicant to resolve discrepancies associated with setpoint value nomenclature in LCO Table 3.3.1-2, and FSAR Tables 15.0-7 and 15.0-8 .
- RAI 311, Question 16-317 is being tracked as an open item. This open item involves providing an assessment to confirm that all the LCO values in the proposed TS are consistent with the initial conditions assumed in the safety analyses.
- RAI 315, Question 16-318 was issued as a follow-up RAI for the applicant to provide the additional information necessary for the staff to conclude that exclusion of the following safety-related reactor trip initiation signals from the Generic TS is warranted: Manual Reactor Trip, Safety Injection System Actuation, and Emergency Feedwater System (EFWS) Actuation.
- RAI 315, Question 16-319 was issued as a follow-up RAI for the applicant to provide the additional information necessary for the staff to conclude that exclusion of the EFWS Isolation on High Steam Generator Level function from the Generic TS is warranted.

Description of Open Items

- RAI 110, Question 16-230, is being tracked as an open item to determine if adequate provisions exist to periodically test the continuous self-monitoring functions and automatic test features, and how the execution of automatic tests are confirmed during plant operation. The Continuous self-testing and online diagnostic monitoring capabilities, including the means to confirm that these features remain functional, are being evaluated in Chapter 7 of the SER.
- RAI 315, Question 16-321 was issued as a follow-up RAI for the applicant to provide the additional information necessary to resolve the staff's concerns regarding the ability of plant operations personnel to effectively implement manual protective actions in all cases.

Overview of Technical Presentation

- Applicable Regulations and Review Guidance
- TS Review Criteria
- RAI Status Summary
- Significant Open Issues

Applicable Regulations and Review Guidance

- 10 CFR 50.36 and 50.36a
- 10 CFR 52.47(a)(11)
- Primary SRP Section: 16.0, Rev. 3

Technical Specifications Review Criteria

- Meet requirements of 10 CFR 50.36 regarding SLs, LSSS, LCOs, SRs, Design Features, and Administrative Controls
- Conform to STS conventions regarding format and usage rules
- Reflect EPR design and accident analyses

RAI Status Summary

• Total number of RAIs	293
• Number of Open Items	30
• Number of Confirmatory Items	15

Significant Open Issues

- 120-day completion time to restore train to operable status for condition of one out of four required trains inoperable due to maintenance
- Instrumentation Surveillance Requirements (SRs)
- Post Accident Monitoring (PAM) Instrumentation
- Remote Shutdown System (RSS)
- Omission of Manual Reactor Trip (RT) Function from Generic TS (GTS)

120-Day Completion Time for One Train Inoperable

- The 120-day completion time is proposed in TS LCO for six safety-related systems having four independent trains.
- Except for the Emergency Diesel Generator (EDG) system, the remaining three operable trains still satisfy the single failure criterion without further system equipment realignment.
- Under STS guidance, unlimited operation is allowed with capability to withstand a single failure.

120-Day Completion Time for One EDG Inoperable

- The alternate feed design feature serves as the basis for the 120-day Completion Time (CT) in LCO 3.8.1, AC Sources - Operating.
- The alternate feed alignment is:
  - Not a temporary modification (actual design feature).
  - Not the normal configuration.
  - Implemented only when in a TS Action Statement that is intended to be temporary in nature.
- In order to conclude that the 120-day CT is acceptable, the staff needs assurance that use of the alternate feed design feature to support maintenance activities rendering an EDG inoperable, will be infrequent.

120-Day Completion Time for One EDG Inoperable (cont'd)

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- The staff requested that AREVA provide the following information:
  - A detailed list of maintenance activities that would result in an EDG being out of service for a period up to 120 days.
  - The approximate maintenance time associated with each activity.
  - The frequency of these maintenance activities.
  - The type of compensatory measures that would be in effect during the 120 days and what configuration control management would be in place for an additional EDG failure.

Instrumentation SRs

- The Protection System (PS) utilizes a "component-based" approach to surveillance testing rather than the "function-based" approach that has been the standard for nuclear power plants currently operating in the United States.
- The staff was unable to determine how surveillance testing specified solely at the component level, ensures that each safety function required by TS is adequately tested, including verification of Limiting Safety System Settings.

Instrumentation SRs (cont'd)

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- The U.S. EPR Digital Protection System includes continuous self-monitoring and online diagnostics to verify proper functioning of digital systems and to ensure the integrity of the installed application and system software.
- FSAR credits these features as a means of
  - ensuring partial compliance with established SRs for reactor protection systems, and
  - justifying deletion of Channel Check and Actuation Logic Test surveillances.

Post Accident Monitoring (PAM) Instrumentation

- COL applicants that reference the U.S. EPR design certification must address Revision 4 of RG 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants"
- PAM variable selection criteria in RG 1.97, Revision 4, depend on the prior development of plant-specific Emergency Operating Procedures (EOPs) and Abnormal Operating Procedures (AOPs), which are post-COL activities

PAM Instrumentation (cont'd)

- COL applicants must complete site-specific TS information in the plant-specific TS in accordance with DC/COL-ISG-8, "Necessary Content of Plant-Specific Technical Specifications When a Combined License Is Issued," prior to COL issuance using one of three options:
  - Option1 provides site-specific TS information (PAM function list derived from RG 1.97 guidance – cannot do before COL issuance).
  - Option 2 provides useable bounding information (i.e. development of a bounding list of PAM functions).
  - Option 3 relocates site-specific information to licensee-controlled document and establishes an administrative control TS that requires determining the information using an NRC-approved methodology and that controls changes to the information (PAM function list derived from RG 1.97 guidance).

PAM Instrumentation (cont'd)

- AREVA has proposed a useable bounding list of PAM functions (Option 2). COL applicants could incorporate the bounding list by reference.
- The staff is evaluating the proposed PAM function list to determine if the list is truly bounding.

Remote Shutdown System

- AREVA proposes to no longer specify the required Remote Shutdown System functions in the generic TS and associated bases, which is a deviation from the STS bases (NUREG 1431, Rev 3).

Remote Shutdown System (cont’d)

- Instead, AREVA proposes that the GTS bases state that the displays and controls at the “Remote Shutdown Station” are functionally the same as the displays and controls normally used by the operator to achieve and maintain safe shutdown from the MCR.
  - The proposed RSS TS and bases do not identify or provide an FSAR reference that lists the required RSS functions relied upon to achieve and maintain safe shutdown from outside the main control room.

Remote Shutdown System (cont'd)

- Unclear how to determine that the operability requirements of GTS LCO 3.3.3 ("The RSS Functions shall be OPERABLE.") are met.
- Therefore, staff is unable to conclude that the GTS 3.3.3, "Remote Shutdown Station" is implementable.

Omission of Manual RT Function from GTS

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- AREVA has omitted the Manual RT function from the GTS on the basis that:
  - The trip is not credited in the Chapter 15 accident analyses, and
  - The trip does not satisfy 10 CFR 50.36, Criterion 3 (an SSC that is part of the primary success path which functions or actuates to mitigate a DBA or transient that either assumes failure of or presents a challenge to the integrity of a fission product barrier).

Omission of Manual RT Function from GTS (cont'd)

- The staff questions omission of the Manual RT function from the GTS on the basis that the Steam Generator Tube Rupture Accident Analysis in Chapter 15 states:
  - "In three cases, RT by operator action and concurrent LOOP were postulated to take place at 30 minutes into the accident."

Staff Findings

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- The Staff conducted a review and evaluation of the U.S. EPR FSAR, which generated in 293 Questions with 30 remaining as Open Items. Through the use of public meetings, audits and conference calls the open items have been defined and the staff and AREVA have arrived at a common understanding of the requirements that must be satisfied. Presently the staff concludes that resolution of the 30 open items is manageable within the planned schedule. Upon resolving the open items, the Chapter 16 U.S. EPR FSAR will provide sufficient information to assist the COL applicant in constructing a U.S. EPR that satisfies the requirements of 10 CFR Part 52.